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## Supplemental Final Environmental Impact Report EOEA No. 15765

# Submitted by Proponent:

# ND Acquisitions, LLC

2310 Washington Street Newton Lower Falls, MA 02463



# Prepared by:

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## Project Management: National Development

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Wrentham Business Center Wrentham, MA

August 30, 2023

# **ND Acquisitions, LLC**

2310 WASHINGTON STREET NEWTON LOWER FALLS, MA 02463

August 30, 2023

Secretary Rebecca Tepper Executive Office of Energy & Environmental Affairs 100 Cambridge St. Suite 900 Attn: MEPA Office Boston MA 02114

#### **RE: WRENTHAM BUSINESS CENTER (EOEA #15765)**

Dear Secretary Tepper:

Pursuant to 301 CMR 11.07 we are submitting herewith a Supplemental Final Environmental Impact Report (SFEIR) for the redevelopment of the Wrentham Business Center (WBC or Project) located on Commerce Boulevard and Washington Street in Wrentham, MA on 31.2 acres of land currently subdivided in to 3 lots. The Project consists of a mixed-use commercial development to include: a 116,000 sf indoor recreation facility (Phase 1, already completed), a 180,000 sf warehouse (Phase 2), and a 4,500 convenience store (Phase 3).

As noted, the Project is proposed to be built in 3 phases, with the first phase being the indoor recreation facility, which has already been completed, Phase 2 being the construction of a 180,000+/- sf warehouse on Lot 3, and which has received a Special Permit/Site Plan approval from the Wrentham Planning Board and an Order of Conditions from the Wrentham Conservation Commission. Phase 3 is the construction of 4,500 sf convenience store that is currently being reviewed by the Wrentham Planning Board under an application filed by the current owner, WBH, LLC.

An Expanded ENF (EENF) was filed in August 2017 and a certificate was issued by the Secretary on November 29, 2017 outlining the scope for the DEIR and approving a Phase One waiver. A DEIR was filed in September 2021 and a certificate was issued by the Secretary on November 15, 2021 outlining the scope for the FEIR. The FEIR was filed on September 30, 2022 and on November 14, 2022 the FEIR was found to not adequately and properly comply with the Massachusetts Environmental Policy Act and the Secretary required the Proponent to file an SFEIR in accordance with the limited scope outlined in the FEIR Certificate (Appendix A).

The scope of work for the project has changed from the filing of the FEIR in September 2022 in that the design on Lot 1 has changed from a 3,350 sf family-style restaurant and 2,200 sf drive-through coffee shop with a total of 150 parking spaces to a 4,500 convenience store with 25 parking spaces that includes 6 gasoline pumps. The construction of the indoor recreation facility, Supercharged Racing of Wrentham, allowed under the Phase One waiver on Lot 2 has been completed and the facility is now operational. Phase 1 of the Project underwent review from the Wrentham Planning Board, Wrentham Board of Health, Wrentham Conservation Commission, and the MassDOT. Phase 2 has received approvals from the Town of Wrentham Planning Board, Conservation Commission and Board of Health. The Special Permit/Site Plan approval was appealed and is currently before the Massachusetts Land Court. Phase 3 has been filed with the Wrentham Planning Board for a Special Permit/Site Plan approval and the first public hearing was held on August 16, 2023, and continued to September 20, 2023.

The SFEIR has been prepared to conform to the general guidance for outline and content contained in section 11.07 of the MEPA regulations as limited by the scope presented in the FEIR Certificate. Comments received on the FEIR, to the extent that they are within the subject matter jurisdiction of MEPA, have been addressed. We have held several meetings with MassDOT on the traffic impacts and proposed improvements necessary for the construction of the project. We have met with the Town's professional staff for their input. As noted, we have received approvals for Phase 2 from the Town's land use boards and are currently before them on Phase 3. We will continue to coordinate with stakeholders, as required, including the public, local agencies and Commonwealth agencies in the design of this Project.

This SFEIR describes the impacts and proposed mitigation measures for the Project at the level of detail possible given the present state of planning and design. Planning and design will continue to progress during the review period for the SFEIR and will allow us to react to issues and concerns raised during the review of the SFEIR.

The point of contact for this Project is William Buckley, Jr., P.E. Bay Colony Group, Inc. and he can be reached at 508-543-3939 and billbuckley@baycolonygroup.com. The point of contact for ND Acquisitions, LLC is Sherry Clancy, and she can be reached at 617-559-5080 and sclancy@natdev.com.

Very truly yours,

ND Acquisitions, LLC

Sherry A. Clancy Senior Vice President, Development

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#### 1.0 Site Description

The Project is located approximately 1,200 feet from the northbound Route 495 off-ramp onto Route One and the property consists of 31.7 acres (see below). The majority of the site has been cleared and generally leveled which is the result of previous gravel extraction activities, use of the site as truck parking and as a commercial rental facility, and then site preparation in anticipation of development from permits received in 2002/2003 for the development of a 1,000,000-sf commercial center. The topography slopes gently from west to east toward the Rabbit Hill Stream. The site contains bordering vegetated wetlands (BVW), Bank, Isolated Land Subject to Flooding (ISLF), and Bordering Land Subject to Flooding (BLSF). It also lies partially within a Zone A - Tributary to a Surface Water Supply. Abutters include an auto salvage yard, an active cranberry bog and a gated over-night truck parking area. On the west side of Route One across from the site is a family-style restaurant and a truck stop. The site has approximately 1,500 feet of frontage along Route One and is currently zoned C-1 South. Existing Conditions Plans are included as Figures 2 & 2A.

#### Figure 1 - Locus Map



#### 2.0 Project Summary

The Project, Wrentham Business Center (EOEEA 15765), includes the construction of mixed-use facilities on three lots that were created in 2017 through the use of the Subdivision Control Law through the Wrentham Planning Board. Lot 2 is the first phase; it has been constructed and is operational and contains a 116,000 sf indoor recreational facility called Supercharged Racing. Phase 2, will be on Lot #3 and will consist of a 179,000+/- gsf warehouse with a minor office component and 150 parking spaces. Phase 3 of the Project will include the construction on Lot 1 of a convenience store (4,500+/- sf) with 6 gasoline pumps and 33 parking spaces. The Phase 3 portion of the Project is undergoing Site Plan/Special Permit review by the Wrentham Planning Board. A conceptual development plan illustrating the Project is attached as Figure 3 and Table A lists the major components of the Phases.

The overall Project will require an Order of Conditions from the Town of Wrentham Conservation Commission, a Disposal Works Construction Permit from the Wrentham Board of Health, and a MassDOT Vehicular Access Permit and Signal Permit for the construction of the proposed intersection improvements at Commerce Boulevard and Washington Street. The Project will require a NPDES permit from the USEPA under the Construction General Permit. No financial assistance or land transfers are proposed for any of the Phases. Phase 3 of the Project will require a Site Plan/Special Permit from the Town of Wrentham Planning Board, a Disposal Works Construction Permit from the Wrentham Board of Health, and a MassDOT Vehicular Access Permit.

The completed indoor recreation facility on Lot #2 along with associated roadway and drainage improvements were permitted through the Wrentham Planning Board, Conservation Commission and Board of Health. The building has been completed and has been in operation since 2019. The roadway has been completed except for a portion of the sidewalk, the top course of pavement for the roadway and sidewalk, and the installation of street trees. Phase 2 of the project has received a Site Plan/Special Permit from the Wrentham Planning Board and an Order of Conditions from the Wrentham Conservation Commission. The Site Plan/Special Permit has been appealed and is currently undergoing review in the Massachusetts Land Court. Phase 3 is under review by the Wrentham Planning Board.

|                | Phase 1 (Completed)                  | Phase 2                               | Phase 3                               |
|----------------|--------------------------------------|---------------------------------------|---------------------------------------|
| Chrushuman     | 116,000 gsf indoor recreation        |                                       | 4,500 sf convenience store w/6        |
| Structures     | facility                             | 180,000+/- sf warehouse               | gasoline pumps                        |
| Parking        | 200 parking spaces                   | 150 parking spaces                    | 33 parking spaces                     |
|                | 1. Commerce Blvd constructed to      | 1. Public water improvements by       | Construction of remainder of sidewalk |
|                | base course of pavement for          | looping system from Commerce Blvd     | along Route One frontage of Lot 1.    |
|                | roadway and sidewalk, curbing        | to Route One.                         |                                       |
|                | installed, lighting installed, storm | 2. Construction of remainder of       |                                       |
|                | water installed for roadway and      | sidewalk on Route One along Lot 3     |                                       |
| Infrastructure | Lot-1                                | frontage.                             |                                       |
|                | 2. Public 12" water main and         | 3. Traffic improvements at            |                                       |
|                | electrical/cable systems installed   | Commerce Blvd/Route One               |                                       |
|                | for roadway and Lot 2                | 4. Removal of storm water basin on    |                                       |
|                |                                      | Lot 3 and within Zone A and           |                                       |
|                |                                      | reconstruction outside Zone A.        |                                       |
|                | 1.Special Permit/Site                | 1.Special Permit/Site Plan/Definitive | 1.Special Permit/Site Plan/Definitive |
|                | Plan/Definitive Plan - Wrentham      | Plan - Wrentham Planning Board        | Plan - Wrentham Planning Board        |
|                | Planning Board                       | 2.Order of Conditions - Wrentham      | 2. Disposal Works Construction Permit |
|                | 2.Order of Conditions - Wrentham     | Conservation Commission               | - Wrentham Board of Health            |
|                | Conservation Commission              | 3.Stormwater Permit and Disposal      | 3.Vehicular Access Permit -           |
| Dormite        | 3.Stormwater Permit and Disposal     | Works Construction Permit -           | MassDOT                               |
| rennus         | Works Construction Permit -          | Wrentham Board of Health              | 4.NPDES Consruction General           |
|                | Wrentham Board of Health             | 4.Vehicular Access Permit -           | Permit                                |
|                | 4.Vehicular Access Permit -          | MassDOT                               |                                       |
|                | MassDOT                              | 5.NPDES Consruction General           |                                       |
|                | 5.NPDES Consruction General          | Permit                                |                                       |
|                | Permit                               |                                       |                                       |

#### Table A – Summary of Phases

#### 3.0 Changes from DEIR to FEIR

The scope of work for the project has changed from the filing of the FEIR in September 2022 in that the design on Lot 1 has changed from a 3,350 sf family-style restaurant and 2,200 sf drive-through coffee shop with a total of 150 parking spaces to a 4,500 convenience store with 33 parking spaces that includes 6 gasoline pumps. (Figures 2, 2A, & 3)

#### 4.0 Traffic and Transportation

A Traffic Impact and Access Study (TIAS) dated August 2017 was submitted as part of the Expanded Environmental Notification Form (EENF) for Phase I of the project at 591 Washington Street in Wrentham, MA. A Draft Environmental Impact Report (DEIR) was submitted in September 2021 documenting the assessment of the remaining portions of the Wrentham Business Center. The proposed project under that filing included the construction of an approximately 179,000 square foot warehouse building with associated office space and two restaurant uses, one approximately 2,200 square foot

coffee shop with drive-thru and one approximately 3,350 square foot sit-down restaurant. The TIAS was updated and submitted as part of the Final Environmental Impact Report (FEIR). The proposed project under the FEIR filing continued to include an approximately 179,000 square foot warehouse building with associated office space, one approximately 2,200 square foot coffee shop with drive-thru, and one approximately 3,350 square foot sit-down restaurant.

This Supplemental Final Environmental Impact Report (SFEIR) further refines the analyses of the FEIR based on comments received in the FEIR Certificate as well as revisions to the proposed Build program for the project site. This SFEIR is based on the most recent site plans for the Wrentham Business Center project, prepared by Bay Colony Group, Inc., dated April 19, 2023. These plans include both Lot 1 and Lot 3 of the proposed project, which include an approximately 179,000 square foot warehouse building with associated office space and an approximately 4,500 square foot convenience store and gas station providing six fuel pumps (a total of 12 vehicle fueling positions), respectively.

During the preparation of the SFEIR transportation section below, coordination with MassDOT has occurred including a meeting with MassDOT representatives from District 5, Traffic and Safety, and Public/Private Development Unit (PPDU) on May 4, 2023. An additional follow up meeting with the MassDOT PPDU was held on June 22, 2023 to confirm volume and trip generation methodologies for inclusion in this filing. The following SFEIR Transportation section was prepared using standards presented in MassDOT's Transportation Impact Assessment Guidelines and incorporating comments received from MassDOT in the FEIR certificate as well as the coordination meetings held with MassDOT. Supporting transportation data, analysis, and information are presented in the appendices.

## 4.1 Study Methodology

The analysis completed as part of the SFEIR follows the methodology previously outlined in the DEIR and FEIR. The analysis contained within this SFEIR is intended to address comments raised by MassDOT on the FEIR and the new build program for Lot 1. The updated analysis includes new traffic counts, revised trip generation for Lot 1, revised capacity analysis for Existing, No Build and Build conditions, and updates to the intersection signalization concept for the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard. A description of the updated analysis is provided below.

## 4.2 Existing Conditions

To evaluate the potential project impacts, an inventory of the existing study area roadway and intersection conditions was performed. The existing conditions assessment included an inventory of all intersection and roadway geometries, an

inventory of traffic control devices, and a review of available recent crash data, as outlined in the DEIR.



#### 4.2.1 Study Area

The study area for the SFEIR matches the previous submissions and consists of the intersections of:

- Washington Street (Route 1) at Thurston Street
- Washington Street (Route 1) at Hawes Street/Commerce Boulevard (project site driveway)
- Washington Street (Route 1) at Madison Street.

The site location and study area are depicted in Figure 1.

#### 4.2.2 Peak Hour Traffic Volumes

The FEIR used traffic data collected in July 2021. In order to provide an up-to-date analysis for this SFEIR, new turning movement counts were conducted at the study area intersections during the weekday morning, weekday afternoon, and Saturday midday peak periods. Weekday counts were conducted at the intersections of Washington Street (Route 1) at Thurston Street and Washington Street (Route 1) at Madison Street on Tuesday, April 4, 2023 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. Weekday counts at the intersection of Washington Street at Hawes Street/ Commerce Boulevard were conducted April 4, 2023 from 7:00 AM to 7:00 PM. Saturday counts at all the study area intersections were conducted on Saturday, April 1, 2023 from 11:00 AM to 2:00 PM. The results of the turning movement counts are tabulated by 15-minute periods and are provided in the SFEIR appendices. The four highest consecutive 15-minute intervals during each of these count periods constitute the peak hours that are the basis of the traffic analysis provided in this report. Based on a review of the peak period traffic data, the weekday morning peak hour at the study area intersections is shown to occur between 7:00 AM and 8:00 AM, the weekday afternoon peak hour is shown to occur between 4:45 PM and 5:45 PM, and the Saturday midday peak hour is shown to occur between 11:45 AM and 12:45 PM. Table 1 below presents a comparison of the 2021 Existing volumes used in the FEIR and approved by MassDOT with the April 2023 counted volumes at the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard.

|      |    | Weekday  | / Morning Pe | eak Hour | Weekday  | Afternoon P | eak Hour | Saturday Midday Peak Hour |            |        |  |  |  |
|------|----|----------|--------------|----------|----------|-------------|----------|---------------------------|------------|--------|--|--|--|
|      |    | MassDOT  |              |          | MassDOT  |             |          | MassDOT                   |            |        |  |  |  |
|      |    | Approved |              |          | Approved |             |          | Approved                  |            |        |  |  |  |
| Dir. |    | 2021     | April 2023   | Change   | 2021     | April 2023  | Change   | 2021                      | April 2023 | Change |  |  |  |
| EB   | L  | 0        | 1            | +1       | 0        | 0           | 0        | 0                         | 0          | 0      |  |  |  |
|      | Т  | 0        | 0            | 0        | 1        | 0           | -1       | 0                         | 0          | 0      |  |  |  |
|      | R  | 17       | 11           | -6       | 16       | 17          | +1       | 12                        | 17         | +5     |  |  |  |
| WB   | L  | 0        | 0            | 0        | 14       | 7           | -7       | 10                        | 11         | +1     |  |  |  |
|      | Т  | 0        | 0            | 0        | 1        | 0           | -1       | 0                         | 0          | 0      |  |  |  |
|      | R  | 2        | 1            | -1       | 23       | 4           | -19      | 2                         | 10         | +8     |  |  |  |
| NB   | L  | 8        | 23           | +15      | 13       | 13          | 0        | 9                         | 11         | +2     |  |  |  |
|      | Т  | 1,805    | 1,892        | +87      | 922      | 818         | -104     | 940                       | 1,093      | +153   |  |  |  |
|      | R  | 1        | 1            | 0        | 27       | 14          | -13      | 33                        | 57         | +24    |  |  |  |
| SB   | L  | 1        | 1            | 0        | 11       | 5           | -6       | 11                        | 18         | +7     |  |  |  |
|      | Т  | 602      | 516          | -86      | 1,753    | 1,895       | +142     | 941                       | 883        | -58    |  |  |  |
|      | R  | 3        | 13           | +10      | 9        | 8           | -1       | 5                         | 1          | -4     |  |  |  |
| Tot  | al | 2,439    | 2,459        | +20      | 2,790    | 2,781       | -9       | 1,963                     | 2,101      | +138   |  |  |  |

#### Table 1: Washington Street (Route 1) at Hawes Street Peak Hour Volume Comparison

#### 4.2.3 Seasonal Adjustment

Normal variation in traffic volumes is expected to occur throughout the year. To determine whether any seasonal adjustment of the counted traffic volumes was necessary, historic continuous count station data was obtained from the MassDOT Transportation Data Management System database. Based on station ID 6312 located on I-495 in Mansfield, traffic volumes in April are shown to be approximately 3.6% below the annual average during the month of April. In order to provide an accurate analysis, the counted vehicle volumes were adjusted upward to reflect a typical month. The resulting 2023 Existing peak hour traffic volumes are displayed in Figures 2, 3, and 4 for the weekday morning, weekday afternoon, and Saturday midday peak hours, respectively.







### 4.3 No Build Conditions

To determine the future traffic demands on the study area roadways and intersections, the 2023 Existing traffic volumes were projected to the future year 2030. Background traffic growth and developments independent of the proposed project were accounted for in the future 2030 No Build (without project) traffic volumes.

#### 4.3.1 Future Roadway Improvements

Based on previous discussions with the Town of Wrentham, no future town funded roadway improvement projects are currently proposed in the vicinity of the project site that would be expected to impact traffic volumes or operations. Since the completion of the FEIR, no additional future roadway improvements have been identified. As outlined the FEIR, the following roadway improvement projects are under consideration:

- Hawes Street signage and striping modifications to be determined by Wrentham Police Department and Wrentham Department of Public Works. The complete scope of potential modifications is unknown at the time of the filing of the SFEIR.
- Intersection improvements at the intersection of Washington Street (Route 1) at Thurston Street are planned as part of the development of a proposed gas station and convenience store and a proposed warehouse development on Thurston Street.
- MassDOT Washington Street (Route 1) Corridor Project that is evaluating alternative cross-sections for the Washington Street (Route 1) corridor from just north of the I-495 interchange in the south to the Wrentham town-line in the north. At the time of coordination with MassDOT, the Washington Street (Route 1) Corridor project was in the pre-25% design submittal stage, where MassDOT and the project team were exploring concepts for the corridor. Additional details regarding potential cross-sections were not available prior to the filing of the SFEIR.

Based on the information received to date, no specific corridor improvements are included as part of the Wrentham Business Center project. The proposed signalized concept for the intersection of Washington Street (Route 1) and Commerce Boulevard/Hawes Street, included in this SFEIR filing, is intended to not preclude the implementation of potential corridor concept by MassDOT. The project team will continue to work with MassDOT to implement the proposed signalization of Hawes Street/Commerce Boulevard in an appropriate manner in conjunction with their plans for the Washington Street (Route 1) corridor project.

## 4.3.2 Background Traffic Growth

As documented in the FEIR, a one percent per year growth rate, compounded annually, was utilized to conservatively capture traffic growth associated with general changes in population and any developments that may not be known at this time.

#### 4.3.3 Background Developments

The Town of Wrentham has identified two planned developments located within close proximity to the project site that would be expected to impact future traffic volumes on the study area roadways, namely:

- A proposed gas station and convenience store at 500 Thurston Street
- A proposed warehouse development at 500-524 Thurston Street

The proposed gas station and convenience store project located at 500 Thurston Street involves the construction of an approximately 6,000 square foot convenience store and 17 total vehicle fueling positions, as well as a single-stall car wash. The April 2019 Transportation Impact Assessment conducted by Vanasse & Associates, Inc. was referenced to determine the number of additional trips on the study area roadways estimated to be generated by the project. The resulting trips are included in the future year conditions analyzed in this SFEIR.

The proposed warehouse project to be located at 500-524 Thurston Street would construct an approximately 132,000 square foot building on the southeast corner of the intersection of Washington Street at Thurston Street. The trips associated with this proposed warehouse were included in the future traffic volume projections based on information provided in the Traffic Impact Assessment prepared by Vanasse & Associates, Inc. dated September 2021.

The Town also identified two other development projects in the vicinity of the project site: a potential warehouse project at 544 Thurston Street and a solar farm project at 80 Washington Street which is anticipated to be under construction in 2023. At the time of discussion, the warehouse development project had not yet filed with the Wrentham Planning Board. Therefore, traffic estimated to be generated by this development is not known at this time and is expected to be captured in the background growth rate discussed above. ITE does not provide data for vehicle trips associated with solar energy facilities, however a review of impact studies prepared for solar farms shows that trip generation associated with operations are generally minimal. Any trips associated with occasional maintenance or other occurrences at the solar farm are expected to be captured in the background growth rate.

The additional vehicle trips associated with the one percent per year background growth rate and the two projects identified above were added to the 2023 Existing conditions

vehicle volumes to establish the 2030 No Build traffic volumes. The resulting volumes are presented in Figures 5, 6, and 7 for the weekday morning, weekday afternoon, and Saturday midday peak hours, respectively.







#### 4.4 Build Conditions

To evaluate the projected impacts to the study area roadways and intersections by the project, the estimated trips associated with the proposed project and the proposed improvements to be implemented for the project were evaluated.

#### 4.4.1 Trip Generation

In order to estimate the number of vehicle trips associated with the proposed development, the Institute of Transportation Engineers' (ITE) publications, *Trip Generation Manual, 10<sup>th</sup> Edition* and *Trip Generation Manual, 11<sup>th</sup> Edition,* were referenced. The original Wrentham Business Center DEIR was prepared using the 10<sup>th</sup> Edition of the *Trip Generation Manual*. Between the DEIR and FEIR submissions, ITE released the 11<sup>th</sup> Edition. In coordination with and at the direction of MassDOT, the analysis presented in the FEIR continued to use the 10<sup>th</sup> Edition for the estimation of project trips. In order to maintain consistency with the FEIR, vehicle trips associated with the warehouse portion of Wrentham Business Center project are estimated in this SFEIR using the *Trip Generation Manual, 10<sup>th</sup> Edition*, and the resulting trip estimates are the same as within the FEIR submission. Table 2 below provides a comparison of the estimated trips for the proposed warehouse using the 10<sup>th</sup> Edition and the 11<sup>th</sup> Edition.

|                                    |  |                                    | We                    | ekda                 | y AM                  | Weekday PM           |                       | Saturday              |                    | Weekday Daily      |                     |                         |                         |                          |
|------------------------------------|--|------------------------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|-----------------------|--------------------|--------------------|---------------------|-------------------------|-------------------------|--------------------------|
|                                    |  |                                    | Peak Hour             |                      | Peak Hour             |                      |                       | Midday Peak           |                    |                    |                     |                         |                         |                          |
| Ed.                                | Description  | Size                               | In                    | Out                  | Total                 | In                   | Out                   | Total                 | In                 | Out                | Total               | In                      | Out                     | Total                    |
| 10th                               | Warehouse Trips <sup>1</sup>   | 169,800 s.f.                       | 35                    | 11                   | 46                    | 13                   | 35                    | 48                    | 5                  | 3                  | 8                   | 157                     | 157                     | 314                      |
|                                    | Office Trips <sup>2</sup>  | <u>10,000 s.f.</u>                 | <u>10</u>             | <u>2</u>             | <u>12</u>             | <u>2</u>             | <u>11</u>             | <u>13</u>             | <u>3</u>           | <u>2</u>           | <u>5</u>            | 57                      | <u>57</u>               | <u>114</u>               |
|                                    | Total Trips  |                                    | 45                    | 13                   | 58                    | 15                   | 46                    | 61                    | 8                  | 5                  | 13                  | 214                     | 214                     | 428                      |
| 11th                               | Warehouse Trips <sup>3</sup><br><u>Office Trips<sup>4</sup></u><br>Total Trips | 169,800 s.f.<br><u>10,000 s.f.</u> | 34<br><u>13</u><br>47 | 10<br><u>2</u><br>12 | 44<br><u>15</u><br>59 | 13<br><u>2</u><br>15 | 34<br><u>10</u><br>44 | 47<br><u>12</u><br>59 | 5<br><u>3</u><br>8 | 3<br><u>2</u><br>5 | 8<br><u>5</u><br>13 | 153<br><u>54</u><br>207 | 153<br><u>54</u><br>207 | 306<br><u>108</u><br>414 |
| Chang                              | ge in Warehouse Trips  | 169,800 s.f.                       | -1                    | -1                   | -2                    | 0                    | -1                    | -1                    | 0                  | 0                  | 0                   | -4                      | -4                      | -8                       |
| Change in Office Trips 10,000 s.f. |  | <u>10,000 s.f.</u>                 | <u>3</u>              | <u>0</u>             | <u>3</u>              | <u>0</u>             | <u>-1</u>             | <u>-1</u>             | <u>0</u>           | <u>0</u>           | <u>0</u>            | <u>-3</u>               | <u>-3</u>               | <u>-6</u>                |
| Chanc                              | ae in Total Trips  |                                    | 2                     | -1                   | 1                     | 0                    | -2                    | -2                    | 0                  | 0                  | 0                   | -7                      | -7                      | -14                      |

| Table 2: | Warehouse | Trip  | Generation | 10 <sup>th</sup> vs | 11 <sup>th</sup> | Edition |
|----------|-----------|-------|------------|---------------------|------------------|---------|
|          | Marchouse | 1 I P | Concration | 10 13               |                  | Lattion |

1 ITE 10th Edition, Land Use Code 150 (Warehousing), based on 169,800 square feet

2 ITE 10th Edition, Land Use Code 710 (General Office Building), based on 10,000 square feet

3 ITE 11th Edition, Land Use Code 150 (Warehousing), based on 169,800 square feet

4 ITE 11th Edition, Land Use Code 710 (General Office Building), based on 10,000 square feet

As shown in Table 2 above, the difference in the number of estimated project trips associated with the warehouse is minimal. Therefore, MassDOT agreed that the use of the 10<sup>th</sup> Edition trip generation estimates was appropriate. The projected trips associated with the warehouse and office space are consistent with those presented in the DEIR and FEIR.

Trips associated with the now proposed gas station and convenience store on Lot 1 have been estimated using the *Trip Generation Manual, 11<sup>th</sup> Edition* in order to provide a more up-to-date analysis. To estimate vehicle trips associated with the proposed gas station and convenience store, Land Use Code (LUC) 945 (Convenience Store/Gas Station) was utilized. This reference establishes vehicle trip rates (in this case expressed in trips per vehicle fueling position) based on actual traffic counts conducted at similar types of existing land uses.

Not all trips to convenience stores and gas stations are new trips. A significant portion of the total trips attracted to such uses are pass-by trips. According to ITE, for Land Use Code 945 (Convenience Store/Gas Station), approximately 76 percent of the total weekday morning peak hour trips of this land use type are attributed to pass-by trips, while approximately 75 percent of the total weekday afternoon peak hour trips of this land use type are attributed for the Saturday midday site peak hour through ITE. Therefore, the more conservative weekday afternoon peak hour pass-by rate of 75 percent was used to estimate total pass-by trips for the Saturday midday site peak hour.

The total number of estimated vehicle trips entering and exiting the site is presented in Table 3.

|      |  |              | Weekday AM   |             | We   | ekday       | PM          | Saturday Midday |            |            |             |
|------|--|--------------|--------------|-------------|------|-------------|-------------|-----------------|------------|------------|-------------|
|      |  |              | Peak Hour    |             |      | P           | eak Ho      | ur              | Peak Hour  |            |             |
| Ed.  | Description                                      | Size         | In Out Total |             | In   | Out         | Total       | In              | Out        | Total      |             |
| 10th | Warehouse Trips <sup>1</sup>                     | 169,800 s.f. | 35           | 11          | 46   | 13          | 35          | 48              | 5          | 3          | 8           |
|      | Office Trips <sup>2</sup>                        | 10,000 s.f.  | 10           | 2           | 12   | 2           | 11          | 13              | 3          | 2          | 5           |
| 11th | Convenience Store/Gas Station Trips <sup>3</sup> | 12 VFP       | 162          | 162         | 324  | 137         | 137         | 274             | 125        | 120        | 245         |
|      | <u>- Pass-by Trips <sup>4</sup></u>              |              | <u>-123</u>  | <u>-123</u> | -246 | <u>-103</u> | <u>-103</u> | -206            | <u>-92</u> | <u>-92</u> | <u>-184</u> |
|      | Convenience Store New Trips                      |              | 39           | 39          | 78   | 34          | 34          | 68              | 33         | 28         | 61          |
|      | Total Project New Trips                          |              | 84           | 52          | 136  | 49          | 80          | 129             | 41         | 33         | 74          |

#### Table 3: Proposed Project Trips

1 ITE 10th Edition, Land Use Code 150 (Warehousing), based on 169,800 square feet.

2 ITE 10th Edition, Land Use Code 710 (General Office Building), based on 10,000 square feet.

3 ITE 11th Edition, Land Use Code 945 (Convenience Store/Gas Station), based on 12 VFP.

4 Based on ITE LUC 945, 76% of weekday morning and 75% of weekday afternoon peak hour vehicle trips are considered pass-by

trips. Saturday midday peak hour pass-by rates are not available for LUC 945, therefore weekday afternoon rates were applied.

As shown in Table 3, the proposed development is estimated to result in a total of approximately 136 new vehicle trips (84 entering vehicles and 52 exiting vehicles) during the weekday morning peak hour, approximately 130 new vehicle trips

(49 entering vehicles and 80 exiting vehicles) during the weekday afternoon peak hour, and approximately 242 vehicle trips (123 entering vehicles and 119 exiting vehicles) during the Saturday midday peak hour. The proposed Lot 1 and Lot 3 land uses are estimated to result in approximately 2,608 daily trips (1,304 entering vehicles and 1,304 exiting vehicles) during a typical weekday.

### 4.4.2 Trip Distribution

The additional traffic estimated to be generated by the proposed development was distributed onto the study area roadways and intersections based on the methodology outlined in the DEIR. The resulting arrival and departure patterns for both the warehouse and the gas station/convenience store trips are presented in Figure 8 and are documented in the traffic projection model found in the appendix of this report. The trip distribution patterns previously provided for the restaurant land uses were applied to the proposed gas station and convenience store. Pass-by trips associated with the gas station and convenience store distributed onto the study area roadways based on travel patterns for each peak hour individually, not as an average over multiple time periods as was done for the new trips entering and exiting the site.

The project-related traffic was then assigned to the surrounding roadway network based on the project trip distribution patterns presented in Figure 8 and described above. The resulting distributed new project trips associated with the proposed warehouse are shown in Figures 9, 10, and 11 for the weekday morning, weekday afternoon, and Saturday midday peak hours, respectively. The resulting distributed new project trips associated with the proposed gas station and convenience store are shown in Figures 12, 13, and 14 for the weekday morning, weekday afternoon, and Saturday midday peak hours, respectively. The new project trips and pass-by trips were added to the 2030 No Build trips to determine the 2030 Build traffic volumes, which are displayed in Figures 15, 16, and 17 for the weekday morning, weekday afternoon, and Saturday midday peak hours, respectively.





















### 4.4.3 MUTCD Signal Warrant Analysis

Based on the intention to signalize the currently unsignalized intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard, signal warrant analyses were completed. Signal warrant analyses were performed based on methodologies described in the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD). The analyses performed for this report are based on the criteria for the eight-hour and four-hour volume warrants.

The Eight-Hour (Warrant 1) and Four-Hour (Warrant 2) vehicular volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing traffic signal control. For the Eight-Hour vehicular volume signal warrant to be met, minimum vehicular volumes for the major street and minor street, found in Table 4C-1 of the MUTCD, must be exceeded. To satisfy the Four-Hour signal warrant, the plotted point representing the hourly volumes on the major street and minor street intersection approaches during any four hours of an average weekday must be above the applicable curve in Figure 4C-1 of the MUTCD.

The 12-hour turning movement count data collected at the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard is used as the basis of the signal warrant analysis. In order to present a conservative analysis, the vehicle volumes entering the intersection from Washington Street (Route 1) and from Hawes Street are based directly on the counted vehicle volumes, with no upwards adjustments for seasonal variation or future growth. The vehicle volumes approaching the intersection from Commerce Boulevard are based on the counted vehicle volumes, as well as the projected vehicle trips exiting the proposed Wrentham Business Center development. These exiting trips were identified utilizing the daily trip generation and hourly distribution identified by ITE for each of the proposed land uses associated with the project, as outlined in the FEIR. The use of the daily trip generation and hourly distribution results in different exiting volumes for the project site than are presented in the previous sections of this report. While different, the vehicle trip estimate completed using hourly distribution of traffic applied to the daily trip generation for the project provides a more conservative approach to the signal warrant analysis. A reduction in right-turning volumes on the minor approach has not been included in the warrant analysis due to the high peak hour volumes on Washington Street (Route 1), which limit the ability of vehicles to turn right from Commerce Boulevard onto Washington Street (Route 1). A signal warrant sensitivity analysis was conducted, which indicated that even if 50 percent of right-turns were removed from the westbound Commerce Boulevard approach, the findings described below would not be substantially different.

The eight-hour and four-hour warrant analyses were completed utilizing Highway Capacity Software (HCS). The HCS worksheets and volumes utilized for the analysis are provided in the appendix of this report for refence. Based on the completed signal warrant analysis, the intersection of Washington Street (Route 1) at Hawes Street/

Commerce Boulevard meets the eight-hour and the four-hour warrants under the 2030 Build conditions. Based on the warrant analysis, coordination with the Town of Wrentham, coordination with MassDOT, and anticipated excessive delay for vehicles on Commerce Boulevard, a traffic signal is proposed at the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard as part of the Wrentham Business Center project.

## 4.4.4 Intersection Control Evaluation (ICE) Procedure

During a coordination with MassDOT on May 4, 2023, completion of the Intersection Control Evaluation (ICE) procedure was requested for the intersection of Washington Street (Route 1) and Hawes Street/Commerce Boulevard, where signalization is proposed as part of the Wrentham Business Center development. MassDOT's ICE forms compare the intersection control alternatives by incorporating several considerations with a focus on safety, performance, operational and capacity considerations, and costs associated with right-of-way (ROW), design, and construction. As part of the ICE analysis, the CAP-X tool was utilized in order to preliminarily screen intersection control alternatives for operational and capacity feasibility. The ICE and CAP-X forms completed are included as appendices to this SFEIR.

Based on the results of the ICE forms, signalization was determined to be a viable control strategy. The primary factor which eliminated other control alternatives was ROW considerations. Because the proposed intersection improvements would be designed and constructed by a private entity, it was considered essential that the proposed control alternative fit within the existing state ROW, and not require private land takings. Overall, no control alternatives other than signalization were identified which meet more than four of the six criteria provided in the MassDOT ICE form.

#### 4.4.5 Intersection Improvements

As discussed above, traffic signal warrants were reviewed at the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard. Based on the review of the traffic signal warrants and discussions with the Town of Wrentham and MassDOT, a traffic signal is proposed to be installed at the intersection of Washington Street (Route 1) and Hawes Street/Commerce Boulevard as part of the development of Lots 1 and 3 on the project site. The Washington Street (Route 1) and Commerce Boulevard approaches to the intersection would be restriped to accommodate the traffic signal.

The intersection improvements would include restriping the northbound and southbound Washington Street (Route 1) approaches to accommodate an exclusive left-turn lane, a through lane, and a shared through/right-turn lane. The westbound Commerce
Boulevard approach would include an exclusive left-turn lane and a shared through/right-turn lane. The eastbound Hawes Street approach would continue to provide one general purpose travel lane.

The intersection phasing would include a protected left-turn phase for Washington Street (Route 1) northbound and southbound traffic followed by northbound and southbound general traffic, an exclusive pedestrian phase activated upon push-button only, and a phase for the Hawes Street/Commerce Boulevard eastbound and westbound general traffic. The proposed traffic signal would be coordinated with the signals along Washington Street (Route 1) at Thurston Street, Madison Street, and the existing pedestrian crossing signal, as appropriate and feasible, to facilitate traffic flow through the corridor.

During the local permitting process, Washington Street (Route 1) southbound queues extending back from its signalized intersection with Madison Street were observed during the weekday afternoon peak hour. During a field review, the eastbound right-turn movement from Madison Street was observed to be calling the full side street phase in the signal (stopping all Washington Street (Route 1) traffic), even though the vehicles turning right could be accommodated during the overlap phase with the northbound left-turn. In order to address this, and ultimately provide additional time to the Washington Street (Route 1) southbound movement, adjustments to the Madison Street signal phasing could be implemented as part of the signal coordination update along the corridor. The signal phase modification would primarily include adjusting the detector phase for the Madison Street eastbound right-turn movement to call the northbound left-turn phase instead of the full eastbound/westbound Madison Street phase. This potential detector adjustment is included in the analysis provided as part of this SFEIR.

The 2028 Build condition includes the proposed signal at the intersection of Washington Street (Route 1) and Hawes Street/Commerce Boulevard and associated coordination and signal timing adjustments along the Washington Street (Route 1) corridor from Thurston Street to Madison Street.

## 4.4.6 Project and Signal Phasing and Permitting

The proposed warehouse portion of the Wrentham Business Center has been reviewed by the Town of Wrentham Planning Board and received its special permit and site plan approval on August 17, 2022. Plans for the proposed gas station and convenience store on Lot 1 of the Wrentham Business Center were filed with the Town of Wrentham Planning Board in June 2023 and are currently under review by the Wrentham Planning Board. As the proposed gas station and convenience store proceed through the local permitting process, the proposed warehouse and signal design would be expected to continue through the MassDOT permitting process concurrently. The project team Supplemental Final Environmental Impact Report Wrentham Business Center Wrentham, MA

would keep MassDOT apprised of local permitting progress as it may relate to the proposed signalization of Washington Street (Route 1) at Hawes Street/Commerce Boulevard. The project team would also continue to coordinate with MassDOT on the progress of the Washington Street (Route 1) corridor project as it relates to incorporating into the proposed design.



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## 4.4.7 Site Access and Circulation

Access to the warehouse would be provided via two driveways on Commerce Boulevard, one full-access driveway to the office space, warehouse, and parking spaces and one full-access driveway to the warehouse loading docks in the rear. The gas station and convenience store would be accessed via two full-access driveway on the south side of Commerce Boulevard. Sidewalks along the south side of Commerce Boulevard would be maintained to facilitate pedestrian access around the project site and new sidewalks along the north side of Commerce Boulevard would be constructed to provide additional connections to the proposed pedestrian facilities on Washington Street (Route 1).

The following pedestrian facilities are included to help aid in circulation in and around the project site:

- Maintain existing sidewalk on the south side of Commerce Boulevard for pedestrian traffic traveling between uses on Commerce Boulevard and Washington Street (Route 1).
- Construct sidewalk on Washington Street (Route 1) for the entire site frontage, replacing the existing walkway area on the northern end of the project site.
- Provide sidewalk access directly from the proposed warehouse to the existing pedestrian crossing.
- Provide signalized crossings and crosswalks along the north side and east side of the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard.
- Construct a crosswalk across Commerce Boulevard approximately 100 feet east of Washington Street (Route 1) to provide access between the proposed Wrentham Business Center land uses.
- Construct a sidewalk on the north side of Commerce Boulevard between the warehouse site driveways and Washington Street (Route 1).

Pedestrians from the convenience store and the Supercharged facility would be able to utilize sidewalks on Commerce Boulevard to access and cross Washington Street (Route 1) or to travel north on Washington Street (Route 1) using the proposed crosswalk across Commerce Boulevard. Individuals walking from the warehouse would be able to access the existing Washington Street (Route 1) pedestrian crossing or travel south to the proposed crosswalk across Commerce Boulevard to access the proposed gas station and convenience store.

As discussed in previous sections of this SFEIR, MassDOT is in the pre-25% design phase of a corridor project on Route 1. During the progression of that project, it is expected that MassDOT will identify the preferred accommodations for pedestrians and bicycles along Route 1. With that, the Wrentham Business Center project team would coordinate with MassDOT during the access permitting process to align the proposed improvements as part of this development with the proposed Route 1 corridor design.

As outlined in the previous FEIR filing, transit access to and from the project site would be provided by the Greater Attleboro Taunton Regional Transit Authority's (GATRA) current micro transit service, GATRA GO. During a previous meeting with GATRA, it was noted that there are no current plans to provide fixed service to the Commerce Boulevard area. The ability to track ridership through their GATRA GO service would provide them with the opportunity to evaluate future transit needs at the project site. Should the demand of fixed service become apparent through a review of the available micro transit service ridership, GATRA would coordinate with the proponent to discuss potential options for additional transit service, including potential fixed route service, at that time. Based on this previous coordination, no additional modifications to the proposed project are anticipated.

With the new proposed build program for Lot 1, access that was previously proposed to the property south of the project site is no longer included in the proposal and the approaches to the new signal are expected to only include Washington Street (Route 1), Commerce Boulevard, and Hawes Street. Due to the MassDOT jurisdiction along Washington Street (Route 1), the project will be required to obtain an access permit from MassDOT for the proposed signal and intersection improvement work. Additional refinement to the signalization at the Hawes Street/Commerce Boulevard intersection and the timings along the Washington Street (Route 1) corridor are expected. The required permitting in addition to the ongoing MassDOT Washington Street (Route 1) corridor project would result in additional coordination with MassDOT regarding the proposed signalization of Hawes Street.

The local review of the Lot 1 gas station and convenience store development is ongoing at the time of this filing. An easement area over Lot 1 has been reserved in order to accommodate potential future shared access, but no specific development or access plans have been finalized with the abutter to the south. Based on discussions with MassDOT District 5, any changes to property access along the corridor from the Washington Street (Route 1) corridor project would be fully assessed and managed through that process.

## 4.5 Traffic Operations Analysis

In previous sections of this report, the quantity of traffic at the study area intersections has been discussed. The following sections describe the overall quality of the traffic flow at the study area intersections during the weekday morning, weekday afternoon, and Saturday midday peak hours. As a basis for this assessment, intersection capacity analysis was conducted using the Synchro capacity analysis software at the study area intersections under the 2023 Existing, 2030 No Build, and 2030 Build peak hour traffic conditions. The analysis is based on Synchro capacity analysis methodologies and procedures contained in the *Highway Capacity Manual*, 6<sup>th</sup> Edition (HCM), which is summarized in the appendix of this report. A discussion of the evaluation criteria and a summary of the results of the capacity analysis are presented below.

## 4.5.1 Capacity Analysis

Intersection capacity analysis was conducted using Synchro capacity analysis software for the study area intersections to evaluate the 2023 Existing, 2030 No Build, and 2030 Build with Improvements traffic conditions during the weekday morning, weekday afternoon, and Saturday midday peak hours. The 2030 No Build and 2030 Build conditions incorporate the proposed changes at the intersection of Washington Street (Route 1) at Thurston Street associated with the 500 Thurston Street gas station and convenience store development. The 2030 Build condition incorporates the proposed traffic signal at Washington Street (Route 1) at Hawes Street/Commerce Boulevard as well as the proposed signal updates and coordination along the Washington Street (Route 1) corridor between Thurston Street and Madison Street. As mentioned previously, the peak hour traffic volumes utilized as part of this analysis are provided in the traffic projection model attached in the appendix of this report.

The Synchro capacity analysis results for the 2023 Existing, 2030 No Build, and 2030 Build conditions are presented in the appendix. The capacity analysis results for the unsignalized intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard are presented in Table 4. The capacity analysis results for the signalized study area intersections are presented in Table 5. A more detailed summary of the capacity analysis and queue diagrams for each study area intersection is provided in the appendix of this report. The results of the specific capacity analysis at the study area intersections are discussed below.

|                  |      |       | Peak | 2023 Existing    |                    |                  | 2030 No Build |       |      |
|------------------|------|-------|------|------------------|--------------------|------------------|---------------|-------|------|
| Intersection     | Move | ement | Hour | LOS <sup>1</sup> | Delay <sup>2</sup> | V/C <sup>3</sup> | LOS           | Delay | V/C  |
| Washington Stree | t EB | LTR   | AM   | В                | 13.4               | 0.05             | С             | 15.3  | 0.04 |
| at Hawes Street/ |      |       | PM   | С                | 22.2               | 0.12             | С             | 23.9  | 0.10 |
| Site Driveway    |      |       | SAT  | В                | 11.8               | 0.04             | В             | 12.7  | 0.04 |
|                  | WB   | LTR   | AM   | Е                | 37.4               | 0.04             | Е             | 49.5  | 0.01 |
|                  |      |       | PM   | F                | 163.9              | 0.50             | F             | 273.2 | 0.52 |
|                  |      |       | SAT  | F                | 83.8               | 0.39             | F             | 156.9 | 0.53 |

Table 4: Unsignalized Intersection Capacity Analysis Results

1 Level-of-Service

2 Average vehicle delay in seconds

3 Volume to capacity ratio

As shown in Table 4 above, the eastbound Hawes Street approach of the intersection of Washington Street (Route 1) and Hawes Street/Commerce Boulevard is shown to currently operate at LOS B during the weekday morning peak hour, LOS C during the weekday afternoon peak hour, and LOS B during the Saturday midday peak hour. Under 2030 No Build conditions, the Hawes Street approach is shown to operate at LOS C during the weekday morning peak hour, LOS C during the weekday afternoon peak hour, and LOS B during the Saturday midday peak hour. Under 2030 No Build conditions, the Hawes Street approach is shown to operate at LOS C during the weekday morning peak hour, LOS C during the weekday afternoon peak hour, and LOS B during the Saturday midday peak hour. The westbound Commerce Boulevard approach is shown to operate at LOS E during the weekday morning peak hour and at LOS F during the weekday afternoon and Saturday midday peak periods under the 2023 Existing and 2030 No Build conditions. Under 2030 Build conditions, the intersection of Washington Street at Hawes Street/Commerce Boulevard would be signalized, and the operations are summarized in Table 5 below.

|                    | Peak | 2023 Existing    |                    | 2030 No Build    |     |       | 2030 Build |     |       |      |
|--------------------|------|------------------|--------------------|------------------|-----|-------|------------|-----|-------|------|
| Intersection       | Hour | LOS <sup>1</sup> | Delay <sup>2</sup> | ICU <sup>3</sup> | LOS | Delay | ICU        | LOS | Delay | ICU  |
| Washington Street  | AM   | В                | 11.3               | 0.71             | D   | 44.9  | 0.90       | С   | 31.3  | 0.90 |
| at Thurston Street | PM   | В                | 13.9               | 0.73             | С   | 27.6  | 0.88       | С   | 27.3  | 0.89 |
|                    | SAT  | А                | 9.3                | 0.49             | В   | 16.0  | 0.65       | В   | 18.2  | 0.65 |
| Washington Street  | AM   | n/a              | n/a                | n/a              | n/a | n/a   | n/a        | С   | 20.4  | 0.82 |
| at Hawes Street/   | PM   | n/a              | n/a                | n/a              | n/a | n/a   | n/a        | В   | 12.1  | 0.92 |
| Site Driveway      | SAT  | n/a              | n/a                | n/a              | n/a | n/a   | n/a        | В   | 10.2  | 0.68 |
| Washington Street  | AM   | В                | 14.8               | 0.81             | В   | 19.2  | 0.87       | В   | 12.1  | 0.90 |
| at Madison Street  | PM   | D                | 48.1               | 0.87             | Е   | 67.9  | 0.94       | С   | 27.9  | 0.95 |
|                    | SAT  | В                | 19.0               | 0.61             | В   | 19.7  | 0.65       | В   | 12.2  | 0.66 |

Table 5: Overall Signalized Intersection Capacity Analysis Results

1 Level-of-Service

2 Average vehicle delay in seconds

3 Intersection capacity utilization

As shown in Table 5 above, under 2023 Existing conditions the intersection of Washington Street (Route 1) at Thurston Street is shown to operate at an overall LOS B during the weekday morning and weekday afternoon peak hours and at overall LOS A during the Saturday midday peak hour. Under 2030 No Build conditions, the intersection is projected to operate at an overall LOS D during the weekday morning peak hour, overall LOS C during the weekday afternoon peak hour, and LOS B during the Saturday midday peak hour. Under 2030 Build conditions, the intersection is projected to operate at overall LOS C during the weekday afternoon peak hour, and LOS B during the Saturday midday peak hour. Under 2030 Build conditions, the intersection is projected to operate at overall LOS C during the saturday midday peak hour. Under 2030 Build conditions, the intersection peak hours and at overall LOS B during the Saturday midday peak hour.

With the proposed project and signalization of Hawes Street/Commerce Boulevard in place under 2030 Build conditions, the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard is projected to operate at overall LOS C during the weekday morning peak hour and at overall LOS B during the weekday afternoon and Saturday midday peak hours.

The intersection of Washington Street (Route 1) at Madison Street is shown to currently operate at overall LOS B during the weekday morning peak hour, overall LOS C during the weekday afternoon peak hour, and overall LOS B during the Saturday midday peak hour. Under 2030 No Build and 2030 Build conditions, operations during the weekday morning and Saturday midday peak periods are projected to be maintained at overall LOS B. During the weekday afternoon peak hour, the intersection is projected to operate at overall LOS E under 2030 No Build conditions.

Figures displaying the estimated 50<sup>th</sup> and 95<sup>th</sup> percentile queue lengths based on the Synchro capacity analysis for the three peak hours analyzed and under 2023 Existing, 2030 No Build, and 2030 Build conditions are included in the appendices of this report.

## 4.6 Conclusion

The analysis conducted for this SFEIR was based on turning movement counts taken in April 2023. These counted volumes were shown to be similar to or greater than the volumes approved by MassDOT for the FEIR, and were further adjusted upward based on estimated seasonal variation.

The proposed Wrentham Business Center project, including the warehouse and associated office space on Lot 3 and the gas station and convenience store on Lot 1, is estimated to result in a total of approximately 136 new vehicle trips (84 entering vehicles and 52 exiting vehicles) during the weekday morning peak hour, approximately 130 new vehicle trips (49 entering vehicles and 80 exiting vehicles) during the weekday afternoon peak hour, and approximately 242 vehicle trips (123 entering vehicles and 119 exiting vehicles) during the Saturday midday peak hour. The proposed Lot 1 and Lot 3 land uses are estimated to result in approximately 2,608 daily trips (1,304 entering vehicles and 1,304 exiting vehicles) during a typical weekday.

Signal warrant analysis was conducted at the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard. The analysis utilized the April 2023 weekday counted volumes, with the estimated exiting trips from the proposed Wrentham Business Center project added to the Commerce Boulevard approach. Based on this analysis, the intersection is shown to meet the Eight-Hour and Four-Hour vehicle volume warrants for a traffic signal.

Capacity analysis conducted at the study area intersections projects that overall delay at the study area intersections is not shown to be significantly increased under 2030 Build conditions compared to 2030 No Build conditions. Overall, with the proposed signalization of Washington Street (Route 1) at Hawes Street/Commerce Boulevard in place and the proposed adjustments made at the adjacent signalized intersections, the Wrentham Business Center project is not shown to have a major impact on traffic operations within the study area.

## 5.0 Greenhouse Gas Analysis

## 5.1 Greenhouse Gas Analysis

A revised greenhouse gas (GHG) emissions analysis was performed for Wrentham Business Center Lots 1 & 3, consistent with the EEA "Greenhouse Gas Emissions

Policy and Protocol" (May 5, 2010). The project will consist of two buildings: a 179,800-sf warehouse (including a 10,000-sf office) in Phase 2, and a 4,500-sf convenience store in Phase 3. The warehouse will be heated, but not air conditioned.

Since the FEIR, the following changes have been made to the Proposed Design, adopting recommendations made by DOER:

- 1. This report demonstrates compliance with the 2023 Stretch Code (see Table 6).
- 2. The Base Case and Appendix G Baseline eQUEST models for the warehouse have been modified to increase heating demand above 15 kBtu/sf-yr.
- 3. The warehouse space will use a Hybrid ASHP/Gas heating system with the ASHP equipment sized to 20% of peak heating demand. The reduction of gas use for heating with the Hybrid 20/100 design uses DOER's estimate of a 60% reduction.
- 4. The wall air infiltration has been reduced to 0.35 cfm/sf at 75 Pa test pressure and post- construction testing will be performed.
- 5. Heating systems will be equipped with Energy Recovery Ventilation (ERV) units designed for 70% heat recovery.
- 6. The U value for window units has been reduced to U=0.24.
- 7. All continuous insulation (c.i.) will be on the inside of concrete walls eliminating thermal bridging through cladding fasteners. The Project's architects will include all reasonable and feasible measures in the envelope design to minimize interior thermal bridging in the Detailed Design Plans, including c.i. at the wall-roof, wall-slab perimeter, and wallfooting intersections. All window and door units will have thermal breaks. The envelope performance described in this revised report is our best estimate of thermal performance after accounting for thermal bridging given the fact the Project is only at Concept Design.
- 8. Ten percent of the parking spaces near each building will be EV-ready. Two EV charging stations will be installed at each building.

GHG emissions for the Proposed Design are reduced by the following EEMs:

- Low-TEDI design with better than Code building envelopes.
- Energy Recovery Ventilation (ERV) units for all building spaces.
- Solar gain management via external shading of windows and low Solar Heat Gain Coefficient (SHGC<0.35).
- Higher efficiency than Code Air Source Heat Pumps (ASHPs) for office space

and convenience store.

- Hybrid ASHP/Gas heating for the manufacturing space with ASHPs sized to 20% of peak heating demand (Proposed Design 20/100).
- High efficiency heat pump hot water systems.
- Inside and exterior lighting systems LED with a lower light power density than Code
- Designating 80% of the building flat roofs as solar-ready space.

The GHG Policy requires a project to quantify CO<sub>2</sub> emissions and identify measures to avoid, minimize or mitigate such emissions, quantifying the effect in terms of energy savings and emissions reduction. Wrentham adopted the Stretch Code on January 1, 2022. CO<sub>2</sub> emissions were quantified for: (1) the <u>Base Case</u> corresponding to the 10th Edition of the Massachusetts Building Code that includes the 2021 IECC Commercial Code with MA amendments and the 2023 Stretch Code, and (2) the <u>Proposed Design</u>, which includes all energy saving measures, detailed in Section 5.5.3.

Compliance with the 2023 Stretch Code uses the Relative Performance Pathway that follows ASHRAE 90.1-2019 Section 4.2 Appendix G pathway with MA amendments. The compliance method compares a building's site energy use for the <u>App. G Baseline Case</u> (ASHRAE 90.1-2004) to the energy use of the <u>Proposed Design</u>. Compliance is demonstrated when a building's Performance Energy Index (PEI) for the Proposed Design is less than or equal to the PEI-target value. The results for this Project, presented in Table 6, confirm the Proposed Design complies with the 2023 Stretch Code with individual buildings demonstrating 11% to 32% improvement over the Stretch Code.

Regarding provisions of the 2023 Stretch Code as they apply to this Project, compliance is demonstrated as follows:

- C402.1.5, see wall assembly U values in Tables 4A and 4B.
- C402.3, see PV commitment listed above.
- C402.4, see fenestration U values in Tables 4A and 4B.
- C402.5, see air infiltration rate commitment listed above and in Tables 4A and 4B
- C402.7, see thermal bridging commitments listed above.
- C403.7, see ERV commitment listed above and in Tables 4A and 4B.
- C405.13, see EV-ready commitments listed above.
- C406.1, energy efficiency credits (see Tables 4A and 4B):

For the <u>convenience store</u> (Group M Occupancies): using renewable space heating (15 credits).

For the <u>office space</u> in the warehouse (Group B Occupancies): C406.2.4 10% cooling efficiency improvement = 4 credits, C406.3 reduced LPD = 7 credits, C406.2.3 renewable space heating = 15 credits, C406.8 enhanced envelope performance = 10 credits, for a subtotal (office) of 36 credits. For the <u>warehouse space</u> (Other Occupancies): C406.2.4 10% cooling efficiency improvement = 2 credits, C406.3 reduced LPD = 7 credits, C406.8 enhanced envelope performance = 5 credits, for a subtotal (warehouse) of 14 credits. Subtotals are weighted by the area of use, office space 6%, manufacturing space 94%. <u>Building total</u> credits = ((0.06\*36) + (0.94\*14)) = 15 credits.

• C407.2, PEI compliance demonstrated in Table 6.

## 5.2 Summary of Results

The Proponent commits to the  $CO_2$  reduction presented below, but retains the flexibility to achieve this goal using energy efficiency measures that may be refined at the stage of detailed design for the Project. Table 3 reveals that the <u>Proposed Design</u> will reduce  $CO_2$  emissions (for stationary sources) by 39.6% compared to the <u>Base Case</u>. As discussed in Section 5.3, Transportation Demand Management (TDM) measures for this project will reduce Project-related motor vehicle  $CO_2$  emissions by 2%. The net reduction of the Project's total  $CO_2$  emissions (stationary sources plus transportation) is 30.5% compared to the Base Case. Table 6 confirms the <u>Proposed Design</u> complies with the energy use reduction requirements of the 2023 Stretch Code with individual buildings demonstrating 11% to 32% improvement over the Stretch Code.

## 5.3 Transportation GHG Emissions

The transportation portion of the GHG analysis calculated emissions of  $CO_2$  for the traffic study area for three traffic analysis scenarios:

- 2030 No-Build
- 2030 Build without TDMs
- 2030 Build with TDMs

The vehicle miles traveled (VMT) for the major roadway segments in the traffic study area were calculated by multiplying the length of each road segment by the average daily traffic (ADT) volume on the segment. The  $CO_2$  emissions for each roadway segment were calculated with the EPA MOVES model. Average daily traffic volumes were provided by McMahon Associates, Inc. (Appendix B) presents the VMT and emission calculations.

Transportation CO<sub>2</sub> emissions are summarized in Table 1. The emissions listed for the No-Build and Build cases include both existing volumes on the roadway network and new project-generated trips. The project's transportation emissions are calculated by subtracting the No-Build values from those for the Build case without TDMs.

The Proponent is committed to a program of Transportation Demand Management (TDM) strategies to reduce employee and customer vehicle trips, listed below, and which in aggregate it is estimated will reduce  $CO_2$  transportation emissions by 2%.

• **Nearby Food Service** – There is an existing Italian restaurant (Luciano's) across Washington Street from the project site and within a short walk. There is also a full-service restaurant/bar in the Supercharged Entertainment building, as well as grab-and-go options at the truck stop across Washington Street from the Project site. It is also a part of the proposed Project to construct food service facilities in Phase 3.

• **Provide Bicycle Storage** – Bicycle racks will be provided within the project in convenient, weather-protected locations.

• **Transportation Coordinator** – The Proponent will designate a Transportation Coordinator to create programs to encourage the use of alternative modes of travel to single-occupancy vehicles.

• *Rideshare Matching* – The Proponent will establish a rideshare-matching program to match employees in carpools and/or vanpools on at least a quarterly basis. The services of MassRIDES may be enlisted to carry out this program.

### Table 1: Motor Vehicle CO<sub>2</sub> Emissions Summary

| 2030 No-Build   | 2030 Build without TDMs | 2030 Build with TDMs    |
|-----------------|-------------------------|-------------------------|
| 9,338.82 kg/day | 9,622.43 kg/day         | 9,616.76 kg/day         |
|                 | Project: 283.61 kg/day  | Project: 277.94 kg/day  |
|                 |                         |                         |
| 3,754.0 tons/yr | 3,868.0 tons/yr         | 3,865.8 tons/yr         |
|                 | Project: 114.01 tons/yr | Project: 111.73 tons/yr |

### Total Predicted CO<sub>2</sub> Emissions Burden

## 5.4 Greenhouse Gas (GHG) Mitigation Analysis

The GHG Policy requires that the Proponent identify measures to avoid, minimize, or mitigate GHG emissions. Section 5.5.1 presents the methodology and summary of results. Sections 5.5.2 through 5.5.6 discuss the Project's site, building design and proposed mitigation, infeasible efficiency measures, additional mitigation measures being studied further, and draft outline of a tenant manual.

## 5.5.1 Methodology and Results

A greenhouse gas (GHG) emissions analysis was performed for Wrentham Business Center Lots 1 & 3, consistent with the EEA "Greenhouse Gas Emissions Policy and Protocol" (May 5, 2010). The project will consist of two buildings: a 179,800 sf warehouse (including a 10,000 sf office) in Phase 2, and a 4,500 sf convenience store in Phase 3. All buildings will be core and shell construction for future tenants.

The warehouse will be heated, but not air conditioned. Due to the different heating and cooling demands of the warehouse vs. office spaces, and the fact the office space will have a ceiling height only one-quarter of that for the warehouse, energy use for the office was modeled in a separate run, and the results for the two building components were summed.

The GHG Policy requires a project to quantify carbon dioxide ( $CO_2$ ) emissions and identify measures to avoid, minimize or mitigate such emissions, quantifying the effect of proposed mitigation in terms of energy savings and emissions reduction. The GHG Policy requires quantification of GHG emissions from three sources: direct emissions from on-site stationary sources, indirect emissions from energy generated off-site (electricity), and traffic generated by the Project. The Project's GHG emissions will include: 1) direct emissions of  $CO_2$  from propane gas combustion for space heating; 2) indirect emissions of  $CO_2$  from electricity generated off-site and used on-site for lighting, building cooling and ventilation, and the operation of other equipment; and 3) transportation emissions of  $CO_2$  from Project traffic.

The GHG Policy requires a project to quantify CO<sub>2</sub> emissions and identify measures to avoid, minimize or mitigate such emissions, quantifying the effect in terms of energy savings and emissions reduction. Wrentham adopted the Stretch Code on January 1, 2022. CO<sub>2</sub> emissions were quantified for: (1) the <u>Base Case</u> corresponding to the 10th Edition of the Massachusetts Building Code that includes the 2021 IECC Commercial Code with MA amendments and the 2023 Stretch Code, and (2) the <u>Proposed Design</u>, which includes all energy saving measures, detailed in Section 5.5.3. Compliance with the 2023 Stretch Code uses the Relative Performance Pathway that follows ASHRAE 90.1-2019 Section 4.2 Appendix G pathway with MA amendments. The compliance method compares a building's site energy use for the <u>App. G Baseline Case</u> (ASHRAE 90.1-2004) to the energy use of the <u>Proposed Design</u>. Compliance is demonstrated when a building's Performance Energy Index (PEI) for the Proposed Design is less than or equal to the PEI-target value.

This analysis used the eQUEST energy design software (version 3.65.7175), which incorporates the U.S. Department of Energy's DOE-2 building energy use model, and CO<sub>2</sub> emission rates of 139.1 lb/MMBtu cubic feet of propane gasand 654 lb/MWhr electricity. The eQUEST model inputs are summarized in Tables 4A and 4B. Energy

use and CO<sub>2</sub> emissions are detailed in Tables 2A through 2D in Section 5.5.1, and the eQUEST model output is provided in Appendix A.

The Proponent commits to the CO<sub>2</sub> reduction presented below but retains the flexibility to achieve this goal using energy efficiency measures that may be refined at the stage of detailed design for the Project. Table 3 reveals that the <u>Proposed</u> <u>Design</u> will reduce CO<sub>2</sub> emissions (for stationary sources) by 39.6% compared to the <u>Base Case</u>. As discussed in Section 5.3, Transportation Demand Management (TDM) measures for this project will reduce Project-related motor vehicle CO<sub>2</sub> emissions by 2%. The net reduction of the Project's total CO<sub>2</sub> emissions (stationary sources plus transportation) is 30.5% compared to the Base Case. Table 6 confirms the <u>Proposed Design</u> complies with the energy use reduction requirements of the 2023 Stretch Code with individual buildings demonstrating 11% to 32% improvement over the Stretch Code.

### TABLE 2A ENERGY AND CO<sub>2</sub> MODELING - WAREHOUSE AND OFFICE

|   |          | indual integ                    | acter measu              |                         |                   |  |   |   |  |
|---|----------|---------------------------------|--------------------------|-------------------------|-------------------|--|---|---|--|
| Mitigation Measures - eQUEST Model Run                | GLA (sf) | Electrical<br>Usage<br>(MWh/yr) | Electrical<br>Change (%) | Gas Usage<br>(MMBtu/yr) | Gas<br>Change (%) | Heating<br>CO <sub>2</sub><br>Emissions<br>(tons/yr) | Electrical<br>CO <sub>2</sub><br>Emissions<br>(tons/yr) | Total CO <sub>2</sub><br>Emissions<br>(tons/yr) | CO <sub>2</sub><br>Emissions<br>Change (%) |
|   |          |                                 |                          |                         |                   |  |   |   |  |
| Base Case   | 179,800  | 584.67                          |                          | 1,651.10                |                   | 114.83   | 191.19  | 306.02  |  |
| Increased Roof Insulation                             |          | 583.70                          | -0.2%                    | 1,580.00                | -4.3%             | 109.89   | 190.87  | 300.76  | -1.7%                                      |
| Increased Wall Insulation                             |          | 581.76                          | -0.5%                    | 1,597.00                | -3.3%             | 111.07   | 190.24  | 301.31  | -1.5%                                      |
| Lower Window Unit U Value                             |          | 567.60                          | -2.9%                    | 1,334.10                | -19.2%            | 92.79  | 185.61  | 278.39  | -9.0%                                      |
| Lower Window Glass Area                               |          | 555.79                          | -4.9%                    | 1,483.00                | -10.2%            | 103.14   | 181.74  | 284.89  | -6.9%                                      |
| Lower Light Power Density                             |          | 550.00                          | -5.9%                    | 1,715.70                | 3.9%              | 119.33   | 179.85  | 299.18  | -2.2%                                      |
| Higher Gas Heating Efficiency and ASHPs (Office)      |          | 582.58                          | -0.4%                    | 1,392.10                | -15.7%            | 96.82  | 190.50  | 287.32  | -6.1%                                      |
| Heat Pump Hot Water Heaters                           |          | 534.84                          | -8.5%                    | 1,651.10                | 0.0%              | 114.83   | 174.89  | 289.73  | -5.3%                                      |
| Mitigtion Alternative with Warehouse 100% Gas Heating |          | 463.28                          | -20.8%                   | 1,149.50                | -30.4%            | 79.95  | 151.49  | 231.44  | -24.4%                                     |
| Proposed Design - Hybrid 20/100 Warehouse Heating     |          | 445.74                          | -23.8%                   | 459.80                  | -72.2%            | 31.98  | 145.76  | 177.74  | -41.9%                                     |

#### Effects of Individual Mitigation Measures

## TABLE 2B ENERGY AND CO2 MODELING - CONVENIENCE STORE 4,500 SF

#### Effects of Individual Mitigation Measures

| Mitigation Measures - eQUEST Model Run      | GLA (sf) | Electrical<br>Usage<br>(MWh/yr) | Electrical<br>Change (%) | Gas Usage<br>(MMBtu/yr) | Gas Change<br>(%) | Heating<br>CO <sub>2</sub><br>Emissions<br>(tons/yr) | Electrical<br>CO <sub>2</sub><br>Emissions<br>(tons/yr) | Total CO <sub>2</sub><br>Emissions<br>(tons/yr) | CO <sub>2</sub><br>Emissions<br>Change<br>(%) |
|---|----------|---------------------------------|--------------------------|-------------------------|-------------------|--|---|---|---|
|   |          |                                 |                          |                         |                   |  |   |   |   |
| Base Case                                   | 4,500    | 94.51                           |                          | 0.00                    |                   | 0.00   | 30.90   | 30.90   |   |
| Lower Window Area and Glass U Value         |          | 84.87                           | -10.2%                   | 0.00                    | 0.0%              | 0.00   | 27.75   | 27.75   | -10.2%  |
| Higher ASHP Efficiency                      |          | 91.95                           | -2.7%                    | 0.00                    | 0.0%              | 0.00   | 30.07   | 30.07   | -2.7%   |
| Lower Light Power Density                   |          | 91.75                           | -2.9%                    | 0.00                    | 0.0%              | 0.00   | 30.00   | 30.00   | -2.9%   |
| Heat Pump Hot Water Heaters                 |          | 90.43                           | -4.3%                    | 0.00                    | 0.0%              | 0.00   | 29.57   | 29.57   | -4.3%   |
| Higher Refrigeration Efficiency             |          | 91.51                           | -3.2%                    | 0.00                    | 0.0%              | 0.00   | 29.92   | 29.92   | -3.2%   |
| Proposed Design - All Measures Listed Above |          | 80.73                           | -14.6%                   | 0.00                    | 0.0%              | 0.00   | 26.40   | 26.40   | -14.6%  |

### TABLE 2C ENERGY AND CO<sub>2</sub> MODELING - WRENTHAM BUSINESS PARK LOTS 1 & 3

### **Outdoor Lighting for Public Areas and Internal Roadways**

| Mitigation Measures                     | Electrical<br>Usage<br>(MWh/yr) | Electrical<br>Change (%) | Gas Usage<br>(MMBtu/yr) | Gas<br>Change (%) | Heating<br>CO <sub>2</sub><br>Emissions<br>(tons/yr) | Electrical<br>CO <sub>2</sub><br>Emissions<br>(tons/yr) | Total CO2<br>Emissions<br>(tons/yr) | CO <sub>2</sub><br>Emissions<br>Change<br>(%) |
|---|---------------------------------|--------------------------|-------------------------|-------------------|--|---|-------------------------------------|---|
|   |                                 |                          |                         |                   |  |   |                                     |   |
| Base Case - Lighting Zone 2, 0.060 W/SF | 72.2                            |                          | 0.0                     |                   | 0.0  | 23.6  | 23.6                                |   |
| Proposed Design - LED Lights 0.035 W/SF | 42.1                            | -41.7%                   | 0.0                     | 0.0%              | 0.0  | 13.8  | 13.8                                | -41.7%  |

 TABLE 2D

 ENERGY AND CO2 MODELING - WRENTHAM BUSINESS PARK

 LOTS 1 & 3

 Totals for All Buildings and Outdoor Lighting

| Totals for All Buildings and Outdoor Lighting |  |  |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|--|--|
|   |  |  |  |  |  |  |  |  |  |

| All Buildings - Combined Mitigation | Electrical<br>Usage<br>(MWh/yr) | Electrical<br>Change (%) | Gas Usage<br>(MMBtu/yr) | Gas Change<br>(%) | Heating CO <sub>2</sub><br>Emissions<br>(tons/yr) | Electrical<br>CO <sub>2</sub><br>Emissions<br>(tons/yr) | Total CO <sub>2</sub><br>Emissions<br>(tons/yr) | CO <sub>2</sub><br>Emissions<br>Change<br>(%) |
|-------------------------------------|---------------------------------|--------------------------|-------------------------|-------------------|---|---|---|---|
|                                     |                                 |                          |                         |                   |   |   |   |   |
| Base Case - 2023 Stretch Code       | 751.4                           |                          | 1,651.1                 |                   | 114.8   | 245.7   | 360.5   |   |
| Proposed Design                     | 568.6                           | -24.3%                   | 459.8                   | -72.2%            | 32.0  | 185.9   | 217.9   | -39.6%  |

## TABLE 3 GREENHOUSE GAS (CO<sub>2</sub>) EMISSIONS SUMMARY FOR THE BASE CASE AND PROPOSED DESIGN (TONS/YEAR)

| Source                                    | Base Case<br>2023 Stretch Code | Proposed Design | Change in GHG<br>Emissions |
|---|--------------------------------|-----------------|----------------------------|
| Direct Emissions                          | 114.8                          | 32.0            | -72.2%                     |
| Indirect Emissions                        | 245.7                          | 185.9           | -24.3%                     |
| Subtotal Direct and<br>Indirect Emissions | 360.5                          | 217.9           | -39.6%                     |
| Transportation<br>Emissions               | 114.0                          | 111.7           | -2.0%                      |
| Total CO <sub>2</sub> Emissions           | 474.5                          | 329.6           | -30.5%                     |

### 5.5.2 Site Design Mitigation Measures

The Project will adopt all reasonable and feasible site design mitigation measures. The Project is committed to the following mitigation measures:

- No Irrigation for Landscaping Drought-resistant and native plants will be used for landscaping. There will be no irrigation on site for landscaping.
- Low Impact Development (LID) for Stormwater Design The design integrates landscaping and open space to generate less stormwater runoff. The storm management system will utilize Best Management Practices (BMP).

### 5.5.3 Building Design and Operation Mitigation Measures

The eQUEST energy model inputs are given in Tables 4A and 4B. The Proposed Design incorporates the following building energy efficiency measures.

• *Higher Efficiency Building Envelopes* – Building envelope insulation will exceed Code. For the warehouse building, the roof

insulation target is R40ci. For the convenience store, the target roof insulation value is R49 batt. The design will account for thermal bridging at the vertical wall as required in C402.7 and roof insulation thickness will be modified based on the design requirements for the roof-to-wall intersection to meet the target values.

For the warehouse building, the target concrete wall assembly value is U=0.0654 (equivalent to R15.3ci) after derating for all linear and point thermal bridging. Note the c.i. is on the inside of the concrete wall. For the convenience store, the target wood-framed wall assembly value is U=0.051 after derating for all linear and point thermal bridging.

The vision glass assembly will be double-glazed with thermal breaks and a U value below 0.25 and SHGC<0.30. Overall window areas will be 2% for the warehouse building and 9% for the convenience store. Aggregate wall assembly U values are provided in Table 5.

- Higher Efficiency Heating, Cooling, and Hot Water Systems Heating, hot water, and cooling systems will have better efficiencies than Code. All heating systems will have ERV with a design 70% heat recovery. The warehouse will only be heated, with no air conditioning, and will use a Hybrid 20/100 ASHP/Gas heating system in which the ASHP capacity is equal to 20% of the gas heating design capacity. In the warehouse space, ASHPs (10-ton) will provide heating and cooling (COP 3.6, IEER 21.0). The gas heating equipment will achieve 92% efficiency and will run for the coldest hours of the heating season. For the convenience store and the warehouse office, ASHPs will be used to provide heating and cooling (HSPF 10.0, SEER 20.0). In all buildings, hot water will be produced by heat pump hot water heaters with EF≥3.00.
- **Convenience Store Refrigeration Equipment**. In the convenience store, high efficiency refrigeration equipment will be selected to reduce electrical use by 5% below Code-rated units.
- **Energy Efficient Interior Lighting** High-efficiency LED fixtures will be used to reduce interior light power density.
- **Energy Efficient Exterior Lighting** Energy efficient LED fixtures will be used to light the public areas and interior roadways.
- *Water Conserving Fixtures* All buildings will have low-flow toilets and faucets.
- **Recycle Materials** Both buildings will have recycling areas for cardboard, paper, and plastics.

- Use Building Materials with Recycled Content, Building Materials that are manufactured in the Region – Whenever practical, environmentally friendly building materials will be used, including materials with recycled content, rapidly renewable building materials, and low-VOC materials. Also, when practical, the Project will purchase building materials that are manufactured within the region.
- Energy Efficiency Incentives for Commercial Projects The Project's electric supplier is National Grid, which offers "Whole-Building Approach Customer Incentives" for commercial buildings designed better than Code. The Proponent is pursuing design support and customer incentives offered by National Grid.

### 5.5.4 Infeasible Efficiency Measures

Other building design and operation mitigation measures were considered for the Project, but were rejected because they are either technically/financially infeasible or inappropriate for the Project:

- Reduce Energy Demand by Using Peak Shaving or Load Shifting Strategies These measures are not appropriate for buildings that must use power during peak periods.
- **Construct Green Roof** -- The proponent does not consider it technically, or economically, feasible to construct and maintain a green roof on flat-roof industrial and commercial buildings. Green roofs, which consist of layers of gravel, soil and vegetation atop a rubberized water-proof membrane, are expensive to install and maintain. They typically require a steel-reinforced concrete roof that can support a dead weight of 35 lb/sf and the installation cost exclusive of roof redesign is \$30/sf. While green roof technology has the potential to improve stormwater management on the Project and reduce overall energy costs, the significant additional costs (over \$5.6 million for the Project) related to the required engineering, construction and installation of the green roof is not economically feasible.

# TABLE 4A SUMMARY OF MODELING ASSUMPTIONS – WAREHOUSE WITH OFFICE

| Energy Efficiency<br>Measure (EEM)            | App. G Baseline<br>90.1-2004 <sup>2</sup>                   | Base Case<br>2023 Stretch Code <sup>1</sup>             | Proposed Design                          |  |
|---|---|---|--|--|
| Building Envelope<br>Mass Walls               | Roof U=0.063=R15ci<br>Wall U=0.084                          | Roof U=0.027=R36ci<br>Wall U=0.0765                     | Roof U=0.024=R40ci<br>Wall U=0.0654      |  |
| Glass Area % of Wall<br>Window Glass<br>Fixed | 6% - 31% <sup>3</sup><br>U=0.57, SHGC=0.39<br>DOE Type 2636 | 23% (see Table 5)<br>U=0.30, SHGC=0.38<br>DOE Type 2638 | 2%<br>U=0.24, SHGC=0.28<br>DOE Type 2668 |  |
| Wall Assembly U                               | 0.1132 – 0.2347 <sup>3</sup>                                | 0.1285  | 0.0689                                   |  |
| Air Infiltration<br>(cfm/sf wall @75Pa)       | Air Infiltration<br>(cfm/sf wall @75Pa)                     |   | 0.35                                     |  |
| Gas-Fired Heating                             | 80% Efficiency  | 80% Efficiency  | 92% Efficiency                           |  |
| DX Cooling (15 ton)                           | EER 10.8  | EER 11.9  | EER 11.9                                 |  |
| ASHPs VRF<br>Warehouse 10-ton                 |   |   | COP 3.6 (@47F)<br>IEER 21.0              |  |
| ASHPs VRF<br>Office 4-ton                     |   | HSPF 7.7<br>SEER 13.0                                   | HSPF 10.0<br>SEER 20.0                   |  |
| ERV   | No  | Yes, 70% heat recovery                                  | Yes, 70% heat recovery                   |  |
| Hot Water Heaters                             | Electrics, Storage Tank<br>EF = 0.72                        | Electric, Storage Tank<br>EF = 0.95                     | Electric, Heat Pump<br>EF ≥ 3.00         |  |
| Light Power Density<br>(W/SF)                 | Light Power Density<br>(W/SF)Warehouse 0.90<br>Office 1.10  |   | 0.35<br>0.50                             |  |
| Electric Plug Load<br>(W/SF)                  | Electric Plug Load<br>(W/SF) 0.25                           |   | Same as Baseline                         |  |
| Parking Lots<br>Lighting Zone 3               | 150 W/1,000 SF  | 60 W/1,000 SF   | 35 W/1,000 SF                            |  |

<sup>1</sup>ASHRAE 90.1-2019 with Mass. Stretch Code Amendments. See report section 1.1 for C406.1 credit calculation. <sup>2</sup>App. G Tables G3.4-5, G3.1, G3.6, G3.7, G3.1.1-2, -3 and -4 define the App. G Baseline that includes

gas-fired hot water boiler, DX cooling, and electric storage-tank hot water heater.

<sup>3</sup> App. G Table G3.1.1-1, window area: warehouse 6%, office 31%; wall assembly U: 0.1132 warehouse, 0.2347 office.

# TABLE 4BSUMMARY OF MODELING ASSUMPTIONS – CONVENIENCE STORE

| Energy Efficiency<br>Measure (EEM)            | App. G Baseline<br>90.1-2004 <sup>2</sup>              | Base Case<br>2023 Stretch Code <sup>1</sup> | Proposed Design                          |  |
|---|--|---|--|--|
| Building Envelope<br>Wood-Framed<br>2x6 16"OC | Roof U=0.063=R15ci<br>Wall U=0.084                     | Roof U=0.021=R49 batt<br>Wall U=0.051       | Roof U=0.021=R49 batt<br>Wall U=0.051    |  |
| Glass Area % of Wall<br>Window Glass<br>Fixed | 11% <sup>3</sup><br>U=0.57, SHGC=0.39<br>DOE Type 2636 | 30%<br>U=0.30, SHGC=0.38<br>DOE Type 2638   | 9%<br>U=0.24, SHGC=0.28<br>DOE Type 2668 |  |
| Wall Assembly U                               | 0.1375   | 0.1285                                      | 0.0671                                   |  |
| Air Infiltration<br>(cfm/sf wall @75Pa)       | 1.00   | 0.35  | 0.35                                     |  |
| Gas-Fired Heating                             | 80% Efficiency   |   |  |  |
| DX Cooling (15 ton)                           | EER 10.8   |   |  |  |
| ASHPs VRF 4- ton                              |  | HSPF 7.7<br>SEER 13.0                       | HSPF 10.0<br>SEER 20.0                   |  |
| ERV   | No   | Yes, 70% heat recovery                      | Yes, 70% heat recovery                   |  |
| Hot Water Heaters                             | Electric, Storage Tank<br>EF = 0.72                    | Electric, Storage Tank<br>EF = 0.95         | Electric, Heat Pump<br>EF ≥ 3.00         |  |
| Light Power Density<br>(W/SF)                 | 1.50   | 0.84  | 0.60                                     |  |
| Electric Plug Load<br>(W/SF) <sup>3</sup>     | 0.70   | Same as Baseline                            | Same as Baseline                         |  |
| Parking Lots<br>Lighting Zone 3               | 150 W/1,000 SF   | 60 W/1,000 SF                               | 35 W/1,000 SF                            |  |

<sup>1</sup>ASHRAE 90.1-2019 with Mass. Stretch Code Amendments. See report section 1.1 for C406.1 credit calculation. <sup>2</sup> App. G Tables G3.4-5, G3.1, G3.6, G3.8, G3.1.1-2, -3 and -4 define the App. G Baseline that includes gas-fired furnace, DX cooling, and gas-fired hot water heater. <sup>3</sup> Table G3.1.1-1.

| Building<br>Name        | Base Case<br>2023 Stretch Code   | Proposed<br>Design  | Improvement<br>in<br>U-Value |
|-------------------------|--|---|------------------------------|
| Warehouse<br>And Office | 76.7% (U=0.0765 wall) <sup>1</sup> +<br>23.3% (U=0.30 glass) =<br><b>U = 0.1285</b> <sup>2</sup> | 98% (U=0.0654 wall) +<br>2% (U=0.24 glass) =<br><b>U = 0.0689</b> | 46%                          |
| Convenience<br>Store    | 70% (U=0.055 wall) +<br>30% (U=0.30 glass) =<br><b>U = 0.1285</b>                                | 91% (U=0.050 wall) +<br>9% (U=0.24 glass) =<br><b>U = 0.0671</b>  | 47%                          |

TABLE 5AGGREGATE U VALUES FOR WALL ASSEMBLIES

<sup>1</sup> IECC 2021 Code value is U=0.090, reduced 15% for C406.8, Enhanced Envelope.

<sup>2</sup> Given the built wall U value of 0.0765, glass area is 23.3% so assembly = 0.1285, Section C402.1.5.1.

|   | Warehouse and Office 179,800 sf | Convenience<br>Store 4,500 sf |
|---|---------------------------------|-------------------------------|
|   |                                 |                               |
| Building Area Type (%)                  | 0.00(                           | 0.00/                         |
| Hotel                                   | 0.0%                            | 0.0%                          |
| Restaurant                              | 0.0%                            | 0.0%                          |
| Ketali<br>Morehouse                     | 0.0%                            | 100.0%                        |
| Others                                  | 94.4%                           | 0.0%                          |
| Others                                  | 5.0%                            | 0.0%                          |
|   | 0.410                           | 0.470                         |
| Calculation of PEI-target               |                                 |                               |
| BBUE (MMBtu) from eQUEST <sup>1</sup>   | 133                             | 7                             |
| BBRE (MMBtu) from eQUEST                | 6,740                           | 474                           |
| BBRE (MMBtu) External Load <sup>2</sup> | 0                               | 167                           |
| BBSE (MMBtu)                            | 6,873                           | 648                           |
| PEI-target                              | 0.427                           | 0.476                         |
| Proposed Building Site Energy           |                                 |                               |
| From eQUEST (MMBtu)                     | 1,981                           | 118                           |
| External Load (MMBtu)                   | 0                               | 157                           |
| Total Proposed Site Energy              | 1,981                           | 275                           |
| Performance Energy Index (PEI)          | 0.288                           | 0.424                         |
| Improvement Over Stretch Code           | 32%                             | 11%                           |
| Notes                                   |                                 |                               |
| 1 - Plug Load from eQUEST               |                                 |                               |
| 2 - Refrigeration                       |                                 |                               |

 TABLE 6

 RELATIVE PERFORMANCE PATHWAY COMPLIANCE RESULTS

## 5.5.5 Additional Energy Mitigation Measures

The following energy efficiency measures will be studied further during detailed building design:

**On-Site Photovoltaic (PV) System** - The Proponent affirms its commitment to designate 50% of the pitched-roof surface of the convenience store, and 80% of the flat-roof surface of warehouse, as solar ready, a total of 146,090 sf. PV capacity is calculated as approximately 1.46 MW using the ratio of 10 kW/1,000 sf of useable roof area. Silicon-based solar cell energy conversion efficiencies are in the range of 14-17%, and it depends on multiple factors.

The following cost feasibility analysis assumes the maximum potential of 1.46 MW for the site. The analysis uses the most recent data from the Massachusetts Energy and Environmental Affairs (EEA) website on Qualified Generation Units. The average installed cost for 1-2 MW size installations starting commercial operation in 2016-2018 is \$2.45/W. DOER replaced SREC-II incentives with the Solar Massachusetts Renewable Target (SMART) Program. Under the new SMART program, a stand-alone rooftop solar system can be built and operated without net-metering, and a 20-year fixed price is set. For National Grid, Block 8 projects over 1 MW in size receive an incentive of 0.11695/kWh. To this, \$0.02/kWh is added for a building-mounted system, yielding a total price of \$0.13695/kWh for this feasibility analysis.

Total potential installed capacity of 1.46 MW PV, flat-mounted, is projected to generate 1,738 MWh per year, which equates to 572 tons per year (tpy) in reduced GHG emissions, which is more than 100% of the Full Build Mitigation Case CO<sub>2</sub> emissions (see Table 3).

The economics of a PV installation were calculated using the EEA 2015 Revised SREC II Financial Model (model output is in Appendix C), with the following assumptions:

- PV system size of 1.46 MW
- System cost of \$2.45/Watt
- Annual capacity factor of 13.6% (Mass., flush mounted on roof)
- 20-year fixed, capacity-based rate of \$0.13695/kWh
- An inverter replacement cost of \$0.50/W

The calculations assume a reasonable customer discount rate of 6%, federal tax credits and State tax deductions. The calculated Net Present Value of the PV system -\$274,991 for a 1.46 MW system. The Simple Payback Period is 14 years. Based on market research, almost 90 percent of strong prospects would consider a payback of 4 years, but acceptance begins to drop rapidly once paybacks reach 5 years. The NPV is negative, suggesting a PV system near the maximum size of 1.46 MW is not cost feasible for the project. A smaller size system, which would earn a higher incentive price per kWh, may be cost feasible, given the current National Grid incentive structure. The Proponent affirms its commitment to designate 50% of the pitched-roof surface of the convenience store, and 80% of the flat-roof surface of the warehouse, as solar ready.

All-Electric Heating for the Warehouse – This section examines the first costs for equipment, comparing the Proposed Design with a Hybrid 20/100 ASHP/Gas heating system to the all-electric alternative of 100% ASHPs. The estimated peak heating design for the warehouse space is 2.4 MMBtu/hr, and the proposed design will use Cambridge Air Solutions Model S800 direct-fired heaters, with Blow-Thru<sup>™</sup> Space Heating Technology, which distributes warm air down to the floor of the warehouse and meets ASHRAE Code for outside fresh air. Each CAS unit supplies 0.631 MMBtu/h of heat. To achieve the design criterion of 2.4 MMBtu/h, four (4) CAS units will be installed at a cost of \$198,400.

The Proposed Design adds a set of ASHPs with heating capacity of 20% of 2.4 MMBtu = 0.48 MMBtu/hr. The recommended commercial-size ASHPs with high efficiency are 10-ton units and the MEP selected the AAON 10-ton ASHP (Model RN-010-3-0-K609-000) that has a design heat output of 0.12 MMBtu/h. The installed cost for four (4) AAON 10-ton is \$170,800. The total equipment cost for the Proposed Design is \$369,200.

The all-electric alternative has no gas-fired heaters, but it would require twenty (20) 10-ton ASHPs with an equipment cost of \$854,000. The all-electric alternative would impose an approximate \$500,000 additional equipment cost over the Proposed Design. The all-electric alternative would reduce CO2 emissions by 11 tons per year (4% of the Proposed Design emissions).

## 5.5.6 Summary

The all-electric alternative for warehouse heating compared to the Proposed Design would provide a small 4% reduction in  $CO_2$  emissions (11 tons) but it would impose an additional equipment cost of approximately \$500,000. For that reason, the Proponent considers the all-electric alternative as economically infeasible.

## 5.6 Draft Outline for Tenant Manual

It is assumed at this preliminary stage that the project will construct core-and-shell buildings for the warehouse and convenience store tenant. As part of the design phase of the project, the Proponent will implement a set of tenant guidelines in the Project Tenant Manual, which will either mandate or encourage specific sustainable measures, where applicable, reasonable and/or feasible for specific users. Each tenant and their design team will be provided with a copy of the Tenant Manual upon executing a lease. The Tenant Manual will include the following requirements:

• Where heating and cooling systems, or hot water heaters, are not provided by the lessor, the tenant will be required to design such systems with an efficiency equivalent to the Proposed Design values listed in Tables 4A and 4B.

- Where interior lighting is not provided by the lessor, the tenant will be required to design interior hard-wired lighting systems with light power densities (whole building method) equivalent to the Proposed Design values in Table 4A and 4B.
- The Proponent will provide to tenants a list of amenities within walking distance for tenants to pass on to their employees.
- The Proponent will encourage all tenants to collect and recycle cans, bottles, and paper.

Appendix A Certificate of the Secretary of Energy & Environmental Affairs on the FEIR for the Wrentham Business Center dated November 14, 2022.



Charles D. Baker GOVERNOR

Karyn E. Polito LIEUTENANT GOVERNOR

> Bethany A. Card SECRETARY

The Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs 100 Cambridge Street, Suite 900 Boston, MA 02114

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November 14, 2022

### CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS ON THE FINAL ENVIRONMENTAL IMPACT REPORT

PROJECT NAME PROJECT MUNICIPALITY PROJECT WATERSHED EEA NUMBER PROJECT PROPONENT DATE NOTICED IN MONITOR : Wrentham Business Center
: Wrentham
: Taunton
: 15765
: ND Acquisitions, LLC
: October 7, 2022

Pursuant to Section 11.08(8)(c)(2) of the MEPA regulations, I hereby determine that the Final Environmental Impact Report (FEIR) submitted for the project **does not adequately and properly comply** with the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00), and therefore requires the filing of a Supplemental FEIR (SFEIR). Specifically, I find that further analysis is required to satisfy the MEPA requirement that the project's environmental impacts and mitigation measures have been clearly described and analyzed prior to the close of MEPA review.

### Project Description and Procedural History

The project consists of a phased commercial development on three lots located in Wrentham. Phase 1, which was authorized to proceed under a Phase 1 Waiver that was previously granted, consists of the redevelopment of Lot 2 with a 116,000-square foot (sf) indoor go-cart facility with 200 parking spaces; this facility has already been constructed. Phase 2 consists of the construction of a 180,000-sf warehouse building with 121 parking spaces on Lot 3 and Phase 3 consists of the construction of a 2,200-sf drive through coffee shop and 3,350-sf family style restaurant with 150 parking spaces on Lot 1. Access to the site is proposed via an existing access driveway (Commerce Boulevard) onto Route 1 opposite Hawes Street. The project includes plans to redesign and signalize this intersection to address impacts associated with the increase in site traffic. The Proponent submitted an Expanded Environmental Notification Form (EENF) with a request for a Phase 1 Waiver that was published in the Environmental Monitor on September 20, 2017.<sup>1</sup> A Certificate and Draft Record of Decision were issued separately on November 29, 2017, proposing to grant the Phase 1 Waiver. A Final Record of Decision (FROD) was issued on December 27, 2017, allowing Phase 1 of the project to proceed prior to completion of a Draft Environmental Impact Report (DEIR) and FEIR for the remainder of the project.

### Project Site

The 31.2-acre project site is located off Route 1 (Washington Street) in Wrentham and was formerly a gravel pit. It is bounded by Washington Street on the west, an auto salvage yard and Rabbit Hill Pond to the south, a commercial property to the north, Rabbit Hill Brook and wetlands associated with an Outstanding Resource Water (ORW) to the east, an active cranberry bog to the northeast, and a capped landfill to the southeast. The project site gradually slopes from west to east toward Rabbit Hill Stream. Portions of the project site are located within a Zone A associated with a surface water supply (Lake Mirimichi) for the City of Attleboro. The site contains Bordering Vegetated Wetlands (BVW), Bank, Isolated Land Subject to Flooding (ISLF), and Bordering Land Subject to Flooding (BLSF).

The project site was previously a part of a proposed one million sf commercial development project that underwent MEPA review (EEA# 12259) concluding with a Certificate on the FEIR in 2002. The project was later abandoned due to lack of economic demand; however, preliminary site development was undertaken which included construction of an access roadway, underground utilities, and stormwater management controls including two stormwater basins that remain on the site. The site is generally cleared and leveled and includes  $\pm 3.4$  acres of impervious surface associated with an existing access road.

### Jurisdiction and Permitting

The project is undergoing MEPA review and is subject to preparation of a mandatory EIR pursuant to 301 CMR 11.03(6)(a)(6) and 11.03(1)(a)(2) because it requires Agency Action and will generate 3,000 or more new average daily trips (adt) on roadways providing access to a single location and create ten or more acres of impervious area. The project requires a Vehicular Access Permit from MassDOT. It is subject to the MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol.

The project will require a National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) from the U.S. Environmental Protection Agency (EPA). The Wrentham Conservation Commission (WCC) issued an Order of Conditions (OOC) for Phase 1 on January 3, 2018 and a separate OOC for Phase 2 on December 20, 2021; neither OOC was appealed.

Because the Proponent is not seeking Financial Assistance from the Commonwealth for the project, MEPA jurisdiction extends to those aspects of the project that are within the subject matter of required or potentially required Agency Actions and that may cause Damage to the Environment as defined in the MEPA regulations.

<sup>&</sup>lt;sup>1</sup> The Certificate on the DEIR issued November 15, 2022 incorrectly identified submission of the EENF and request for Phase 1 Waiver in 2021; the correct year is 2017.

### Environmental Impacts and Mitigation

Environmental impacts associated with Phase 1 included alteration of 2.6 acres of land, generation of 328 new adt on a weekday and 372 adt on a Saturday, and creation of 200 parking spaces. Proposed buildings and other impervious area were developed within existing impervious area (1.6 acres). Environmental impacts associated with Phases 2 and 3 include alteration of 23 acres of land, creation of 11.4 acres of impervious area, generation of 2,608 new adt, and creation of 271 parking spaces. At full build out, cumulative impacts associated with all phases of the project will result in alteration of 25.6 acres of land, creation of 11.4 acres of new impervious area (total of 14.8 acres on-site), generation of 2,936 adt; and construction of 471 parking spaces.

Measures to avoid, minimize and mitigate Damage to the Environment include redevelopment of an altered site; maintenance of a 50-foot buffer zone around resource areas; construction of sidewalks along the entire site frontage and other pedestrian connections; implementation of traffic signal coordination along Route 1; implementation of transportation demand management (TDM) measures; air source heat pumps (ASHPs) for the two restaurants and warehouse office; electric vehicle (EV) charging stations and EV conduit; installation of stormwater management measures including low impact development (LID) measures; and use of construction period best management practices (BMPs). As discussed below, mitigation for GHG emissions and traffic impacts has yet to be finalized.

### Review of the FEIR

The FEIR describes the project, provides plans of existing and proposed site conditions, estimates the project's impacts on transportation and drainage, and identifies proposed mitigation measures. It reviews potential climate change impacts to the site, describes design measures intended to increase the site's resiliency and provides a revised GHG analysis. It describes project components and associated environmental impacts and mitigation measures associated with each phase of the project. Supplemental information, which confirmed that the Town of Wrentham has adopted the MA Stretch Code and included an update to the energy modeling for the Base Case scenario, was submitted on October 14, 2022. For purposes of clarity, all supplemental materials are included in references to "FEIR" unless otherwise indicated.

### Wetlands and Stormwater

The WCC reviewed Phases 1 and 2 for their consistency with the Wetlands Protection Act (WPA), Wetlands Regulations (310 CMR 10.00) and associated performance standards, including stormwater management standards (SMS), and issued separate OOCs on January 3, 2018 and December 20, 2021, respectively; neither OOC was appealed. Phase 2 includes work in 50,000 sf of buffer zone to BVW associated with removal of an existing stormwater basin that lies within the Zone A Wellhead Protection Area, construction of portions of a proposed surface stormwater infiltration basin (outside the Zone A), construction of a driveway and retaining wall (within the Zone A), and construction of a gravel driveway to access an abutting bog. The FEIR affirms that the project will maintain a 50-foot No Disturb Zone around all wetland resource areas.

Two existing storm water management basins (fully vegetated) are located on Lots 2 and 3, which were constructed in 2003 as part of the anticipated development that was not advanced. As

previously mentioned, Phase 2 will remove the basin on Lot 3 within the Zone A and reconstruct it outside the Zone A. The FEIR addresses the jurisdiction status of the existing stormwater basin to be decommissioned and filled as it relates to the definition of a "Pond" pursuant to 310 CMR 10.04. It indicates that during discussion of the Abbreviated Notice of Resource Area Delineation (ANRAD) on July 22, 2021, the WCC was asked to confirm that storm water basin (B-1) was not jurisdictional, and the WCC confirmed that interpretation.<sup>2</sup>

The project includes installation of a stormwater management system that exceeds requirements identified in the SMS and local by-laws. Several man-made ponds for surface water management and roof runoff will be used to provide groundwater recharge. Pretreated surface runoff from parking lots and roadways will also be partially used to recharge groundwater. Rabbit Hill Brook has been designated as an ORW as a tributary to a surface water supply and requires enhanced storm water management under 310 CMR 10.00 and the SMS to provide further treatment of runoff prior to discharge to the new storm water basin proposed on Lot 3. Treatment measures include a separate roof drain system to directly discharge clean runoff from roofs to the infiltration system, and tree box filters where possible in addition to deep sump catch basins. The FEIR indicates that an updated storm water design for the project was submitted for local review by the Wrentham Planning Board and WCC (and also peer reviewed) to demonstrate the efficacy of the drainage system (Appendix E).

### Traffic and Transportation

The project abuts Route 1 (Washington Street), a state highway; therefore, a MassDOT Vehicular Access Permit is required. The FEIR includes an updated Transportation Impact Assessment (TIA) prepared in conformance with the current MassDOT/EOEEA *Transportation Impact Assessment Guidelines*. The study includes an assessment of the transportation impacts of the project and analysis of site access in the immediate vicinity of the project. At present, there is an approved MassDOT project in the design stage to improve conditions along this corridor. According to MassDOT comments, there are still some key concerns raised in the MassDOT comment letter on the DEIR that are not addressed in the FEIR as described further below; these outstanding concerns should be addressed in the SFEIR. Although the Proponent met with MassDOT during preparation of the FEIR (December 2021) to discuss technical issues associated with the TIA, the Proponent did not follow up with MassDOT to address some of the issues regarding phasing and timing of implementation of the mitigation program.

Site access is proposed via an existing access driveway (Commerce Boulevard) onto Route 1 opposite Hawes Street. The Proponent proposes to redesign and signalize this intersection to address impacts associated with the increase in site traffic. The DEIR included a traffic signal warrant analysis (TSWA), which indicated that this intersection meets Warrants 1, 2, and 3 under 2028 Build conditions. However, MassDOT comments on the DEIR identified concerns regarding the immediate installation of the traffic signal on Route 1 based on the use of future volumes as justification because it normally requires provision of traffic counts. In this particular case, if Phase 3 is delayed to a later date, it is unlikely that the traffic signal would be approved because Phase 2 is unlikely to generate enough traffic to meet signal warrants to justify installation of the traffic signal. The FEIR provides a discussion of the timing and need for the signal at the site access driveway and existing safety concerns along the Route 1 corridor due to high traffic volumes on Route 1 and turning movements at the numerous driveways along Route 1 in this area. While the FEIR includes a revised TSWA in response to MassDOT

<sup>&</sup>lt;sup>2</sup> The FEIR includes a copy of the minutes of the meeting on July 22, 2022 in Appendix B.

comments, it continues to use future volumes to justify installation of the traffic signal during Phase 2. The Proponent was directed to work with MassDOT during preparation of the FEIR to clarify the schedule of the project, and if necessary, discuss an interim access plan for Phase 2 only. The FEIR indicates that the Proponent does not anticipate interim access to be necessary prior to construction and occupation of the warehouse; however, this assumption was not confirmed with MassDOT during consultation and MassDOT comments indicate that the FEIR does not offer a clear timeline for advancing Phase 3.

I received comments from several abutters and residents which identify concerns regarding project-related traffic, safety and operation of adjacent uses. These comments (from Attorney Jonathan M. Silverstein, submitted on behalf of the owners of four abutting or adjacent properties; a resident of Hawes Street; and Turnpike Truck Parts) indicate that the project, coupled with the proposed signalization and signage of Route 1/Hawes Street will impact the functioning/safety of Hawes Street and the developability of lots with frontage on Hawes Street; has not provided connectivity to allow internal circulation with the abutting property to the north (579 Washington Street) to improve safety and traffic flow; has not evaluated an alternative to move the proposed signal further north to provide better spacing of traffic signals along the corridor, mitigate queuing that will prevent left-turns into adjacent properties, and avoid overuse and cut-through traffic of Hawes Street; and has not identified potential access to Commerce Boulevard for Turnpike Truck Parts to mitigate potential impacts to existing access to Interstate 495 (I-495).

The FEIR indicates that a future vision for comprehensive bicycle and pedestrian accommodations on the Route 1 corridor has not been identified by MassDOT. Once a future corridor plan has been identified, the Proponent will work with MassDOT to implement pedestrian and/or bicycle accommodations within the existing right-of-way adjacent to the project site that work towards the planned vision. The Proponent is reminded that any proposed improvement on state highways should be consistent with the MassDOT Healthy Transportation Initiative. The Proponent should continue discussions with MassDOT to obtain any necessary waivers if bicycle facilities cannot be provided along Route 1.

The Greater Attleboro Taunton Regional Transit Authority (GATRA) provides fixed route bus service (Route 14) along Route 1 in the Town of Plainville,  $\pm 2.5$  miles to the south of the project site. The Proponent met with GATRA in October 2021 to discuss the potential for extending fixed route bus service along Route 1. The project site is currently served by micro-transit services including GATRA-GO, an on-demand service that allows riders to request same-day service for transportation services. The FEIR does not describe any additional consultations between the Proponent and GATRA during preparation of the FEIR nor does it document the input from GATRA regarding infrastructure needed to support the service extension. The Proponent will continue to coordinate with GATRA and has proposed internal site infrastructure to support transit service to the project site. The Proponent should work toward identifying the details of TDM measures and consult with the local Transportation Management Association to help implement the TDM program.

### Greenhouse Gas Emissions

The FEIR includes a revised GHG analysis which generally responds to recommendations outlined in the comments from the Massachusetts Department of Energy Resources (DOER) on the

DEIR. The SFEIR should provide further evaluation of DOER recommendations as described in the Scope below. The FEIR provides the following analyses and clarifications to the project:

- Use of ASHPs for space heating and cooling in both restaurants and the warehouse office
- Analysis of a hybrid space heating approach in the warehouse (this measure was not adopted)
- Review of lower air infiltration (0.25 cfm/SF at 75 Pa) for the restaurants with results showing an insignificant (<1%) change in energy use compared to Code (0.40 cfm/SF at 75 Pa). A lower air infiltration rate was considered impractical in the warehouse given the large number of 90-sf overhead doors at the loading docks that cannot be perfectly sealed (this measure was not adopted for restaurant or warehouse buildings)
- Section C406.1 extra efficiency options for the warehouse and office are:
  - More efficient HVAC performance (Section C406.2)
  - Reduced lighting power density (LPD) (Section C406.3)
  - Enhanced envelope performance (Section C406.8)
- Section C406.1 extra efficiency options for the restaurants are:
  - More efficient HVAC performance (Section C406.2)
  - Reduced lighting power density (LPD) (Section C406.3)
  - High-efficiency service water heating (Section C406.7)
- Installation of two EV charging stations for the warehouse building and EV conduit for an additional five spaces with a similar commitment for the two restaurant buildings in Phase 3
- Enhanced roof insulation for restaurants (R40 batt) and for warehouse/office (R36ci)

The project will be required to meet the applicable version of the Stretch Code, which requires a 10% energy performance improvement over ASHRAE 90.1-2013-Appendix G plus Massachusetts amendments including C402.1.5 (envelope), C405.3 and C405.4 (lighting), C405.10 (EV charging), and C406 (three additional efficiency measures – identified above for each use).

The project's overall stationary source CO<sub>2</sub> emissions were estimated at 367.4 tons per year (tpy) in the Base Case. According to the FEIR, the mitigation measures included in the Preferred Case will reduce GHG emissions to 312.1 tpy, a reduction of 55.3 tpy (15.0%). Total project-related emissions are 438.0 tpy (stationary and mobile source) and will be reduced by 56.8 tpy for a  $\pm 13.0\%$  reduction. DOER comments indicate the mitigation level for stationary sources for the warehouse is 8%, when considering energy efficiency improvements already required under the Stretch Code. DOER continues to urge further measures to reduce GHG emissions from building energy use.

DOER comments indicate that the project would benefit significantly from efficient electrification of space heating (using electric ASHPs), which would reduce both emissions and lower operating costs. As currently proposed, the project is using propane for space heating of the warehouse. DOER comments indicate that propane is the highest cost and highest emissions heating approach and is not preferred. The DEIR evaluated efficient electric space heating which indicated this approach would have lower emissions and cost less than currently proposed. Despite these findings, the project did not commit to efficient electric space heating or hybrid electrification of space heating.

As stated in DOER comments, while the FEIR analyzed a "hybrid" electrification approach as an alternative, the analysis assumed a fully redundant system using both propane and ASHP for the full energy load of the building; accordingly, the cost estimate for this approach was almost 70% higher than

what would be expected of the hybrid system recommended by DOER. According to DOER comments, a true hybrid approach that uses electric heat pumps as a primary heating source (sized to provide 20% of the space heating load) and fuel as a secondary heating source (sized to provide 100% of the space heating load) would increase the mitigation level from 8% to 29% and reduce overall operating costs for the building. The SFEIR should evaluate the hybrid space heating approach recommended by DOER, which assumes use of electric heat pumps as a primary heating source (sized to provide 20% of the space heating load) and fuel as a secondary heating source (sized to provide 100% of the space heating load). This hybrid approach, which results in significant mitigation ( $\pm 60$  lower emissions than propane heating), is in the same cost ballpark as the proposed all-propane system (\$2.42/sf compared to \$1.00/sf). According to DOER comments, operating costs for a hybrid system are much less than those proposed; however, there appears to be errors in the energy model which underestimate warehouse space heating by a factor of about five. When space heating is corrected, the cost savings and emissions reductions associated with swapping from propane heating to efficient electric heating are multiple times larger than characterized in the FEIR. The FEIR concludes that the swap would save \$5,166 per year and result in a  $\pm 5\%$  reduction in emissions; in fact, the swap would save between \$28,000 (17%) improvement compared to Code) and \$49,000 (26% improvement compared to code), depending on assumed cost of propane, and result in  $\pm 29\%$  less emissions. The Proponent should consult with DOER on the revised GHG analysis to ensure accuracy prior to filing the SFEIR.

### Adaptation and Resiliency

The project will comply with the SMS and include separation of drainage paths, recharge of clean storm water, use of green infrastructure (tree box filters), and maintenance of a significant amount of green space. The storm water design will use the Northeast Regional Climate Center (NRCC) runoff volumes instead of the TP40 values to address larger and more frequent storms. According to the FEIR, the project storm water design was based on the current 2-inch, 2-year, 10-year, 50-year, and 100-year storm events. The Climate Resilience Design Standards Tool developed by the Resilient MA Action Team (RMAT) estimated a high exposure to urban flooding and riverine flooding. The storm return period recommendation for 2070 was identified as the 10-year storm event with a rainfall projection of 7.1 inches over a 24-hour period. The 100-year design storm for the project is 8.8 inches over a 24-hour period, which is 24% larger than the rainfall volume associated with the 2070 10-year storm. I note, however, that the 10-year storm recommendation appears to be based on a "low" criticality assessment (based on user inputs) of the building asset. For medium to high critical assets with a 2070 planning horizon (11 to 50 years), the Tool recommends planning for a 2070 25-year to 50-year storm event. The Proponent should continue to evaluate future storm scenarios in estimating the efficacy of the stormwater management system, and maximize opportunities for resiliency on the site.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), (Map No. 25021C0341E, effective date July 17, 2012), Rabbit Hill Stream to the east of the project site is mapped as Zone AE with a Base Flood Elevation (BFE) up to 185 feet.<sup>3</sup> The finished floor of the proposed warehouse building is at elevation 208 feet (23 feet above the BFE), which appears to be resilient to future storm conditions.

<sup>&</sup>lt;sup>3</sup> All elevations referenced in this Certificate are based on North American Vertical Datum of 1988 (NAVD88) unless otherwise specified.

### Conclusion

As noted above, the FEIR did not adequately address the requirements of the Scope included in the DEIR Certificate. In particular, comments from MassDOT and DOER identify additional information and analysis requested in the agency's comments on the DEIR that will be required to determine whether impacts will be avoided, minimized, and mitigated to the extent feasible and to demonstrate compliance with permitting requirements. Accordingly, I am requiring the Proponent to file an SFEIR in accordance with the limited Scope below.

### SCOPE

### General

The SFEIR should follow Section 11.07 of the MEPA regulations for outline and content, and include the information and analyses identified in this Scope. It should clearly demonstrate that the Proponent has sought to avoid, minimize and mitigate Damage to the Environment to the maximum extent feasible. The SFEIR should provide an update on state and local permitting required for the project.

The information and analyses identified in this Scope should be addressed within the main body of the SFEIR and not in appendices. In general, appendices should be used only to provide raw data, such as drainage calculations, traffic counts, capacity analyses and energy modeling, that is otherwise adequately summarized with text, tables and figures within the main body of the SFEIR. Information provided in appendices should be indexed with page numbers and separated by tabs, or, if provided in electronic format, include links to individual sections. Any references in the SFEIR to materials provided in an appendix should include specific page numbers to facilitate review.

### Traffic and Transportation

As previously mentioned, MassDOT comments indicate the FEIR does not address some key concerns raised in its comments on the DEIR. The SFEIR should provide a comprehensive response to MassDOT comments, which are incorporated by reference herein.

MassDOT comments on the DEIR specifically indicated that future volumes were not to be used to conduct the TSWA and justify the installation of a traffic signal. Although the TSWA was revised in the FEIR, it is still based on 2028 Build volume projections on Route 1, instead of Route 1 traffic volumes at site occupancy as directed by MassDOT. The SFEIR should include a revised TSWA as directed by MassDOT. The SFEIR should also provide a clear timeline to advance Phase 3 and describe an interim access plan that does not include the traffic signal as requested by MassDOT.

The Proponent indicated that properties south of the site along Route 1 could be provided access to the proposed traffic signal at the project site driveway via an internal shared roadway connection to allow traffic from these sites the ability to safely reverse direction towards Route 1 southbound to access I-495. While the Proponent has accounted for the trips associated with the Turnpike Truck Parts (TTP)
facility in the TSWA, it was vague on any arrangement with the owner of the TTP site to facilitate or implement this connection. The SFEIR should incorporate the shared access into the project site plan and document initial approval or formal arrangement to justify these volumes in their analysis. Furthermore, the SFEIR should address the need to modify the site driveway of the TTP site to ensure it operates as a right-in, right-out driveway to prevent unsafe maneuvers on Route 1. The SFEIR should provide a discussion of the alternative access to the project site as described in the comment letter from Attorney Silverstein.

The Proponent is directed to continue consultation with appropriate MassDOT units to address their comments including revising the TSWA, reviewing access management along the Route 1 corridor in the vicinity of the site and documenting any agreement/arrangement in place to facilitate the implementation of an access management plan. The SFEIR should describe the consultations undertaken with MassDOT and include a revised commitment letter to MassDOT once these details have been finalized. The Draft Section 61 Finding will be the basis for MassDOT to issue a final Section 61 Finding for the project.

#### Greenhouse Gas Emissions

The FSEIR should include a revised GHG analysis prepared in accordance with the GHG Policy, guidance and recommendations provided in the detailed comment letter submitted by DOER, which is incorporated in this Certificate in its entirety. The SFEIR should contain the following analysis and evaluations recommended in DOER comments:

- 1. Provide a revised analysis of the warehouse energy use with a heating end use in the order of 15 kBtu/sf-yr consistent with other warehouse buildings in our climate zone
- 2. Evaluate hybrid electric/propane heating system consisting of an ASHP system sized to 20% of the space peak heating, used for primary heating, plus a propane heating system sized to 100% of the space peak heating, used for secondary heating, which incorporates the following (consistent with the pricing information provided in the FEIR):
  - a. Heat pump and other necessary supporting infrastructure should price at about \$1.42/sf, or, about 20% of the pricing for this equipment and infrastructure already provided
  - b. Propane heating should price at about \$1.00/sf, which would be same pricing as already provided

Evaluation range operating costs should capture the uncertainty in commercial propane costs with a recommended propane range: low (\$30.43/Mmbtu, the value provided in the FEIR) and high (\$39/Mmbtu, most up to date EIA residential propane cost).

- 3. Calculate a 30-year total heating end use carbon footprint to better evaluate heating emissions life cycle of all-propane heating scenario versus hybrid electric/propane heating scenario (e.g., total carbon footprint associated with heating end use, period 2022 through 2052, units of tons) for these two scenarios using the following:
  - a. Propane emissions of 139 lbs/Mmbtu
  - b. Electric grid emissions as follows:
    - i. Year 2022: 633 lbs/MWhr
    - ii. Year 2052: 200 lbs/MWhr

- iii. Linearly interpolate in-between years
- 4. Estimate the following:
  - a. costs to retrofit the building to convert from all-propane heating to hybrid electric/propane heating scenario at some point in the future, which includes premium costs to undertake retrofit while building is in service
  - b. total operating cost, period 2022 through 2052, for the all-propane and hybrid propane/electric scenarios

#### Mitigation and Draft Section 61 Findings

The SFEIR should include a separate chapter summarizing all proposed mitigation measures, including construction-period measures. The SFEIR should contain clear commitments to implement these mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and a schedule for implementation. The list of commitments should be provided in a tabular format organized by subject matter (traffic, water/wastewater, GHG, environmental justice, construction period, etc.) and identify the Agency Action or Permit associated with each category of impact. Revised draft Section 61 Findings should be separately included for each Agency Action to be taken on the project. The SFEIR should clearly indicate which mitigation measures will be constructed or implemented based upon project phasing, either tying mitigation commitments to overall project square footage/phase or environmental impact thresholds, to ensure that adequate measures are in place to mitigate impacts associated with each development phase.

The SFEIR should include a commitment to provide a GHG self-certification to the MEPA Office prior to issuance of building permits. It should be signed by an appropriate professional (e.g. engineer, architect, transportation planner, general contractor) indicating that all of the GHG mitigation measures, or equivalent measures that are designed to collectively achieve identified reductions in stationary source GHG emission and transportation-related measures, have been incorporated into the project. The commitment to provide this self-certification in the manner outlined above shall be incorporated into the draft Section 61 Findings included in the SFIR.

#### Response to Comments

The SFEIR should contain a copy of this Certificate, and a copy of each comment letter received on the FEIR. It should include a comprehensive response to comments on the FEIR that specifically address each issue raised in the comment letter; references to a chapter or sections of the SFEIR alone are not adequate and should only be used, with reference to specific page numbers, to support a direct response. This directive is not intended to, and shall not be construed to, enlarge the Scope of the SFEIR beyond what has been expressly identified in this certificate.

#### Circulation

In accordance with 301 CMR 11.16, the Proponent should circulate the SFEIR to each Person or Agency who commented on the ENF, DEIR or FEIR, each Agency from which the project will seek Permits, Land Transfers or Financial Assistance, and to any other Agency or Person identified in the Scope. Pursuant to 301 CMR 11.16(5), the Proponent may circulate copies of the SFEIR to commenters

in a digital format (e.g., CD-ROM, USB drive) or post to an online website. However, the Proponent should make available a reasonable number of hard copies to accommodate those without convenient access to a computer to be distributed upon request on a first come, first served basis. The Proponent should send correspondence accompanying the digital copy or identifying the web address of the online version of the SFEIR indicating that hard copies are available upon request, noting relevant comment deadlines, and appropriate addresses for submission of comments. A copy of the SFEIR should be made available for review in the Wrentham Public Library.

November 14, 2022 Date

Bethany A. Card

Comments received:

11/07/2022 Massachusetts Department of Environmental Protection (MassDEP) – Southeast Regional Office (SERO)
11/07/2022 Blatman, Bobrowski, Haverty & Silverstein, LLC on behalf of the owners of four properties either abutting or directly across the street from the project site
11/07/2022 Andrew Gordon
11/07/2022 Ro Welling
11/10/2022 Massachusetts Department of Transportation (MassDOT)
11/10/2022 Massachusetts Department of Energy Resources (DOER)

BAC/PPP/ppp

| From:        | Andrew Gordon  |
|--------------|--|
| To:          | Patel, Purvi (EEA)   |
| Cc:          | Harvey Gordon  |
| Subject:     | WRENTHAM BUSINESS CENTER (EOEA #15765)                       |
| Date:        | Monday, November 7, 2022 4:59:32 PM                          |
| Attachments: | WRENTHAM BUSINESS CENTER EOEA 15765 Turnpike Truck parts.pdf |

CAUTION: This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Good evening Purvi,

Please find attached a comment letter on behalf of Turnpike Truck Parts of Wrentham.

Thank you for the opportunity, and please feel free to contact me if you have any questions or concerns.

Thank you, Andrew Gordon Turnpike Truck Parts of Wrentham 781.879.3883 andrewpgordon@gmail.com BY EMAIL: purvi.patel@mass.gov

Secretary Kathleen A. Theoharides Executive Office of Energy & Environmental Affairs 100 Cambridge St. Suite 900 Attn: MEPA Office Boston MA 02114

#### RE: WRENTHAM BUSINESS CENTER (EOEA #15765)

Dear Secretary Theoharides:

We appreciate your careful review and consideration for this project.

Our family is the owner of several properties (687-805 Washington Street) on Route 1 in Wrentham just south of the proposed Wrentham Business Center Project. The Project proposes a new traffic signal at the intersection of Route 1/Commerce/Hawes that will effectively eliminate our current access to Route 1 south which is a critical travel pattern for us given our need to access Interstate 495.

Since Phase 3 of the project has not yet been proposed, we are waiting to see what the proposed access for our property would look like. Without that, the potential impact of this on our existing and future operations is significantly detrimental. Furthermore, the proposed stoplight poses a significant risk to our drivers and customers by restricting their travel movements or proposing that they cross additional busy lanes of traffic extremely close to an intersection while vehicles are merging.

We are writing to notify you that the proposed signal represents a substantial risk to our business and general safety unless the Project provides suitable alternate access. We are currently working cooperatively with the applicant to solve the problem and hope for an equitable outcome but are providing this comment for the purposes of your on-going review because such access has not yet been provided.

Furthermore, during our review of the proposal, we noticed a number of inconsistencies with the measurements and reporting which indicate that the traffic impact of the project will be significantly larger than the DEIR reflects. Our goal is to make sure that the most accurate figures are used for the benefit of the neighborhood and overall community, and to enable proper mitigation so that projects can be implemented successfully.

#### **Current Traffic Conditions**

The DEIR description of traffic at the site does not accurately reflect the current conditions at the site. The FEIR acknowledges on page 45 that southbound queues extend back from Madison St, but do not describe the extent to which they extend back.

Currently, during the afternoon peak hours, traffic backs up over 2,000 ft from the Madison st stoplight Southbound to a near standstill. This can be regularly observed at the site. Pictures from Interstate Travel Plaza showing the queue are included in Exhibit A.

The DEIR certificate references that the LOS analysis are expected to be LOS C or better. However, the current conditions on the site are worse than LOS C considering that the travel speeds in the afternoon peak hour are currently under 15 mph with a queue of over 2,000 ft.

The FEIR states that "The potential detector adjustment is not reflected in the analysis provided as part of this FEIR but can be incorporated into future filings with MassDOT should MassDOT be interested in pursuing this adjustment. "Any project in this corridor must include these changes before more traffic is added to the corridor.

#### 2019 Traffic Volume Assumptions

As we read through the logic and data in the DEIR justifying the current traffic volumes and conditions at the site, we noticed a number of inconsistencies that indicate the volume at the site is more than 30% higher than the measurements used in the DEIR. There are numerous pieces of data both within the DEIR and from traffic reports of local projects that support that the traffic volume at the site is significantly higher than what is used in the DEIR.

Upon reviewing the September 2019 traffic data in the DEIR, we noticed that the September 2019 data collected around page 135 undercounts a full weekday's traffic since it starts at 10am on Friday, after the peak weekday AM traffic. The DEIR appeared to originally comment that a covid-19 adjustment is not necessary since the daily total traffic counts are similar, but the September 2019 data is underrepresenting the actual traffic that was present on a full weekday if the AM peak hours were included in the count. The start and end times are listed in Exhibit C.

It is also worth noting that we couldn't follow the daily count numbers used in the original DEIR to make the case that daily volumes were the same as pre-pandemic levels. Table 2 on page 22 of the DEIR shows 28,470 average daily vehicles (totals from the ATR in Appendix E divided by 4). The volume listed in the next paragraph and table 3 is 30,460. It is not clear why 30,460 is used when the average from Table 2 is 28,470. The comparison of daily volumes uses the 30,460 number, even though it is unclear where it comes from and the 28,470 number appears to be the correct average. If the number is actually 28,460, then the 2021 traffic data is significantly lower than the 2019 data, and, since the 2019 data did not even include the weekday AM traffic in that day's count, the 2021 data is even more significantly lower than the actual 2019 data had it included a full weekday's traffic.

The peak hour volume SB in 2019 was 2213, whereas the peak hour volume SB in 2021 was 1684 from the data included in the DEIR. Since we don't have a full 24 hours during a weekday from 2019, the peak hour volume suggests that 2019 had 31% more traffic than 2021, not the same, and a subsequent 31% adjustment is more appropriate than a 10% covid adjustment.

September 2019 data was included on page 135 of the DEIR, and clearly shows a peak of 2213 vehicles per hour in the afternoon. In the 2021 Existing conditions for the stoplight, the traffic volume used to simulate stoplight performance and Level of Service was 1753 (page 251 of the DEIR). This volume is significantly smaller than was measured in the September 2019 reading, indicating that the 2021 Existing conditions and subsequent simulation is undercounting vehicles. Unfortunately, the traffic data collection was started on Friday at 10AM, so it missed the Weekday AM Peak Hour, but the Weekday PM Peak Hour was collected.

The data on page 135 of the DEIR clearly shows sustained traffic for 3 hours at levels higher than the value used to describe existing conditions for peak hour volume. Peak volume measured at 26% higher.

Traffic counts were measured along the same corridor for the gas station project at 500 Thurston St in Wrentham in 2018, and those counts are included in Exhibit B. This shows 2142 current trips on Route 1 North through Thurston st, which is significantly less than the 1572 used in the 2021 Existing on page 244 of the DEIR. Both of these counts are also less than the September 2019 data on Page 135 of the DEIR referenced in the last paragraph.

That same 500 Thurston st project registered 2142 vehicle trips Northbound on Thurston St during the morning peak hour. The 2021 Existing conditions on page 244 of the DEIR shows only 1572 trips for the same period and corridor. In the Supplemental analysis provided on May 2 by McMahon and Associates, the volumes were raised to 1729 trips for the weekday Peak AM period, which is still 24% less than what 500 Thurston St measured in 2018. There are no major roads adding or removing traffic between Hawes and Thurston; therefore it should be reasonable to assume that the 2021 Existing simulation volume for Hawes St is also significantly underestimating the actual volume present in that corridor.

Page 12 of the FEIR acknowledges that daily traffic on I-495 was generally consistent from 2019 to 2021, which indicates that the 2019 higher traffic values should also be considered relevant traffic volumes while analyzing the impact of the project.

I am aware from the FEIR page 206 that MassDOT corresponded on this issue. We are raising this because it does not appear that the discussion spoke about any of these points. They seem relevant to that discussion.

#### Impact of the Madison St Stoplight

During the Wrentham Planning Board presentations, McMahon and Associates noted that the Madison St stoplight timing is contributing to an additional delay in traffic. This was noted in the

FEIR as well. Fixing this will likely alleviate some of the 2,000+ ft queues that appear most days, however once that stoplight is fixed, traffic volumes will return to at least 2019 levels.

The Madison St intersection regularly backs up over 2000+ feet. While the traffic volumes might be lower today than they were before the installation of the Madison/Washington St stoplight, the stoplight has caused a significant delay to the travel time on the route due to the system being over-capacity. McMahon and Associated investigated this situation during their Planning Board application, and found that this was in part due to pedestrian crossings, driveway access/egress friction, and inefficient phasing of the Madison St right-turns. The proposed signal adjustment would hopefully help alleviate some of these massive real-world queues that are not shown in the modeling software.

The roadways are at capacity for their current configuration during the peak periods. The roadways could handle 30% more traffic in 2019 before the installation of the Madison st light and associated signal timing. The rest of the region's traffic volume in general is fairly consistent with what it was pre-covid.

One clue that we can look at to see the capacity of the system in the afternoons is page 198 from the DEIR. In the afternoon peak hours, most of the vehicles are traveling between 1 and 15 mph. There are more cars trying to travel through the intersection during that time and cannot due to the traffic congestion. In the 2021 data displayed on the same page, the intersection is at capacity from 3:00 pm to 5:00 pm between 1533 and 1582 vehicles per hour (page 198 from the DEIR). The data from 2019 provided on page 135 shows 2213 vehicles per hour in the same period. The traffic volume is about 40% higher in 2019 than the 2021 data from page 198 of the DEIR when it is not being rate limited by the Madison St stoplight.

McMahon and Associates commented that they can alleviate most of the traffic and queue caused by Madison St by adjusting the signal timing for Madison St. First, we thank them, because that change would significantly help traffic in the area. However, if so, we should expect that to cause a dramatic increase in traffic volumes to at least the 2213 vehicles per hour seen in 2019. The vehicles are trying to get through and rate-limited by the slow speeds caused by the light timing.

The reduction in traffic volume is because the current configurations of the stoplight will not allow for any more traffic volume, however more traffic would return if the Madison St stoplight was optimized to allow for efficient traffic flow through the roadways. Any 7-year future projections should use the larger volume that existed before the inefficient signal phasing.

#### Updated Stoplight Design Concerns

Based on feedback about how the stoplight design was restricting turning movements into and out of properties, the stoplight was redesigned with updated island locations and an additional phase for Interstate Travel Plaza. This was a large step forward that protects the important access of local businesses, but there are still a number of flaws that exist in the contemplated design. Numerous queues exceeded their travel lanes. For example on page 370 of the FEIR, the 2028 Build With Improvements plan for Weekday Afternoon travel shows that the 95th percentile Left turn from Commerce Blvd to Route 1 has a 139 ft queue inside a 100 ft turning bay.

It does not look like the stoplight design incorporates the merge from the "slower vehicles" travel lane northbound as vehicles come up the hill. Page 47 from the FEIR describes the traffic light, however it does not appear to include the merge from the "slower vehicles" lane. The image of the traffic queue on page 409 of the FEIR shows this merge lane and has been include in Exhibit E along with a few images from Google Maps showing the lane.

#### Turning movements would be more dangerous

Today, we have full access along Washington St without encumbrances. Traffic never blocks the driveway, and traffic is allowed to take a left-in, left-out from the Southbound side of Washington St. The updated design dramatically changes this such that it will be dangerous and difficult to access our property, and the entire frontage of our driveway would often be completely blocked by traffic during peak volumes.

The design is projected to create a queue in front of our property restricting access to our only entrance. The projection in the FEIR on page 362 shows that the queue would be 385 ft and also adds a # signifying that 95th percentile volume exceeds capacity and the queue may be longer. This projection was derived using the 2021 pandemic data that was shown to be significantly less than the measured traffic volumes in 2018; the actual queues at this stoplight could be much longer when the 2018 traffic volumes are used.

This updated design also restricts turning movements into and out of our business and makes turns much more dangerous. First, customers entering or exiting from the Southbound direction would have to cross an additional travel lane to enter our property. They already have to cross 3 travel lanes (2 Route 1 travel lanes plus the ending "slower" traffic lane on the right") and now would have to cross a fourth. Our driveway location at Washington St is also in the middle of the merge zone where the right lane ends. In addition to this, the entrance to our property is just after the crest of a hill in a 55 mph speed limit zone. The close proximity to the proposed intersection would split drivers' attention as they're driving in either direction. Between the merge, the hill, the multiple lanes, and the speed, adding an extra travel lane and a complicated intersection makes a rear-end or broad-side collision much more likely. This design poses a significant risk to the safety of our employees, our customers, and the public, and would effectively eliminate our access to Washington St.

Furthermore, we own several residential rental properties located just to the South of Turnpike Truck Parts. The stoplight design also restricts turning movements into and out of these properties, which would make them extremely difficult for existing tenants and make it difficult for us to rent to future tenants. This would effectively eliminate their access to Route 1 as well, besides making it incredibly dangerous for them to enter their home.

We have been in discussions with the owners of Lot 1, the location for the proposed coffee shop, about them potentially incorporating an access from our property to Commerce Blvd. Page 43 of the FEIR refers to this potential connection. However, no access has been granted thus far, and therefore we currently have no alternative means of access.

#### Conclusion

Without alternative means of access, the stoplight design as proposed would effectively eliminate our access on Route 1. The turning movements into and out of our business and rental properties would be much more dangerous, rendering them effectively non-existent and significantly harming our business. We hope that the actual conditions that currently exist at the site can be reflected in the existing conditions simulations, and that the traffic volumes used for projections can be reflective of the data that is known to exist at the site.

Thank you for your attention to this matter.

Andrew Gordon Turnpike Truck Parts

#### Exhibit A

Pictures from Interstate Travel Plaza showing the 2,000+ ft queue from the Madison St stoplight Southbound.



#### Exhibit B

Traffic Volumes from 500 Thurston St measured in 2018 from the Wrentham Planning Board

|                                       |         |       | ~      | 1      | +        |          |        | +      |      | ~      | 1     | 1    |
|---------------------------------------|---------|-------|--------|--------|----------|----------|--------|--------|------|--------|-------|------|
| Loss Contra                           | 501     |       | •      | •      | 14/07    |          | 1      | 1      | -    | -      | •     | -    |
| Lane Group                            | EBL     | EBI   | EBR    | WBL    | WBI      | WBR      | NBL    | NB1    | NBR  | SBL    | 581   | SBH  |
| Lane Configurations                   | 7       | *     |        |        | 4        | 100      |        | TH     |      |        | TP    |      |
| Tranc Volume (vpn)                    | 21      | 28    | 82     | 48     | 39       | 120      | 33     | 2142   | 23   | 3      | 495   | 6    |
| Puture Volume (vpn)                   | 1000    | 28    | 82     | 48     | 39       | 120      | 33     | 2142   | 23   | 9      | 495   | 0000 |
| Ideal Plow (vphpi)                    | 1900    | 1900  | 1900   | 1900   | 1900     | 1900     | 1900   | 1900   | 1900 | 1900   | 1900  | 1900 |
| Lane width (It)                       | 13      | 13    | 13     | 13     | 13       | 13       | 12     | 12     | 12   | 12     | 12    | 12   |
| Storage Lenger (n)                    | 00      |       | 0      | 80     |          | 0        | 250    |        | 0    | 2/0    |       |      |
| Siorage Lanes                         | 25      |       | 0      |        |          | 0        | - 26   |        | 0    | 1      |       | 0    |
| Laper Length (n)                      | 1 00    | 1.00  | 4.00   | 20     | 4.00     | 1.00     | 25     | 0.05   | 0.05 | 0      | 0.05  |      |
| Lane Util, Factor                     | 1.00    | 1.00  | 1.00   | 1.00   | 1.00     | 1.00     | 1.00   | 0.95   | 0.95 | 1.00   | 0.95  | 0.95 |
| FII<br>Fit Destanted                  | 0.050   | 0.888 |        | 0.050  | 188.0    |          | 0.050  | 0.998  |      |        | 0.998 |      |
| Fit Protected                         | 0.950   |       |        | 0.950  |          |          | 0.950  |        |      | 0.950  |       |      |
| Said. Flow (prot)                     | 1865    | 1641  | 0      | 1/93   | 16/1     | 0        | 1656   | 3461   | 0    | 1626   | 3221  | 0    |
| Fit Permitted                         | 0.392   |       |        | 0.500  |          |          | 0.950  |        |      | 0.950  |       |      |
| Sald. Flow (perm)                     | //0     | 1641  | 0      | 944    | 16/1     | 0        | 1655   | 3461   | 0    | 1626   | 3221  | 0    |
| Right Turn on Red                     |         |       | Yes    |        |          | Yes      |        |        | Yes  |        |       | Yes  |
| Satd. Flow (RTOR)                     |         | 91    |        |        | 141      |          |        | 2      |      |        | 3     |      |
| Link Speed (mph)                      |         | 30    |        |        | 30       |          |        | 55     |      |        | 55    |      |
| Link Distance (ff)                    |         | 1183  |        |        | 727      |          |        | 668    |      |        | 2177  |      |
| Travel Time (s)                       |         | 26.9  | 100101 | 121217 | 16.5     | 10212-14 | 10000  | 8.3    |      |        | 27.0  |      |
| Peak Hour Factor                      | 0.90    | 0.90  | 0.90   | 0.81   | 0.81     | 0.81     | 0.93   | 0.93   | 0.93 | 0.87   | 0.87  | 0.87 |
| Heavy Vehicles (%)                    | 0%      | 7%    | 6%     | 4%     | 8%       | 3%       | 9%     | 4%     | 13%  | 11%    | 12%   | 0%   |
| Adj. Flow (vph)                       | 30      | 31    | 91     | 59     | 48       | 148      | 35     | 2303   | 25   | 10     | 569   | 7    |
| Shared Lane Traffic (%)               |         |       |        |        |          |          |        |        |      |        |       |      |
| Lane Group Flow (vph)                 | 30      | 122   | 0      | 59     | 196      | 0        | 35     | 2328   | 0    | 10     | 576   | 0    |
| Number of Detectors                   | 1       | 2     |        | 1      | 2        |          | 1      | 2      |      | 1      | 2     |      |
| Detector Template                     | Left    | Thru  |        | Left   | Thru     |          | Left   | Thru   |      | Left   | Thru  |      |
| Leading Detector (ft)                 | 20      | 100   |        | 20     | 100      |          | 20     | 100    |      | 20     | 100   |      |
| Trailing Detector (ft)                | 0       | 0     |        | 0      | 0        |          | 0      | 0      |      | 0      | 0     |      |
| Detector 1 Position(It)               | 0       | 0     |        | 0      | 0        |          | 0      | 0      |      | 0      | 0     |      |
| Detector 1 Size(ft)                   | 20      | 6     |        | 20     | 6        |          | 20     | 6      |      | 20     | 6     |      |
| Detector 1 Type<br>Detector 1 Channel | CI+Ex   | CI+Ex |        | CI+Ex  | CI+Ex    |          | CI+Ex  | CI+Ex  |      | CI+Ex  | CI+Ex |      |
| Delector 1 Extend (s)                 | 0.0     | 0.0   |        | 0.0    | 0.0      |          | 0.0    | 0.0    |      | 0.0    | 0.0   |      |
| Detector 1 Queue (s)                  | 0.0     | 0.0   |        | 0.0    | 0.0      |          | 0.0    | 0.0    |      | 0.0    | 0.0   |      |
| Detector 1 Delay (s)                  | 0.0     | 0.0   |        | 0.0    | 0.0      |          | 0.0    | 0.0    |      | 0.0    | 0.0   |      |
| Detector 2 Position(ft)               |         | 94    |        | 2.2.4  | 94       |          | 2.27   | 94     |      |        | 94    |      |
| Detector 2 Size(ff)                   |         | 6     |        |        | 6        |          |        | 6      |      |        | 6     |      |
| Detector 2 Type                       |         | CI+Ex |        |        | CHEX     |          |        | Cl+Ex  |      |        | CI+Ex |      |
| Detector 2 Channel                    |         | 0.000 |        |        | 497 6671 |          |        | 50. GA |      |        |       |      |
| Detector 2 Extend (s)                 |         | 0.0   |        |        | 0.0      |          |        | 0.0    |      |        | 0.0   |      |
| Turn Turne                            | Perm    | NA    |        | Perm   | NA       |          | Prot   | NA     |      | Prot   | 510   |      |
| Protected Phases                      | r units | 4     |        | r grin | 8        |          | 5      | 2      |      | 1      | 6     |      |
| Permitted Phases                      | 4       |       |        | 8      |          |          |        |        |      | 1.1    | 0     |      |
| Detector Phase                        | 4       | 4     |        | 8      | R        |          |        | 2      |      | 4      | 8     |      |
| Switch Phase                          |         |       |        | 0      | 0        |          | -      |        |      |        | 0     |      |
| Mojenum taitial (a)                   | 6.0     | 6.0   |        | 6.0    | 6.0      |          | 8.0    | 30.0   |      | 6.0    | 30.0  |      |
| Minimum Selit (a)                     | 21.0    | 21.0  |        | 21.0   | 21.0     |          | 12.0   | 30.0   |      | 12.0   | 30.0  |      |
| Total Celli (c)                       | 14.0    | 14.0  |        | 14.0   | 21.0     |          | 14.0   | 52.0   |      | 12.0   | 30.0  |      |
| Total Opti (5)                        | 14.0    | 14.0  |        | 19.0   | 14.0     |          | 16.06  | 02.0   |      | 14.0   | 62.0  |      |
| Loren Obser ( 14)                     | 10.076  | 10.0% |        | 10.0.% | 10.0%    |          | 10.038 | 00.379 |      | 10.076 | 00,9% |      |

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Synchro 8 Report Page 1

#### Exhibit C 9/20/2019 traffic data

https://mhd.public.ms2soft.com/tcds/tsearch.asp?loc=Mhd&mod=TCDS https://mhd.public.ms2soft.com/tcds/tcount.asp?offset=0&local\_id=S19-028-350-01&a=96&sdat e=9/20/2019 https://mhd.public.ms2soft.com/tcds/tcount.asp?offset=0&local\_id=S19-028-350-01\_NB&a=96& sdate=9/20/2019 https://mhd.public.ms2soft.com/tcds/tcount.asp?offset=0&local\_id=S19-028-350-01\_SB&a=96&

sdate=9/20/2019

| COUNT DATA INFO    |               |  |
|--------------------|---------------|--|
| Count Status       | Accepted      |  |
| Holiday            | No            |  |
| Start Date         | Fri 9/20/2019 |  |
| End Date           | Sat 9/21/2019 |  |
| Start Time         | 10:00:00 AM   |  |
| End Time           | 10:00:00 AM   |  |
| Direction          |               |  |
| Notes              |               |  |
| Station            | 190280000057  |  |
| Study              |               |  |
| Speed Limit        |               |  |
| Description        |               |  |
| Sensor Type        | Axle/Tube     |  |
| Source             |               |  |
| Latitude,Longitude |               |  |

#### Exhibit D



### CM A HON

Washingto 2028

FEIR Page 409 showing the slower traffic lane





| From:        | Jonathan Silverstein                      |  |  |  |
|--------------|---|--|--|--|
| To:          | Patel, Purvi (EEA)                        |  |  |  |
| Subject:     | Wrentham Business Center – EEA No. 15765  |  |  |  |
| Date:        | Monday, November 7, 2022 4:43:47 PM       |  |  |  |
| Attachments: | Abutter Comment Letter - EEA No 15765.pdf |  |  |  |
|              | Wrentham Exhibit A.pdf                    |  |  |  |
|              | Wrentham Exhibit B.pdf                    |  |  |  |
|              | Wrentham Exhibit C.pdf                    |  |  |  |

CAUTION: This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Good afternoon, Purvi,

Thank you for taking the time to speak with me earlier today regarding the above referenced project.

As discussed, please find attached a comment letter on behalf of my four clients, with exhibits.

Thank you for your consideration, and please do not hesitate to contact me with any questions.

Best regards,

Jonathan

Jonathan M. Silverstein Blatman, Bobrowski, Haverty & Silverstein, LLC 9 Damonmill Square, Suite 4A4 Concord, MA 01742 C: (617) 281-6913 jms@bbhslaw.net

### BLATMAN, BOBROWSKI, HAVERTY & SILVERSTEIN, LLC

9 DAMONMILL SQUARE, SUITE 4A4 CONCORD, MA 01742 PHONE 978.371.2226 FAX 978.371.2296

JONATHAN M. SILVERSTEIN JMS@bbhslaw.net

November 7, 2022

Bethany A. Card, Secretary Executive Office of Energy and Environmental Affairs Attn: Purvi Patel, Environmental Analyst 100 Cambridge Street, Suite 900 Boston, Massachusetts 02114

RE: Wrentham Business Center - EEA No. 15765

Dear Secretary Card:

This office represents the owners of four properties, all of which either abut or are directly across the street from the above-referenced project, specifically:

- 574 Washington Street (574 Washington Street, LLC)
- 579 Washington Street (John N. Lamperelli and James Lamperelli, Trustees of the MTS Nominee Trust East)
- 580 Washington Street (Interstate Travel Plaza West, LLC); and
- 600 Washington Street (Helping Hands Foundation of America, LLC)

My clients are in support of reasonable development of the subject property. However, they are deeply concerned that the proposed development, coupled with the proposed signalization and signage of the Washington Street/Hawes Street intersection, will adversely affect the functioning of Hawes Street and the developability of their lots with frontage on Hawes Street. As to 579 Washington Street, my client is concerned that the applicant has failed to provide for connectivity to allow internal circulation among the properties, which would improve safety and traffic flow along this corridor. Finally, and most importantly, the applicant has refused to conduct a meaningful alternatives analysis regarding the possibility of moving the proposed signal further north, which would: (a) provide for better spacing of the traffic signals along the corridor; (b) mitigate the inevitable queuing problems that will prevent left turns in and out of my clients' commercial properties; and (c) avoid the overuse and cut-through traffic of Hawes Street without the use of inappropriate and confusing signage as is currently proposed.

My clients retained Kimley Horn to evaluate the applicant's submissions to the Planning Board. The comment letter and a Power Point presentation of my clients' traffic consultant are attached for your reference as <u>Exhibits A and B</u>, respectively.

#### 1. Impacts to Hawes Street

Central to the applicant's proposal is the installation of a new traffic signal at the intersection of Washington Street and Hawes Street. This will undoubtedly assist the applicant's

business plan, since tractor trailers leaving the site will now be able easily to turn left onto Route 1 from Commerce Boulevard, but it will also have the effect of significantly increasing traffic on Hawes Street, which is not of sufficient width and construction to safely accommodate this increased use.

The applicant's claim that there is unlikely to be significantly increased use of Hawes Street is simply not credible and was flatly contradicted by both the Town's Police Chief and the Public Works Director during public hearing sessions before the Town's Planning Board. Hawes Street is already used as a cut-through to and from Thurston Street when traffic backs up on Route 1. The applicant has designed its intersection improvements to create a new left-turn-only lane, with a dedicated turn signal onto Hawes Street. This will make it significantly easier and more attractive for cars seeking to avoid the traffic backups along Route 1 to turn onto Hawes Street and travel to Thurston Street to re-access Route 1 closer to Route 495.<sup>1</sup>

To address this issue, the applicant and the Town's Planning Board (in a special permit decision filed with the Town Clerk on August 18, 2022, a copy of which is attached hereto as <u>Exhibit C</u>) propose that "Road Closed to Thru Traffic' and 'No Trucks' signs would be placed at the Hawes St entrance from Washington St." <u>Exhibit C</u>, p.7, ¶12. Such signage is only going to exacerbate the already significant problems that signalization of this intersection will create. As shown on page 41 of the FEIR, the applicant continues to propose a dedicated left turn from Washington Street onto Hawes Street. To place signage at this intersection discouraging use of this dedicated left turn phase will clearly create driver confusion and is likely only to create a more dangerous situation without mitigating the traffic impacts to Hawes. Moreover, three of my clients' properties (574, 580 and 600 Washington Street) each with frontage on Hawes and would be adversely impacted by the proposed signage.

Moreover, the applicant's traffic projections and queuing analyses are simply inconsistent with the readily observable traffic volumes along this corridor. Traffic data from 2018 shows 2,142 Existing Northbound Weekday AM trips and 1,981 Existing Southbound Weekday PM trips. Yet the applicant's study shows only 1,572 Existing Northbound Weekday AM and 1,684 Existing Southbound Weekday PM. The 2018 measurement is 36% and 17% higher, respectively, than the 2021 COVID-era data utilized by the applicant. Similarly, the 2022 traffic data should be viewed skeptically, since traffic volumes simply have not fully rebounded from the pandemic, but there is no reason to believe they will not do so. In any event, the applicant's data is demonstrably inaccurate. Traffic regularly (several times per week) backs up far past Hawes Street from the signal at Madison Street (see representative photographs below, taken from the property at 600 Washington Street on March 17, 2022, May 18, 2022 and June 1, 2022,

<sup>&</sup>lt;sup>1</sup> The applicant variously asserts that 5% or 14% (see p. 226 of the DEIR) of warehouse employees will travel north on Route 1 to turn left on Thurston Street. It is wholly unrealistic to suggest that employees will travel on heavily congested Route 1 to turn left on Thurston, when they can readily use the new signal to travel straight on Hawes and access Thurston Street much more directly. Moreover, the inconsistency with the applicant's journey to work estimates merits examination.

respectively), yet the applicant suggests that traffic from the new signal it proposes will not result in queuing of more than a few hundred feet.





3

These photographs demonstrate that traffic regularly backs up more than 2,000 feet from the signal at Madison Street—over double the 900-foot queue projected by the applicant. Clearly the addition of another signal at Hawes Street is untenable. The applicant's use of unrealistic data and assumptions is clearly intended to lead the MEPA office to believe that its development and the installation of a traffic light at the Hawes Street intersection will not result in substantially increased traffic along Hawes Street itself.

The creation of a dedicated left-turn lane, coupled with the increase in heavy-truck traffic from the applicant's facility and traffic backups resulting from both the facility and the installation of a new signal, will make the option of using Hawes Street as a cut-through to Thurston Street significantly easier and more attractive for vehicles seeking to avoid the effects of the applicant's project. As discussed above, the signage proposed by the applicant and the Planning Board will only aggravate this problem by creating significant driver confusion.

Hawes Street, as currently constructed, is ill equipped to accommodate this increased traffic. The road (especially along the stretch closest to Route 1) is narrow, with dense vegetation, ledge and guardrails bordering the way. The grades and site lines are also inadequate to handle significantly increased traffic. Moreover, there are no sidewalks to accommodate pedestrians, who may seek to access developments along Route 1 by crossing at the new proposed traffic signal.

#### 2. Queuing Impacts

In addition to the impacts of increased traffic on Hawes Street, the queuing on Washington Street that will result from the signalization of the intersection will adversely impact all of my clients' properties. Left turns out of these properties will no longer be possible as a result of these queues. This will have a devastating effect on the business fuel station at 580 Washington Street, particularly the sale of diesel to trucks that will no longer be able to turn left out of the property to access Route 495. For the same reason, the queues on Washington Street also will make development of 574 Washington Street and 579 Washington Street extremely challenging. The photographs shown above demonstrate that the queuing analysis performed by the applicant is faulty.

#### 3. Failure to Meet Traffic Warrant

It is my understanding that that the warrant for signalizing the Hawes Street intersection is not met by this project unless both: (a) right turns out of Commerce Boulevard are counted and (b) the so-called "Phase 3" of the project is considered. My clients respectfully submit that right turns out of the project site should not count toward satisfying the warrant for a signal. Moreover, the site of the so-called Phase 3 is not large enough to allow for a drive-through

restaurant without zoning relief under the Town's Zoning Bylaws, and the applicant has not even applied for that zoning relief.

#### 4. <u>Refusal to Consider Alternatives</u>

Finally, as currently designed the proposed traffic signal at Hawes Street would benefit just one property<sup>2</sup> to the significant detriment of at least four others. The abutters have requested repeatedly that the applicant study the possibility of moving the proposed signal further north to the existing truck parking access road, in order to mitigate the negative impacts of the proposal, but the applicant has refused to meaningfully consider this alternative. Moving the signal north would:

- 1. Allow for more even spacing of traffic signals along the Route 1 corridor;
- 2. Allow each of my clients to access the proposed traffic signal, so as not to deprive them of the ability to have left turns into and out of their properties; and
- 3. Still allow the applicant to access the proposed traffic signal.

A short presentation from my clients' traffic consultant Kimley Horn Associates conceptually discussing this alternative is attached hereto as <u>Exhibit B</u>. Note that this concept was intended to start a dialogue with the applicant and was, of course, not intended to present a definitive plan.

Unfortunately, instead of embracing an opportunity to work with numerous commercial abutters to the project, the applicant has refused to work with my clients to meaningfully study the alternative signal location, even though creating an access road to a signal further north would avoid the negative impacts of a signal at Hawes Street and allow all of the properties fronting on this segment of Route 1 to benefit from a protected left turn movement. Instead, the applicant has superficially addressed the issue by providing a glib list of "reasons" the alternative is not viable in its view. The applicant's clear goal was not to truly explore whether the alternative is viable but rather to reject the proposal out of hand and move on.

<sup>&</sup>lt;sup>2</sup> The signal may well help a second property owner—the seller of the project site, who also happens to own Luciano's Restaurant on the southwest corner of Washington Street and Hawes Street, who would no doubt benefit by having his patrons able to turn onto Hawes and exit at the signalized intersection.

#### Conclusion

My clients have sought to work with the applicant for many months to explore alternatives that would minimize the tremendous adverse impacts the applicant's current proposal will have on their existing and planned businesses. To date, those efforts have been unsuccessful. It is clear that the applicant will only consider such alternatives if directed by a regulator to do so. My clients respectfully submit that their interests are entitled to the same consideration and weight as a particular property owner and applicant.

Thank you for your consideration of this matter.

Very truly yours donathan-M. Silverstein

cc: Clients

Kimley **»Horn** 

April 20, 2022

Ms. Beth Ferrari 574 Washington Street LLC P.O. Box 2 Wrentham, MA 02093

#### RE: Initial Traffic Review Proposed Development, 15 Commerce Blvd, Wrentham

Dear Beth,

In response to your request, Kimley-Horn & Associates, Inc. has completed a preliminary review of the traffic related assessment and plan for access related to the proposed development at off Commerce Boulevard. The current project consists of the proposed 180,000 squrae foot (sf) warehouse while the traffic studies completed for the MEPA process as well as the local Planning Board review has included the full build out of the site. The full buildout includes in addition to the warehouse, a drive thru coffee shop and a fast-food restaurant. The one use built on the site at the present time is the Supercharge entertainment and go cart facility. Commerce Boulevard intersects with Route 1 opposite Hawes Street.

#### INTRODUCTION

This initial review has consisted of reviewing the following documents and material:

- earlier traffic study completed by the applicant during the MEPA activity in which the Drat EIR was submitted in late 2021,
- reviewed the town's peer review comments dated November 15, 2021 by Environmental Partners (EP)
- reviewed the McMahon Associate (MA) response to the EP comments dated January 5, 2022
- reviewed DEIR comments by MassDOT
- reviewed the Town's Corridor Study: The Future of Route 1 in Wrentham Report dated April 2018

A site visit was also conducted to review the current conditions of the project area and the characteristics of the street network in the vicinity of the development site.

While this has not been an exhaustive review thus far, the review to date has identified a number of concerns and potential issues that, in our opinion, would be prudent for the Planning Board to have the Applicant address before making any decision related to the project. Contrary to the Applicant's Engineer's opinion that they can or should be addressed during the next phase of the MEPA process, the critical issues that would linger affect the local streets, the local area, and the abutting lands all of which are of high importance and jurisdiction to the town through the Planning Board in this instance.

These issues are elaborated on in the following paragraphs relate to the traffic analysis, the effects of the proposed access plan, and the lack of a meaningful mitigation program. Given these three key areas and as discussed further, more answers and potential changes to the plans require additional time and thoughtfulness before taking action. If in fact the Applicant wishes to answer all these questions and address the outstanding issues during the next phase of MEPA, it would not be unreasonable to then have the Planning Board postpone any action until the Final EIR is completed

and presented to the Board and public. The MEPA process does NOT require the site plan and local review process be completed prior to preparing the Final EIR. In fact, it's common for the local process to wait on final decisions and approvals until MEPA process is completed. That said, we have selected some of the more important aspects or shortcomings of the analysis and access plan to consider and discuss in detail. Some of our comments our like those raised by the town's peer review consultant. However, for the more critical questions and comments, the Applicant's engineer has not provided a substantive response simply indicating to wait for the Final EIR.

#### **ANALYSIS OF PROJECT**

Prior to the following areas of concern, we recognize that Route 1 is a MassDOT owned and maintained facility and is a high volume, high speed highway. This offers opportunity for the town in terms of economic development that has increased in the past 10 years between Thurston Street and I-495. It was one of the reasons the town completed the land use and zoning study several years ago. That study also included examining potential build out of the corridor with likely or desired types of land uses. While that study did not result in a detailed design concept for this subject section of Route 1 in Wrentham, it did include some guidance. The current concerns or issues with the analysis are:

- The study likely understates to an extent the base traffic volume conditions that then leads to understating the future volume conditions. The traffic counts collected for the project took place during July 2021. While we were coming out of the significant Covid "lockdown" period by that time, there were still significant restrictions placed on large gatherings for places such as Supercharge. Traffic patterns were also still in a state of flux at that time as well. The understating also relates to the seasonable adjustments given I-495 monthly variations may not be reflective of Route 1. Consequently, more support documentation is needed to justify the foundation of the analysis or potentially modify and update the analysis. These questions appear to have been made for some time now and there has been an opportunity for the applicant's engineer to collect some additional new data to either confirm the July 2021 data or determine that it needs to be completely updated or adjusted.
- In reviewing the engineer's estimated trip distribution and assignment of projected new trips, there were a number of questions that should be reviewed. While the truck traffic may be mostly oriented to and from the south, they represent a relatively small portion of the new site trips according to the analysis. The information provided by the applicant shows more than 30% of those working in Wrentham come from the town or neighboring Franklin most of which all that travel will likely come thru the town center or Route 140 and to the connecting routes to Route 1. Under future conditions and if a signal is at Hawes Street then many of them will likely reach or leave the site via Hawes Street. This situation creates "unintended consequences" of the action and needs attention by the Planning Board.
- Given the above point, the physical and operational conditions of Hawes Street between Route 1 and Thurston Street need to be reviewed by the engineer to determine its adequacy for accommodating additional traffic and/or mitigating actions necessary to avoid impact.
- The amount of additional traffic during the peak hours and over the day that will occur on Hawes Street needs to be estimated and reported in order that everyone understands the impact of not only the development but also having the access as currently proposed.
- The safety of the corridor has been raised for a long period of time. The proponent of 500 Thurston Street is having to design improvements at the Route 1/Thurston Road intersection, which has been noted as a high crash location. The Route 1/Madison Street intersection was noted also as a high crash cluster location but since the data was prior to the new signal and mixed-use center being constructed, the analysis has set it aside assuming that the signal would resolve the issue. However, a review of the 2017-2019 cluster data also indicates that

it remains a high crash cluster location. While the full operation of the center occurred after 2019, this location deserves to be revisited in the analysis going forward at least to update the understanding.

#### **PROPOSED ACCESS PLAN**

The applicant's engineers have developed a proposed access plan that includes signalizing the intersection of Route 1 at Commerce Boulevard and Hawes Street, adding left turn lanes in both directions on Route 1 and constructing a section of sidewalk along the frontage between Commerce Boulevard and the existing pedestrian crossing signal north of Commerce Boulevard. It is our understanding that MassDOT has not approved this plan to date. Based on our review, the following concerns with this proposed access plan are as follows:

- Traffic signal warrants are not satisfied under the current project under review,
- The proposed left turn lanes for Rt 1 don't meet generally desirable criteria as presented by the engineer, particularly the NB direction,
- The length of the left turn lanes, particularly the NB left turn is substantially excessive; creation of both lanes as designed creates access issues for a number of adjacent properties including associated with left turns in and out of those properties that are currently allowed for the sake of accommodating a low volume warehouse operation and a potential future drive thru coffee shop,
- The NB left turn lane will further encourage turns onto Hawes Street as noted previously once a traffic signal is installed; need for this as well as impact on Hawes Street should be revisited,
- No discussion is presented in relation to the potential longer range MassDOT plan for the Route 1 corridor that will potentially include a center median; how does this access plan affect that work in the future and does anything impact MassDOT abilities to put forth a safe improvement plan?
- If the installation of signal and turn lanes is approved and completed at Commerce Blvd/Hawes Street, should the center median start be included at this time? is this intersection going to be designed to accommodate U-Turns? Truck movements testing this aspect should be completed; doesn't appear enough room exists under current ROW to accommodate so this would start to suggest ROW may need to be increased thru this proposed development project.
- Has a Route 1 NB right turn lane into the site been evaluated as opposed to the NB left turn lane?
- The proposed access plan does not appear to consider any of the findings or recommendations from the town's Route 1 land use and zoning plan. The recommendations from that plan included a potential median along Rt 1, set back developments that allow for aesthetic improvements along the highway, off Rt 1 shared access connections between abutting properties, etc. The problem is that no alternative access plans were examined and no demonstration of how the proposed is consistent with the town's desired redevelopment plan along this portion of the Rt 1 corridor.
- With the Rt 1/Thurston Street intersection being redesigned (by others), it may be reasonable due to the timing to consider modifying the access plan for the 15 Commerce Blvd project; one option could be a right in/right out access for warehouse and U-Turn accommodated at Thurston for trucks and others to head south. Under this option, no signal would be installed at Rt 1/Commerce/Hawes, which is not warranted at least not until a coffee shop and fast-food restaurant are developed. With If it can be shown that this alternative approach to be feasible, then the need for the signal at Hawes Street would be negated even if those uses are built.

#### **MITIGATION**

The mitigation proposed by the Applicant's engineer essentially consists of installing a traffic signal at the Route 1 access point, making some modifications to Rt 1 to create left turn lanes, construction of a sidewalk abutting Rt 1 from Commerce Blvd to the existing pedestrian crossing 400 feet north of Commerce Boulevard, having internal sidewalks between the warehouse site and the other lots, and putting a bike rack on site.

In essence, this represents no mitigation for the project or meaningful improvements to the Route 1 corridor as the following explains:

- The Applicant wants the traffic signal to accommodate site traffic that turns left out of the site and drive south; other than for this purpose, the traffic signal and the design changes to the intersection appear to create more negative impacts by encouraging new traffic on Hawes Street, resulting in turn restrictions for abutting properties, increasing the delays to traffic on Route 1 and does not appear to have any relation to the town's desired plan for Route 1 corridor. Consequently, this action if pursued and approved is for site access and not representing "mitigation".
- The sidewalk along the frontage between Commerce Blvd and the current Route 1 pedestrian crossing, while consistent with current MassDOT policy to accommodate pedestrian movement, it simply serves the project and meeting the technical requirement and not necessarily providing a good public improvement. Constructing the sidewalk immediately along the paved section of Route 1 does not create a comfortable, safe walking environment along this route. The Applicant has the potential ability to provide additional ROW and set the sidewalk back from the highway with a buffer potentially create a treed buffer to enhance the walking condition as well as begin to improve the aesthetics along the corridor section.
- The Applicant's engineer was very quick to indicate they cannot accommodate bikes "no room" and no bike accommodation currently exists on Route 1 so concluded that it was not an option. Yet, this is a major MassDOT policy and practice to explore and create multimodal facilities throughout the Commonwealth. It should be noted that this same engineer (firm) designed the improvements to Route 1 for the Plainville Casino and was required by MassDOT to incorporate bike lanes from south of the casino through the I-495 interchange. While MassDOT has updated its recommended practice to design with a more physical buffer along highways such as Route 1, clearly there is a start to one south of this particular project area.

Coupled with the above comment related to pedestrian accommodation, a more thoughtful approach would be to have the Applicant evaluate providing the additional ROW necessary to accommodate off road, buffered shared use path to accommodate both bikes and pedestrians instead of simply the sidewalk. The town could request the same for adjoining properties under development or future projects to continue this separated path to at least Thurston Street from which safe crossings can be accommodated at the improved intersection. It's simply an idea and based on our reviews of documents available, has not been explored – only stated "no room", "cannot do". The intent of the early stages of project development and including the MEPA process is to explore how can a project be designed that both minimizes the negative effects and also is consistent with current goals, policies, and practices. To date, it is not clear that this has been done in this case based on review of the Applicant's documents.

• Finally, it is a bit ironic that given the conclusion that bike accommodation improvements on Route 1 could not be provided as part of this project, the engineer has included as a

component of the mitigation program a bike rack installed on site. Clearly, the engineer recognizes bike accommodation needs to be considered and this provides further justification to explore the above actions or some variations of them.

#### CONCLUSION

In conclusion and based on our review of the submitted analysis as well as awareness of the project area, serious concerns exist with the analysis and access plan that deserve further review and consideration of alternatives. Furthermore, it would appear that opportunities exist to create a better project that includes actions that reduce or eliminate the negative impacts of the plan as currently proposed as well as becoming more consistent with the town's stated goals and plan for this section of Route 1.

I would be happy to meet to discuss these issues and questions with the Board. Please feel free contact me at <u>bill.scully@kimley-horn.com</u> to discuss these comments further.

Very truly yours, **KIMLEY-HORN & ASSOCIATES, INC**.

William J Scully

William J. Scully, P.E. (MA #33298)

WJS/-

Cc J. Silverstein

Kimley **Whorn** 

EXHIBIT B

# Proposed ND Development Route 1/Access Plan Review

Kimley **»Horn** 

Presentation to Wrentham Planning Board June 1, 2022

### 1. Concerns

# Presentation Outline

- 2. Town's Route 1 Recommendations
- 3. Key Affected Properties
- 4. Potential Alternative Plan-Actions
- 5. Potential Benefits of Alternative

# **Current Access Plan & Analysis Concerns**

- Traffic signal at Hawes Street facilitates shift and increase in traffic to Hawes Street
- Queues created by signal at Hawes Street increase the difficulties to access to Interstate Truck, Helping Hands and 574 Washington Street
- The revised signal plan that includes fueling station exit drive increases the delays and queues during the peak times; also is unusual layout
- It's still not clear that signal is justified at Hawes Street not warranted with only Supercharged and ND warehouse operating
- If signal is installed at Hawes Street, the ability for large vehicle reverse direction turnaround needs to be evaluated (assumes that left turn restrictions will be put in place in future
- Project as currently proposed provides little true mitigation Applicant recognizes the need for signal to access Route 1
- Plan as proposed could potentially restrict future access to nearby properties

# **Town's Route 1 Transportation Recommendations**

- Dedicated turning lanes
- Landscaped center median and access management
- Outside curbing
- Interconnected lots shared access
- Signalization through phased implementation
- Concentrated development closer to Madison Street
- Off-street/separated bicycle accommodations along Route 1
- Pursue transit service
- Safety improvements including increasing distance between signals
- Preserve right of way for future improvements

# **Key Affected Properties**



## **Potential Alternative Access Plan**



# **Potential Alternative Access Plan** – With Connection to Hawes Street



# **Potential Alternative Access Plan** – With Connection to Hawes Street


# **Potential Alternative Access Plan** – With Connection to Hawes Street



### What Alternative Could Offer

- Accommodates ND as well as 3 key abutting properties for full Route 1 access
- Minimize or eliminate additional, thru traffic on Hawes Street
- Provide more even spacing between the 3 signals for better coordination
- Reduce or consolidate curb cuts along Route 1 section while accommodating growth
- Businesses would still have rear access to Hawes Street
- Potentially could provide the off-road bike/pedestrian accommodation along entire frontage of Lot 3

### What Alternative Could Offer

- Accommodates ND as well as 3 key abutting properties for full Route 1 access
- Minimize or eliminate additional, thru traffic on Hawes
   Street
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- Reduce or consolidate curb cuts along Route 1 section while accommodating growth
- Businesses would still have rear access to Hawes Street
- Potentially could provide the off-road bike/pedestrian accommodation along entire frontage of Lot 3

## Kimley »Horn

Expect More. Experience Better.

## Questions?

#### TOWN OF WRENTHAM PLANNING BOARD

#### DECISION

#### SPECIAL PERMIT (SP 2021-05) & SITE PLAN APPROVAL WAREHOUSE

15 Commerce Boulevard (f/k/a 591 Washington Street), Wrentham, MA

| Owner(s)                 | W.B.H., LLC, 320 South Street, Suite 202 Plainville, MA 02762                           |  |  |  |
|--------------------------|---|--|--|--|
| Applicant                | ND Acquisitions, LLC, 2310 Washington Street Newton Lower Falls, MA 02462               |  |  |  |
| Location:                | 15 Commerce Boulevard, f/k/a 591 Washington Street. Assessor's Parcel ID 0-06-4-2 and 3 |  |  |  |
| Zoning District:         | • C-2* (*see Findings #3 and #4)  |  |  |  |
| Permits Sought:          | Article   | Permit Required                                |  |  |
|                          | 4.2 (ZBL)   | Special Permit / Site Plan Approval: Warehouse |  |  |
|                          |   | and Storage Facility                           |  |  |
|                          | 6.1 footnote 9 (ZBL)  | Special Permit for reduced front & side yard   |  |  |
|                          |   | setbacks                                       |  |  |
|                          | 7 (ZBL)   | Site Plan Approval                             |  |  |
|                          | 14.1 (ZBL)  | Earth Removal                                  |  |  |
|                          | 275-4 (GBL)   | Earth Removal                                  |  |  |
|                          | ZBL = 2016 Zoning Bylaw, GBL = General Bylaw  |  |  |  |
| <b>Application Date:</b> | September 28, 2021, amended May 12, 2022  |  |  |  |
| Public Hearing           | /21, 12/15/21, 01/05/2022, 01/19/22, 02/02/22,  |  |  |  |
| Dates*:                  | 03/02/22, 03/16/22, 04/20/22, 05/18/22, 06/01/22, 06/15/22, 07/20/22,                   |  |  |  |
|                          | 08/03/22  |  |  |  |

**DECISION** of the Planning Board of the Town of Wrentham, Massachusetts (hereinafter the Board) on the petition of ND Acquisitions, LLC (hereinafter the "Applicant") for Special Permits and Site Plan Approval to construct a new approximately 180,000 square foot warehouse building with office space & associated site improvements on the following parcel: 15 Commerce Boulevard, Wrentham Assessors Map Parcel ID 0-06-4-2 & 3, owned by W.B.H., LLC (hereinafter the "Owner") by deed recorded in the Norfolk County Registry of Deeds at Book 15085, Page 174, and Deed dated December 9, 2019 and recorded in the Norfolk County Registry of Deeds at Book 37457, Page 327 (hereinafter the "Site").

#### BACKGROUND

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The above referenced application for a Special Permit and Site Plan Approval (hereinafter the "Original Application") was formally received on September 28, 2021. Notice of the public hearing and the subject matter thereof was published in the Sun Chronicle on October 5 & 12, 2021, posted with the Town Clerk's Office on October 4, 2021 and abutters were notified by First Class Mail. The public hearing on the Original Application was opened on October 20, 2021 and continued to November 17 (no testimony), December 1, December 15, 2021, January 5, 2022, January 19, February 2, March 2 (no testimony), March 16 (no testimony), April 20, May 18 (no testimony), June 1, June 15, July 20, August 3, 2022 (closed).

\*Pursuant to Governor Baker's June 16. 2021 Executive Order Extending the Suspension of Certain Provisions of the Open Meeting Law, G.L. c. 30A §18, as amended, the Town of Wrentham Planning Board conducted their public hearings via remote participation.

Decision – Wrentham Planning Board Special Permit (SP 2021-05) & Site Plan Approval W.B.H., LLC (Owner) / ND Acquisitions, LLC (Applicant) Page 2 of 18

On May 12, 2022, the Applicant amended the Original Application (hereinafter the "Amended Application" or the "Application"). Notice of the public hearing on the Amended Application and subject matter thereof was published in the Sun Chronicle on May 17 & 24, 2022, posted with the Town Clerk's office on May 13, 2022 and abutters were notified by First Class Mail. The public hearing on the Amended Application was opened on June 1, 2022 and continued as noted above. During the public hearings all those wishing to speak were heard. Following public input, the hearing was closed on August 3, 2022.

The following Planning Board members were present throughout the public hearing: Chairperson Michael McKnight (absent 02/02/22), Vice Chairperson Charles Woodhams, Jr., Clerk James Lawrence, Members Robert Cass (absent 06/15/22), Stephen Schwarm, Everett Skinner, Jr. and Thomas Wrynn (absent 01/05/22). Mr. Wrynn was absent for the January 5, 2022 public hearing and completed a Mullin's Certificate in order to remain eligible to vote on this application. Mr. McKnight was absent for the February 2, 2022 public hearing and completed a Mullin's Certificate in order to remain eligible to vote on this application. Mr. Cass was absent for the June 15, 2022 public hearing and completed a Mullin's Certificate in order to remain eligible to vote on this application. At the public hearing, Samantha Randel and Sherry Clancy of ND Acquisitions, LLC presented the Application. The record of proceedings and submission upon which this decision is based may be referred to in the Planning & Community Development Office or the Town Clerk's Office.

#### **SUBMITTALS**

The following items were submitted as Exhibits to the Board for its consideration of this application:

- 1. Application packet submitted by Bay Colony Group, Inc., dated 09/27/21; 11 pages to include:
  - a. Application for Special Permit/Site Plan Approval, 4 pages
  - b. Checklist for Article 7 Site Plan Approval/Special Permit Applications, 3 pages
  - c. Checklist for Article 8 Community and Environmental Assessment, 1 page
  - d. Mitigation of Adverse Impact, dated 9/27/21, 1 page
  - e. Tax Collector sign-off, dated 9/9/21, 1 page
  - f. Owner Authorization Letter, dated 8/23/21, 1 page
- 2. Certified Abutters List; dated August 31, 2021, received 9/27/21; 4 pages
- 3. Site Plan prepared by Bay Colony Group, Inc. entitled "Site Development-Plan of Land 591 Washington Street", dated 9/12/21, received 9/27/21, 24"x36", black & white, 19 sheets:
  - Sheet CV: Cover Sheet
  - Sheet 1.0: Legend & General Notes
  - Sheet 2.0: Existing Conditions Plan
  - Sheet 3.0: Master Layout Plan
  - Sheet 3.1: Layout & Grading Plan
  - Sheet 3.2: Layout & Grading Plan

PLANS BY OTHERS

- Sheet L1.1: Landscape Plan
- Sheet L2.1: Parking Lot Shading
- Calculation Plan
- Sheet L3.1: Landscape Enlargement Plan 1
- Sheet L3.2: Landscape Enlargement Plan 2

- Sheet 4.0: Drainage & Utility Plan
- Sheet 5.1: Details
- Sheet 5.2: Details
- Sheet 5.3: Details
- Sheet 6.0: SWPP & Snow Storage Plan
- Sheet 7.0: Certificate of Action-not included
- Sheet L4.1: Landscape Details
- Sheet LT-1: Lighting Plan
- Sheet A-1: Floor Plan
- Sheet A-2: Building Elevations
- 4. Project Narrative prepared by William R. Buckley, Jr., P.E., received 9/27/21, 4 pages

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- 5. Stormwater Management Report, dated 09/27/21; 283 pages
- Community & Environmental Assessment, dated 09/30/21; 54 pages
   a. Transportation Impact Assessment (Section 4.9, Figures 2-14)
- 7. Public Hearing Notice, dated 10/04/21; 1 page
- 8. Email Correspondence, Assessor; Re: Request for Comments (PB): Commerce Blvd Warehouse Facility, dated/received 10/04/21, 2 pages
- 9. Email Correspondence, Police; Re: Request for Comments (PB): Commerce Blvd Warehouse Facility, dated/received 10/15/21, 2 pages
- 10. Email Correspondence, Water Dept.; Re: Wrentham: Request for Comments (PB): Commerce Blvd Warehouse Facility, dated/received 10/15/21, 8 pages
- 11. Email Correspondence, BoH Agent; Re: Wrentham: Request for Comments (PB): Commerce Blvd Warehouse Facility, dated/received 10/15/21, 2 pages
- 12. Email Correspondence, Fire Chief; Re: Request for Comments (PB): Commerce Blvd Warehouse Facility, dated/received 10/20/21, 3 pages
- 13. Public Hearing Continuance Request dated 10/20/21, 1 page
- 14. Peer Review-Stormwater, prepared by PSC, dated 11/06/21, received 11/08/21; 24 pages
- 15. Peer Review-Zoning/Site Plan, prepared by Beals & Thomas, dated/received 11/08/21, 10 pages
- 16. Peer Review-Traffic, prepared by Environmental Partners, dated/received 11/11/21, 14 pages
- 17. Public Hearing Continuance Request to 12/01/21, 1 page
- 18. Peer Review-Zoning/Site Plan, prepared by Beals & Thomas, dated/received 12/07/21, 12 pages
- 19. Applicant Response to Peer Review-Zoning/Site Plan, prepared by Bay Colony Group, Inc., dated/received 12/2/21, 5 pages
- 20. Revised Site Plan prepared by Bay Colony Group, Inc., entitled "Site Development-Plan of Land 591 Washington Street", revision dated 11/22/21, received 12/02/21; 24"x36" & 11"x17", black & white, 22 sheets to include:
  - Sheet CV: Cover Sheet
  - Sheet 1.0: Legend & General Notes
  - Sheet 2.0: Existing Conditions Plan
  - Sheet 3.0: Master Layout Plan
  - Sheet 3.1: Layout & Grading Plan
  - Sheet 3.2: Layout & Grading Plan

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- Sheet L3.1: Landscape Enlargement Plan

Sheet L3.2: Landscape Enlargement Plan

- Sheet 4.0: Drainage & Utility Plan
- Sheet 5.1: Details
- Sheet 5.2: Details
- Sheet 5.3: Details
- Sheet 6.0: SWPP & Snow Storage Plan
- Sheet 7.0: Certificate of Action-not included
- Sheet L4.1: Landscape Details
- Sheet LT-1: Lighting Plan
- Sheet A-1: Floor Plan
- Sheet A-2: Building Elevations
- 21. Peer Review-Stormwater, prepared by PSC, PC, dated/received 12/07/21, 23 pages
- 22. Public Hearing Continuance Request to 12/15/21, 1 page
- 23. Revised Stormwater Management Report, dated 11/21; 451 pages
- 24. Applicant Response to Peer Review-Traffic, prepared by McMahon, dated/received 01/05/22, 23 pages
- 25. Public Hearing Continuance Request to 01/05/22, 1 page

Decision – Wrentham Planning Board Special Permit (SP 2021-05) & Site Plan Approval W.B.H., LLC (Owner) / ND Acquisitions, LLC (Applicant) Page 4 of 18

- 26. Waiver Narrative prepared by Samantha Randel, VP National Development received 01/18/22, 5 pages
- 27. Public Hearing Continuance Request to 01/19/22, 1 page
- 28. Public Hearing Continuance Request to 02/02/22, 1 page
- 29. Architectural Renderings presented on 12/01/21
- 30. Mullin's Certificate completed by Thomas Wrynn for January 5, 2022 meeting, 1 page.
- 31. Site Plan prepared by Bay Colony Group, Inc. entitled "Site Development-Plan of Land 591 Washington Street", dated 12/14/21, received 01/27/22; 24"x36" & 11"x17", black & white, 23 sheets to include:
  - Sheet CV: Cover Sheet
  - Sheet 1.0: Legend & General Notes
  - Sheet 2.0: Existing Conditions Plan
  - Sheet 3.0: Master Layout Plan
  - Sheet 3.1: Layout & Grading Plan
  - Sheet 3.2: Layout & Grading Plan

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- Sheet L1.1: Landscape Plan
- Sheet L2.1: Parking Lot Shading Calculation Plan

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Sheet L3.1: Landscape Enlargement Plan

- Sheet 4.0: Drainage & Utility Plan
- Sheet 5.1: Details
- Sheet 5.2: Details
- Sheet 5.3: Details
- Sheet 6.0: SWPP & Snow Storage Plan
- Sheet 7.0: Certificate of Action-not included
- Sheet L4.1: Landscape Details

• Sheet A-2: Building Elevations

- Sheet LT-1: Lighting Plan
- Sheet A-1: Floor Plan

Sheet L3.2: Landscape Enlargement Plan 2

- 32. Email Correspondence, Abutter Gordon, dated/received 01/31/22, 11 pages
- 33. Email Correspondence, Abutter Welling, dated/received 01/31/22, 2 pages
- 34. Email Correspondence, Abutter Lamparelli, dated/received 02/01/22, 2 pages
- 35. Email Correspondence, Abutter Heck, dated/received 02/01/22, 2 pages
- 36. Correspondence, Attorney Daniel C. Hill on behalf of Gordon, letter dated/received 02/02/22, 9 pages
- 37. Mullin's Certificate completed by Michael McKnight for February 2, 2022 meeting, 1 page
- 38. Public Hearing Continuance Request, dated 2/16/22, received 02/11/22, 1 page
- 39. Public Hearing Continuance Request, dated 3/2/22 received 02/28/22, 1 page

40. Email Correspondence, Abutter Lamparelli, dated/received 03/01/22, 1 page

- 41. Email Correspondence, Abutter Sacchetti, dated 03/07/22, received 03/08/22, 1 page
- 42. Correspondence, Abutter Welling, letter dated/received 03/08/22, 1 page
- 43. Email Correspondence, Abutter Syverson, dated/received 03/15/22, 1 page
- 44. Public Hearing Continuance Request, dated/received 03/15/22, 1 page
- 45. Correspondence, Abutter Alexander, letter dated 03/30/22, received 04/04/22, 1 page
- 46. Email Correspondence, Abutter Lamparelli, dated/received 04/12/22, 1 page
- 47. Email Correspondence, Abutter Ferrari, dated 04/18/22, received 04/19/22, 1 page
- 48. Correspondence, Attorney Jonathan Silverstein on behalf of 575 Washington Street, LLC and Interstate Travel Plaza, LLC, dated/received 04/19/22, 5 pages
- 49. Email Correspondence, Attorney Jonathan Silverstein on behalf of Helping Hands of America Foundation, Inc., dated/received 04/20/22, 2 pages
- 50. Applicant Response to Attorney Silverstein comments, dated/received 04/20/22, 13 pages

- 51. Traffic Review prepared by Kimley/Horn on behalf of Beth Ferrari of 575 Washington Street, LLC, dated/received 04/21/22, 6 pages
- 52. National Development Presentation to PB, 04/20/22 received 04/27/22, 10 pages
- 53. Traffic Analysis, McMahon, dated/received 05/02/22, 145 pages
- 54. Public Hearing Continuance Request, dated/received 05/03/22, 1 page
- 55. McMahon Response Letter to Kimley-Horn, dated/received 05/05/22, 6 pages
- 56. Revised Public Hearing Notice for 06/01/22, 1 page
- 57. McMahon Response to EP Comments, dated/received 05/17/22, 8 pages
- 58. Amended Application packet & Cover Letter submitted by ND Acquisitions, LLC., dated 05/12/22; 19 pages
- 59. Amended Site Plan prepared by Bay Colony Group, Inc. entitled "Site Development Plan of Land – 15 Commerce Boulevard (formerly 591 Washington Street)", dated 5/11/22, received 5/12/22; 22 pages
- 60. DPW Comment, dated/received 05/25/22, 1 page
- 61. Talerman Memo, dated/received 06/01/22, 2 pages
- 62. Abutter Email Ferrari, dated/received 06/01/22, 6 pages
- 63. National Development Presentation to PB, dated/received 06/01/22, 6 pages
- 64. Public Hearing Continuance Request, dated/received 06/02/22, 1 page
- 65. Kimley-Horn Presentation to PB, dated 06/01/22, received 06/02/22, 14 pages
- 66. Planning Director Email to Kimley-Horn, dated/received 06/03/22, 2 pages
- 67. Randel Response Email to Kimley-Horn, dated/received 06/08/22, 2 pages
- 68. BTI Peer Review, dated/received 06/09/22, 3 pages
- 69. Abutter Comment, Butler, dated/received 06/09/22, 1 page
- 70. Comments, Police Chief, dated/received 06/14/22, 3 pages
- 71. Planning Director Response to Police Chief, dated/received 06/14/22, 3 pages
- 72. Residents Traffic Light Petition, received 06/15/22, 7 pages
- 73. Kimley-Horn Response to Planning Director, dated/received 06/15/22, 3 pages
- 74. Mullin's Certificate completed by Robert Cass for June 15, 2022 meeting, 1 page
- 75. Hawes St Concept Plan, received 07/14/22, 2 pages
- 76. Abutter Letter Ferrari, dated/received 07/18/22, 2 pages
- 77. Attorney Silverstein Letter, dated/received 07/20/22, 10 pages
- 78. Public Hearing Continuance Request, dated/received 07/21/22, 1 page
- 79. Decision Edits, Silverstein, Talerman, dated/received 07/27/22
- 80. Peer Review, Traffic; confirmation of Applicant responses, dated/received 08/03/22, 3 pages
- 81. Email Correspondence, Fire Chief, dated/received 08/03/22, 1 page

#### FINDINGS

At their meeting of August 17, 2022, after due consideration of the Exhibits submitted and the entire record of proceedings introduced and accepted in this matter, the Wrentham Planning Board made the following Findings:

1. That determinations regarding the following Findings are based upon the documents and plans identified in this Decision, as well as the information and Exhibits submitted and presented in association with the Application.

Decision – Wrentham Planning Board Special Permit (SP 2021-05) & Site Plan Approval W.B.H., LLC (Owner) / ND Acquisitions, LLC (Applicant) Page 6 of 18

- 2. That determinations regarding the following Findings are also predicated upon the maintenance and development of the Site in accordance with this Decision, as well as all applicable Federal, State and Local regulations, except where modified by this Decision.
- 3. That the Applicant is proposing to construct a 179,800 gross square foot (gsf) warehouse building with ancillary business offices (the "Project"). The Site is approximately 15.8 acres, and is on a parcel that was created under a 2017 definitive subdivision plan entitled "Subdivision Plan, Project: Wrentham Business Park Wrentham, Massachusetts" dated July 20, 2017. The park is a commercial development located in the then C-2 Zoning District. The definitive subdivision plan was also subject to a 2001 MEPA filing & review. The Board further finds that in accordance with State Zoning Act, the filing of a preliminary subdivision plan followed by the definitive subdivision plan within seven months thereafter, "freezes" the zoning in effect at the time of submittal of the preliminary plan with regard to the land shown on such plan, for a period of eight (8) years, beginning with the date of endorsement of the plan (see M.G.L. 40A, Sec. 6). The preliminary and the definitive subdivision plans were filed with the Town simultaneously on August 9, 2017 and the definitive plan Certificate of Action was endorsed on November 15, 2017 and is recorded with the Norfolk County Registry of Deeds in Book 35774, Page 370 and definitive subdivision plan in NCRD Plan Book 666, Page 58 of 2018. Accordingly, zoning bylaws adopted during the "freeze" period are not applicable and the Amended Application is based upon zoning as it existed at the time of the submittal of the preliminary subdivision plan.
- 4. That the Applicant is requesting (a) Special Permits for: (i) Use (ZBL §4.2.F.4 Warehouse and storage facility, other than a facility for storage of so-called junk vehicles and other scrapped materials), (ii) Front & Side Yard Setback Reduction (ZBL §6.1 footnote 9), (iii) Earth Removal (ZBL §14 & General Bylaw Art. 275-4); and (b) Site Plan Approval for Use (ZBL §4.2.F.4 and §7) (Exhibit #58); and (c) the waivers described below. The Board finds that at the time of filing of the preliminary subdivision plan on August 9, 2017, the Zoning Bylaw that was in effect was dated November 14, 2016, as amended through August 9, 2017, and therefore governs the land shown on such plan, including the Site and the Project.
- 5. That, during the public hearing, the Applicant and Applicant's Engineer presented the Application, noting that portions of the Site had been previously disturbed in conjunction with the approved definitive plan for the commercial subdivision. The Engineer reviewed the proposed Site utilities of underground propane for heating, stormwater management system to collect the surface water from the Site, septic designed to meet State Title 5 regulations, site lighting and landscaping using Low Impact Development techniques. The parking lot would consist of 150 parking spaces, 32 loading bays and 11 tractor trailer parking spaces (Exhibit #3, #20, #31 & #59).
- 6. The Engineer noted that the Site would be served by Town water, a sprinkler system and hydrants would be located on Site as required by the Town's Water System regulations. The water line on Commerce Blvd would be looped through the Site and connected back to the water main on Commerce Blvd to create redundancy in the section of Route 1.
- 7. That, during the public hearing, the Engineer discussed that the proposed stormwater treatment on Site has been designed to meet both MassDEP Stormwater Management Standards as well as the requirements of the Wrentham Board of Health Regulations for Stormwater Management and Runoff Management and consists of a surface infiltration basin to capture and infiltrate all runoff up to and including the 100-year storm event without any outflow. The overdesign was chosen in order to ensure that the water supply tributary will receive the maximum feasible amount of protection and recharge (Exhibits #3-#5, #14, #20, #21, #23, #31, #58 & #59). The Board further notes that a peer review of the stormwater management system was performed on behalf of the Town by PSC, PC and, in

accordance with their letter dated 12/07/21 (Exhibit #21), all stormwater issues have been resolved by the Applicant.

- 8. That the building is proposed to be served by an on-site septic system conforming to State Title 5 and local Board of Health regulations for the treatment of purely domestic sanitary discharges (Exhibits #3, #4, #20 & #31). The Board further notes that the septic system will be reviewed and approved by the Board of Health.
- 9. That a peer review of the zoning/site plan has been performed on behalf of the Town by Beals & Thomas, Inc. In accordance with their letter dated 06/09/22 (Exhibit #68), all zoning/site plan issues have been resolved by the Applicant.
- 10. That during the public hearing the Applicant discussed that they would be applying to Massachusetts Department of Transportation (hereinafter "MassDOT") for a traffic light to be installed at the intersection of Commerce Boulevard, Hawes Street and Washington Street to ensure the proposed trucks associated with the proposed use would be able to safely enter and exit onto Washington Street. The Board further finds that the traffic light would also aid in the safety of the existing and future uses' access in this commercial subdivision but that, ultimately, the final approval of the traffic light is under the authority of MassDOT (see Finding #11).
- 11. That, during the public hearing, residents and abutters noted concerns with the traffic striping, signaling, how their existing site access would be affected and that there was an existing traffic issue on Hawes St. The Hawes St residents expressed their concern that the proposed traffic light would encourage and ultimately increase the vehicles accessing Hawes St. The neighboring businesses were concerned that the striping would have a negative impact to customers accessing their sites. The Applicant held multiple meetings to strategize with the residents, businesses and the Town's Public Safety personnel to revise their plans and to otherwise address these concerns (Exhibit #32-#36, #40-#43, #52, #59 & #60).
- 12. That, during the public hearing, the Applicant noted that the Project is undergoing review by the MEPA Unit of the EOEEA as well as MassDOT and, to that end, several meetings have been held with each to review the proposed traffic improvements; and that, based upon the discussions noted in Finding #11, the Applicant is proposing the intersection improvements, subject to approval by MassDOT, to include restriping the northbound and southbound Washington St approaches to accommodate a U-turn, "Road Closed to Thru Traffic" and "No Trucks" signs would be placed at the Hawes St entrance from Washington St. & Thurston St. (Exhibit #60), along with pushing back the southbound stop line an additional traffic light phase would be included for the 580 Washington St gas station, northbound & southbound centerline striping to allow for continued access to 579 Washington St, 687 Washington St & 600 Washington St properties.
- 13. That a peer review of the traffic has been performed on behalf of the Town by Environmental Partners. In accordance with their letter dated 11/11/21 (Exhibits #16, #24, #53 & #57), the Applicant's response letter dated 01/05/22 and EP's subsequent testimony during the public hearings, excepting a few items recommended as conditions of approval, all traffic issues have been resolved.

#### Criteria for Special Permit Reduced Front & Side Yard Setback (2016 ZBL §6.1, footnote 9)

In addition to the Findings referenced above, the Board makes the following Findings and makes the determination that the Project meets the following criteria:

14. With regard to ZBL §6.1, footnote 9.a, the reduction of front yard setback and side yard setback shall not have an adverse effect on public infrastructure and services (Finding #5-#8 & #10-#13).

- 15. With regard to ZBL §6.1, footnote 9.b, the reduction of front yard and side yard setbacks shall have no effect on environmentally sensitive lands (Finding #5 & #7).
- 16. With regard to ZBL §6.1 footnote 9.c., the proposed appearance of the building and structures as well as landscaping features on the lot from adjoining public ways will be improved (Finding #5, #20 & #24).
- 17. With regard to ZBL §6.1 footnote 9.d., the site layout does serve to facilitate safe and adequate circulation along adjoining public ways (Finding #19).

#### Criteria for Site Plan Approval (2016 ZBL §7.7)

- 18. With regard to ZBL §7.7(a), that, based upon the Findings stated within this Decision, there is adequate storm water retention on the Site (Exhibit #3-#5, #14, #21, #23, #31 & #59, Finding #5 & #7). The Drainage Report demonstrates that stormwater runoff from the site will be reduced in the proposed condition for all storm events up to and including the 100-year storm. The Site design conforms to the performance standards of the DEP's Storm Water Management Policy and all other state and local requirements. The Board further notes that Stormwater has been reviewed and approved by the Board of Health.
- 19. With regard to ZBL §7.7(b), that, based upon the Findings stated within this Decision, there is adequate access to the Site for public safety vehicles (Exhibit #3, #20, #31 & #59). The proposed site plan includes access from Commerce Boulevard, which is a private way and was approved and constructed in accordance with a 2017 definitive plan. The proposed drive aisles within the Site provide adequate access to emergency vehicles to all sides of the building.
- 20. With regard to ZBL §7.7(c), that, based upon the Findings stated within this Decision, the Site is currently a vacant lot and was previously disturbed as part of the earlier definitive plan permitting (Exhibit #3, #4, #20, #31 #59, Finding #5) causing all existing vegetation to be removed from the Site. The Board finds that the Applicant is minimizing further disturbance of existing natural features, including vegetation, and is proposing to install a visual screen comprised of a graded berm with trees along the Washington Street (Route 1) lot line and also proposing to install landscaped areas that incorporate Low Impact Development best practices throughout the Project.
- 21. With regard to ZBL §7.7(d), the Project is designed to minimize air and water pollution (Exhibit #3, #4, #20, #31 & #59, Finding #5-#7, & #18). Mitigation measures will be implemented as necessary to minimize and control the dust that may occur as a result of the proposed grading and construction activities. All demolition activities will be conducted in accordance with the applicable provisions of the Dust, Odor, Construction and Demolition regulations, 310 CMR 7.09. Upon completion of construction, there will be large trucks associated with delivery on the Site with associated truck and car emissions, due to engine idling, all of which will be regulated by the Massachusetts Anti-Idling Law, MGL Chapter 90, Section 16A, as implemented through the Massachusetts Air Pollution Control Regulations, 310 CMR 7.11.
- 22. With regard to ZBL §7.7(e), that, based upon the Findings stated within this Decision, the collection and disposal of solid waste is satisfactory (Exhibit #3, #20, #31 & #59). The proposed facility will have an onsite dumpster/compactor set on a concrete pad on the rear of the building in the loading bay area. A solid waste contractor will be retained to perform weekly refuse removal services.

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- 23. With regard to ZBL §7.7(f), that, based upon the Findings stated within this Decision, pedestrian and vehicular safety on the Site and with adjoining properties is adequate (Exhibit #3, #6a, #20, #20, #24, #31 & #59, Findings #10-#13). The proposed warehouse facility and office space is estimated to generate approximately 428 vehicle trips on an average weekday, consisting of a total of 328 passenger car trips and 100 truck trips. During the weekday morning peak-hour, the Site is estimated to generate 58 vehicles trips consisting of 52 passenger car trips and 6 truck trips. During the weekday afternoon peak-hour the Site is estimated to generate 61 vehicle trips consisting of 54 passenger car trips and 7 truck trips. Site circulation and parking has been designed to comply with the requirements of ZBL §6.4. Based on ZBL §6.4, the proposed facility requires 150 passenger car parking spaces of which 150 spaces are provided, 6 of which are accessible. The Site also proposes 32 truck loading bays and 11 tractor trailer spaces. A peer review of the traffic issues has been performed on behalf of the Town by Environmental Partners. In accordance with their final review all traffic issues have been adequately addressed.
- 24. With regard to ZBL §7.7(g), that, based upon the Findings stated within this Decision, the Project has been designed to minimize the visibility of parking, any outdoor storage and service areas from the public view and any glare from headlights and facility lighting through additional plantings (Exhibit #3, #20, #31 & #59). The Site has been designed to distribute parking around two sides of the building to minimize large expanses of pavement. Existing vegetation, where it exists, has been maintained where possible and landscaping proposed within and around the perimeter of the site provides for additional buffering of parking as well as minimizing the glare from headlights and facility lighting. All loading and outdoor service areas are located behind the building and screened from public view.
- 25. With regard to ZBL §7.7(h), that, based upon the Findings stated within this Decision, the Project adequately minimizes the intrusion of light from stationary fixtures on the site to adjoining properties (Findings #5, #20 & #24). The proposed lighting layout and fixtures have been designed to minimize intrusion of light from stationary fixtures on the site into adjoining properties.
- 26. With regard to ZBL §7.7(i), that, based upon the Findings stated within this Decision, the proposed architectural design is compatible with the surrounding neighborhood (Exhibit #3, #20, #31 & #59). The proposed building architecture will incorporate the use of stepped front facades and a color scheme so as to reduce the visual effect of the building mass. The architecture and landscaping will be an improvement to the surrounding area and consistent with the surrounding area's character and intensity of use.

#### Criteria for Special Permit Decisions (2016 ZBL §9.1)

- 27. With regard to ZBL §9.1(a), that, based upon the Findings stated within this Decision, the Project has a vehicle and pedestrian traffic of a type and quantity that is in harmony with and does not adversely affect the immediate neighborhood (Findings #10-#13, #19 & #23). Subject to MassDOT approval, the Applicant shall install a traffic signal at the intersection of Washington Street, Hawes Street and Commerce Boulevard for this project to be viable. A copy of the Site's Application for Permit to Access the State Highway will be submitted to the Planning Board. The Board further notes that monitoring of the traffic light operations and vehicle traffic will commence as noted in the Conditions.
- 28. With regard to ZBL §9.1(b), that, based upon the Findings stated within this Decision, the Project will not have an excessive number of employees, customers or visitors so as to adversely affect the

immediate neighborhood (Findings #23). The Board further notes that the proposed traffic signal in conjunction with recent MassDOT traffic improvements in the area will increase vehicle safety along this highly traveled corridor.

- 29. With regard to ZBL §9.1(c), that, based upon the Findings stated within this Decision, the Application does not have lot coverage greater than allowed in the applicable zoning district (Exhibit #3, #20, #31 & #59).
- 30. With regard to ZBL §9.1(d), that, based upon the Findings stated within this Decision, the use will not be dangerous to the immediate neighborhood through fire, explosion, emission of wastes or other causes (Exhibit #4, #6 & #58, Findings #5-#9, #18, #15, #17, #19 & #21).
- 31. With regard to ZBL §9.1(e), that, based upon the Findings stated within this Decision, the use does not adversely affect the immediate neighborhood by creation of noise, vibration, dust, heat, smoke, fumes, odor, glare or other nuisance or serious hazard to the immediate neighborhood (Findings #5, #8, #19-#22, #24, #25 & #26). Should the use of the building change, or the use's intensity materially exceeds what was proposed, an amendment to this approval shall be required.
- 32. With regard to ZBL §9.1(f), that, based upon the Findings stated within this Decision, the use will not adversely affect the character of the immediate neighborhood (Exhibit #6, Finding #26 & #31). The Board further notes that the proposed use is permitted within the district and that the project's proposed landscape and architectural plans will improve the quality of the existing Site and neighborhood.

#### Criteria for Special Permit Decisions (2016 ZBL §9.2)

- 33. With regard to ZBL §9.2, that based upon the Findings stated within this Decision, the Project will be in harmony with the intent and purpose of the bylaw as set forth in Article 1, §1.2, and shall not be in conflict with public health, safety, convenience and welfare, and shall not adversely affect the neighborhood (including, without limitation, the zoning district and all abutting zoning districts).
- 34. With regard to ZBL §9.2(a), that, based upon the Findings stated within this Decision, the Project complies with ZBL Articles 4 and 6 (Exhibit #4 & #59).
- 35. With regard to §9.2(b), that, based upon the Findings stated within this Decision and subject to the Conditions of this Decision, the vehicular and pedestrian traffic of the Project will not be a significant impact on the neighborhood, the primary or secondary roads, or the intersections serving the project area and further, the estimated additional employees, customers and visitors to the Site will not have an adverse effect to the environment nor on the immediate neighborhood (Findings #5, #9-#13, #19, #21, #23, #27 & #28). The Board further notes that the Applicant has submitted plans to MassDOT for the installation of a traffic light at the intersection of Washington Street (Route 1), Hawes St & Commerce Blvd in order to further improve traffic safety to the surrounding area.
- 36. With regard to ZBL §9.2(c), that, based upon the Findings stated within this Decision, there will be adequate provisions to control litter, reduce, separate, recycle and/or compost solid waste generated at the site (Exhibit #4, Finding #22).
- 37. With regard to ZBL §9.2(d), that based upon the Findings stated within this Decision, the Project will not significantly impact the quality of surface water, ground, waters, soil, and the environment to include noise, vibration, dust, smoke, fumes, odor, glare or another nuisance or serious hazard so as to adversely affect the immediate neighborhood (Exhibits #3-#6, #20, #23, #31, #58, #59 & #68, Findings #5, #7, #9, #14, #18, #20, #21, #25, #30, #31 & #35).

- 38. With regard to ZBL §9.2(e), that based upon the Findings stated within this Decision, the use will not be a danger to the immediate neighborhood and/or the community or premises through fire, explosion, emission of wastes or runoff or other causes (Finding #36).
- 39. With regard to ZBL §9.2(f), that, based upon the Findings stated within this Decision, the proposed water and subsurface sewage disposal for the site are adequate (Exhibit #3, #20 & #25). The Board further notes that the septic system is reviewed and approved through the Board of Health and the water system will be inspected by the DPW Water Department.
- 40. With regard to ZBL §9.2(g), that, based upon the Findings stated within this Decision, the Project will not have a significant impact on municipal public safety services including water, sewer, police, fire protection and ambulance services (Exhibits #3-6, #9-#12, #14, #20, #21, #23, #31, #58, #59 & #60, Findings #3, #5-#8, #10-#14, #17, #19, #30, #31, #34, #37 & #38).
- 41. With regard to ZBL §9.2(h), that, based upon the Findings stated within this Decision, that the architecture of the proposed building is in harmony with the surrounding neighborhood, including, without limitation, the zoning district and all abutting zoning districts (Exhibits #3, #4, #6, #20, #31, #58, #59 & #68, Findings #3, #5, #9, #16, #20, #24-#27 & #32).
- 42. With regard to ZBL §9.2(i), that, based upon the Findings stated within this Decision, the visual impacts of the project will not adversely impact the character of the neighborhood, including, without limitation, the zoning district and all abutting zoning districts (Finding #40). The Board further notes that the building and site improvements as proposed and conditioned will be an improvement to the surrounding area.
- 43. With regard to ZBL §9.2(j), that, based upon the Findings stated within this Decision, the Project will not have an adverse impact on the character of the neighborhood, the Town, its residents or surrounding properties (Finding #41). The Board further notes that the building has been designed to be in conformance with the commercial character of the neighborhood and with ZBL §4.2.
- 44. With regard to ZBL §9.2(k), that, based upon the Findings stated within this Decision, the use will not have an adverse economic impact on the Town, its residents and surrounding properties (Exhibits #3-#6, #14-#16, #18-#21, #23, #24, #31, #53, #57-#59 & #68, Findings #3, #5-#14, #18, #20, #23, #26, #32, #35, #38, #39). The Board further notes that the project as proposed and conditioned will increase the tax revenue for the Town.
- 45. With regard to ZBL §9.4, that, based upon the Findings stated within this Decision, the proposed use and Project will have an acceptable environmental lot impact, is consistent with the land use objectives of the Town, complies with the Bylaws and in particular, ZBL §1.2, and will comply with the bylaw and regulations of the Town and applicable laws and regulations of the Commonwealth.

#### Criteria for Earth Removal Special Permit (2016 ZBL §14.6 and GBL §275-4)

- 46. With regard to ZBL §14.6 and GBL §390-275-6(D)(2), that, based upon the Findings stated within this Decision, the earth removal for the project may be accomplished without unreasonable danger to the health, safety and general welfare of the inhabitants of the Town in general nor to that of those in the immediate vicinity (Exhibit #58, #59 & #68).
- 47. With regard to ZBL §14.6(b) and GBL §275-6(D)(2)(b), that, based upon the Findings stated within this Decision, the earth removal for the project will not produce unreasonable noise, dust or other

effects observable as detrimental to the normal use of adjacent land (Finding #18, #21, #25, #30 & #36).

- 48. With regard to ZBL §14.6(c) and GBL §275-6(D)(c), that, based upon the Findings stated within this Decision, the earth removal and change in topography for the project will be accomplished without adverse effect to abutting land by reason of surface water drainage, recharge of the water table not to the pumping rate of any nearby Town well site (Exhibit #58, #59 & #68, Finding #47).
- 49. With regard to ZBL §14.6(d) and GBL §275-6(D)(d), that, based upon the Findings stated within this Decision, the earth removal for the Project will not have a material adverse effect on the health or safety of persons living in the neighborhood or on the use or amenities of adjacent land (Finding #1-#47).

#### WAIVERS

At their meeting on February 2, 2022 and August 17, 2022, after due consideration of the Exhibits submitted and the entire record of proceedings introduced and accepted in this matter, and as supported by the foregoing findings, the Wrentham Planning Board (MOTION by Mr. Lawrence, SECOND by Mr. Skinner) voted 7-0 by Roll Call vote: Mr. Cass-Aye, Mr. Lawrence-Aye, Mr. McKnight-Aye, Mr. Schwarm-Aye, Mr. Skinner-Aye, Mr. Woodhams-Aye, Mr. Wrynn-Aye to GRANT the Applicant's request for waivers from the following sections of the Wrentham Zoning Bylaw and General Bylaw, finding that the GRANT of these waivers are in the best interests of the Town and are consistent with the intent and purpose of the Zoning Bylaw and General Bylaw:

- 1. ZBL §18.5(d)(2): To allow up to two (2) 100 SF signs on the building in lieu of the ZBL-permitted 10 SF sign size. The Board finds that this waiver is not detrimental to the intent of §18.1, which is protection of the visual environment of the Town, and the safety, convenience, and welfare of the public. The proposed signs are consistent with other signs in the area.
- 2. ZBL §14.7(c) & GBL §275-7(B)(3): To allow for a waiver to excavate to the property line and eliminate the 50-foot buffer strip along the property line to allow for the installation of the stormwater basin. The Board finds that compliance with the buffer requirement would not serve to reduce the impacts of the proposed project to the natural environment and the waiver of the buffer requirement will not substantially compromise the protection of the public and the environment. The Board notes that the stormwater basin will be constructed in accordance with the regulations of the Planning Board and Board of Health and is located in a commercial zone. The Board further finds that waiver of the foregoing requirements will not derogate from the intent of the general requirements of the bylaw and that the buffer strip is not in the Town's best interest.
- 3. ZBL §14.7(k) & GBL §275-7(B)(11): To allow for a waiver to excavate within 10' of the estimated high ground water to allow for the construction of the stormwater basin. The Board finds that construction of the stormwater basin will be limited to the lowest portion of the site, which lies approximately 4' above the estimated high ground water elevation. The storm water basin will be constructed in accordance with the regulations of the Planning Board and Board of Health and is located in a commercial zone. The bottom of the basin will be at least 4' above the estimated high ground water elevation. The Board finds that the compliance with the foregoing requirement would not serve to reduce the impacts of the proposed project to the natural environment and that granting the waiver will not substantially compromise the protection of the public and the environment.

#### **CONDITIONS OF APPROVAL**

Decision – Wrentham Planning Board Special Permit (SP 2021-05) & Site Plan Approval W.B.H., LLC (Owner) / ND Acquisitions, LLC (Applicant) Page 13 of 18

At their meeting of August 17, 2022, after due consideration of the exhibits submitted and the entire record of proceedings introduced and accepted in this matter, the Wrentham Planning Board voted to **GRANT** the Application for Special Permits and Site Plan Approval with the following conditions:

#### STANDARD CONDITIONS

- 1. This Decision specifically is limited to the authority to construct a 179,800 square foot warehouse building with up to 10,000 s.f. of office space, 150 passenger vehicle parking spaces, 32 loading bays, 11 tractor trailer parking spaces, stormwater retention system, landscaping and other associated site improvements on the Site, all as shown on the Plans identified as Exhibit #59 of this Decision, or as modified by the Conditions of this Special Permit / Site Plan Approval.
- 2. The work authorized by this Decision shall be solely for the purposes noted within Condition #1 of this Decision and shall run with the land and be binding upon the property owners as well as their administrators, successors and assigns, including future tenants. Any instrument for sale, transfer of rights or interest in all or any part of the Site shall reference this Decision and shall include a provision that the successors are bound to its terms and conditions.
- 3. The Applicant shall adhere to the applicable Wrentham Zoning Bylaws except as waived herein, and all other applicable provisions of municipal law and regulation, Federal and State statutes and related regulations promulgated by Federal and State agencies.
- 4. Any modifications to the use, Site, structure(s) and/or Site improvements as described within and as authorized by this Decision and as presented to the Board during the public hearing and in the above referenced Exhibits shall require, prior to implementing such change, a request in writing, from the Applicant to the Board for a determination as to whether the proposed change constitutes a Minor or Major Modification. Insubstantial modifications, such as minor field changes, slight variations in building or site layout and changes that are de minimis in nature shall not require additional review and approval of the Board and may be approved by the Wrentham Building Commissioner in consultation with the Planning Director. Minor changes required by other municipal boards and commissions are allowed subject to revised plans incorporating all changes being submitted to the Board for the record file. Major modifications shall require a formal amendment to this decision, after a public hearing in compliance with the Zoning bylaws and G.L. c. 40A.
- 5. All maintenance of the Site hereafter shall be in accordance with all applicable Federal, State and Local regulations, as well as this Decision.
- 6. In accordance with ZBL §7.7, §9.4 and M.G.L. c. 40A §9, these Special Permits and Site Plan Approval are valid for two (2) years from the date of the expiration of the appeal period. Development must be completed within the two-year time limit unless an extension is granted. Extensions shall be considered a Modification of this permit and shall be submitted in writing to the Board prior to expiration for review and approval.
- 7. These Special Permits and Site Plan Approval shall not take effect until this Decision and Plan Cover Sheet have been recorded at the Norfolk County Registry of Deeds (NCRD) within thirty (30) days following the expiration of the appeal period. Proof of recording of the Decision and Plans, including Deed Book and Page Number or Instrument Number shall be submitted to the Planning Board office within thirty (30) days of recording.
- 8. By recording this Decision in the NCRD, the Applicant agrees to and accepts the Conditions set forth in this Special Permit & Site Plan Approval decision.
- 9. Any inability, failure or refusal by the Applicant to comply with the Conditions of this Decision, when notified of failure of compliance, shall be grounds for zoning enforcement, including an order to

immediately halt any site work, construction or operations; or a denial of building or occupancy permits with respect to this project.

- 10. This approval shall not be construed as final approval of any on- or off-site improvements or work (such as water, sewer, drainage, or other utility installation) associated with this project and shown on the Plans. All applicable Federal, State and Local approvals/permits shall be obtained by the Applicant prior to the construction of any portion of the development or off-site improvements that warrant such approval/permits. All applicable requirements of the Wrentham Board of Health, Conservation Commission, Department of Public Works and all other utilities, are hereby incorporated by reference as a requirement of this Decision.
- 11. This approval is contingent upon the Applicant obtaining any and all required approvals for a connection to an adequate water supply.

#### CONDITIONS TO BE MET PRIOR TO THE START OF CONSTRUCTION

- 12. Prior to the endorsement of the site plan a final revised plan, with a revised plan set date, incorporating all conditions and changes listed herein, stamped by the appropriate professional engineers and/or land surveyors shall be submitted to the Board. A block for Planning Board endorsement shall be placed on the cover sheet.
- 13. Prior to the commencement of any site work, the Applicant shall submit to the Board a final construction phasing schedule which also identifies the designated route for construction vehicles, and their anticipated hours of travel. The installation of haybales, compost socks and silt fence and the clearing and grubbing necessary for such installation shall not be considered "site work" for purposes of compliance with this condition. The plan shall clearly explain the building construction and utility sequencing and the provisions for safe access during construction. The Applicant shall ensure that, during construction, the design engineer, or its qualified representative, visits the Site regularly and, at a minimum, twice a month during peak activity periods provides regular reports to the Building Commissioner, Planning Director and Board's Consulting Engineer to advise of the status of the work, erosion control measures and any special circumstances which may arise in connection with the construction of the Project. The Applicant shall direct construction vehicles to avoid secondary residential roads.
- 14. A pre-construction meeting shall be held with the Planning Board's Consulting Engineer, Planning Director and applicable Department heads prior to the start of construction. The Board may require the services of a peer review engineer to inspect portions of the work both during and after construction. The costs for these inspections shall be borne by the Applicant. Based on the results of the pre-construction meeting, a review deposit may be required from the Applicant at that time, but failure to require a deposit at that time shall not preclude the Board from requiring a deposit at a later date if it deems additional inspections are needed.
- 15. Prior to the start of any construction activity on the Site, an initial inspection of the delineated limits of work, erosion control and site stabilization measures shall be performed by agent(s) of both the Planning Board and Conservation Commission in the presence of a representative of the Applicant/Developer, and notice of such inspection forwarded to both Boards. No construction activity shall occur on the Site until the Applicant/Developer receives written authorization from both agent(s) of the Planning Board and Conservation Commission regarding the adequacy of the initial erosion control and site stabilization measures. The Planning Board reserves the right to require additional erosion control/site stabilization measures at any time during the construction process should the Planning Board, Conservation Commission or their agent(s) deem such measures necessary. The Applicant/Developer shall be notified in writing of the necessity for such additional measures, and

shall complete all such requirements within ten (10) days of receiving said notice, or other time as may be agreed upon by both the Planning Board and Conservation Commission.

16. Prior to the issuance of a building permit, the 50% MassDOT design plans associated with the proposed traffic signal and intersection improvements on Route 1 shall be submitted to the Planning Board.

#### CONDITIONS TO BE MET DURING CONSTRUCTION

- 17. The Applicant shall take all necessary measures to minimize dust from rising and blowing across the site and onto roads and adjacent properties. Any sediment or dirt tracked onto public ways shall be swept prior to the end of the construction day.
- 18. The Applicant shall be responsible for control and removal of litter/debris both during and after construction.
- 19. Hours of construction shall be as follows:
  - a. Interior Building Fit Out: Monday Friday 7 a.m. to 7:30 p.m.; Saturdays 8 a.m. to 6:30 p.m.; Sundays no work allowed
  - b. Exterior Building Construction and Site Work: Monday Friday 7 a.m. to 6:30 p.m. and earthwork proposed shall only occur Monday through Friday between the hours of 7 a.m. and 5 p.m. and Saturdays from 8 a.m. to 5 p.m. There shall be no construction activity on Sundays or Federal and State holidays.
- 20. All grading and construction shall be in accordance with the approved Plans and the Conditions of this Special Permit, as well as all applicable Federal, State and Local regulations, and shall be accomplished so as not to discharge any pollutants or siltation into waterways or resource areas from the site and its associated improvements during construction, and after completion.
- 21. The Planning Board reserves the right to utilize review fees as allowed under M.G.L. Ch. 44 §53G for engineering, legal and any other professional review services that may be needed to adequately review the project, monitor construction activities and impacts, and review final as-built plans.
- 22. Prior to the issuance of the Building Permit (BP) or Certificate of Occupancy (CO) for the Project, the Applicant shall satisfy the following requirements of the Wrentham Fire Department:
  - a. Before BP: Submit to the Fire Department for review and approval a fire protection/detection plan and sprinkler plan. The plan shall include detailed information for the water distribution system and anticipated water flow data, building sprinkler details and hydrant locations.
  - b. Before CO: The Applicant shall install a fire alarm radio box providing a direct connection to the Fire Department. It should be compatible with the current Fire Department receiving equipment. The Applicant may choose its own equipment, provided it is approved in advance by the Fire Department, and the receiving equipment and programming software are provided by the Applicant to the Fire Department in an acceptable manner
  - c. Before CO: A fire department connection shall be installed at a location approved by the fire department, if required.
  - d. Before CO: Bidirectional radio amplifiers shall be installed unless an alternate method is agreed to by the Department. This will include two Fire Department radio channels and one Police Department channel, as specified by each Department.

#### CONDITIONS TO BE MET AFTER CONSTRUCTION

#### A. General

23. Unless modified by this Decision, the Site shall be developed, constructed and maintained in accordance with all applicable Federal, State and Local regulations, and as shown on the Plans

identified as Exhibit #59 of this Decision or as modified by the Conditions of this Special Permit and Site Plan Approval. All required permits and approvals shall be secured by the Applicant at the appropriate stage of construction and copies of all pertinent documents regarding said permits and approvals shall be filed with the Planning Board in a timely manner.

- 24. All final grades and installation of improvements authorized by this Special Permit and Site Plan Approval, or approved modifications thereto, shall be shown on an as-built plan prepared by a registered professional engineer or land surveyor registered in the Commonwealth of Massachusetts. Copies of said plan shall be submitted to the Board and the Building Commissioner prior to the issuance of a Certificate of Occupancy.
- 25. The final as-built plans shall be submitted in electronic format compatible and/or able to be converted for use with the Town's GIS. A copy shall also be submitted in pdf format for more general use.
- 26. All landscaping, berms, walls and fencing shown on the approved plans shall be permanently maintained by the owner, and landscaping shall be replaced as needed to maintain the buffer to neighboring parcels and compliance with the requirements of the zoning bylaws and approved plans.

#### B. Noise

- 27. No vehicles shall be allowed to idle for more than 5 minutes in accordance with the State Air Pollution Regulations, 310 CMR 7.11(1). "No idling" signs shall be placed around the building so to be clearly visible to all trucks.
- 28. Idling reduction technologies, including electric parking spaces (anti-idling plugs) shall be installed at all operational loading bays throughout the building.
- 29. The Applicant and tenant(s) will endeavor to use low-noise back-up beepers for tenant owned vehicles.
- 30. If rooftop air conditioning units are installed, they shall be screened and sufficiently set back from building parapet to prevent noise impacts to surrounding areas.
- 31. Noise levels shall not exceed average ambient levels (at abutting property lines) by more than 10 dB between 7:30 pm and 6:30 am.
- 32. Building occupants shall conform to Massachusetts DEP noise regulations.
- 33. No refrigerated storage or refrigerated trucks are allowed unless they meet the noise conditions contained in this Decision.
- 34. The Zoning Agent or Planning Board may require at their discretion and at the Applicant's expense, a post-occupancy sound study to ensure compliance with noise conditions set forth herein. This sound study shall be completed by a sound consultant of the Applicant's choosing for consistency. This post-occupancy sound monitoring shall occur no sooner than two months after full building occupancy to allow time to establish routine procedures within the facility. Should the post-occupancy sound study show that noise levels exceed the conditioned levels, the tenant(s) shall be required to propose mitigation measures to eliminate such noise that exceeds the conditioned levels.

#### C. Operations

35. Exterior and parking lot lighting shall be turned off or dimmed during hours the facility is closed for operation, unless otherwise deemed necessary by the Wrentham Police Department for safety reasons. All sign illumination shall also be turned off during these hours except for the illumination of signs regarding hours of operation, truck idling and wayfinding for the purpose of directing trucks access and egress in accordance with the conditions in this Decision. Lighting and illumination levels shall follow the submitted lighting plan. All fixtures shall have LED bulbs and adjustable shields so that none of the site lighting extends beyond the property line nearest the residential neighborhood.

- 36. The loading bay doors shall be closed when the bays are not in operation (active loading or unloading) to prevent noise transmitting from the building from interior operations.
- 37. Operation and emptying of trash containers shall be between the hours of 6:00 AM and 10:00 PM. There shall be no trash pick-up on Sundays.
- 38. Forklift operations in the truck court area are prohibited from the hours of 10:00 PM to 6:00 AM. There shall be no forklift operations in the truck court area from the hours of 7:00 PM to 7:00 AM on Sundays.
- 39. Public roadways shall not be used for staging of vehicles, all staging of vehicles shall occur on site.
- 40. Snow storage shall be consistent with operations & management plan. No snow shall be deposited in resource areas.
- 41. Use of drones for shipping and receiving is not allowed unless specifically approved by Planning Board.

#### **D.** Traffic

- 42. A Certificate of Occupancy shall not be obtained for the project unless and until a fully operational traffic signal, as approved by MassDOT, is installed at the intersection of Commerce Boulevard, Hawes Street and Washington Street, as set forth below. If the Applicant commences construction prior to receiving an approval for the traffic signal, the Applicant shall bear all risk that the building will not receive a Certificate of Occupancy if the traffic signal is not installed and shall not be entitled to a modification of this Decision.
- 43. A traffic monitoring program will be conducted as directed by MassDOT and/or MEPA in five annual intervals with ongoing communication with the Town of Wrentham and the appropriate MassDOT units. The monitoring plan will begin six-months after initial full occupancy of the warehouse. The Planning Board shall be provided the results of this traffic monitoring program.
- 44. Should post-occupancy traffic monitoring indicate significant impacts to traffic operations, Applicant will propose mitigation measures to MassDOT and the Planning Board, at a public meeting, such as but not limited to signal timing adjustments.
- 45. The project's average daily trip generation shall not exceed the trip counts in the Transportation Impact Assessment dated October 2021 (Exhibit #6a) by more than 20%. The project's average daily trip generation is as follows: 428 total vehicle trips consisting of a total of 328 passenger car trips and 100 truck trips.
- 46. If a specific tenant is identified by the Applicant that is anticipated to generate traffic exceeding the project's average daily trip counts as stated within Exhibit #6a by more than 20%, the Applicant must apply for an amendment to the Special Permit and produce a new traffic impact study using trip generation specific to that tenant to prove no substantial impacts will result and, following review and approval by the Planning Board, to adjust the above specified threshold limits as appropriate.
- 47. In connection with the future traffic operation of Hawes Street apart from this Application, the Applicant agreed to and shall contribute funds in the amount of \$25,000 to the Planning Gift Fund towards any further studies, plans and / or mitigation measures, prior to the issuance of building permits. Additionally, as was agreed upon at the two (2) meetings held with three (3) Planning Board members, Planning and DPW staff, the Police Chief, Fire Department and the Applicant on June 30, 2022 and July 7, 2022, the Applicant has agreed to fund and orchestrate traffic monitoring, at the request of the Town, at three (3) and six (6) months following the installation of traffic signage (exact signs to be decided upon by the Town) at Hawes St and Route 1 (Washington St). If post-occupancy traffic monitoring indicates direct impacts from the proposed project to Hawes Street, the Applicant shall propose reasonable mitigation measures, subject to the review and approval of the Planning

Decision – Wrentham Planning Board Special Permit (SP 2021-05) & Site Plan Approval W.B.H., LLC (Owner) / ND Acquisitions, LLC (Applicant) Page 18 of 18

Board after a public meeting, which may require mitigation measures in addition to those proposed by the Applicant.

#### E. Site Specific

- 48. A gravel haul road access to the adjacent cranberry bog will be provided to allow for harvesting and other agricultural activities related to cranberry bog operations for so long as such operations continue.
- 49. Applicant will continue to coordinate with the Planning Board and its agent regarding the design and implementation of the proposed traffic signal under review by MassDOT.
- 50. Design and location of building mechanicals will consider environmental impacts such as noise and view and will be adequately screened and positioned away from surrounding streets.

#### **RECORD OF VOTE**

Constituting a majority of the Planning Board, the following members (MOTION by Mr. Lawrence, SECOND by Mr. Skinner) voted 6-1 by Roll Call vote: Mr. Cass-Aye, Mr. Lawrence-Aye, Mr. McKnight-Aye, Mr. Schwarm-Aye, Mr. Skinner-Aye, Mr. Woodhams-Nay, Mr. Wrynn-Aye to **APPROVE with Conditions** the Special Permit for Use (ZBL §4.2.F.4), Special Permit for Front & Side Yard Setback Reduction (ZBL §6.1, footnote 9), Special Permit for Earth Removal (ZBL §14 & GBL §275-4) and Site Plan Approval for Use (ZBL §4.2.F.4 & §7) and waivers under ZBL §18.5.d.2 (Signs), ZBL §14.7.c. and ZBL §14.7.k. (Earth Removal) and GBL Article 275-7.B(3) and 275-7.B (11) for a new 179,800 square foot warehouse building with up to 10,000 s.f. of office space & associated site improvements at **15 Commerce Boulevard** based on the information received at the public hearing and the aforementioned findings.

BY ORDER OF THE BOARD:

Michael McKnight, Chairman

Date:

cc:

- Applicant
  Building Commissioner
  DPW
- Owner
- Conservation Commission
- Fire Department

Charles Woodhams, Jr., Vice-Chairman

AssessorBoard of Health



Department of Environmental Protection

Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

Charles D. Baker Governor

Karyn E. Polito Lieuten ant Governor Bethany A. Card Secretary

Martin Suuberg Commissioner

November 7, 2022

**RE: FEIR Review. EOEEA 15765** Secretary of Energy and the Environment WRENTHAM. Wrentham Business Executive Office of Energy and Center at 589-591 Washington Street 100 Cambridge Street, Suite 900

Dear Secretary Card,

**Environmental Affairs** 

ATTN: MEPA Office Boston, MA 02114

Bethany A. Card

The Southeast Regional Office of the Department of Environmental Protection (MassDEP) has reviewed the Final Environmental Impact Report (FEIR) for the Proposed Mixed-Use Development at 655 Washington Street, Wrentham, Massachusetts (EOEEA #6383). The Project Proponent provides the following information for the Project:

The proposed Phase I will be the construction of a 116,000 SF NasKart entertainment center with associated off-street Parking, completion of the subdivision access road and further enhancements to the stormwater management infrastructure (i.e. tree wells to capture stormwater). This will occur on Lot #2 and within the proposed subdivision. Construction expected to begin in the 1st quarter of 2018. A future Phase II is expected to involve the construction of a 5,000 SF (+-) familystyle restaurant and 2,000 SF (+-) donut/coffee shop on Lot #1. A Phase III will potentially be the construction of 184,000 SF of warehousing in two (2) buildings on Lot 3 (Exhibit #4). There are no time frames associated with these two (2) future Phases as they will be exclusively market driven. In all cases, additional local approvals will be required, and a future MEPA filing will be necessary.

#### **MassDEP** Comments

The Project Proponent has addressed the Department's comments and offers the following for further guidance.

The Wetlands and Waterways Program has reviewed the Final Environmental Impact Report (FEIR) for Phase 2 of the Project, the subject of this filing. The Proponent has adequately addressed the concerns raised in the Wetlands Program comments. Phase 2 of the Project was reviewed by the Department through the submittal of a Notice of Intent

> This information is available in alternate format. Contact Glynis Bugg at 617-348-4040. TTY# MassRelay Service 1-800-439-2370 MassDEP Website: www.mass.gov/dep

and received an Order of Conditions (SE 351-1171) from the Wrentham Conservation Commission on December 20, 2021. This Order was not appealed to the Department.

Pursuant to the Department's internal review, no work appears within a geographic area subject to jurisdiction pursuant to Chapter 91 and its regulations at 310 CMR 9.00.

The MassDEP Southeast Regional Office appreciates the opportunity to comment on this FEIR. If you have any questions regarding these comments, please contact George Zoto at (508) 946-2820.

Very truly yours,

Jonathan E. Hobill Regional Engineer Bureau of Water Resources

JH/GZ

Cc: DEP/SERO

ATTN: Millie Garcia-Serrano, Regional Director Gerard Martin, Deputy Regional Director, BWR John Handrahan, Acting Deputy Regional Director, BWSC Seth Pickering, Deputy Regional Director, BAW Jennifer Viveiros, Deputy Regional Director, ADMIN Daniel Gilmore, Chief, Wetlands and Waterways, BWR Maissoun Reda, Wetlands, BWR Brendan Mullaney, Waterway, BWR Carlos Fragata, Waterways, BWR Michelle Regon, Drinking Water, BWR Daniel DiSalvio, Chief, Compliance and Enforcement, BAW Mark Dakers, Chief, Solid Waste, BAW Elza Bystrom, Solid Waste Management, BAW Allen Hemberger, Site Management, BWSC

| From:    | Ro Welling                            |
|----------|---------------------------------------|
| То:      | Patel, Purvi (EEA)                    |
| Subject: | Wrentham Business Center(EOEA #15765) |
| Date:    | Monday, November 7, 2022 9:09:34 PM   |

## CAUTION: This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Dear Ms. Patel:

My name is Ro Welling, and I live on Hawes Street in Wrentham, Mass, and one end of our road comes out onto Route 1. Commerce Boulevard is on the other side of Route 1, and is directly across from Hawes Street. A traffic light will eventually be installed at this intersection, with a signal for traffic to enter Hawes Street. The neighborhood opposes this light for the following reasons:

- 1. Hawes Street is a thickly settled, residential neighborhood.
- 2. It is a "country road", narrow in width, curvy and hilly at points.
- 3. There are no sidewalks.
- 4. It is almost impossible for 2 vehicles to pass at the same time.
- 5. A few residents have been hit by oversized vehicles trying to use Hawes St.

If this light has a turn signal onto Hawes Street, it will destroy this neighborhood! There are 3 streets involved; Hawes, Arrowhead, and Indian Head, with approximately 50 families. The elementary, junior high, and high school children that will be in danger due to the increase in traffic, as they are waiting to the school bus. We also have elderly residents that have lived in this neighborhood for more than 50 years, myself being one of them. It is not safe to do so now, and with the increase in traffic and the impact it will have on this street, we will no longer be able to walk on our own street. This is a "safety issue", The project says that the warehouse will not add any traffic to Hawes St. People traveling to Thurston St.. will supposedly drive down Rte. !. and take a left on Thurston. When Supercharged was built on Commerce Boulevard, many people starting using Hawes St. as a "cut through" to avoid the stop lights on Rte. 1. The stop light will make is easier for more people to get to Thurston St. by using Hawes St. All of these changes will result in an increase in traffic on Hawes St., and it is no equipped to handle it., resulting in a dangerous situation.

I, as well as the neighborhood, are asking you to "PLEASE" help save our neighborhood! Everyone deserves to be safe, especially on their own street.

Respectfully,

Ro Welling



Charles D. Baker, Governor Karyn E. Polito, Lieutenant Governor Jamey Tesler, Secretary & CEO



November 9, 2022

Bethany A. Card, Secretary Executive Office of Energy and Environmental Affairs 100 Cambridge Street, Suite 900 Boston, MA 02114-2150

RE: Wrentham: Business Park – FEIR (EEA #15765)

ATTN: MEPA Unit Purvi Patel

Dear Secretary Card:

On behalf of the Massachusetts Department of Transportation, I am submitting comments regarding the Final Environmental Impact Report for the Wrentham Business Park project in Wrentham as prepared by the Office of Transportation Planning. If you have any questions regarding these comments, please contact J. Lionel Lucien, P.E., Manager of the Public/Private Development Unit, at (857) 368-8862.

Sincerely,

Dancf Moth

David J. Mohler Executive Director Office of Transportation Planning

DJM/jll

cc: Jonathan Gulliver, Administrator, Highway Division
 Carrie Lavallee, P.E., Chief Engineer, Highway Division
 Mary Joe Perry, District 5 Highway Director
 Neil Boudreau, Assistant Administrator of Traffic and Highway Safety
 Metropolitan Area Planning Council
 Planning Board, Town of Wrentham





#### MEMORANDUM

| TO:   | David J. Mohler, Executive Director<br>Office of Transportation Planning |
|-------|--|
| FROM: | J. Lionel Lucien, P.E, Manager<br>Public/Private Development Unit        |
| DATE: | November 9, 2022   |
| RE:   | Wrentham – Wrentham Business Center: FEIR (EEA #15765)                   |

The Public/Private Development Unit (PPDU) has reviewed the Final Environmental Impact Report (FEIR) for the proposed Wrentham Business Center project in Wrentham by ND Acquisitions, LLC (the "Proponent"). The 31.1-acre site is proposed to be developed in three phases into a mixed-use commercial and warehouse development (the "Project"). The site is located along the east side of Route 1 in Wrentham (589-591 Washington Street).

The Project consists of a mixed-use commercial development to be built in three phases. Phase 1 consists of a 116,000-square foot (sf) indoor recreation facility, which has already been completed; Phase 2 would entail the construction of a 180,000-sf warehouse; and Phase 3 would consist of a drive-through coffee shop and family restaurant. According to the FEIR, Phase 3 is in the design stage and have yet to receive local approvals but is expected to be built at a later date.

Based on information included in the EENF, Phase 1 of the Project was expected to generate 328 vehicle trips on an average weekday and 372 vehicle trips on an average Saturday. According to the DEIR, the Project is expected to generate 2,608 additional vehicle trips for Phase 2 & 3. The project abuts Route 1, a state highway; therefore, a MassDOT Vehicular Access Permit is required.

The FEIR includes an updated Transportation Impact Assessment (TIA) prepared in conformance with the current MassDOT/EOEEA *Transportation Impact Assessment Guidelines*. The study includes an assessment of the transportation impacts of the Project and analysis of site access in the immediate vicinity of the Project. However, there are still some key concerns raised in the MassDOT comment letter in the DEIR that are not addressed in the FEIR. During the preparation of the FEIR, the Proponent met with MassDOT to discuss some of the technical issues associated with the TIA; however, there were no follow up to address some of the issues regarding phasing and timing of implementation of the mitigation program. MassDOT offers the following comments that should be addressed prior to the issuance of a Section 61 Finding for the Project.

Access and egress to the site is proposed via an existing access driveway (Commerce Boulevard) onto Route 1 opposite Hawes Street. As part of the DEIR, the Proponent proposed to redesign and signalize the intersection to address impacts associated with the increase in site traffic. The DEIR included a traffic signal warrant analysis (TSWA) based on the 2009 Manual on Uniform Traffic Control Devices (MTUCD). MassDOT specifically commented that future volumes were not to be used to conduct the TSWA and justify the installation of a traffic signal. The TSWA was revised in the FEIR, but it is still based on 2028 Build volume projections on Route 1 instead of Route 1 traffic volumes at site occupancy.

Second, MassDOT indicated that Phase 2 was unlikely to generate enough site traffic to meet the signal warrants and justify the installation of the traffic signal. As per the FEIR, the Proponent did not offer a clear timeline to advance the Phase 3 component of the Project. In the DEIR comment letter, MassDOT requested that an interim access plan be provided that did not include the traffic signal. This is not addressed in the FEIR.

Last, the Proponent has indicated that properties south of the site along Route 1 could be provided access to the proposed traffic signal at their site driveway via an internal shared roadway connection. This would allow traffic from these sites, particularly the Truck Turnpike site, the ability to safely reverse direction towards Route 1 southbound to access I-495. The Proponent has accounted for the trips associated with the facility in the TSWA and the capacity analysis for the Route 1 intersection with the Project site driveway. However, the Proponent was vague on any arrangement with the owner of the Truck Turnpike site to facilitate or implement this connection. The Proponent should incorporate the shared access into their site plan and document initial approval or formal arrangement to justify these volumes in their analysis. Additionally, the site driveway of the Truck Turnpike site may need to be modified to ensure it operates as right-in, right-out driveway to prevent unsafe maneuvers on Route 1.

The Proponent should continue working with MassDOT to revise the TSWA, review access management along the Route 1 corridor in the vicinity of the site and document any agreement/arrangement in place to facilitate the implementation of an access management plan. The Proponent should submit a revised commitment letter to MassDOT once these details have been finalized. The Draft Section 61 Finding will be the basis for MassDOT to issue a final Section 61 Finding for the project.

The Proponent should provide an update of the local permitting processes for the proposed Project, particularly with respect to Phase 3 and any transportation issues being discussed. We strongly encourage the Proponent to consult with MassDOT before any transportation issues are discussed in local meetings or hearings.

The Proponent should continue consultation with appropriate MassDOT units, including PPDU, Traffic Operations and the District 5 Office, to address the above comments. If you have any questions regarding these comments, please contact me at *Lionel.Lucien@state.ma.us*.



Charles D. Baker Governor

Karyn E. Polito Lt. Governor COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS **DEPARTMENT OF ENERGY RESOURCES** 100 CAMBRIDGE ST., SUITE 1020 BOSTON, MA 02114 Telephone: 617-626-7300 Facsimile: 617-727-0030

> Beth Card Secretary

Patrick Woodcock Commissioner

11 November 2022

Beth Card, Secretary Executive Office of Energy & Environmental Affairs 100 Cambridge Street Boston, Massachusetts 02114 Attn: MEPA Unit

RE: Wrentham Business Center, Wrentham, MA, EEA #15765

cc: Maggie McCarey, Director of Energy Efficiency, Department of Energy Resource Patrick Woodcock, Commissioner, Department of Energy Resources

Dear Secretary Card:

We've reviewed the Final Environmental Impact Report (FEIR) for the proposed project. The project includes a 180,000-sf warehouse.

#### **Executive Summary**

The warehouse building is proposing space heating with propane which is the **highest emissions** and **highest cost approach** to space heating that was evaluated by the proponent. Mitigation Level is a relatively low 8%.

Mitigation Level can be improved by a factor of more than **x3.6** to 29% by using a hybrid space heating system consisting of air source and propane. **This hybrid approach, recommended in our DEIR comments, was unevaluated.** 

This hybrid approach is commonly used by other warehouse buildings reviewed by DOER. As proposed, this warehouse project represents a **significant outlier** compared to other warehouse projects. At a minimum, hybrid electrification should be used to address the insufficient mitigation.

Wrentham Business Center, EEA No. 15765 Wrentham, Massachusetts

The proponent states that hybrid electrification is not feasible based on cost. However, hybrid electrification was not evaluated. Rather, the project evaluated a fully-redundant approach (which we did not recommend in the DEIR). A hybrid system would cost **70% less** than described in the submission.

In addition, there appears to be errors in the energy model which underestimate warehouse space heating by about a factor of x5. When space heating is corrected, the cost savings and emissions reductions of hybrid are multiple times larger than characterized in the submission.

Simple payback of hybrid electric/propane ranges from 9 to 16 years, depending upon assumed cost of propane, once up-front and operating costs are corrected. This is well within building life and thus is recommended.

#### **Potential Error in the Submission**

There appears to be an error in the submission which leads to underestimating of space heating consumption by a factor of about x5. In the illustration below, the left and middle stacked bars represent the energy use as presented in the submission. The stacked bar on the right represents the energy use for a warehouse in our climate zone taken from Pacific Northwest National Laboratories prototype<sup>1</sup>.

As a result, the submission appears to be significantly underestimating benefits, both cost savings and emissions savings, associated with swap from propane heating to efficient electric heating. For example, the submission concludes that the swap would save \$5,166 per year and would result in about a 5% reduction in emissions. In fact, the swap would save between \$28,000 and \$49,000, depending upon assumed cost of propane, and would result in about 29% less emissions



<sup>&</sup>lt;sup>1</sup> Warehouse prototype, Climate Zone 5A, ASHRAE 90.1-2010, Report "Achieving the 30% Goal", Thornton et al, Pacific Northwest National Laboratory, May 2011

#### **Mitigation Level**

The illustration below compares what is currently proposed to a hybrid alternative. In the illustration, we have estimated Mitigation Level based on correct warehouse energy use and proposed efficiency measures. In summary:

- Mitigation Level<sup>2</sup> as proposed is about 8% (left column).
- Building as proposed, swapping for all gas to a hybrid electric/gas heating system, would improve ML by x3.6 to 29% (right column).



#### **Propane vs Efficient Electric Space Heating**

Propane has much higher cost and emissions than efficient electric space heating with air source heat pumps.

With our current (2022) Massachusetts electric grid emissions rates, efficient electric heating has approximately **60% lower emissions** than condensing propane heating. By 2050, however, with the planned deployment of renewables into the Massachusetts grid, heat pump heating is expected to have **87% lower emissions** in Massachusetts than condensing propane heating. See illustration below.

<sup>&</sup>lt;sup>2</sup> Mitigation Level is the GHG reduction in percent above and beyond what is required by building code, including Stretch Code if applicable. A Mitigation Level of 0% means the project has no mitigation.



Propane heating is also significantly more expensive for space heating than efficient electric heating with heat pumps. Propane is **x1.9 more costly** than heat pumps using a cost of propane of 30.4/MMBtu (the propane price used in the submission). This may be a low-cost estimate as commercial propane costs can vary significantly. Using the latest EIA residential propane costs for Massachusetts customers as an upper bound (39.5/MMBtu), propane could cost up to **x2.5 more** to space heat compared to efficient heat pumps<sup>3</sup>.



#### **Hybrid Electrification**

The submission information states that hybrid electrification was not chosen due to cost. However, a hybrid elec/propane system was not actually evaluated in the submission. Instead, a much more expensive, fully-redundant, electric/propane system consisting of a was evaluated consisting of an electric heat pump system, sized for 100% space heating, plus a propane system, also sized for 100% space heating.

 $<sup>^3</sup>$  We used latest EIA cost of electricity of \$0.19/kWhrs. The submission used \$0.166/kWhrs.

Wrentham Business Center, EEA No. 15765 Wrentham, Massachusetts

While a fully redundant system would be very expensive, a hybrid system offers a much more cost-effective approach that still improves GHG emissions mitigation and significantly reduces costs.

Hybrid systems typically consist of a combination of propane heating systems, sized to provide 100% of the space heating load, and electric heat pump systems, sized to provide 20% of the space heating load. The electric heat pump systems are used as the primary space heating system while the propane system is used as the secondary space heating system, used only to supplement when the capacity of the electric heat pump system is exceeded. Because heating loads are typically only a fraction of the peak heating load most of the time, it's possible that the electric heat pump system is the only system necessary 80 to 90% of the time.

In the submission, the system described as the "hybrid" elec/propane system has heat pump equipment sized to **100%** of the peak heating load, or, about **x5 larger** than a typical hybrid system would use. The proponent dismisses this system on the basis of cost (\$8.07/sf).

To assess a more appropriately sized hybrid system, DOER pro-rated the component cost values supplied in the detailed cost estimate. DOER assumed electric heat pumps for 20% of the peak heating and gas for 100% of the peak heating load. Based on this, DOER estimates that a hybrid system would cost about \$2.42/sf, not \$8.07/sf. This is about 70% less than the cost of the fully-redundant system evaluated in the submission.

This hybrid approach, which results in significant mitigation, is in the same cost ballpark as the proposed all-gas system (\$2.42/sf compared to \$1.00/sf).

| Approach  | Configuration   | Unit Cost (\$/sf) |
|---|---|-------------------|
| Proposed - all propane  | 250-ton (equiv) gas heating   | \$1.00            |
| Fully-redundant elec/propane system in submission (described as hybrid) | 250-ton electric heat pump (primary)<br>plus 250-ton (equiv) propane<br>(secondary) | \$8.07            |
| Hybrid elec/propane   | 50-ton electric heat pump (primary)<br>plus 250-ton (equiv) propane<br>(secondary)  | \$2.42            |

In summary:

#### **Operating Costs**

Operating costs for a hybrid electric/propane system are much less than operating costs as proposed. In our summary below, we have estimated operating costs based on correct warehouse energy heating use.

#### Wrentham Business Center, EEA No. 15765 Wrentham, Massachusetts

|                                | Code Building | Proposed<br>all propane | Hybrid<br>electric/propane |
|--------------------------------|---------------|-------------------------|----------------------------|
| Total cost to operate          | \$167,000     | \$162,000               | \$139,000                  |
| Operating cost improvement     | -             | \$5,000                 | \$28,000                   |
| % Improvement compared to code | -             | 3%                      | 17%                        |
| Mitigation Level               | -             | 8%                      | 29%                        |

#### Operating Costs – Low Cost of Propane (\$30.43/MMBtu)

#### *Operating Costs – High Cost of Propane (\$39/MMBtu)*

|                                | Code Building | Proposed<br>all propane | Hybrid<br>electric/propane |
|--------------------------------|---------------|-------------------------|----------------------------|
| Total cost to operate          | \$189,000     | \$179,000               | \$140,000                  |
| Operating cost improvement     | -             | \$10,000                | \$49,000                   |
| % Improvement compared to code | -             | 5%                      | 26%                        |
| Mitigation Level               | -             | 8%                      | 29%                        |

Depending upon the cost of propane, savings with hybrid could be between \$28,000 (17%) and \$49,000 (26%). Compare this to savings of only \$5,000 (3%) to \$10,000 (5%) for the as-proposed case.

#### Simple Payback

The submission's financial analysis, and ultimately the conclusion that electrification is too costly, was based on a fully-redundant propane and electric heat pump system cost \$8.09 as described above. This fully redundant system was not recommended in our DEIR comments.

A hybrid system, which was recommended in our DEIR, consisting of electric heat pump system, sized to 20% of the peak load and a propane system, sized to 100% of peak load is estimated as: \$2.42/sf, also noted above.

Using these additional capital costs, simple payback works out to the following:

|                                   | Low Cost<br>Propane | High Cost<br>Propane |
|-----------------------------------|---------------------|----------------------|
| Additional Capital Cost           | \$434,000           | \$434,000            |
| Annual operating cost improvement | 28,000              | \$49,000             |
| Simple Payback (years)            | 16                  | 9                    |

The simple payback results show that a hybrid pays for itself well within the building life cycle. This finding, coupled with the x3.6 improvement in Mitigation Level, demonstrates that hybrid electric/propane is both feasible and effective.

#### **Conclusions and Recommendations**

As proposed, the building has relatively low Mitigation Level. The all-propane heating system represents a significant outlier for warehouse buildings that we have reviewed.

A hybrid (20% air source space heating, used as primary and 100% propane heating, used as secondary) system is recommended. Such an approach would cost about \$2.42 per square foot, save between \$28,000 to \$49,000 in operating costs annually, and improve Mitigation Level by a factor of x3.6. Simple payback ranges between 9 to 16 years, well within building life cycle. For these reasons, we recommend that the next submission show a mitigation commitment of hybrid electric/propane.

If the next submission is not committing to hybrid electric/propane space heating as described above, we recommend the next submission contain the following:

- 1. A revised analysis of the warehouse energy use. Consistent with other warehouse buildings in our climate zone, we expect the heating end use be in the order of 15 kBtu/sf-yr.
- 2. An evaluation of hybrid electric/propane heating system consisting of: an air source heat pump system sized to 20% of the space peak heating, used for primary heating, plus a propane heating system sized to 100% of the space peak heating, use for secondary heating.

Consistent with the pricing information already provided in the FEIR, we would expect the following in the evaluation:

- a. Heat pump and other necessary supporting infrastructure should price at about \$1.42/sf, or, about 20% of the pricing for this equipment and infrastructure already provided.
- b. Propane heating should price at about \$1.00/sf, which would be same pricing as already provided.

We also recommend the evaluation range operating costs to capture the uncertainty in commercial propane costs. Recommended propane range is: low (\$30.43/Mmbtu, the value provided in the FEIR) and high (\$39/Mmbtu, most up to date EIA residential propane cost).

- 3. To better evaluate heating emissions life cycle of all-propane heating scenario versus hybrid electric/propane heating scenario, we recommend that the evaluation calculate a 30-year total heating end use carbon footprint (e.g. total carbon footprint associated with heating end use, period 2022 through 2052, units of tons) for these two scenarios using the following:
  - a. Propane emissions of: 139 lbs/Mmbtu
  - b. Electric grid emissions as follows:
    - i. Year 2022: 633 lbs/MWhr

Wrentham Business Center, EEA No. 15765 Wrentham, Massachusetts

- ii. Year 2052: 200 lbs/MWhr
- iii. Linearly interpolate in-between years
- 4. To better evaluate costs, we recommend the following:
  - a. Providing an estimate of costs to retrofit the building to convert from all-propane heating to hybrid electric/propane heating scenario at some point in the future. Such cost should include premium costs to undertake retrofit while building is in service.
  - b. Estimate total operating cost, period 2022 through 2052, for the all-propane and hybrid propane/electric scenarios.

Sincerely,

Paul F. Ormond, P.E. Energy Efficiency Engineer Massachusetts Department of Energy Resources
Appendix B Traffic Impact Report Synchro Appendix, Wrentham Business Center, McMahon Associates, 7/7/2023

|                         | ٦     | -     | $\mathbf{\hat{z}}$ | 4     | +     | *    | 1     | 1           | ۲    | 1     | ŧ           | ~    |
|-------------------------|-------|-------|--------------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR                | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     |       | 4     |                    |       | \$    |      | ሻ     | <b>≜</b> 16 |      | ۲     | <b>4</b> 16 |      |
| Traffic Volume (vph)    | 39    | 9     | 66                 | 33    | 15    | 45   | 24    | 1881        | 33   | 5     | 424         | 5    |
| Future Volume (vph)     | 39    | 9     | 66                 | 33    | 15    | 45   | 24    | 1881        | 33   | 5     | 424         | 5    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900               | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Grade (%)               |       | 2%    |                    |       | -3%   |      |       | 0%          |      |       | 0%          |      |
| Storage Length (ft)     | 0     |       | 0                  | 0     |       | 0    | 255   |             | 0    | 270   |             | 0    |
| Storage Lanes           | 0     |       | 0                  | 0     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25    |       |                    | 25    |       |      | 25    |             |      | 25    |             |      |
| Satd. Flow (prot)       | 0     | 1646  | 0                  | 0     | 1544  | 0    | 1656  | 3482        | 0    | 1805  | 3193        | 0    |
| Flt Permitted           |       | 0.817 |                    |       | 0.746 |      | 0.950 |             |      | 0.950 |             |      |
| Satd. Flow (perm)       | 0     | 1368  | 0                  | 0     | 1172  | 0    | 1656  | 3482        | 0    | 1805  | 3193        | 0    |
| Right Turn on Red       |       |       | Yes                |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd. Flow (RTOR)       |       | 65    |                    |       | 44    |      |       | 3           |      |       | 2           |      |
| Link Speed (mph)        |       | 30    |                    |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |       | 204   |                    |       | 338   |      |       | 3010        |      |       | 582         |      |
| Travel Time (s)         |       | 4.6   |                    |       | 7.7   |      |       | 37.3        |      |       | 7.2         |      |
| Peak Hour Factor        | 0.79  | 0.79  | 0.79               | 0.82  | 0.82  | 0.82 | 0.91  | 0.91        | 0.91 | 0.90  | 0.90        | 0.90 |
| Heavy Vehicles (%)      | 0%    | 22%   | 3%                 | 16%   | 29%   | 9%   | 9%    | 3%          | 25%  | 0%    | 13%         | 0%   |
| Shared Lane Traffic (%) |       |       |                    |       |       |      |       |             |      |       |             |      |
| Lane Group Flow (vph)   | 0     | 144   | 0                  | 0     | 113   | 0    | 26    | 2103        | 0    | 6     | 477         | 0    |
| Turn Type               | Perm  | NA    |                    | Perm  | NA    |      | Prot  | NA          |      | Prot  | NA          |      |
| Protected Phases        |       | 8     |                    |       | 4     |      | 1     | 6           |      | 5     | 2           |      |
| Permitted Phases        | 8     |       |                    | 4     |       |      |       |             |      |       |             |      |
| Detector Phase          | 8     | 8     |                    | 4     | 4     |      | 1     | 6           |      | 5     | 2           |      |
| Switch Phase            |       |       |                    |       |       |      |       |             |      |       |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |                    | 6.0   | 6.0   |      | 6.0   | 30.0        |      | 6.0   | 1.0         |      |
| Minimum Split (s)       | 11.0  | 11.0  |                    | 11.0  | 11.0  |      | 12.5  | 36.0        |      | 12.5  | 36.0        |      |
| Total Split (s)         | 18.0  | 18.0  |                    | 18.0  | 18.0  |      | 16.0  | 56.0        |      | 16.0  | 56.0        |      |
| Total Split (%)         | 20.0% | 20.0% |                    | 20.0% | 20.0% |      | 17.8% | 62.2%       |      | 17.8% | 62.2%       |      |
| Yellow Time (s)         | 3.5   | 3.5   |                    | 3.5   | 3.5   |      | 3.5   | 5.0         |      | 3.5   | 5.0         |      |
| All-Red Time (s)        | 1.5   | 1.5   |                    | 1.5   | 1.5   |      | 3.0   | 1.0         |      | 3.0   | 1.0         |      |
| Lost Time Adjust (s)    |       | 0.0   |                    |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     |       | 5.0   |                    |       | 5.0   |      | 6.5   | 6.0         |      | 6.5   | 6.0         |      |
| Lead/Lag                |       |       |                    |       |       |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |       |       |                    |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None  | None  |                    | None  | None  |      | None  | C-Min       |      | None  | C-Min       |      |
| Act Effct Green (s)     |       | 10.1  |                    |       | 10.1  |      | 7.1   | 66.2        |      | 6.2   | 62.9        |      |
| Actuated g/C Ratio      |       | 0.11  |                    |       | 0.11  |      | 0.08  | 0.74        |      | 0.07  | 0.70        |      |
| v/c Ratio               |       | 0.68  |                    |       | 0.66  |      | 0.20  | 0.82        |      | 0.05  | 0.21        |      |
| Control Delay           |       | 37.9  |                    |       | 42.6  |      | 47.3  | 8.3         |      | 40.0  | 6.7         |      |
| Queue Delay             |       | 0.0   |                    |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             |       | 37.9  |                    |       | 42.6  |      | 47.3  | 8.3         |      | 40.0  | 6.7         |      |
| LOS                     |       | D     |                    |       | D     |      | D     | А           |      | D     | Α           |      |
| Approach Delay          |       | 37.9  |                    |       | 42.6  |      |       | 8.8         |      |       | 7.1         |      |
| Approach LOS            |       | D     |                    |       | D     |      |       | A           |      |       | A           |      |
| Queue Length 50th (ft)  |       | 43    |                    |       | 37    |      | 16    | 123         |      | 3     | 32          |      |
| Queue Length 95th (ft)  |       | 83    |                    |       | 80    |      | m21   | #798        |      | 15    | 96          |      |
| Internal Link Dist (ft) |       | 124   |                    |       | 258   |      |       | 2930        |      |       | 502         |      |
| Turn Bay Length (ft)    |       |       |                    |       |       |      | 255   |             |      | 270   |             |      |

|                                   | ٦              | <b>→</b>   | $\mathbf{r}$ | 4          | +           | •          | •    | 1    | 1   | 1    | Ļ    | ~   |
|-----------------------------------|----------------|------------|--------------|------------|-------------|------------|------|------|-----|------|------|-----|
| Lane Group                        | EBL            | EBT        | EBR          | WBL        | WBT         | WBR        | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| Base Capacity (vph)               |                | 253        |              |            | 206         |            | 174  | 2563 |     | 190  | 2233 |     |
| Starvation Cap Reductn            |                | 0          |              |            | 0           |            | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn             |                | 0          |              |            | 0           |            | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn               |                | 0          |              |            | 0           |            | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio                 |                | 0.57       |              |            | 0.55        |            | 0.15 | 0.82 |     | 0.03 | 0.21 |     |
| Intersection Summary              |                |            |              |            |             |            |      |      |     |      |      |     |
| Area Type:                        | Other          |            |              |            |             |            |      |      |     |      |      |     |
| Cycle Length: 90                  |                |            |              |            |             |            |      |      |     |      |      |     |
| Actuated Cycle Length: 90         |                |            |              |            |             |            |      |      |     |      |      |     |
| Offset: 0 (0%), Referenced        | to phase 2:8   | SBT and (  | 6:NBT, St    | tart of Gr | een         |            |      |      |     |      |      |     |
| Natural Cycle: 90                 |                |            |              |            |             |            |      |      |     |      |      |     |
| Control Type: Actuated-Co         | ordinated      |            |              |            |             |            |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.82           |                |            |              |            |             |            |      |      |     |      |      |     |
| Intersection Signal Delay: 1      | 1.3            |            |              | In         | itersection | LOS: B     |      |      |     |      |      |     |
| Intersection Capacity Utilization | ation 70.8%    |            |              | IC         | CU Level c  | of Service | С    |      |     |      |      |     |
| Analysis Period (min) 15          |                |            |              |            |             |            |      |      |     |      |      |     |
| # 95th percentile volume          | exceeds cap    | bacity, qu | eue may      | be longe   | r.          |            |      |      |     |      |      |     |
| Queue shown is maxim              | um after two   | cycles.    |              |            |             |            |      |      |     |      |      |     |
| m Volume for 95th percer          | ntile queue is | s meterec  | l by upstr   | eam sign   | nal.        |            |      |      |     |      |      |     |
| Splits and Phases: 1: Wa          | ashington St   | reet & Th  | urston St    | reet       |             |            |      |      |     |      |      |     |

| <b>▲</b> Ø1 | Ø2 (R)    | <b>₩</b> Ø4 |  |
|-------------|-----------|-------------|--|
| 16 s        | 56 s      | 18 s        |  |
| Ø5          | ♥ ¶Ø6 (R) | <u>∞</u> 8  |  |
| 16 s        | 56 s      | 18 s        |  |

|                         | ٭     | -     | $\mathbf{r}$ | 4     | -     | •    | 1     | 1           | 1    | 1     | Ŧ        | -     |
|-------------------------|-------|-------|--------------|-------|-------|------|-------|-------------|------|-------|----------|-------|
| Lane Group              | EBL   | EBT   | EBR          | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT      | SBR   |
| Lane Configurations     |       | स्    | 1            |       | 4     |      | 5     | <b>≜1</b> } |      | ሻ     | <b>^</b> | 1     |
| Traffic Volume (vph)    | 26    | 1     | 193          | 4     | 4     | 10   | 113   | 1927        | 27   | 5     | 512      | 17    |
| Future Volume (vph)     | 26    | 1     | 193          | 4     | 4     | 10   | 113   | 1927        | 27   | 5     | 512      | 17    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900         | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900     | 1900  |
| Lane Width (ft)         | 12    | 12    | 12           | 12    | 16    | 12   | 12    | 12          | 12   | 12    | 12       | 12    |
| Grade (%)               |       | -5%   |              |       | 2%    |      |       | 2%          |      |       | -4%      |       |
| Storage Length (ft)     | 309   |       | 0            | 0     |       | 0    | 562   |             | 0    | 274   |          | 480   |
| Storage Lanes           | 0     |       | 1            | 0     |       | 0    | 1     |             | 0    | 1     |          | 1     |
| Taper Length (ft)       | 25    |       |              | 25    |       |      | 25    |             |      | 25    |          |       |
| Satd. Flow (prot)       | 0     | 1858  | 1623         | 0     | 1521  | 0    | 1769  | 3430        | 0    | 1534  | 3259     | 1384  |
| Flt Permitted           |       | 0.716 |              |       | 0.916 |      | 0.950 |             |      | 0.950 |          |       |
| Satd. Flow (perm)       | 0     | 1394  | 1623         | 0     | 1409  | 0    | 1769  | 3430        | 0    | 1534  | 3259     | 1384  |
| Right Turn on Red       |       |       | Yes          |       |       | Yes  |       |             | Yes  |       |          | Yes   |
| Satd. Flow (RTOR)       |       |       | 184          |       | 13    |      |       | 2           |      |       |          | 224   |
| Link Speed (mph)        |       | 30    |              |       | 30    |      |       | 55          |      |       | 55       |       |
| Link Distance (ft)      |       | 359   |              |       | 496   |      |       | 788         |      |       | 1704     |       |
| Travel Time (s)         |       | 8.2   |              |       | 11.3  |      |       | 9.8         |      |       | 21.1     |       |
| Peak Hour Factor        | 0.84  | 0.84  | 0.84         | 0.75  | 0.75  | 0.75 | 0.95  | 0.95        | 0.95 | 0.93  | 0.93     | 0.93  |
| Heavy Vehicles (%)      | 0%    | 0%    | 2%           | 0%    | 25%   | 40%  | 1%    | 4%          | 4%   | 20%   | 13%      | 19%   |
| Shared Lane Traffic (%) | • / • | •,•   | _/*          | • / • | _0 // |      | . , • | .,.         | .,•  |       |          | ,.    |
| Lane Group Flow (vph)   | 0     | 32    | 230          | 0     | 23    | 0    | 119   | 2056        | 0    | 5     | 551      | 18    |
| Turn Type               | Perm  | NA    | pt+ov        | Perm  | NA    | •    | Prot  | NA          | •    | Prot  | NA       | Prot  |
| Protected Phases        |       | 4     | 4 5          |       | 8     |      | 5     | 2           |      | 1     | 6        | 6     |
| Permitted Phases        | 4     |       |              | 8     |       |      |       |             |      |       |          | -     |
| Detector Phase          | 4     | 4     | 45           | 8     | 8     |      | 5     | 2           |      | 1     | 6        | 6     |
| Switch Phase            |       |       |              |       |       |      |       |             |      |       |          | -     |
| Minimum Initial (s)     | 6.0   | 6.0   |              | 6.0   | 6.0   |      | 10.0  | 10.0        |      | 6.0   | 10.0     | 10.0  |
| Minimum Split (s)       | 13.0  | 13.0  |              | 13.0  | 13.0  |      | 17.5  | 16.5        |      | 13.0  | 16.5     | 16.5  |
| Total Split (s)         | 22.0  | 22.0  |              | 22.0  | 22.0  |      | 25.0  | 55.0        |      | 13.0  | 43.0     | 43.0  |
| Total Split (%)         | 24.4% | 24.4% |              | 24.4% | 24.4% |      | 27.8% | 61.1%       |      | 14.4% | 47.8%    | 47.8% |
| Yellow Time (s)         | 4.0   | 4.0   |              | 4.0   | 4.0   |      | 4.5   | 5.0         |      | 4.5   | 5.0      | 5.0   |
| All-Red Time (s)        | 3.0   | 3.0   |              | 3.0   | 3.0   |      | 3.0   | 1.5         |      | 2.5   | 1.5      | 1.5   |
| Lost Time Adjust (s)    |       | 0.0   |              |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0      | 0.0   |
| Total Lost Time (s)     |       | 7.0   |              |       | 7.0   |      | 7.5   | 6.5         |      | 7.0   | 6.5      | 6.5   |
| Lead/Lag                |       |       |              |       |       |      | Lead  | Lag         |      | Lead  | Lag      | Lag   |
| Lead-Lag Optimize?      |       |       |              |       |       |      | Yes   | Yes         |      | Yes   | Yes      | Yes   |
| Recall Mode             | None  | None  |              | None  | None  |      | None  | C-Min       |      | None  | C-Min    | C-Min |
| Act Effct Green (s)     |       | 7.9   | 26.9         |       | 7.8   |      | 11.5  | 66.0        |      | 6.0   | 49.6     | 49.6  |
| Actuated g/C Ratio      |       | 0.09  | 0.30         |       | 0.09  |      | 0.13  | 0.73        |      | 0.07  | 0.55     | 0.55  |
| v/c Ratio               |       | 0.26  | 0.38         |       | 0.17  |      | 0.53  | 0.82        |      | 0.05  | 0.31     | 0.02  |
| Control Delay           |       | 42.6  | 7.5          |       | 26.3  |      | 40.7  | 14.9        |      | 44.2  | 9.9      | 0.1   |
| Queue Delay             |       | 0.0   | 0.0          |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0      | 0.0   |
| Total Delay             |       | 42.6  | 7.5          |       | 26.3  |      | 40.7  | 14.9        |      | 44.2  | 9.9      | 0.1   |
| LOS                     |       | D     | А            |       | С     |      | D     | В           |      | D     | А        | А     |
| Approach Delav          |       | 11.8  |              |       | 26.3  |      |       | 16.3        |      |       | 9.8      |       |
| Approach LOS            |       | В     |              |       | С     |      |       | B           |      |       | A        |       |
| Queue Length 50th (ft)  |       | 18    | 20           |       | 6     |      | 59    | 396         |      | 3     | 65       | 0     |
| Queue Length 95th (ft)  |       | 40    | 54           |       | 22    |      | m78   | #814        |      | m13   | 95       | m0    |
| Internal Link Dist (ft) |       | 279   |              |       | 416   |      |       | 708         |      |       | 1624     |       |

07/07/2023 McMahon

|                              | ≯              | <b>→</b>   | $\mathbf{i}$          | 4          | +          | •           | •      | Ť    | 1   | 1    | ţ    | ~    |
|------------------------------|----------------|------------|-----------------------|------------|------------|-------------|--------|------|-----|------|------|------|
| Lane Group                   | EBL            | EBT        | EBR                   | WBL        | WBT        | WBR         | NBL    | NBT  | NBR | SBL  | SBT  | SBR  |
| Turn Bay Length (ft)         |                |            |                       |            |            |             | 562    |      |     | 274  |      | 480  |
| Base Capacity (vph)          |                | 232        | 694                   |            | 245        |             | 343    | 2515 |     | 102  | 1796 | 863  |
| Starvation Cap Reductn       |                | 0          | 0                     |            | 0          |             | 0      | 0    |     | 0    | 0    | 0    |
| Spillback Cap Reductn        |                | 0          | 0                     |            | 0          |             | 0      | 0    |     | 0    | 0    | 0    |
| Storage Cap Reductn          |                | 0          | 0                     |            | 0          |             | 0      | 0    |     | 0    | 0    | 0    |
| Reduced v/c Ratio            |                | 0.14       | 0.33                  |            | 0.09       |             | 0.35   | 0.82 |     | 0.05 | 0.31 | 0.02 |
| Intersection Summary         |                |            |                       |            |            |             |        |      |     |      |      |      |
| Area Type:                   | Other          |            |                       |            |            |             |        |      |     |      |      |      |
| Cycle Length: 90             |                |            |                       |            |            |             |        |      |     |      |      |      |
| Actuated Cycle Length: 90    | )              |            |                       |            |            |             |        |      |     |      |      |      |
| Offset: 0 (0%), Reference    | d to phase 2:  | NBT and    | 6:SBT, S <sup>.</sup> | tart of Ye | llow, Mas  | ter Interse | ection |      |     |      |      |      |
| Natural Cycle: 90            |                |            |                       |            |            |             |        |      |     |      |      |      |
| Control Type: Actuated-Co    | oordinated     |            |                       |            |            |             |        |      |     |      |      |      |
| Maximum v/c Ratio: 0.82      |                |            |                       |            |            |             |        |      |     |      |      |      |
| Intersection Signal Delay:   | 14.8           |            |                       | In         | tersectior | LOS: B      |        |      |     |      |      |      |
| Intersection Capacity Utiliz | zation 81.2%   |            |                       | IC         | U Level o  | of Service  | D      |      |     |      |      |      |
| Analysis Period (min) 15     |                |            |                       |            |            |             |        |      |     |      |      |      |
| # 95th percentile volume     | e exceeds ca   | bacity, qu | eue may               | be longe   | r.         |             |        |      |     |      |      |      |
| Queue shown is maxim         | num after two  | cycles.    |                       |            |            |             |        |      |     |      |      |      |
| m Volume for 95th perce      | entile queue i | s metereo  | l by upstr            | eam sign   | al.        |             |        |      |     |      |      |      |

#### Splits and Phases: 3: Washington Street & Madison Street

| Ø1           | fø2 (R) |          |  | <b>↓</b> <sub>Ø4</sub> |  |
|--------------|---------|----------|--|------------------------|--|
| 13 s         | 55 s    |          |  | 22 s                   |  |
| <b>\$</b> Ø5 |         | 🗣 Ø6 (R) |  | <b>₩</b> Ø8            |  |
| 25 s         |         | 43 s     |  | 22 s                   |  |

#### Intersection

Int Delay, s/veh

0.5

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations      |      | ¢    |      |      | \$   |      |      | đ þ  |      |      | सीरे |      |
| Traffic Vol, veh/h       | 1    | 0    | 11   | 0    | 0    | 1    | 24   | 1963 | 1    | 2    | 535  | 13   |
| Future Vol, veh/h        | 1    | 0    | 11   | 0    | 0    | 1    | 24   | 1963 | 1    | 2    | 535  | 13   |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 1    |
| Sign Control             | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized           | -    | -    | None |
| Storage Length           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | 4 -  | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %                 | -    | -4   | -    | -    | 1    | -    | -    | -1   | -    | -    | 1    | -    |
| Peak Hour Factor         | 60   | 60   | 60   | 25   | 25   | 25   | 97   | 97   | 97   | 93   | 93   | 93   |
| Heavy Vehicles, %        | 0    | 0    | 9    | 0    | 0    | 100  | 0    | 4    | 0    | 100  | 13   | 0    |
| Mvmt Flow                | 2    | 0    | 18   | 0    | 0    | 4    | 25   | 2024 | 1    | 2    | 575  | 14   |

| Major/Minor          | Minor2 |      | ľ    | Minor1 |      | Ν    | 1ajor1 |   | Ν | /lajor2 |   |   |  |
|----------------------|--------|------|------|--------|------|------|--------|---|---|---------|---|---|--|
| Conflicting Flow All | 1649   | 2662 | 296  | 2367   | 2669 | 1013 | 590    | 0 | 0 | 2025    | 0 | 0 |  |
| Stage 1              | 587    | 587  | -    | 2075   | 2075 | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 1062   | 2075 | -    | 292    | 594  | -    | -      | - | - | -       | - | - |  |
| Critical Hdwy        | 6.7    | 5.7  | 6.68 | 7.7    | 6.7  | 9    | 4.1    | - | - | 6.1     | - | - |  |
| Critical Hdwy Stg 1  | 5.7    | 4.7  | -    | 6.7    | 5.7  | -    | -      | - | - | -       | - | - |  |
| Critical Hdwy Stg 2  | 5.7    | 4.7  | -    | 6.7    | 5.7  | -    | -      | - | - | -       | - | - |  |
| Follow-up Hdwy       | 3.5    | 4    | 3.39 | 3.5    | 4    | 4.3  | 2.2    | - | - | 3.2     | - | - |  |
| Pot Cap-1 Maneuver   | 96     | 41   | 703  | 17     | 20   | 115  | 995    | - | - | 78      | - | - |  |
| Stage 1              | 533    | 569  | -    | 50     | 86   | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 307    | 154  | -    | 686    | 480  | -    | -      | - | - | -       | - | - |  |
| Platoon blocked, %   |        |      |      |        |      |      |        | - | - |         | - | - |  |
| Mov Cap-1 Maneuver   | · 90   | 39   | 702  | 16     | 19   | 115  | 994    | - | - | 78      | - | - |  |
| Mov Cap-2 Maneuver   | · 90   | 39   | -    | 16     | 19   | -    | -      | - | - | -       | - | - |  |
| Stage 1              | 532    | 547  | -    | 50     | 86   | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 296    | 154  | -    | 643    | 461  | -    | -      | - | - | -       | - | - |  |
|                      |        |      |      |        |      |      |        |   |   |         |   |   |  |

| Approach             | EB   | WB   | NB  | SB  |  |
|----------------------|------|------|-----|-----|--|
| HCM Control Delay, s | 13.4 | 37.4 | 0.1 | 1.2 |  |
| HCM LOS              | В    | E    |     |     |  |

| Minor Lane/Major Mvmt | NBL   | NBT | NBR | EBLn1\ | VBLn1 | SBL   | SBT | SBR |  |
|-----------------------|-------|-----|-----|--------|-------|-------|-----|-----|--|
| Capacity (veh/h)      | 994   | -   | -   | 448    | 115   | 78    | -   | -   |  |
| HCM Lane V/C Ratio    | 0.025 | -   | -   | 0.045  | 0.035 | 0.028 | -   | -   |  |
| HCM Control Delay (s) | 8.7   | 0   | -   | 13.4   | 37.4  | 52.5  | 1   | -   |  |
| HCM Lane LOS          | А     | A   | -   | В      | E     | F     | A   | -   |  |
| HCM 95th %tile Q(veh) | 0.1   | -   | -   | 0.1    | 0.1   | 0.1   | -   | -   |  |

|                         | ٦     | -     | $\mathbf{\hat{z}}$ | 4     | +     | *    | 1     | Ť           | 1    | 1     | Ŧ           | ~    |
|-------------------------|-------|-------|--------------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR                | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     |       | 44    |                    |       | ÷.    |      | 5     | <b>≜</b> 15 |      | 5     | <b>4</b> 16 |      |
| Traffic Volume (vph)    | 8     | 27    | 46                 | 38    | 21    | 23   | 38    | 775         | 50   | 40    | 1870        | 12   |
| Future Volume (vph)     | 8     | 27    | 46                 | 38    | 21    | 23   | 38    | 775         | 50   | 40    | 1870        | 12   |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900               | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Grade (%)               |       | 2%    |                    |       | -3%   |      |       | 0%          |      |       | 0%          |      |
| Storage Length (ft)     | 0     |       | 0                  | 0     |       | 0    | 255   |             | 0    | 270   |             | 0    |
| Storage Lanes           | 0     |       | 0                  | 0     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25    |       |                    | 25    |       |      | 25    |             |      | 25    |             |      |
| Satd, Flow (prot)       | 0     | 1598  | 0                  | 0     | 1788  | 0    | 1805  | 3512        | 0    | 1671  | 3570        | 0    |
| Flt Permitted           |       | 0.948 |                    |       | 0.787 |      | 0.950 |             |      | 0.950 |             |      |
| Satd, Flow (perm)       | 0     | 1523  | 0                  | 0     | 1440  | 0    | 1805  | 3512        | 0    | 1671  | 3570        | 0    |
| Right Turn on Red       | •     |       | Yes                |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd. Flow (RTOR)       |       | 52    |                    |       | 17    |      |       | 14          |      |       | 1           |      |
| Link Speed (mph)        |       | 30    |                    |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |       | 204   |                    |       | 338   |      |       | 3010        |      |       | 582         |      |
| Travel Time (s)         |       | 4.6   |                    |       | 77    |      |       | 37.3        |      |       | 7.2         |      |
| Confl Bikes (#/hr)      |       | 1.0   |                    |       |       |      |       | 01.0        |      |       | 1.2         | 1    |
| Peak Hour Factor        | 0.89  | 0.89  | 0.89               | 0 79  | 0 79  | 0 79 | 0 95  | 0.95        | 0.95 | 0 94  | 0 94        | 0.94 |
| Heavy Vehicles (%)      | 13%   | 12%   | 5%                 | 0%    | 0%    | 5%   | 0%    | 2%          | 0%   | 8%    | 1%          | 0%   |
| Shared Lane Traffic (%) | 1070  | 1270  | 070                | 070   | 070   | 070  | 070   | 270         | 070  | 070   | 170         | 070  |
| Lane Group Flow (vph)   | 0     | 91    | 0                  | 0     | 104   | 0    | 40    | 869         | 0    | 43    | 2002        | 0    |
|                         | Perm  | NA    | U                  | Perm  | NA    | U    | Prot  | NA          | U    | Prot  | NA          | Ū    |
| Protected Phases        | i onn | 8     |                    | i onn | 4     |      | 1     | 6           |      | 5     | 2           |      |
| Permitted Phases        | 8     | Ū     |                    | 4     | Т     |      |       | U           |      | 0     | 2           |      |
| Detector Phase          | 8     | 8     |                    | 4     | 4     |      | 1     | 6           |      | 5     | 2           |      |
| Switch Phase            | U     | Ū     |                    |       | Т     |      |       | U           |      | 0     | 2           |      |
| Minimum Initial (s)     | 6.0   | 60    |                    | 6.0   | 60    |      | 50    | 30.0        |      | 60    | 10          |      |
| Minimum Split (s)       | 11.0  | 11.0  |                    | 11.0  | 11.0  |      | 12.0  | 36.0        |      | 12.5  | 36.0        |      |
| Total Split (s)         | 14.0  | 14.0  |                    | 14.0  | 14.0  |      | 12.0  | 62.0        |      | 14.0  | 64.0        |      |
| Total Split (%)         | 15.6% | 15.6% |                    | 15.6% | 15.6% |      | 13.3% | 68.9%       |      | 15.6% | 71.1%       |      |
| Yellow Time (s)         | 3.5   | 3.5   |                    | 3.5   | 3.5   |      | 3.5   | 5.0         |      | 3.5   | 5.0         |      |
| All-Red Time (s)        | 1.5   | 1.5   |                    | 1.5   | 1.5   |      | 3.0   | 1.0         |      | 3.0   | 1.0         |      |
| Lost Time Adjust (s)    |       | 0.0   |                    |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     |       | 5.0   |                    |       | 5.0   |      | 6.5   | 6.0         |      | 6.5   | 6.0         |      |
| Lead/Lag                |       | 0.0   |                    |       | 0.0   |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |       |       |                    |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None  | None  |                    | None  | None  |      | None  | C-Min       |      | None  | C-Min       |      |
| Act Effct Green (s)     |       | 8.4   |                    |       | 8.4   |      | 5.5   | 65.6        |      | 7.0   | 66.8        |      |
| Actuated g/C Ratio      |       | 0.09  |                    |       | 0.09  |      | 0.06  | 0.73        |      | 0.08  | 0.74        |      |
| v/c Ratio               |       | 0.48  |                    |       | 0.69  |      | 0.36  | 0.34        |      | 0.33  | 0.76        |      |
| Control Delay           |       | 28.3  |                    |       | 57.5  |      | 50.2  | 6.8         |      | 46.3  | 12.6        |      |
| Queue Delay             |       | 0.0   |                    |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             |       | 28.3  |                    |       | 57.5  |      | 50.2  | 6.8         |      | 46.3  | 12.6        |      |
|                         |       | C     |                    |       | F     |      | D     | A           |      | D     | B           |      |
| Approach Delay          |       | 28.3  |                    |       | 57 5  |      |       | 87          |      | -     | 13 3        |      |
| Approach LOS            |       | C     |                    |       | F     |      |       | A           |      |       | B           |      |
| Queue Length 50th (ff)  |       | 21    |                    |       | 48    |      | 22    | 115         |      | 23    | 433         |      |
| Queue Length 95th (ft)  |       | 66    |                    |       | #94   |      | 55    | 152         |      | 57    | 559         |      |
| Internal Link Dist (ft) |       | 124   |                    |       | 258   |      |       | 2930        |      | 0.    | 502         |      |

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|                              | ٨             | -          | $\mathbf{r}$          | 4          | +           | •          | •    | 1    | *   | 1    | Ļ    | ~   |
|------------------------------|---------------|------------|-----------------------|------------|-------------|------------|------|------|-----|------|------|-----|
| Lane Group                   | EBL           | EBT        | EBR                   | WBL        | WBT         | WBR        | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| Turn Bay Length (ft)         |               |            |                       |            |             |            | 255  |      |     | 270  |      |     |
| Base Capacity (vph)          |               | 199        |                       |            | 159         |            | 110  | 2563 |     | 139  | 2650 |     |
| Starvation Cap Reductn       |               | 0          |                       |            | 0           |            | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn        |               | 0          |                       |            | 0           |            | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn          |               | 0          |                       |            | 0           |            | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio            |               | 0.46       |                       |            | 0.65        |            | 0.36 | 0.34 |     | 0.31 | 0.76 |     |
| Intersection Summary         |               |            |                       |            |             |            |      |      |     |      |      |     |
| Area Type:                   | Other         |            |                       |            |             |            |      |      |     |      |      |     |
| Cycle Length: 90             |               |            |                       |            |             |            |      |      |     |      |      |     |
| Actuated Cycle Length: 90    | )             |            |                       |            |             |            |      |      |     |      |      |     |
| Offset: 0 (0%), Reference    | d to phase 2: | SBT and    | 6:NBT, S              | tart of Gr | een         |            |      |      |     |      |      |     |
| Natural Cycle: 70            |               |            |                       |            |             |            |      |      |     |      |      |     |
| Control Type: Actuated-Co    | oordinated    |            |                       |            |             |            |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.76      |               |            |                       |            |             |            |      |      |     |      |      |     |
| Intersection Signal Delay:   | 13.9          |            |                       | In         | itersection | n LOS: B   |      |      |     |      |      |     |
| Intersection Capacity Utiliz | zation 72.5%  |            |                       | IC         | CU Level o  | of Service | С    |      |     |      |      |     |
| Analysis Period (min) 15     |               |            |                       |            |             |            |      |      |     |      |      |     |
| # 95th percentile volume     | exceeds cap   | pacity, qu | eue may               | be longe   | r.          |            |      |      |     |      |      |     |
| Queue shown is maxim         | num after two | cycles.    |                       |            |             |            |      |      |     |      |      |     |
| Solits and Phases: 1. W      | /ashington St | reet & Th  | urston S <sup>r</sup> | treet      |             |            |      |      |     |      |      |     |
|                              | (D)           |            |                       |            |             |            |      |      |     | -    | - 04 |     |

| <b>0</b> 1 | 🔰 Ø2 (R) | Ø4              |  |
|------------|----------|-----------------|--|
| 12 s       | 64 s     | 14 s            |  |
| Ø5         | 🗖 Ø6 (R) | A <sub>08</sub> |  |
| 14 s       | 62 s     | 14 s            |  |

|                         | ۶     | -     | $\mathbf{\hat{z}}$ | 4     | +     | *    | 1     | 1     | ۲    | 1     | ŧ     | ~     |
|-------------------------|-------|-------|--------------------|-------|-------|------|-------|-------|------|-------|-------|-------|
| Lane Group              | EBL   | EBT   | EBR                | WBL   | WBT   | WBR  | NBL   | NBT   | NBR  | SBL   | SBT   | SBR   |
| Lane Configurations     |       | र्स   | 1                  |       | 4     |      | ۲     | A12   |      | 5     | 44    | 1     |
| Traffic Volume (vph)    | 32    | 1     | 199                | 13    | 1     | 3    | 166   | 840   | 5    | 4     | 1914  | 59    |
| Future Volume (vph)     | 32    | 1     | 199                | 13    | 1     | 3    | 166   | 840   | 5    | 4     | 1914  | 59    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900               | 1900  | 1900  | 1900 | 1900  | 1900  | 1900 | 1900  | 1900  | 1900  |
| Lane Width (ft)         | 12    | 12    | 12                 | 12    | 16    | 12   | 12    | 12    | 12   | 12    | 12    | 12    |
| Grade (%)               |       | -5%   |                    |       | 2%    |      |       | 2%    |      |       | -4%   |       |
| Storage Length (ft)     | 309   |       | 0                  | 0     |       | 0    | 562   |       | 0    | 274   |       | 480   |
| Storage Lanes           | 0     |       | 1                  | 0     |       | 0    | 1     |       | 0    | 1     |       | 1     |
| Taper Length (ft)       | 25    |       |                    | 25    |       |      | 25    |       |      | 25    |       |       |
| Satd, Flow (prot)       | 0     | 1858  | 1623               | 0     | 1712  | 0    | 1752  | 3467  | 0    | 1473  | 3610  | 1584  |
| Flt Permitted           |       | 0.711 |                    |       | 0.756 |      | 0.950 |       |      | 0.950 |       |       |
| Satd, Flow (perm)       | 0     | 1385  | 1623               | 0     | 1343  | 0    | 1752  | 3467  | 0    | 1473  | 3610  | 1584  |
| Right Turn on Red       |       |       | Yes                |       |       | Yes  |       |       | Yes  |       |       | Yes   |
| Satd. Flow (RTOR)       |       |       | 38                 |       | 5     |      |       | 1     |      |       |       | 202   |
| Link Speed (mph)        |       | 30    |                    |       | 30    |      |       | 55    |      |       | 55    |       |
| Link Distance (ft)      |       | 359   |                    |       | 496   |      |       | 788   |      |       | 1704  |       |
| Travel Time (s)         |       | 8.2   |                    |       | 11.3  |      |       | 9.8   |      |       | 21.1  |       |
| Peak Hour Factor        | 0.89  | 0.89  | 0.89               | 0.61  | 0.61  | 0.61 | 0.98  | 0.98  | 0.98 | 0.89  | 0.89  | 0.89  |
| Heavy Vehicles (%)      | 0%    | 0%    | 2%                 | 15%   | 0%    | 33%  | 2%    | 3%    | 0%   | 25%   | 2%    | 4%    |
| Shared Lane Traffic (%) |       |       |                    |       |       |      |       |       |      |       |       |       |
| Lane Group Flow (vph)   | 0     | 37    | 224                | 0     | 28    | 0    | 169   | 862   | 0    | 4     | 2151  | 66    |
| Turn Type               | Perm  | NA    | pt+ov              | Perm  | NA    |      | Prot  | NA    |      | Prot  | NA    | Prot  |
| Protected Phases        | -     | 4     | 45                 |       | 8     |      | 5     | 2     |      | 1     | 6     | 6     |
| Permitted Phases        | 4     |       |                    | 8     |       |      |       |       |      |       |       |       |
| Detector Phase          | 4     | 4     | 4 5                | 8     | 8     |      | 5     | 2     |      | 1     | 6     | 6     |
| Switch Phase            |       |       |                    |       |       |      |       |       |      |       |       |       |
| Minimum Initial (s)     | 6.0   | 6.0   |                    | 6.0   | 6.0   |      | 10.0  | 10.0  |      | 6.0   | 10.0  | 10.0  |
| Minimum Split (s)       | 13.0  | 13.0  |                    | 13.0  | 13.0  |      | 17.5  | 16.5  |      | 13.0  | 16.5  | 16.5  |
| Total Split (s)         | 18.0  | 18.0  |                    | 18.0  | 18.0  |      | 23.0  | 68.0  |      | 14.0  | 59.0  | 59.0  |
| Total Split (%)         | 18.0% | 18.0% |                    | 18.0% | 18.0% |      | 23.0% | 68.0% |      | 14.0% | 59.0% | 59.0% |
| Yellow Time (s)         | 4.0   | 4.0   |                    | 4.0   | 4.0   |      | 4.5   | 5.0   |      | 4.5   | 5.0   | 5.0   |
| All-Red Time (s)        | 3.0   | 3.0   |                    | 3.0   | 3.0   |      | 3.0   | 1.5   |      | 2.5   | 1.5   | 1.5   |
| Lost Time Adjust (s)    |       | 0.0   |                    |       | 0.0   |      | 0.0   | 0.0   |      | 0.0   | 0.0   | 0.0   |
| Total Lost Time (s)     |       | 7.0   |                    |       | 7.0   |      | 7.5   | 6.5   |      | 7.0   | 6.5   | 6.5   |
| Lead/Lag                |       |       |                    |       |       |      | Lead  | Lag   |      | Lead  | Lag   | Lag   |
| Lead-Lag Optimize?      |       |       |                    |       |       |      | Yes   | Yes   |      | Yes   | Yes   | Yes   |
| Recall Mode             | None  | None  |                    | None  | None  |      | None  | C-Min |      | None  | C-Min | C-Min |
| Act Effct Green (s)     |       | 10.4  | 31.2               |       | 9.0   |      | 13.3  | 73.5  |      | 6.0   | 55.3  | 55.3  |
| Actuated g/C Ratio      |       | 0.10  | 0.31               |       | 0.09  |      | 0.13  | 0.74  |      | 0.06  | 0.55  | 0.55  |
| v/c Ratio               |       | 0.26  | 0.42               |       | 0.22  |      | 0.73  | 0.34  |      | 0.05  | 1.08  | 0.07  |
| Control Delay           |       | 45.7  | 24.4               |       | 39.9  |      | 67.1  | 3.3   |      | 45.5  | 68.6  | 0.1   |
| Queue Delay             |       | 0.0   | 0.0                |       | 0.0   |      | 0.0   | 0.0   |      | 0.0   | 0.0   | 0.0   |
| Total Delay             |       | 45.7  | 24.4               |       | 39.9  |      | 67.1  | 3.3   |      | 45.5  | 68.6  | 0.1   |
| LOS                     |       | D     | С                  |       | D     |      | E     | А     |      | D     | Е     | A     |
| Approach Delay          |       | 27.4  |                    |       | 39.9  |      |       | 13.8  |      |       | 66.5  |       |
| Approach LOS            |       | С     |                    |       | D     |      |       | В     |      |       | Е     |       |
| Queue Length 50th (ft)  |       | 22    | 91                 |       | 14    |      | 109   | 43    |      | 2     | ~824  | 0     |
| Queue Length 95th (ft)  |       | 53    | 151                |       | 26    |      | 177   | 93    |      | 13    | #965  | 0     |
| Internal Link Dist (ft) |       | 279   |                    |       | 416   |      |       | 708   |      |       | 1624  |       |

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|                              | ٦              | -          | $\mathbf{F}$ | ∢          | ←           | •           | •      | Ť    | 1   | 5    | Ļ    | ~    |
|------------------------------|----------------|------------|--------------|------------|-------------|-------------|--------|------|-----|------|------|------|
| Lane Group                   | EBL            | EBT        | EBR          | WBL        | WBT         | WBR         | NBL    | NBT  | NBR | SBL  | SBT  | SBR  |
| Turn Bay Length (ft)         |                |            |              |            |             |             | 562    |      |     | 274  |      | 480  |
| Base Capacity (vph)          |                | 152        | 554          |            | 152         |             | 271    | 2548 |     | 103  | 1996 | 966  |
| Starvation Cap Reductn       |                | 0          | 0            |            | 0           |             | 0      | 0    |     | 0    | 0    | 0    |
| Spillback Cap Reductn        |                | 0          | 0            |            | 0           |             | 0      | 0    |     | 0    | 0    | 0    |
| Storage Cap Reductn          |                | 0          | 0            |            | 0           |             | 0      | 0    |     | 0    | 0    | 0    |
| Reduced v/c Ratio            |                | 0.24       | 0.40         |            | 0.18        |             | 0.62   | 0.34 |     | 0.04 | 1.08 | 0.07 |
| Intersection Summary         |                |            |              |            |             |             |        |      |     |      |      |      |
| Area Type:                   | Other          |            |              |            |             |             |        |      |     |      |      |      |
| Cycle Length: 100            |                |            |              |            |             |             |        |      |     |      |      |      |
| Actuated Cycle Length: 10    | 0              |            |              |            |             |             |        |      |     |      |      |      |
| Offset: 0 (0%), Referenced   | I to phase 2:  | NBT and    | 6:SBT, S     | tart of Ye | llow, Mas   | ter Interse | ection |      |     |      |      |      |
| Natural Cycle: 90            |                |            |              |            |             |             |        |      |     |      |      |      |
| Control Type: Actuated-Co    | ordinated      |            |              |            |             |             |        |      |     |      |      |      |
| Maximum v/c Ratio: 1.08      |                |            |              |            |             |             |        |      |     |      |      |      |
| Intersection Signal Delay: 4 | 48.1           |            |              | In         | Itersectior | n LOS: D    |        |      |     |      |      |      |
| Intersection Capacity Utiliz | ation 87.3%    |            |              | IC         | CU Level o  | of Service  | E      |      |     |      |      |      |
| Analysis Period (min) 15     |                |            |              |            |             |             |        |      |     |      |      |      |
| ~ Volume exceeds capac       | city, queue is | theoretic  | ally infini  | te.        |             |             |        |      |     |      |      |      |
| Queue shown is maxim         | um after two   | cycles.    |              |            |             |             |        |      |     |      |      |      |
| # 95th percentile volume     | exceeds ca     | bacity, qu | eue may      | be longe   | r.          |             |        |      |     |      |      |      |
| Queue shown is maxim         | um after two   | cycles.    |              |            |             |             |        |      |     |      |      |      |
|                              |                |            |              |            |             |             |        |      |     |      |      |      |

Splits and Phases: 3: Washington Street & Madison Street

| Ø1         | <b>↑</b> ø2 (R) | <b>₽</b> 04 |
|------------|-----------------|-------------|
| 14 s       | 68 s            | 18 s        |
| <b>Ø</b> 5 |                 | <b>₩</b> Ø8 |
| 23 s       | 59 s            | 18 s        |

#### Intersection

Int Delay, s/veh

1.7

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations      |      | 4    |      |      | 4    |      |      | 4îÞ  |      |      | 4îÞ  |      |
| Traffic Vol, veh/h       | 0    | 0    | 18   | 7    | 0    | 4    | 13   | 849  | 14   | 5    | 1966 | 8    |
| Future Vol, veh/h        | 0    | 0    | 18   | 7    | 0    | 4    | 13   | 849  | 14   | 5    | 1966 | 8    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized           | -    | -    | None |
| Storage Length           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | # -  | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %                 | -    | -4   | -    | -    | 1    | -    | -    | -1   | -    | -    | 1    | -    |
| Peak Hour Factor         | 61   | 61   | 61   | 55   | 55   | 55   | 98   | 98   | 98   | 90   | 90   | 90   |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0    | 8    | 3    | 0    | 0    | 1    | 0    |
| Mvmt Flow                | 0    | 0    | 30   | 13   | 0    | 7    | 13   | 866  | 14   | 6    | 2184 | 9    |

| Major/Minor          | Minor2 |      | N    | Minor1 |      | N   | /lajor1 |   | М | ajor2 |   |   |  |
|----------------------|--------|------|------|--------|------|-----|---------|---|---|-------|---|---|--|
| Conflicting Flow All | 2660   | 3107 | 1097 | 2003   | 3104 | 440 | 2193    | 0 | 0 | 880   | 0 | 0 |  |
| Stage 1              | 2201   | 2201 | -    | 899    | 899  | -   | -       | - | - | -     | - | - |  |
| Stage 2              | 459    | 906  | -    | 1104   | 2205 | -   | -       | - | - | -     | - | - |  |
| Critical Hdwy        | 6.7    | 5.7  | 6.5  | 7.7    | 6.7  | 7   | 4.26    | - | - | 4.1   | - | - |  |
| Critical Hdwy Stg 1  | 5.7    | 4.7  | -    | 6.7    | 5.7  | -   | -       | - | - | -     | - | - |  |
| Critical Hdwy Stg 2  | 5.7    | 4.7  | -    | 6.7    | 5.7  | -   | -       | - | - | -     | - | - |  |
| Follow-up Hdwy       | 3.5    | 4    | 3.3  | 3.5    | 4    | 3.3 | 2.28    | - | - | 2.2   | - | - |  |
| Pot Cap-1 Maneuver   | 20     | 23   | 239  | 32     | 10   | 563 | 218     | - | - | 777   | - | - |  |
| Stage 1              | 76     | 136  | -    | 290    | 343  | -   | -       | - | - | -     | - | - |  |
| Stage 2              | 616    | 437  | -    | 215    | 74   | -   | -       | - | - | -     | - | - |  |
| Platoon blocked, %   |        |      |      |        |      |     |         | - | - |       | - | - |  |
| Mov Cap-1 Maneuver   | 18     | 20   | 239  | 26     | 9    | 563 | 218     | - | - | 777   | - | - |  |
| Mov Cap-2 Maneuver   | 18     | 20   | -    | 26     | 9    | -   | -       | - | - | -     | - | - |  |
| Stage 1              | 67     | 136  | -    | 256    | 303  | -   | -       | - | - | -     | - | - |  |
| Stage 2              | 537    | 386  | -    | 188    | 74   | -   | -       | - | - | -     | - | - |  |
|                      |        |      |      |        |      |     |         |   |   |       |   |   |  |

| Approach             | EB   | WB    | NB  | SB |  |
|----------------------|------|-------|-----|----|--|
| HCM Control Delay, s | 22.2 | 163.9 | 1.6 | 0  |  |
| HCM LOS              | С    | F     |     |    |  |

| Minor Lane/Major Mvmt | NBL   | NBT | NBR | EBLn1V | VBLn1 | SBL   | SBT | SBR |
|-----------------------|-------|-----|-----|--------|-------|-------|-----|-----|
| Capacity (veh/h)      | 218   | -   | -   | 239    | 40    | 777   | -   | -   |
| HCM Lane V/C Ratio    | 0.061 | -   | -   | 0.123  | 0.5   | 0.007 | -   | -   |
| HCM Control Delay (s) | 22.6  | 1.3 | -   | 22.2   | 163.9 | 9.7   | 0   | -   |
| HCM Lane LOS          | С     | А   | -   | С      | F     | А     | А   | -   |
| HCM 95th %tile Q(veh) | 0.2   | -   | -   | 0.4    | 1.8   | 0     | -   | -   |

|                         | ٦     | -        | $\mathbf{r}$ | 4        | -        | •    | 1        | 1         | 1    | 1          | Ļ           | ~    |
|-------------------------|-------|----------|--------------|----------|----------|------|----------|-----------|------|------------|-------------|------|
| Lane Group              | EBL   | EBT      | EBR          | WBL      | WBT      | WBR  | NBL      | NBT       | NBR  | SBL        | SBT         | SBR  |
| Lane Configurations     |       | 4        |              |          | 4        |      | *        | <b>A1</b> |      | 5          | <b>A</b> 1. | -    |
| Traffic Volume (vph)    | 8     | 10       | 31           | 25       | 8        | 18   | 40       | 1032      | 54   | 25         | 863         | 8    |
| Future Volume (vph)     | 8     | 10       | 31           | 25       | 8        | 18   | 40       | 1032      | 54   | 25         | 863         | 8    |
| Ideal Flow (vphpl)      | 1900  | 1900     | 1900         | 1900     | 1900     | 1900 | 1900     | 1900      | 1900 | 1900       | 1900        | 1900 |
| Grade (%)               | 1000  | 2%       | 1000         | 1000     | -3%      | 1000 | 1000     | 0%        | 1000 | 1000       | 0%          | 1000 |
| Storage Length (ft)     | 0     | 270      | 0            | 0        | 070      | 0    | 255      | 070       | 0    | 270        | 070         | 0    |
| Storage Lanes           | 0     |          | 0            | 0        |          | 0    | 1        |           | 0    | 1          |             | 0    |
| Taper Length (ff)       | 25    |          | Ŭ            | 25       |          | Ű    | 25       |           | Ŭ    | 25         |             | Ŭ    |
| Satd Flow (prot)        | 0     | 1705     | 0            | 0        | 1792     | 0    | 1805     | 3537      | 0    | 1736       | 3571        | 0    |
| Flt Permitted           | Ū     | 0.952    | Ŭ            | Ū        | 0.870    | Ű    | 0.950    | 0001      | Ŭ    | 0.950      | 0011        | Ŭ    |
| Satd Flow (perm)        | 0     | 1637     | 0            | 0        | 1597     | 0    | 1805     | 3537      | 0    | 1736       | 3571        | 0    |
| Right Turn on Red       | U     | 1007     | Yes          | U        | 1007     | Yes  | 1000     | 0001      | Yes  | 1700       | 0071        | Yes  |
| Satd Flow (RTOR)        |       | 44       | 103          |          | 22       | 103  |          | 10        | 103  |            | 2           | 103  |
| Link Speed (mph)        |       | 30       |              |          | 30       |      |          | 55        |      |            | 55          |      |
| Link Distance (ff)      |       | 204      |              |          | 338      |      |          | 3010      |      |            | 582         |      |
|                         |       | 204      |              |          | 77       |      |          | 3010      |      |            | 7.0         |      |
| Dook Hour Easter        | 0.71  | 4.0      | 0.71         | 0.85     | 0.82     | 0 83 | 0.03     | 0.03      | 0.03 | 0.03       | 0.03        | 0.03 |
|                         | 0.71  | 0.71     | 0.71         | 0.02     | 0.02     | 0.02 | 0.95     | 0.93      | 0.93 | 0.93       | 0.93        | 0.93 |
| Charad Lana Traffic (%) | 0 %   | 070      | U 70         | 070      | U 70     | 0 %  | 070      | 1 70      | 0 70 | 4 70       | I 70        | 070  |
|                         | ٥     | 60       | 0            | ٥        | 60       | ٥    | 10       | 1160      | ٥    | 07         | 027         | 0    |
|                         | Dermo | 09       | U            | Derree   |          | U    | 43       | 1100      | U    | Z/<br>Dret | 937         | U    |
| Turn Type               | Perm  | NA<br>0  |              | Perm     | NA<br>4  |      | Prot     | NA        |      | Prot       | NA<br>2     |      |
| Protected Priases       | 0     | Ö        |              | 4        | 4        |      | I        | 0         |      | 5          | Z           |      |
| Permilled Phases        | 0     | 0        |              | 4        | 1        |      | 1        | C         |      | F          | 0           |      |
| Detector Phase          | Ö     | Ö        |              | 4        | 4        |      | I        | 0         |      | 5          | Z           |      |
| Switch Phase            | 0.0   | <u> </u> |              | <u> </u> | <u> </u> |      | <u> </u> | 20.0      |      | <u> </u>   | 10          |      |
| Minimum Initial (S)     | 0.0   | 0.0      |              | 0.0      | 0.0      |      | 0.0      | 30.0      |      | 0.0        | 1.0         |      |
| Minimum Split (s)       | 11.0  | 11.0     |              | 11.0     | 11.0     |      | 12.5     | 30.0      |      | 12.5       | 30.0        |      |
| Total Split (S)         | 19.0  | 19.0     |              | 19.0     | 19.0     |      | 14.0     | 57.0      |      | 14.0       | 57.0        |      |
| Total Split (%)         | 21.1% | 21.1%    |              | 21.1%    | 21.1%    |      | 15.6%    | 63.3%     |      | 15.6%      | 63.3%       |      |
| Yellow Time (s)         | 3.5   | 3.5      |              | 3.5      | 3.5      |      | 3.5      | 5.0       |      | 3.5        | 5.0         |      |
| All-Red Time (s)        | 1.5   | 1.5      |              | 1.5      | 1.5      |      | 3.0      | 1.0       |      | 3.0        | 1.0         |      |
| Lost Time Adjust (s)    |       | 0.0      |              |          | 0.0      |      | 0.0      | 0.0       |      | 0.0        | 0.0         |      |
| I otal Lost Time (s)    |       | 5.0      |              |          | 5.0      |      | 6.5      | 6.0       |      | 6.5        | 6.0         | _    |
| Lead/Lag                |       |          |              |          |          |      | Lead     | Lag       |      | Lead       | Lag         |      |
| Lead-Lag Optimize?      |       |          |              |          |          |      | Yes      | Yes       |      | Yes        | Yes         |      |
| Recall Mode             | None  | None     |              | None     | None     |      | None     | C-Min     |      | None       | C-Min       |      |
| Act Effct Green (s)     |       | 8.2      |              |          | 8.2      |      | 7.0      | 68.6      |      | 6.8        | 65.8        |      |
| Actuated g/C Ratio      |       | 0.09     |              |          | 0.09     |      | 0.08     | 0.76      |      | 0.08       | 0.73        |      |
| v/c Ratio               |       | 0.37     |              |          | 0.38     |      | 0.31     | 0.43      |      | 0.21       | 0.36        |      |
| Control Delay           |       | 23.6     |              |          | 33.3     |      | 45.0     | 6.8       |      | 42.8       | 7.2         |      |
| Queue Delay             |       | 0.0      |              |          | 0.0      |      | 0.0      | 0.0       |      | 0.0        | 0.0         |      |
| Total Delay             |       | 23.6     |              |          | 33.3     |      | 45.0     | 6.8       |      | 42.8       | 7.2         |      |
| LOS                     |       | С        |              |          | С        |      | D        | A         |      | D          | A           |      |
| Approach Delay          |       | 23.6     |              |          | 33.3     |      |          | 8.2       |      |            | 8.2         |      |
| Approach LOS            |       | С        |              |          | С        |      |          | A         |      |            | A           |      |
| Queue Length 50th (ft)  |       | 14       |              |          | 22       |      | 23       | 80        |      | 15         | 124         |      |
| Queue Length 95th (ft)  |       | 35       |              |          | 52       |      | 56       | 248       |      | 41         | 184         |      |
| Internal Link Dist (ft) |       | 124      |              |          | 258      |      |          | 2930      |      |            | 502         |      |
| Turn Bay Length (ft)    |       |          |              |          |          |      | 255      |           |      | 270        |             |      |

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|                              | ≯           | +       | *        | 4          | +          | •          | •    | Ť    | 1   | *    | ţ    | ~   |
|------------------------------|-------------|---------|----------|------------|------------|------------|------|------|-----|------|------|-----|
| Lane Group                   | EBL         | EBT     | EBR      | WBL        | WBT        | WBR        | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| Base Capacity (vph)          |             | 291     |          |            | 267        |            | 150  | 2699 |     | 144  | 2612 |     |
| Starvation Cap Reductn       |             | 0       |          |            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn        |             | 0       |          |            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn          |             | 0       |          |            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio            |             | 0.24    |          |            | 0.23       |            | 0.29 | 0.43 |     | 0.19 | 0.36 |     |
| Intersection Summary         |             |         |          |            |            |            |      |      |     |      |      |     |
| Area Type:                   | Other       |         |          |            |            |            |      |      |     |      |      |     |
| Cycle Length: 90             |             |         |          |            |            |            |      |      |     |      |      |     |
| Actuated Cycle Length: 90    |             |         |          |            |            |            |      |      |     |      |      |     |
| Offset: 0 (0%), Referenced   | to phase 2: | SBT and | 6:NBT, S | tart of Gr | een        |            |      |      |     |      |      |     |
| Natural Cycle: 60            |             |         |          |            |            |            |      |      |     |      |      |     |
| Control Type: Actuated-Co    | ordinated   |         |          |            |            |            |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.43      |             |         |          |            |            |            |      |      |     |      |      |     |
| Intersection Signal Delay: 9 | 9.3         |         |          | In         | tersectior | n LOS: A   |      |      |     |      |      |     |
| Intersection Capacity Utiliz | ation 49.4% |         |          | IC         | CU Level o | of Service | А    |      |     |      |      |     |
| Analysis Period (min) 15     |             |         |          |            |            |            |      |      |     |      |      |     |

Splits and Phases: 1: Washington Street & Thurston Street

| ▲ø1  | 🔻 Ø2 (R) | ₩ø4      |  |
|------|----------|----------|--|
| 14 s | 57 s     | 19 s     |  |
| Ø5   | Ø6 (R)   | <u> </u> |  |
| 14 s | 57 s     | 19 s     |  |

|                         | ≯     | -     | $\mathbf{r}$ | 4     | -     | •     | 1     | 1           | 1     | 1     | Ŧ        | -     |
|-------------------------|-------|-------|--------------|-------|-------|-------|-------|-------------|-------|-------|----------|-------|
| Lane Group              | EBL   | EBT   | EBR          | WBL   | WBT   | WBR   | NBL   | NBT         | NBR   | SBL   | SBT      | SBR   |
| Lane Configurations     |       | र्स   | 1            |       | 4     |       | 5     | <b>4</b> 16 |       | 5     | <b>^</b> | 1     |
| Traffic Volume (vph)    | 35    | Ö     | 192          | 1     | 1     | 2     | 222   | 1175        | 6     | 3     | 879      | 49    |
| Future Volume (vph)     | 35    | 0     | 192          | 1     | 1     | 2     | 222   | 1175        | 6     | 3     | 879      | 49    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900         | 1900  | 1900  | 1900  | 1900  | 1900        | 1900  | 1900  | 1900     | 1900  |
| Lane Width (ft)         | 12    | 12    | 12           | 12    | 16    | 12    | 12    | 12          | 12    | 12    | 12       | 12    |
| Grade (%)               |       | -5%   |              |       | 2%    |       |       | 2%          |       |       | -4%      |       |
| Storage Length (ft)     | 309   |       | 0            | 0     |       | 0     | 562   |             | 0     | 274   |          | 480   |
| Storage Lanes           | 0     |       | 1            | 0     |       | 0     | 1     |             | 0     | 1     |          | 1     |
| Taper Length (ft)       | 25    |       |              | 25    |       |       | 25    |             |       | 25    |          |       |
| Satd. Flow (prot)       | 0     | 1850  | 1592         | 0     | 1963  | 0     | 1769  | 3535        | 0     | 1841  | 3646     | 1615  |
| Flt Permitted           |       | 0.752 |              |       | 0.934 |       | 0.950 |             |       | 0.950 |          |       |
| Satd. Flow (perm)       | 0     | 1465  | 1592         | 0     | 1856  | 0     | 1769  | 3535        | 0     | 1841  | 3646     | 1615  |
| Right Turn on Red       |       |       | Yes          |       |       | Yes   |       |             | Yes   |       |          | Yes   |
| Satd. Flow (RTOR)       |       |       | 38           |       | 4     |       |       | 1           |       |       |          | 202   |
| Link Speed (mph)        |       | 30    |              |       | 30    |       |       | 55          |       |       | 55       |       |
| Link Distance (ft)      |       | 359   |              |       | 496   |       |       | 788         |       |       | 1704     |       |
| Travel Time (s)         |       | 8.2   |              |       | 11.3  |       |       | 9.8         |       |       | 21.1     |       |
| Peak Hour Factor        | 0.83  | 0.83  | 0.83         | 0.50  | 0.50  | 0.50  | 0.97  | 0.97        | 0.97  | 0.95  | 0.95     | 0.95  |
| Heavy Vehicles (%)      | 0%    | 2%    | 4%           | 0%    | 0%    | 0%    | 1%    | 1%          | 0%    | 0%    | 1%       | 2%    |
| Shared Lane Traffic (%) | • / • | _/*   | .,•          | •,•   | • , • | • / • | . , • | . , •       | • / • | • / • | . , •    | _//   |
| Lane Group Flow (vph)   | 0     | 42    | 231          | 0     | 8     | 0     | 229   | 1217        | 0     | 3     | 925      | 52    |
| Turn Type               | Perm  | NA    | pt+ov        | Perm  | NA    | •     | Prot  | NA          | Ţ     | Prot  | NA       | Prot  |
| Protected Phases        |       | 4     | 4 5          |       | 8     |       | 5     | 2           |       | 1     | 6        | 6     |
| Permitted Phases        | 4     |       |              | 8     |       |       |       |             |       |       |          | -     |
| Detector Phase          | 4     | 4     | 45           | 8     | 8     |       | 5     | 2           |       | 1     | 6        | 6     |
| Switch Phase            |       |       |              |       |       |       |       |             |       |       |          | -     |
| Minimum Initial (s)     | 6.0   | 6.0   |              | 6.0   | 6.0   |       | 10.0  | 10.0        |       | 6.0   | 10.0     | 10.0  |
| Minimum Split (s)       | 13.0  | 13.0  |              | 13.0  | 13.0  |       | 17.5  | 16.5        |       | 13.0  | 16.5     | 16.5  |
| Total Split (s)         | 30.0  | 30.0  |              | 30.0  | 30.0  |       | 32.0  | 57.0        |       | 13.0  | 38.0     | 38.0  |
| Total Split (%)         | 30.0% | 30.0% |              | 30.0% | 30.0% |       | 32.0% | 57.0%       |       | 13.0% | 38.0%    | 38.0% |
| Yellow Time (s)         | 4.0   | 4.0   |              | 4.0   | 4.0   |       | 4.5   | 5.0         |       | 4.5   | 5.0      | 5.0   |
| All-Red Time (s)        | 3.0   | 3.0   |              | 3.0   | 3.0   |       | 3.0   | 1.5         |       | 2.5   | 1.5      | 1.5   |
| Lost Time Adjust (s)    |       | 0.0   |              |       | 0.0   |       | 0.0   | 0.0         |       | 0.0   | 0.0      | 0.0   |
| Total Lost Time (s)     |       | 7.0   |              |       | 7.0   |       | 7.5   | 6.5         |       | 7.0   | 6.5      | 6.5   |
| Lead/Lag                |       |       |              |       |       |       | Lead  | Lag         |       | Lead  | Lag      | Lag   |
| Lead-Lag Optimize?      |       |       |              |       |       |       | Yes   | Yes         |       | Yes   | Yes      | Yes   |
| Recall Mode             | None  | None  |              | None  | None  |       | None  | C-Min       |       | None  | C-Min    | C-Min |
| Act Effct Green (s)     |       | 12.9  | 37.7         |       | 8.4   |       | 17.3  | 71.0        |       | 6.0   | 48.8     | 48.8  |
| Actuated g/C Ratio      |       | 0.13  | 0.38         |       | 0.08  |       | 0.17  | 0.71        |       | 0.06  | 0.49     | 0.49  |
| v/c Ratio               |       | 0.22  | 0.37         |       | 0.05  |       | 0.75  | 0.48        |       | 0.03  | 0.52     | 0.06  |
| Control Delay           |       | 40.3  | 18.8         |       | 30.5  |       | 53.1  | 11.4        |       | 45.0  | 20.5     | 0.1   |
| Queue Delav             |       | 0.0   | 0.0          |       | 0.0   |       | 0.0   | 0.0         |       | 0.0   | 0.0      | 0.0   |
| Total Delay             |       | 40.3  | 18.8         |       | 30.5  |       | 53.1  | 11.4        |       | 45.0  | 20.5     | 0.1   |
| LOS                     |       | D     | В            |       | С     |       | D     | В           |       | D     | С        | A     |
| Approach Delav          |       | 22.1  |              |       | 30.5  |       | _     | 18.0        |       |       | 19.5     |       |
| Approach LOS            |       | С     |              |       | С     |       |       | В           |       |       | В        |       |
| Queue Length 50th (ft)  |       | 24    | 87           |       | 2     |       | 148   | 189         |       | 2     | 204      | 0     |
| Queue Length 95th (ft)  |       | 50    | 107          |       | 8     |       | 220   | 314         |       | 11    | 325      | 0     |
| Internal Link Dist (ft) |       | 279   |              |       | 416   |       |       | 708         |       |       | 1624     |       |

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|               |   | •  |  |  |  |   | -  | ×  | ÷   | *  |
|---------------|---|--|--|--|--|---|--|--|---|--|
| BL EBT        | EBR   | WBL  | WBT  | WBR  | NBL  | NBT   | NBR  | SBL  | SBT   | SBR  |
|               |   |  |  |  | 562  |   |  | 274  |   | 480  |
| 336           | 730   |  | 429  |  | 433  | 2510  |  | 110  | 1780  | 891  |
| 0             | 0   |  | 0  |  | 0  | 0   |  | 0  | 0   | 0  |
| 0             | 0   |  | 0  |  | 0  | 0   |  | 0  | 0   | 0  |
| 0             | 0   |  | 0  |  | 0  | 0   |  | 0  | 0   | 0  |
| 0.13          | 0.32  |  | 0.02   |  | 0.53   | 0.48  |  | 0.03   | 0.52  | 0.06   |
|               |   |  |  |  |  |   |  |  |   |  |
|               |   |  |  |  |  |   |  |  |   |  |
|               |   |  |  |  |  |   |  |  |   |  |
|               |   |  |  |  |  |   |  |  |   |  |
| se 2:NBT and  | 6:SBT, S  | tart of Ye   | llow, Mas  | ter Interse  | ection   |   |  |  |   |  |
|               |   |  |  |  |  |   |  |  |   |  |
| ed            |   |  |  |  |  |   |  |  |   |  |
|               |   |  |  |  |  |   |  |  |   |  |
|               |   | In   | tersection   | LOS: B   |  |   |  |  |   |  |
| ).9%          |   | IC   | U Level c  | of Service   | В  |   |  |  |   |  |
|               |   |  |  |  |  |   |  |  |   |  |
| on Street & M | adison St   | reet   |  |  |  | <b>.</b>  |  |  |   |  |
|               | BL EBT<br>336<br>0<br>0<br>0<br>0.13<br>se 2:NBT and<br>ed<br>0.9%<br>on Street & M | BL         EBT         EBR           336         730         0         0           0         0         0         0         0           0         0         0         0         0         0           0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         13         0.32 | BL         EBT         EBR         WBL           336         730         0         0           0         0         0         0           0         0         0         0           0         0         0         0           0         0         0         0           0         0         0         0           0         0         0         0           0         0         0         0           0         0         0         0           0         0         0         0           se 2:NBT and 6:SBT, Start of Ye         In           0.9%         IC         In           0.9%         IC         In           0.9%         IC         In | BL         EBT         EBR         WBL         WBT           336         730         429         0         0         0           0         0         0         0         0         0           0 | BL         EBT         EBR         WBL         WBT         WBR           336         730         429         0 | BL         EBT         EBR         WBL         WBT         WBR         NBL         562         562         533         60         0 | BL         EBT         EBR         WBL         WBT         WBR         NBL         NBT           336         730         429         433         2510         0< | BL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR           336         730         429         433         2510         10         10         13         0.32         0.02         0.53         0.48         0         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10 | BL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SBL           336         730         429         433         2510         110           0         0         0         0         0         0         0           0         0         0         0         0         0         0           0         0         0         0         0         0         0           0         0         0         0         0         0         0           0         0         0         0         0         0         0           0.13         0.32         0.02         0.53         0.48         0.03 | BL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SBL         SBT           336         730         429         433         2510         110         1780           0         0         0         0         0         0         0         0         0           0         0         0         0         0         0         0         0         0           0 |



#### Intersection

Int Delay, s/veh

1.6

| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT     | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|---------|------|------|------|------|
| Lane Configurations    |      | \$   |      |      | \$   |      |      | र्ची के |      |      | सीरे |      |
| Traffic Vol, veh/h     | 0    | 0    | 18   | 11   | 0    | 10   | 11   | 1134    | 57   | 19   | 920  | 1    |
| Future Vol, veh/h      | 0    | 0    | 18   | 11   | 0    | 10   | 11   | 1134    | 57   | 19   | 920  | 1    |
| Conflicting Peds, #/hr | 0    | 0    | 1    | 1    | 0    | 0    | 0    | 0       | 1    | 1    | 0    | 0    |
| Sign Control           | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free    | Free | Free | Free | Free |
| RT Channelized         | -    | -    | None | -    | -    | None | -    | -       | None | -    | -    | None |
| Storage Length         | -    | -    | -    | -    | -    | -    | -    | -       | -    | -    | -    | -    |
| Veh in Median Storage, | # -  | 0    | -    | -    | 0    | -    | -    | 0       | -    | -    | 0    | -    |
| Grade, %               | -    | -4   | -    | -    | 1    | -    | -    | -1      | -    | -    | 1    | -    |
| Peak Hour Factor       | 85   | 85   | 85   | 75   | 75   | 75   | 93   | 93      | 93   | 96   | 96   | 96   |
| Heavy Vehicles, %      | 2    | 2    | 6    | 0    | 2    | 0    | 0    | 1       | 0    | 0    | 1    | 0    |
| Mvmt Flow              | 0    | 0    | 21   | 15   | 0    | 13   | 12   | 1219    | 61   | 20   | 958  | 1    |

| Major/Minor          | Minor2 |      | ľ    | Minor1 |      | Ν   | lajor1 |   | Ν | lajor2 |   |   |  |
|----------------------|--------|------|------|--------|------|-----|--------|---|---|--------|---|---|--|
| Conflicting Flow All | 1633   | 2304 | 481  | 1795   | 2274 | 641 | 959    | 0 | 0 | 1281   | 0 | 0 |  |
| Stage 1              | 999    | 999  | -    | 1275   | 1275 | -   | -      | - | - | -      | - | - |  |
| Stage 2              | 634    | 1305 | -    | 520    | 999  | -   | -      | - | - | -      | - | - |  |
| Critical Hdwy        | 6.74   | 5.74 | 6.62 | 7.7    | 6.74 | 7   | 4.1    | - | - | 4.1    | - | - |  |
| Critical Hdwy Stg 1  | 5.74   | 4.74 | -    | 6.7    | 5.74 | -   | -      | - | - | -      | - | - |  |
| Critical Hdwy Stg 2  | 5.74   | 4.74 | -    | 6.7    | 5.74 | -   | -      | - | - | -      | - | - |  |
| Follow-up Hdwy       | 3.52   | 4.02 | 3.36 | 3.5    | 4.02 | 3.3 | 2.2    | - | - | 2.2    | - | - |  |
| Pot Cap-1 Maneuver   | 96     | 63   | 549  | 47     | 35   | 415 | 725    | - | - | 549    | - | - |  |
| Stage 1              | 326    | 399  | -    | 167    | 220  | -   | -      | - | - | -      | - | - |  |
| Stage 2              | 499    | 305  | -    | 498    | 302  | -   | -      | - | - | -      | - | - |  |
| Platoon blocked, %   |        |      |      |        |      |     |        | - | - |        | - | - |  |
| Mov Cap-1 Maneuver   | · 84   | 55   | 548  | 41     | 30   | 414 | 725    | - | - | 548    | - | - |  |
| Mov Cap-2 Maneuver   | 84     | 55   | -    | 41     | 30   | -   | -      | - | - | -      | - | - |  |
| Stage 1              | 307    | 368  | -    | 157    | 207  | -   | -      | - | - | -      | - | - |  |
| Stage 2              | 454    | 287  | -    | 441    | 278  | -   | -      | - | - | -      | - | - |  |
|                      |        |      |      |        |      |     |        |   |   |        |   |   |  |
|                      |        |      |      |        |      |     |        |   |   |        |   |   |  |

| Approach             | EB   | WB   | NB  | SB  |  |
|----------------------|------|------|-----|-----|--|
| HCM Control Delay, s | 11.8 | 83.8 | 0.4 | 0.6 |  |
| HCM LOS              | В    | F    |     |     |  |

| Minor Lane/Major Mvmt | NBL   | NBT | NBR | EBLn1V | VBLn1 | SBL   | SBT | SBR |
|-----------------------|-------|-----|-----|--------|-------|-------|-----|-----|
| Capacity (veh/h)      | 725   | -   | -   | 548    | 72    | 548   | -   | -   |
| HCM Lane V/C Ratio    | 0.016 | -   | -   | 0.039  | 0.389 | 0.036 | -   | -   |
| HCM Control Delay (s) | 10    | 0.3 | -   | 11.8   | 83.8  | 11.8  | 0.4 | -   |
| HCM Lane LOS          | В     | А   | -   | В      | F     | В     | А   | -   |
| HCM 95th %tile Q(veh) | 0.1   | -   | -   | 0.1    | 1.5   | 0.1   | -   | -   |

|                         | ≯     | -     | $\mathbf{\hat{z}}$ | 4     | -     | *    | 1     | 1           | 1    | 1     | ŧ           | ~    |
|-------------------------|-------|-------|--------------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR                | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     | ۲     | ĥ     |                    | ሻ     | ĥ     |      | ۲     | <b>4</b> 16 |      | ሻ     | <b>≜</b> 16 |      |
| Traffic Volume (vph)    | 42    | 14    | 71                 | 113   | 20    | 48   | 26    | 2062        | 35   | 82    | 425         | 5    |
| Future Volume (vph)     | 42    | 14    | 71                 | 113   | 20    | 48   | 26    | 2062        | 35   | 82    | 425         | 5    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900               | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Lane Width (ft)         | 12    | 12    | 12                 | 12    | 12    | 12   | 12    | 12          | 12   | 12    | 12          | 12   |
| Grade (%)               |       | 2%    |                    |       | -3%   |      |       | 0%          |      |       | 0%          |      |
| Storage Length (ft)     | 0     |       | 0                  | 0     |       | 0    | 255   |             | 0    | 270   |             | 0    |
| Storage Lanes           | 1     |       | 0                  | 1     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25    |       |                    | 25    |       |      | 25    |             |      | 25    |             |      |
| Satd. Flow (prot)       | 1787  | 1550  | 0                  | 1579  | 1502  | 0    | 1656  | 3482        | 0    | 1805  | 3192        | 0    |
| Flt Permitted           | 0.709 |       |                    | 0.697 |       |      | 0.950 |             |      | 0.950 |             |      |
| Satd. Flow (perm)       | 1334  | 1550  | 0                  | 1159  | 1502  | 0    | 1656  | 3482        | 0    | 1805  | 3192        | 0    |
| Right Turn on Red       |       |       | Yes                |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd. Flow (RTOR)       |       | 77    |                    |       | 52    |      |       | 3           |      |       | 2           |      |
| Link Speed (mph)        |       | 30    |                    |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |       | 204   |                    |       | 338   |      |       | 3010        |      |       | 582         |      |
| Travel Time (s)         |       | 4.6   |                    |       | 7.7   |      |       | 37.3        |      |       | 7.2         |      |
| Confl. Peds. (#/hr)     |       |       |                    |       |       |      |       |             |      |       |             |      |
| Confl. Bikes (#/hr)     |       |       |                    |       |       |      |       |             |      |       |             |      |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92               | 0.92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92  | 0.92        | 0.92 |
| Growth Factor           | 100%  | 100%  | 100%               | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%        | 100% |
| Heavy Vehicles (%)      | 0%    | 22%   | 3%                 | 16%   | 29%   | 9%   | 9%    | 3%          | 25%  | 0%    | 13%         | 0%   |
| Bus Blockages (#/hr)    | 0     | 0     | 0                  | 0     | 0     | 0    | 0     | 0           | 0    | 0     | 0           | 0    |
| Parking (#/hr)          |       |       |                    |       |       |      |       |             |      |       |             |      |
| Mid-Block Traffic (%)   |       | 0%    |                    |       | 0%    |      |       | 0%          |      |       | 0%          |      |
| Shared Lane Traffic (%) |       |       |                    |       |       |      |       |             |      |       |             |      |
| Lane Group Flow (vph)   | 46    | 92    | 0                  | 123   | 74    | 0    | 28    | 2279        | 0    | 89    | 467         | 0    |
| Turn Type               | Perm  | NA    |                    | Perm  | NA    |      | Prot  | NA          |      | Prot  | NA          |      |
| Protected Phases        |       | 4     |                    |       | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Permitted Phases        | 4     |       |                    | 8     |       |      |       |             |      |       |             |      |
| Detector Phase          | 4     | 4     |                    | 8     | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Switch Phase            |       |       |                    |       |       |      |       |             |      |       |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |                    | 6.0   | 6.0   |      | 6.0   | 30.0        |      | 6.0   | 30.0        |      |
| Minimum Split (s)       | 11.0  | 11.0  |                    | 11.0  | 11.0  |      | 12.0  | 36.0        |      | 12.0  | 36.0        |      |
| Total Split (s)         | 25.0  | 25.0  |                    | 25.0  | 25.0  |      | 14.0  | 53.0        |      | 12.0  | 51.0        |      |
| Total Split (%)         | 27.8% | 27.8% |                    | 27.8% | 27.8% |      | 15.6% | 58.9%       |      | 13.3% | 56.7%       |      |
| Yellow Time (s)         | 3.0   | 3.0   |                    | 3.0   | 3.0   |      | 4.0   | 4.0         |      | 4.0   | 4.0         |      |
| All-Red Time (s)        | 2.0   | 2.0   |                    | 2.0   | 2.0   |      | 2.0   | 2.0         |      | 2.0   | 2.0         |      |
| Lost Time Adjust (s)    | 0.0   | 0.0   |                    | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     | 5.0   | 5.0   |                    | 5.0   | 5.0   |      | 6.0   | 6.0         |      | 6.0   | 6.0         |      |
| Lead/Lag                |       |       |                    |       |       |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |       |       |                    |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None  | None  |                    | None  | None  |      | None  | C-Max       |      | None  | C-Max       |      |
| Act Effct Green (s)     | 14.4  | 14.4  |                    | 14.4  | 14.4  |      | 7.0   | 55.0        |      | 6.0   | 59.0        |      |
| Actuated g/C Ratio      | 0.16  | 0.16  |                    | 0.16  | 0.16  |      | 0.08  | 0.61        |      | 0.07  | 0.66        |      |
| v/c Ratio               | 0.21  | 0.29  |                    | 0.66  | 0.26  |      | 0.22  | 1.07        |      | 0.74  | 0.22        |      |
| Control Delay           | 33.2  | 12.4  |                    | 51.7  | 15.5  |      | 45.6  | 53.2        |      | 76.8  | 8.6         |      |
| Queue Delay             | 0.0   | 0.0   |                    | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             | 33.2  | 12.4  |                    | 51.7  | 15.5  |      | 45.6  | 53.2        |      | 76.8  | 8.6         |      |

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|  | ٦             | -          | $\mathbf{\hat{z}}$ | 4           | -          | *          | 1    | Ť     | ۲   | 1    | ŧ    | ~   |
|--|---------------|------------|--------------------|-------------|------------|------------|------|-------|-----|------|------|-----|
| Lane Group                                 | EBL           | EBT        | EBR                | WBL         | WBT        | WBR        | NBL  | NBT   | NBR | SBL  | SBT  | SBR |
| LOS  | С             | В          |                    | D           | В          |            | D    | D     |     | Е    | А    |     |
| Approach Delay                             |               | 19.3       |                    |             | 38.1       |            |      | 53.1  |     |      | 19.5 |     |
| Approach LOS                               |               | В          |                    |             | D          |            |      | D     |     |      | В    |     |
| Queue Length 50th (ft)                     | 23            | 7          |                    | 66          | 11         |            | 17   | ~787  |     | 51   | 39   |     |
| Queue Length 95th (ft)                     | 51            | 46         |                    | 117         | 45         |            | m19  | m#923 |     | #129 | 110  |     |
| Internal Link Dist (ft)                    |               | 124        |                    |             | 258        |            |      | 2930  |     |      | 502  |     |
| Turn Bay Length (ft)                       |               |            |                    |             |            |            | 255  |       |     | 270  |      |     |
| Base Capacity (vph)                        | 296           | 404        |                    | 257         | 374        |            | 147  | 2127  |     | 120  | 2092 |     |
| Starvation Cap Reductn                     | 0             | 0          |                    | 0           | 0          |            | 0    | 0     |     | 0    | 0    |     |
| Spillback Cap Reductn                      | 0             | 0          |                    | 0           | 0          |            | 0    | 0     |     | 0    | 0    |     |
| Storage Cap Reductn                        | 0             | 0          |                    | 0           | 0          |            | 0    | 0     |     | 0    | 0    |     |
| Reduced v/c Ratio                          | 0.16          | 0.23       |                    | 0.48        | 0.20       |            | 0.19 | 1.07  |     | 0.74 | 0.22 |     |
| Intersection Summary                       |               |            |                    |             |            |            |      |       |     |      |      |     |
| Area Type:                                 | Other         |            |                    |             |            |            |      |       |     |      |      |     |
| Cycle Length: 90                           |               |            |                    |             |            |            |      |       |     |      |      |     |
| Actuated Cycle Length: 90                  |               |            |                    |             |            |            |      |       |     |      |      |     |
| Offset: 0 (0%), Referenced t               | to phase 2:I  | VBT and    | 6:SBT, S           | tart of Gre | een        |            |      |       |     |      |      |     |
| Natural Cycle: 90                          |               |            |                    |             |            |            |      |       |     |      |      |     |
| Control Type: Actuated-Coo                 | rdinated      |            |                    |             |            |            |      |       |     |      |      |     |
| Maximum v/c Ratio: 1.07                    |               |            |                    |             |            |            |      |       |     |      |      |     |
| Intersection Signal Delay: 44              | 4.9           |            |                    | In          | tersectior | LOS: D     | _    |       |     |      |      |     |
| Intersection Capacity Utiliza              | tion 90.2%    |            |                    | IC          | U Level o  | of Service | E    |       |     |      |      |     |
| Analysis Period (min) 15                   |               |            |                    |             |            |            |      |       |     |      |      |     |
| <ul> <li>Volume exceeds capacit</li> </ul> | ty, queue is  | theoretic  | ally infini        | te.         |            |            |      |       |     |      |      |     |
| Queue shown is maximu                      | m after two   | cycles.    |                    |             |            |            |      |       |     |      |      |     |
| # 95th percentile volume e                 | exceeds cap   | bacity, qu | eue may            | be longer   |            |            |      |       |     |      |      |     |
| Queue shown is maximu                      | m after two   | cycles.    |                    |             |            |            |      |       |     |      |      |     |
| m Volume for 95th percen                   | tile queue is | s metered  | i by upstr         | eam sign    | al.        |            |      |       |     |      |      |     |
| Splits and Phases: 1 Wa                    | shinaton St   | reet & Th  | urston St          | reet        |            |            |      |       |     |      |      |     |
|  |               |            |                    |             |            |            |      |       |     |      |      |     |

| Ø1      | ● Ø2 (R)   | <u>⊿</u> Ø4 |  |
|---------|------------|-------------|--|
| 12 s    | 53 s       | 25 s        |  |
| ▲<br>ø5 | ♥ ♥ Ø6 (R) | <b>₩</b> Ø8 |  |
| 14 s    | 51 s       | 25 s        |  |

|   | ≯       | -       | $\mathbf{\hat{z}}$ | 4       | +        | ×     | 1      | 1            | 1      | 1       | Ļ             | ~            |
|---|---------|---------|--------------------|---------|----------|-------|--------|--------------|--------|---------|---------------|--------------|
| Lane Group                              | EBL     | EBT     | EBR                | WBL     | WBT      | WBR   | NBL    | NBT          | NBR    | SBL     | SBT           | SBR          |
| Lane Configurations                     |         | ្រា     | 1                  |         | £.       |       | 5      | <b>4</b> 16  |        | 5       | **            | 1            |
| Traffic Volume (vph)                    | 28      | 1       | 207                | 4       | 4        | 11    | 121    | 2125         | 29     | 5       | 597           | 18           |
| Future Volume (vph)                     | 28      | 1       | 207                | 4       | 4        | 11    | 121    | 2125         | 29     | 5       | 597           | 18           |
| Ideal Flow (vphpl)                      | 1900    | 1900    | 1900               | 1900    | 1900     | 1900  | 1900   | 1900         | 1900   | 1900    | 1900          | 1900         |
| Lane Width (ft)                         | 12      | 12      | 12                 | 12      | 16       | 12    | 12     | 12           | 12     | 12      | 12            | 12           |
| Grade (%)                               | .=      | -5%     |                    |         | 2%       |       |        | 2%           |        |         | -4%           |              |
| Storage Length (ft)                     | 309     | • / •   | 0                  | 0       | _/*      | 0     | 562    | _/*          | 0      | 274     | .,.           | 480          |
| Storage Lanes                           | 0       |         | 1                  | 0       |          | 0     | 1      |              | 0      | 1       |               | 1            |
| Taper Length (ft)                       | 25      |         |                    | 25      |          | •     | 25     |              | •      | 25      |               |              |
| Satd. Flow (prot)                       | 0       | 1858    | 1623               | 0       | 1504     | 0     | 1769   | 3430         | 0      | 1534    | 3259          | 1384         |
| Elt Permitted                           | Ū       | 0 718   | .020               | Ū       | 0.926    | Ŭ     | 0.950  | 0.00         | Ū      | 0.950   | 0200          | 1001         |
| Satd Flow (perm)                        | 0       | 1398    | 1623               | 0       | 1406     | 0     | 1769   | 3430         | 0      | 1534    | 3259          | 1384         |
| Right Turn on Red                       | Ū       | 1000    | Yes                | Ū       | 1100     | Yes   |        | 0.00         | Yes    | 1001    | 0200          | Yes          |
| Satd, Flow (RTOR)                       |         |         | 132                |         | 12       | 100   |        | 2            | 100    |         |               | 224          |
| Link Speed (mph)                        |         | 30      | 102                |         | 30       |       |        | 55           |        |         | 55            | 221          |
| Link Distance (ft)                      |         | 359     |                    |         | 496      |       |        | 788          |        |         | 1704          |              |
| Travel Time (s)                         |         | 8.2     |                    |         | 11 3     |       |        | 9.8          |        |         | 21.1          |              |
| Confl Peds (#/hr)                       |         | 0.2     |                    |         | 11.0     |       |        | 5.0          |        |         | 21.1          |              |
| Confl. Rikes (#/hr)                     |         |         |                    |         |          |       |        |              |        |         |               |              |
| Peak Hour Factor                        | 0 92    | 0 92    | 0 92               | 0 92    | 0 02     | 0 92  | 0 92   | 0 92         | 0 92   | 0.92    | 0.92          | 0 92         |
| Growth Eactor                           | 100%    | 100%    | 10.0%              | 100%    | 100%     | 100%  | 100%   | 100%         | 100%   | 100%    | 100%          | 100%         |
| Heavy Vehicles (%)                      | 0%      | 0%      | 2%                 | 0%      | 25%      | 100%  | 100 /0 | 100 /0       | 100 /0 | 20%     | 13%           | 100%         |
| Bus Blockages (#/br)                    | 0 /8    | 0 /0    | 2 /0               | 0 /0    | 2370     | 40 /0 | 1 /0   | 4 /0         | 4 /0   | 2078    | 1370          | 1370         |
| Dus Diockages (#/iii)<br>Darking (#/br) | 0       | 0       | 0                  | 0       | 0        | 0     | 0      | 0            | 0      | 0       | 0             | 0            |
| Mid Block Traffic (%)                   |         | 0%      |                    |         | 0%       |       |        | 0%           |        |         | 0%            |              |
| Shared Lana Traffic (%)                 |         | 0 70    |                    |         | 0 70     |       |        | 0 70         |        |         | 0 /0          |              |
| Lane Group Flow (vph)                   | ٥       | 31      | 225                | 0       | 20       | 0     | 132    | 2342         | ٥      | 5       | 640           | 20           |
|   | Porm    |         | 22J                | Porm    | ZU<br>NA | 0     | Prot   | 2042<br>NA   | 0      | Prot    | 049<br>NA     | Prot         |
| Protected Phases                        | L CIIII | 1       | μι+0V<br>1 5       | r enn   | 8        |       | 5      | 2            |        | 1       | 6             | 6            |
| Pormitted Phases                        | 1       | 4       | 4 3                | 8       | 0        |       | J      | 2            |        | 1       | 0             | 0            |
| Detector Phase                          | 4       | 1       | 15                 | 0       | 8        |       | 5      | 2            |        | 1       | 6             | 6            |
| Switch Phase                            | 4       | 4       | 4 3                | 0       | 0        |       | J      | 2            |        | 1       | 0             | 0            |
| Minimum Initial (c)                     | 6.0     | 6.0     |                    | 6.0     | 60       |       | 10.0   | 10.0         |        | 6.0     | 10.0          | 10.0         |
| Minimum Split (s)                       | 13.0    | 13.0    |                    | 13.0    | 13.0     |       | 17.5   | 16.5         |        | 13.0    | 16.5          | 10.0         |
| Total Split (s)                         | 22.0    | 22.0    |                    | 22.0    | 22.0     |       | 25.0   | 10.5<br>55.0 |        | 13.0    | 10.5          | 10.0         |
| Total Split (S)                         | 22.0    | 22.0    |                    | 22.0    | 22.0     |       | 23.0   | 61 1%        |        | 1/ /0/  | 43.0          | 43.0         |
| Vollow Time (s)                         | 24.4 /0 | 24.4 /0 |                    | 24.4 /0 | 24.4 /0  |       | 21.0/0 | 5.0          |        | 14.4 /0 | 47.0%         | 47.0%        |
| All Red Time (s)                        | 4.0     | 4.0     |                    | 4.0     | 4.0      |       | 4.0    | 5.0          |        | 4.0     | 5.0<br>1 E    | 5.0          |
| All-Red Time (S)                        | 5.0     | 3.0     |                    | 3.0     | 5.0      |       | 3.0    | 1.5          |        | 2.5     | 1.5           | 1.5          |
| Lost Time Adjust (S)                    |         | 0.0     |                    |         | 0.0      |       | 0.0    | 0.0          |        | 0.0     | 0.0           | 0.0          |
| Total Lost Time (S)                     |         | 1.0     |                    |         | 1.0      |       | C.1    | 0.0          |        | 0.1     | 0.0           | 0.0          |
| Lead/Lag                                |         |         |                    |         |          |       | Lead   | Lag          |        | Lead    | Lag           | Lag          |
| Leao-Lag Optimize?                      | Nese    | Mana    |                    | Name    | Neze     |       | Yes    | res<br>C Min |        | Yes     | res<br>C Mire | res<br>O Min |
|   | None    | None    | 00.0               | None    | None     |       | None   | C-IVIIN      |        | INONE   | C-IVIIN       | C-IVIIN      |
| Act Effect Green (S)                    |         | 9.1     | 28.6               |         | ð.5      |       | 12.0   | 04.8         |        | 6.0     | 47.9          | 47.9         |
| Actuated g/C Ratio                      |         | 0.10    | 0.32               |         | 0.09     |       | 0.13   | 0.72         |        | 0.07    | 0.53          | 0.53         |
| V/C Katio                               |         | 0.22    | 0.37               |         | 0.14     |       | 0.56   | 0.95         |        | 0.05    | 0.37          | 0.02         |
| Control Delay                           |         | 39.3    | 10.8               |         | 24.5     |       | 43.2   | 20.5         |        | 41.0    | 11./          | 0.1          |
| Queue Delay                             |         | 0.0     | 0.0                |         | 0.0      |       | 0.0    | 0.0          |        | 0.0     | 0.0           | 0.0          |
| i otal Delay                            |         | 39.3    | 10.8               |         | 24.5     |       | 43.2   | 20.5         |        | 41.0    | 11.7          | 0.1          |

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|                                 | ≯           | →          | *                     | 4          | Ļ          | *           | •      | t      | 1   | *    | ţ    | ~    |
|---------------------------------|-------------|------------|-----------------------|------------|------------|-------------|--------|--------|-----|------|------|------|
| Lane Group                      | EBL         | EBT        | EBR                   | WBL        | WBT        | WBR         | NBL    | NBT    | NBR | SBL  | SBT  | SBR  |
| LOS                             |             | D          | В                     |            | С          |             | D      | С      |     | D    | В    | A    |
| Approach Delay                  |             | 14.3       |                       |            | 24.5       |             |        | 21.7   |     |      | 11.6 |      |
| Approach LOS                    |             | В          |                       |            | С          |             |        | С      |     |      | В    |      |
| Queue Length 50th (ft)          |             | 17         | 39                    |            | 4          |             | 72     | 635    |     | 3    | 83   | 0    |
| Queue Length 95th (ft)          |             | 42         | 81                    |            | 24         |             | m75 r  | n#1018 |     | m11  | 117  | m0   |
| Internal Link Dist (ft)         |             | 279        |                       |            | 416        |             |        | 708    |     |      | 1624 |      |
| Turn Bay Length (ft)            |             |            |                       |            |            |             | 562    |        |     | 274  |      | 480  |
| Base Capacity (vph)             |             | 233        | 666                   |            | 244        |             | 343    | 2470   |     | 102  | 1735 | 841  |
| Starvation Cap Reductn          |             | 0          | 0                     |            | 0          |             | 0      | 0      |     | 0    | 0    | 0    |
| Spillback Cap Reductn           |             | 0          | 0                     |            | 0          |             | 0      | 0      |     | 0    | 0    | 0    |
| Storage Cap Reductn             |             | 0          | 0                     |            | 0          |             | 0      | 0      |     | 0    | 0    | 0    |
| Reduced v/c Ratio               |             | 0.13       | 0.34                  |            | 0.08       |             | 0.38   | 0.95   |     | 0.05 | 0.37 | 0.02 |
| Intersection Summary            |             |            |                       |            |            |             |        |        |     |      |      |      |
| Area Type: C                    | Other       |            |                       |            |            |             |        |        |     |      |      |      |
| Cycle Length: 90                |             |            |                       |            |            |             |        |        |     |      |      |      |
| Actuated Cycle Length: 90       |             |            |                       |            |            |             |        |        |     |      |      |      |
| Offset: 0 (0%), Referenced to   | phase 2:    | NBT and    | 6:SBT, S <sup>.</sup> | tart of Ye | llow, Mas  | ter Interse | ection |        |     |      |      |      |
| Natural Cycle: 100              |             |            |                       |            |            |             |        |        |     |      |      |      |
| Control Type: Actuated-Coor     | dinated     |            |                       |            |            |             |        |        |     |      |      |      |
| Maximum v/c Ratio: 0.95         |             |            |                       |            |            |             |        |        |     |      |      |      |
| Intersection Signal Delay: 19   | .2          |            |                       | In         | tersectior | LOS: B      |        |        |     |      |      |      |
| Intersection Capacity Utilizati | on 87.4%    |            |                       | IC         | CU Level o | of Service  | E      |        |     |      |      |      |
| Analysis Period (min) 15        |             |            |                       |            |            |             |        |        |     |      |      |      |
| # 95th percentile volume ex     | ceeds ca    | pacity, qu | eue may               | be longe   | r.         |             |        |        |     |      |      |      |
| Queue shown is maximun          | n after two | cycles.    |                       |            |            |             |        |        |     |      |      |      |
| m Volume for 95th percenti      | le queue i  | s metered  | l by upstr            | eam sign   | al.        |             |        |        |     |      |      |      |
| Splits and Phases: 3: Was       | hington S   | treet & Ma | idison Str            | reet       |            |             |        |        |     |      |      |      |
|                                 | ~ ~         |            |                       |            |            |             |        |        |     |      |      |      |

| Ø1           | Ø2 (R) | <b>↓ ↓ ↓ ↓ ↓</b> |
|--------------|--------|------------------|
| 13 s         | 55 s   | 22 s             |
| <b>\$</b> Ø5 |        | ▼ Ø8             |
| 25 s         | 43 s   | 22 s             |

#### Intersection

Int Delay, s/veh

0.8

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations      |      | \$   |      |      | \$   |      |      | đ þ  |      |      | सीरे |      |
| Traffic Vol, veh/h       | 1    | 0    | 12   | 0    | 0    | 1    | 26   | 2164 | 1    | 2    | 622  | 14   |
| Future Vol, veh/h        | 1    | 0    | 12   | 0    | 0    | 1    | 26   | 2164 | 1    | 2    | 622  | 14   |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 1    |
| Sign Control             | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized           | -    | -    | None |
| Storage Length           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | 4 -  | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %                 | -    | -4   | -    | -    | 1    | -    | -    | -1   | -    | -    | 1    | -    |
| Peak Hour Factor         | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   |
| Heavy Vehicles, %        | 2    | 0    | 9    | 0    | 0    | 100  | 0    | 4    | 0    | 100  | 13   | 0    |
| Mvmt Flow                | 1    | 0    | 13   | 0    | 0    | 1    | 28   | 2352 | 1    | 2    | 676  | 15   |

| Major/Minor          | Minor2 |      | 1    | Minor1 |      | Ν    | 1ajor1 |   | Ν | /lajor2 |   |   |  |
|----------------------|--------|------|------|--------|------|------|--------|---|---|---------|---|---|--|
| Conflicting Flow All | 1921   | 3098 | 347  | 2751   | 3105 | 1177 | 692    | 0 | 0 | 2353    | 0 | 0 |  |
| Stage 1              | 689    | 689  | -    | 2409   | 2409 | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 1232   | 2409 | -    | 342    | 696  | -    | -      | - | - | -       | - | - |  |
| Critical Hdwy        | 6.74   | 5.7  | 6.68 | 7.7    | 6.7  | 9    | 4.1    | - | - | 6.1     | - | - |  |
| Critical Hdwy Stg 1  | 5.74   | 4.7  | -    | 6.7    | 5.7  | -    | -      | - | - | -       | - | - |  |
| Critical Hdwy Stg 2  | 5.74   | 4.7  | -    | 6.7    | 5.7  | -    | -      | - | - | -       | - | - |  |
| Follow-up Hdwy       | 3.52   | 4    | 3.39 | 3.5    | 4    | 4.3  | 2.2    | - | - | 3.2     | - | - |  |
| Pot Cap-1 Maneuver   | 62     | 24   | 654  | 8      | 10   | 82   | 912    | - | - | 50      | - | - |  |
| Stage 1              | 469    | 524  | -    | 30     | 57   | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 247    | 111  | -    | 640    | 429  | -    | -      | - | - | -       | - | - |  |
| Platoon blocked, %   |        |      |      |        |      |      |        | - | - |         | - | - |  |
| Mov Cap-1 Maneuver   | 58     | 22   | 653  | 7      | 9    | 82   | 911    | - | - | 50      | - | - |  |
| Mov Cap-2 Maneuver   | 58     | 22   | -    | 7      | 9    | -    | -      | - | - | -       | - | - |  |
| Stage 1              | 469    | 489  | -    | 30     | 57   | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 244    | 111  | -    | 586    | 401  | -    | -      | - | - | -       | - | - |  |
|                      |        |      |      |        |      |      |        |   |   |         |   |   |  |

| Approach             | EB   | WB   | NB  | SB  |  |
|----------------------|------|------|-----|-----|--|
| HCM Control Delay, s | 15.3 | 49.5 | 0.1 | 2.8 |  |
| HCM LOS              | С    | E    |     |     |  |

| Minor Lane/Major Mvmt | NBL   | NBT | NBR | EBLn1V | VBLn1 | SBL   | SBT | SBR |
|-----------------------|-------|-----|-----|--------|-------|-------|-----|-----|
| Capacity (veh/h)      | 911   | -   | -   | 365    | 82    | 50    | -   | -   |
| HCM Lane V/C Ratio    | 0.031 | -   | -   | 0.039  | 0.013 | 0.043 | -   | -   |
| HCM Control Delay (s) | 9.1   | 0   | -   | 15.3   | 49.5  | 80.2  | 2.6 | -   |
| HCM Lane LOS          | А     | А   | -   | С      | Е     | F     | А   | -   |
| HCM 95th %tile Q(veh) | 0.1   | -   | -   | 0.1    | 0     | 0.1   | -   | -   |

|                         | ٦     | -     | $\mathbf{F}$ | 4        | +     | •    | 1     | 1           | 1    | 1     | Ļ           | ~    |
|-------------------------|-------|-------|--------------|----------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR          | WBL      | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     | ሻ     | 1.    |              | <b>N</b> | î.    |      | 5     | <b>4</b> 16 |      | 5     | <b>≜1</b> 5 |      |
| Traffic Volume (vph)    | 9     | 33    | 49           | 129      | 27    | 25   | 41    | 878         | 54   | 116   | 1975        | 13   |
| Future Volume (vph)     | 9     | 33    | 49           | 129      | 27    | 25   | 41    | 878         | 54   | 116   | 1975        | 13   |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900         | 1900     | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Lane Width (ft)         | 12    | 12    | 12           | 12       | 12    | 12   | 12    | 12          | 12   | 12    | 12          | 12   |
| Grade (%)               |       | 2%    |              |          | -3%   |      |       | 0%          |      |       | 0%          |      |
| Storage Length (ft)     | 0     |       | 0            | 0        |       | 0    | 255   |             | 0    | 270   |             | 0    |
| Storage Lanes           | 1     |       | 0            | 1        |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25    |       |              | 25       |       | -    | 25    |             |      | 25    |             |      |
| Satd. Flow (prot)       | 1581  | 1589  | 0            | 1832     | 1748  | 0    | 1671  | 3544        | 0    | 1805  | 3536        | 0    |
| Flt Permitted           | 0.720 |       | -            | 0.699    |       | -    | 0.950 |             | -    | 0.950 |             | -    |
| Satd, Flow (perm)       | 1199  | 1589  | 0            | 1348     | 1748  | 0    | 1671  | 3544        | 0    | 1805  | 3536        | 0    |
| Right Turn on Red       |       |       | Yes          |          |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd. Flow (RTOR)       |       | 53    |              |          | 27    |      |       | 10          |      |       | 1           |      |
| Link Speed (mph)        |       | 30    |              |          | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |       | 204   |              |          | 338   |      |       | 3010        |      |       | 582         |      |
| Travel Time (s)         |       | 4.6   |              |          | 7.7   |      |       | 37.3        |      |       | 7.2         |      |
| Confl. Peds. (#/hr)     |       |       |              |          |       |      |       |             |      |       |             |      |
| Confl. Bikes (#/hr)     |       |       |              |          |       |      |       |             |      |       |             | 1    |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92         | 0.92     | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92  | 0.92        | 0.92 |
| Growth Factor           | 100%  | 100%  | 100%         | 100%     | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%        | 100% |
| Heavy Vehicles (%)      | 13%   | 12%   | 5%           | 0%       | 0%    | 5%   | 8%    | 1%          | 0%   | 0%    | 2%          | 0%   |
| Bus Blockages (#/hr)    | 0     | 0     | 0            | 0        | 0     | 0    | 0     | 0           | 0    | 0     | 0           | 0    |
| Parking (#/hr)          | •     | •     | •            |          | •     | Ū    | Ţ     | Ţ           | •    | •     | •           |      |
| Mid-Block Traffic (%)   |       | 0%    |              |          | 0%    |      |       | 0%          |      |       | 0%          |      |
| Shared Lane Traffic (%) |       | • / • |              |          | • / • |      |       | • / •       |      |       | • / •       |      |
| Lane Group Flow (vph)   | 10    | 89    | 0            | 140      | 56    | 0    | 45    | 1013        | 0    | 126   | 2161        | 0    |
|                         | Perm  | NA    | -            | Perm     | NA    | -    | Prot  | NA          | -    | Prot  | NA          |      |
| Protected Phases        |       | 4     |              |          | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Permitted Phases        | 4     |       |              | 8        |       |      |       |             |      |       |             |      |
| Detector Phase          | 4     | 4     |              | 8        | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Switch Phase            |       |       |              |          |       |      |       |             |      |       |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |              | 6.0      | 6.0   |      | 6.0   | 30.0        |      | 6.0   | 30.0        |      |
| Minimum Split (s)       | 11.0  | 11.0  |              | 11.0     | 11.0  |      | 12.0  | 36.0        |      | 12.0  | 36.0        |      |
| Total Split (s)         | 25.0  | 25.0  |              | 25.0     | 25.0  |      | 12.0  | 49.0        |      | 16.0  | 53.0        |      |
| Total Split (%)         | 27.8% | 27.8% |              | 27.8%    | 27.8% |      | 13.3% | 54.4%       |      | 17.8% | 58.9%       |      |
| Yellow Time (s)         | 3.0   | 3.0   |              | 3.0      | 3.0   |      | 4.0   | 4.0         |      | 4.0   | 4.0         |      |
| All-Red Time (s)        | 2.0   | 2.0   |              | 2.0      | 2.0   |      | 2.0   | 2.0         |      | 2.0   | 2.0         |      |
| Lost Time Adjust (s)    | 0.0   | 0.0   |              | 0.0      | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     | 5.0   | 5.0   |              | 5.0      | 5.0   |      | 6.0   | 6.0         |      | 6.0   | 6.0         |      |
| Lead/Lag                |       |       |              |          |       |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |       |       |              |          |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None  | None  |              | None     | None  |      | None  | C-Max       |      | None  | C-Max       |      |
| Act Effct Green (s)     | 14.4  | 14.4  |              | 14.4     | 14.4  |      | 6.0   | 49.1        |      | 9.5   | 57.4        |      |
| Actuated g/C Ratio      | 0.16  | 0.16  |              | 0.16     | 0.16  |      | 0.07  | 0.55        |      | 0.11  | 0.64        |      |
| v/c Ratio               | 0.05  | 0.30  |              | 0.65     | 0.19  |      | 0.41  | 0.52        |      | 0.66  | 0.96        |      |
| Control Delay           | 29.7  | 17.6  |              | 48.8     | 19.9  |      | 51.6  | 15.0        |      | 56.4  | 30.6        |      |
| Queue Delay             | 0.0   | 0.0   |              | 0.0      | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             | 29.7  | 17.6  |              | 48.8     | 19.9  |      | 51.6  | 15.0        |      | 56.4  | 30.6        |      |

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|---|-------------|-----------|--------------|------------|------------|------------|------|------|-----|------|------|-----|
| Lane Group  | EBL         | EBT       | EBR          | WBL        | WBT        | WBR        | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| LOS   | С           | В         |              | D          | В          |            | D    | В    |     | Е    | С    |     |
| Approach Delay  |             | 18.8      |              |            | 40.6       |            |      | 16.5 |     |      | 32.0 |     |
| Approach LOS  |             | В         |              |            | D          |            |      | В    |     |      | С    |     |
| Queue Length 50th (ft)  | 5           | 18        |              | 75         | 14         |            | 25   | 182  |     | 70   | ~713 |     |
| Queue Length 95th (ft)  | 18          | 55        |              | 128        | 44         |            | 60   | 272  |     | #142 | #924 |     |
| Internal Link Dist (ft)   |             | 124       |              |            | 258        |            |      | 2930 |     |      | 502  |     |
| Turn Bay Length (ft)  |             |           |              |            |            |            | 255  |      |     | 270  |      |     |
| Base Capacity (vph)   | 266         | 394       |              | 299        | 409        |            | 111  | 1938 |     | 200  | 2255 |     |
| Starvation Cap Reductn  | 0           | 0         |              | 0          | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn   | 0           | 0         |              | 0          | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn   | 0           | 0         |              | 0          | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio   | 0.04        | 0.23      |              | 0.47       | 0.14       |            | 0.41 | 0.52 |     | 0.63 | 0.96 |     |
| Intersection Summary  |             |           |              |            |            |            |      |      |     |      |      |     |
| Area Type: C  | Other       |           |              |            |            |            |      |      |     |      |      |     |
| Cycle Length: 90  |             |           |              |            |            |            |      |      |     |      |      |     |
| Actuated Cycle Length: 90   |             |           |              |            |            |            |      |      |     |      |      |     |
| Offset: 81 (90%), Referenced  | d to phase  | 2:NBT ar  | nd 6:SBT,    | Start of ( | Green      |            |      |      |     |      |      |     |
| Natural Cycle: 90   |             |           |              |            |            |            |      |      |     |      |      |     |
| Control Type: Actuated-Coor   | dinated     |           |              |            |            |            |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.96   |             |           |              |            |            |            |      |      |     |      |      |     |
| Intersection Signal Delay: 27   | .6          |           |              | In         | tersectior | n LOS: C   |      |      |     |      |      |     |
| Intersection Capacity Utilizati   | ion 88.0%   |           |              | IC         | U Level o  | of Service | E    |      |     |      |      |     |
| Analysis Period (min) 15  |             |           |              |            |            |            |      |      |     |      |      |     |
| <ul> <li>Volume exceeds capacity, queue is theoretically infinite.</li> </ul> |             |           |              |            |            |            |      |      |     |      |      |     |
| Queue shown is maximum after two cycles.                                      |             |           |              |            |            |            |      |      |     |      |      |     |
| # 95th percentile volume exceeds capacity, queue may be longer.               |             |           |              |            |            |            |      |      |     |      |      |     |
| Queue shown is maximun  | n after two | cycles.   |              |            |            |            |      |      |     |      |      |     |
| Splits and Phases: 1: Was   | hington St  | reet & Th | urston St    | reet       |            |            |      |      |     |      |      |     |

| Ø1      | \$\overline{1}{\overline{\phi}} \verline{2} \verline{\phi}} \verline{\phi} \verline{\phi}} \verlin |   | <u>⊿</u> <sub>Ø4</sub> |  |
|---------|--|---|------------------------|--|
| 16 s    | 49 s   | 2 | 25 s                   |  |
| ▲<br>Ø5 | ▼ <b></b>  |   | <b>₩</b> Ø8            |  |
| 12 s    | 53 s   | 2 | 25 s                   |  |

|                         | ۶      | -     | $\mathbf{\hat{z}}$ | 4     | ←     | *    | 1     | Ť     | ۲    | 1        | ŧ        | ~     |
|-------------------------|--------|-------|--------------------|-------|-------|------|-------|-------|------|----------|----------|-------|
| Lane Group              | EBL    | EBT   | EBR                | WBL   | WBT   | WBR  | NBL   | NBT   | NBR  | SBL      | SBT      | SBR   |
| Lane Configurations     |        | र्भ   | 1                  |       | \$    |      | ۲     | ¢β    |      | <u>ک</u> | <b>^</b> | 1     |
| Traffic Volume (vph)    | 34     | 1     | 213                | 14    | 1     | 3    | 178   | 950   | 5    | 4        | 2110     | 63    |
| Future Volume (vph)     | 34     | 1     | 213                | 14    | 1     | 3    | 178   | 950   | 5    | 4        | 2110     | 63    |
| Ideal Flow (vphpl)      | 1900   | 1900  | 1900               | 1900  | 1900  | 1900 | 1900  | 1900  | 1900 | 1900     | 1900     | 1900  |
| Lane Width (ft)         | 12     | 12    | 12                 | 12    | 16    | 12   | 12    | 12    | 12   | 12       | 12       | 12    |
| Grade (%)               |        | -5%   |                    |       | 2%    |      |       | 2%    |      |          | -4%      |       |
| Storage Length (ft)     | 309    |       | 0                  | 0     |       | 0    | 562   |       | 0    | 274      |          | 480   |
| Storage Lanes           | 0      |       | 1                  | 0     |       | 0    | 1     |       | 0    | 1        |          | 1     |
| Taper Length (ft)       | 25     |       |                    | 25    |       |      | 25    |       |      | 25       |          |       |
| Satd. Flow (prot)       | 0      | 1858  | 1623               | 0     | 1715  | 0    | 1752  | 3467  | 0    | 1473     | 3610     | 1584  |
| Flt Permitted           |        | 0.718 |                    |       | 0.746 |      | 0.950 |       |      | 0.950    |          |       |
| Satd, Flow (perm)       | 0      | 1398  | 1623               | 0     | 1330  | 0    | 1752  | 3467  | 0    | 1473     | 3610     | 1584  |
| Right Turn on Red       |        |       | Yes                |       |       | Yes  |       |       | Yes  |          |          | Yes   |
| Satd, Flow (RTOR)       |        |       | 38                 |       | 3     |      |       | 1     |      |          |          | 202   |
| Link Speed (mph)        |        | 30    |                    |       | 30    |      |       | 55    |      |          | 55       |       |
| Link Distance (ft)      |        | 359   |                    |       | 496   |      |       | 788   |      |          | 1704     |       |
| Travel Time (s)         |        | 8.2   |                    |       | 11.3  |      |       | 9.8   |      |          | 21.1     |       |
| Confl. Peds. (#/hr)     |        |       |                    |       |       |      |       |       |      |          |          |       |
| Confl. Bikes (#/hr)     |        |       |                    |       |       |      |       |       |      |          |          |       |
| Peak Hour Factor        | 0.92   | 0.92  | 0.92               | 0.92  | 0.92  | 0.92 | 0.92  | 0.92  | 0.92 | 0.92     | 0.92     | 0.92  |
| Growth Factor           | 100%   | 100%  | 100%               | 100%  | 100%  | 100% | 100%  | 100%  | 100% | 100%     | 100%     | 100%  |
| Heavy Vehicles (%)      | 0%     | 0%    | 2%                 | 15%   | 0%    | 33%  | 2%    | 3%    | 0%   | 25%      | 2%       | 4%    |
| Bus Blockages (#/hr)    | 0      | 0     | 0                  | 0     | 0     | 0    | 0     | 0     | 0    | 0        | 0        | 0     |
| Parking (#/hr)          | •      | •     |                    | •     | •     | Ū    | •     | · ·   | •    | Ţ        |          | Ū     |
| Mid-Block Traffic (%)   |        | 0%    |                    |       | 0%    |      |       | 0%    |      |          | 0%       |       |
| Shared Lane Traffic (%) |        | 0,0   |                    |       | 0,0   |      |       | 0,0   |      |          | 0,0      |       |
| Lane Group Flow (vph)   | 0      | 38    | 232                | 0     | 19    | 0    | 193   | 1038  | 0    | 4        | 2293     | 68    |
| Turn Type               | Perm   | NA    | pt+ov              | Perm  | NA    | Ŭ    | Prot  | NA    | Ű    | Prot     | NA       | Prot  |
| Protected Phases        |        | 4     | 4 5                |       | 8     |      | 5     | 2     |      | 1        | 6        | 6     |
| Permitted Phases        | 4      |       |                    | 8     | · ·   |      | •     |       |      |          | Ū        | Ū     |
| Detector Phase          | 4      | 4     | 4 5                | 8     | 8     |      | 5     | 2     |      | 1        | 6        | 6     |
| Switch Phase            |        |       |                    |       | · ·   |      | •     |       |      |          | Ū        | Ū     |
| Minimum Initial (s)     | 6.0    | 6.0   |                    | 6.0   | 6.0   |      | 10.0  | 10.0  |      | 6.0      | 10.0     | 10.0  |
| Minimum Split (s)       | 13.0   | 13.0  |                    | 13.0  | 13.0  |      | 17.5  | 16.5  |      | 13.0     | 16.5     | 16.5  |
| Total Split (s)         | 18.0   | 18.0  |                    | 18.0  | 18.0  |      | 23.0  | 68.0  |      | 14.0     | 59.0     | 59.0  |
| Total Split (%)         | 18.0%  | 18.0% |                    | 18.0% | 18.0% |      | 23.0% | 68.0% |      | 14 0%    | 59.0%    | 59.0% |
| Yellow Time (s)         | 4 0    | 4 0   |                    | 4 0   | 4 0   |      | 4.5   | 50    |      | 4.5      | 5.0      | 5.0   |
| All-Red Time (s)        | 3.0    | 3.0   |                    | 3.0   | 3.0   |      | 3.0   | 1.5   |      | 2.5      | 1.5      | 1.5   |
| Lost Time Adjust (s)    | 0.0    | 0.0   |                    | 0.0   | 0.0   |      | 0.0   | 0.0   |      | 0.0      | 0.0      | 0.0   |
| Total Lost Time (s)     |        | 7.0   |                    |       | 7.0   |      | 7.5   | 6.5   |      | 7.0      | 6.5      | 6.5   |
| Lead/Lag                |        | 1.0   |                    |       | 1.0   |      | Lead  | Lag   |      | Lead     | l aq     | l aq  |
| Lead-Lag Optimize?      |        |       |                    |       |       |      | Yes   | Yes   |      | Yes      | Yes      | Yes   |
| Recall Mode             | None   | None  |                    | None  | None  |      | None  | C-Min |      | None     | C-Min    | C-Min |
| Act Effct Green (s)     | 110110 | 10.5  | 31.9               | 10110 | 8.0   |      | 13.9  | 73.4  |      | 6.0      | 54.6     | 54 6  |
| Actuated g/C Ratio      |        | 0 10  | 0.32               |       | 0.08  |      | 0 14  | 0.73  |      | 0.06     | 0.55     | 0.55  |
| v/c Ratio               |        | 0.26  | 0.43               |       | 0.18  |      | 0.79  | 0.41  |      | 0.05     | 1 16     | 0.07  |
| Control Delay           |        | 45.7  | 24.4               |       | 40.5  |      | 69.0  | 3.8   |      | 45.5     | 103.9    | 0.01  |
| Queue Delay             |        | 0.0   | 0.0                |       | 0.0   |      | 0.0   | 0.0   |      | 0.0      | 0.0      | 0.0   |
| Total Delay             |        | 45.7  | 24.4               |       | 40.5  |      | 69.0  | 3.8   |      | 45.5     | 103.9    | 0.0   |
| . c.c. bolaj            |        | .0.7  | - · · ·            |       |       |      | 00.0  | 0.0   |      | .0.0     |          | 0.1   |

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|--|------------|------------|--------------|------------|------------|-------------|--------|------|-----|------|-------|------|
| Lane Group                                   | EBL        | EBT        | EBR          | WBL        | WBT        | WBR         | NBL    | NBT  | NBR | SBL  | SBT   | SBR  |
| LOS  |            | D          | С            |            | D          |             | Е      | А    |     | D    | F     | А    |
| Approach Delay                               |            | 27.4       |              |            | 40.5       |             |        | 14.0 |     |      | 100.8 |      |
| Approach LOS                                 |            | С          |              |            | D          |             |        | В    |     |      | F     |      |
| Queue Length 50th (ft)                       |            | 23         | 93           |            | 10         |             | 124    | 57   |     | 2    | ~944  | 0    |
| Queue Length 95th (ft)                       |            | 55         | 160          |            | 32         |             | #219   | 124  |     | 14   | #1082 | 0    |
| Internal Link Dist (ft)                      |            | 279        |              |            | 416        |             |        | 708  |     |      | 1624  |      |
| Turn Bay Length (ft)                         |            |            |              |            |            |             | 562    |      |     | 274  |       | 480  |
| Base Capacity (vph)                          |            | 153        | 554          |            | 148        |             | 271    | 2546 |     | 103  | 1971  | 956  |
| Starvation Cap Reductn                       |            | 0          | 0            |            | 0          |             | 0      | 0    |     | 0    | 0     | 0    |
| Spillback Cap Reductn                        |            | 0          | 0            |            | 0          |             | 0      | 0    |     | 0    | 0     | 0    |
| Storage Cap Reductn                          |            | 0          | 0            |            | 0          |             | 0      | 0    |     | 0    | 0     | 0    |
| Reduced v/c Ratio                            |            | 0.25       | 0.42         |            | 0.13       |             | 0.71   | 0.41 |     | 0.04 | 1.16  | 0.07 |
| Intersection Summary                         |            |            |              |            |            |             |        |      |     |      |       |      |
| Area Type: Of                                | ther       |            |              |            |            |             |        |      |     |      |       |      |
| Cycle Length: 100                            |            |            |              |            |            |             |        |      |     |      |       |      |
| Actuated Cycle Length: 100                   |            |            |              |            |            |             |        |      |     |      |       |      |
| Offset: 0 (0%), Referenced to                | phase 2:   | NBT and    | 6:SBT, S     | tart of Ye | llow, Mas  | ter Interse | ection |      |     |      |       |      |
| Natural Cycle: 110                           |            |            |              |            |            |             |        |      |     |      |       |      |
| Control Type: Actuated-Coord                 | linated    |            |              |            |            |             |        |      |     |      |       |      |
| Maximum v/c Ratio: 1.16                      |            |            |              |            |            |             |        |      |     |      |       |      |
| Intersection Signal Delay: 67.9              | 9          |            |              | In         | tersectior | LOS: E      |        |      |     |      |       |      |
| Intersection Capacity Utilization            | on 93.6%   |            |              | IC         | CU Level o | of Service  | F      |      |     |      |       |      |
| Analysis Period (min) 15                     |            |            |              |            |            |             |        |      |     |      |       |      |
| <ul> <li>Volume exceeds capacity,</li> </ul> | , queue is | theoretic  | ally infini  | te.        |            |             |        |      |     |      |       |      |
| Queue shown is maximum                       | after two  | cycles.    |              |            |            |             |        |      |     |      |       |      |
| # 95th percentile volume exe                 | ceeds cap  | bacity, qu | eue may      | be longei  | r.         |             |        |      |     |      |       |      |
| Queue shown is maximum                       | after two  | cycles.    |              |            |            |             |        |      |     |      |       |      |
| Splits and Phases: 3: Wash                   | ington St  | reet & Ma  | adison Sti   | reet       |            |             |        |      |     |      |       |      |

| Ø1           | <b>1</b> ø₂ (R) | <b>■ →</b> Ø4 |
|--------------|-----------------|---------------|
| 14 s         | 68 s            | 18 s          |
| <b>\$</b> Ø5 | <b>↓</b> Ø6 (R) |               |
| 23 s         | 59 s            | 18 s          |

#### Intersection

Int Delay, s/veh

1.9

| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT     | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|---------|------|------|------|------|
| Lane Configurations    |      | \$   |      |      | \$   |      |      | र्ची के |      |      | 4îb  |      |
| Traffic Vol, veh/h     | 0    | 0    | 19   | 7    | 0    | 4    | 14   | 959     | 14   | 5    | 2166 | 9    |
| Future Vol, veh/h      | 0    | 0    | 19   | 7    | 0    | 4    | 14   | 959     | 14   | 5    | 2166 | 9    |
| Conflicting Peds, #/hr | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0       | 0    | 0    | 0    | 0    |
| Sign Control           | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free    | Free | Free | Free | Free |
| RT Channelized         | -    | -    | None | -    | -    | None | -    | -       | None | -    | -    | None |
| Storage Length         | -    | -    | -    | -    | -    | -    | -    | -       | -    | -    | -    | -    |
| Veh in Median Storage, | # -  | 0    | -    | -    | 0    | -    | -    | 0       | -    | -    | 0    | -    |
| Grade, %               | -    | -4   | -    | -    | 1    | -    | -    | -1      | -    | -    | 1    | -    |
| Peak Hour Factor       | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92      | 92   | 92   | 92   | 92   |
| Heavy Vehicles, %      | 0    | 0    | 0    | 0    | 0    | 0    | 8    | 3       | 0    | 0    | 1    | 0    |
| Mvmt Flow              | 0    | 0    | 21   | 8    | 0    | 4    | 15   | 1042    | 15   | 5    | 2354 | 10   |

| Major/Minor          | Minor2 |      | ľ    | Minor1 |      | N   | Major1 |   | Ν | 1ajor2 |   |   |  |
|----------------------|--------|------|------|--------|------|-----|--------|---|---|--------|---|---|--|
| Conflicting Flow All | 2920   | 3456 | 1182 | 2267   | 3454 | 529 | 2364   | 0 | 0 | 1057   | 0 | 0 |  |
| Stage 1              | 2369   | 2369 | -    | 1080   | 1080 | -   | -      | - | - | -      | - | - |  |
| Stage 2              | 551    | 1087 | -    | 1187   | 2374 | -   | -      | - | - | -      | - | - |  |
| Critical Hdwy        | 6.7    | 5.7  | 6.5  | 7.7    | 6.7  | 7   | 4.26   | - | - | 4.1    | - | - |  |
| Critical Hdwy Stg 1  | 5.7    | 4.7  | -    | 6.7    | 5.7  | -   | -      | - | - | -      | - | - |  |
| Critical Hdwy Stg 2  | 5.7    | 4.7  | -    | 6.7    | 5.7  | -   | -      | - | - | -      | - | - |  |
| Follow-up Hdwy       | 3.5    | 4    | 3.3  | 3.5    | 4    | 3.3 | 2.28   | - | - | 2.2    | - | - |  |
| Pot Cap-1 Maneuver   | 14     | 15   | 211  | 20     | 6    | 492 | 186    | - | - | 667    | - | - |  |
| Stage 1              | 62     | 116  | -    | 223    | 280  | -   | -      | - | - | -      | - | - |  |
| Stage 2              | 555    | 375  | -    | 190    | 60   | -   | -      | - | - | -      | - | - |  |
| Platoon blocked, %   |        |      |      |        |      |     |        | - | - |        | - | - |  |
| Mov Cap-1 Maneuver   | 12     | 12   | 211  | 15     | 5    | 492 | 186    | - | - | 667    | - | - |  |
| Mov Cap-2 Maneuver   | 12     | 12   | -    | 15     | 5    | -   | -      | - | - | -      | - | - |  |
| Stage 1              | 50     | 116  | -    | 179    | 225  | -   | -      | - | - | -      | - | - |  |
| Stage 2              | 442    | 302  | -    | 171    | 60   | -   | -      | - | - | -      | - | - |  |
|                      |        |      |      |        |      |     |        |   |   |        |   |   |  |
|                      |        |      |      |        |      |     |        |   |   |        |   |   |  |

| Approach             | EB   | WB    | NB  | SB |  |
|----------------------|------|-------|-----|----|--|
| HCM Control Delay, s | 23.9 | 273.2 | 2.8 | 0  |  |
| HCM LOS              | С    | F     |     |    |  |

| Minor Lane/Major Mvmt | NBL   | NBT | NBR | EBLn1V | VBLn1 | SBL   | SBT | SBR |
|-----------------------|-------|-----|-----|--------|-------|-------|-----|-----|
| Capacity (veh/h)      | 186   | -   | -   | 211    | 23    | 667   | -   | -   |
| HCM Lane V/C Ratio    | 0.082 | -   | -   | 0.098  | 0.52  | 0.008 | -   | -   |
| HCM Control Delay (s) | 26.1  | 2.5 | -   | 23.9   | 273.2 | 10.4  | 0   | -   |
| HCM Lane LOS          | D     | А   | -   | С      | F     | В     | А   | -   |
| HCM 95th %tile Q(veh) | 0.3   | -   | -   | 0.3    | 1.5   | 0     | -   | -   |

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|-------------------------|-------|-------|--------------|-------|-------|------|-------|-------------|------|------------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR          | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL        | SBT         | SBR  |
| Lane Configurations     | 5     | î,    |              | 5     | î,    |      | 5     | <b>≜1</b> 5 |      | 5          | <b>≜1</b> 5 |      |
| Traffic Volume (vph)    | 9     | 15    | 33           | 93    | 13    | 19   | 43    | 1150        | 58   | 92         | 903         | 9    |
| Future Volume (vph)     | 9     | 15    | 33           | 93    | 13    | 19   | 43    | 1150        | 58   | 92         | 903         | 9    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900         | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900       | 1900        | 1900 |
| Lane Width (ft)         | 12    | 12    | 12           | 12    | 12    | 12   | 12    | 12          | 12   | 12         | 12          | 12   |
| Grade (%)               |       | 2%    |              |       | -3%   |      |       | 0%          |      |            | 0%          |      |
| Storage Length (ft)     | 0     |       | 0            | 0     |       | 0    | 255   |             | 0    | 270        |             | 0    |
| Storage Lanes           | 1     |       | 0            | 1     |       | 0    | 1     |             | 0    | 1          |             | 0    |
| Taper Length (ft)       | 25    |       |              | 25    |       |      | 25    |             |      | 25         |             |      |
| Satd. Flow (prot)       | 1787  | 1685  | 0            | 1832  | 1755  | 0    | 1805  | 3537        | 0    | 1736       | 3567        | 0    |
| Flt Permitted           | 0.734 |       |              | 0.723 |       |      | 0.950 |             |      | 0.950      |             |      |
| Satd. Flow (perm)       | 1381  | 1685  | 0            | 1394  | 1755  | 0    | 1805  | 3537        | 0    | 1736       | 3567        | 0    |
| Right Turn on Red       |       |       | Yes          |       |       | Yes  |       |             | Yes  |            |             | Yes  |
| Satd. Flow (RTOR)       |       | 36    |              |       | 21    |      |       | 7           |      |            | 2           |      |
| Link Speed (mph)        |       | 30    |              |       | 30    |      |       | 55          |      |            | 55          |      |
| Link Distance (ft)      |       | 204   |              |       | 338   |      |       | 3010        |      |            | 582         |      |
| Travel Time (s)         |       | 4.6   |              |       | 7.7   |      |       | 37.3        |      |            | 7.2         |      |
| Confl. Peds. (#/hr)     |       |       |              |       |       |      |       |             |      |            |             |      |
| Confl. Bikes (#/hr)     |       |       |              |       |       |      |       |             |      |            |             |      |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92         | 0.92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92       | 0.92        | 0.92 |
| Growth Factor           | 100%  | 100%  | 100%         | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%       | 100%        | 100% |
| Heavy Vehicles (%)      | 0%    | 0%    | 0%           | 0%    | 0%    | 0%   | 0%    | 1%          | 8%   | 4%         | 1%          | 0%   |
| Bus Blockages (#/hr)    | 0     | 0     | 0            | 0     | 0     | 0    | 0     | 0           | 0    | 0          | 0           | 0    |
| Parking (#/hr)          |       |       |              |       |       |      |       |             |      |            |             |      |
| Mid-Block Traffic (%)   |       | 0%    |              |       | 0%    |      |       | 0%          |      |            | 0%          |      |
| Shared Lane Traffic (%) |       |       |              |       |       |      |       |             |      |            |             |      |
| Lane Group Flow (vph)   | 10    | 52    | 0            | 101   | 35    | 0    | 47    | 1313        | 0    | 100        | 992         | 0    |
| Turn Type               | Perm  | NA    |              | Perm  | NA    |      | Prot  | NA          |      | Prot       | NA          |      |
| Protected Phases        |       | 4     |              |       | 8     |      | 5     | 2           |      | 1          | 6           |      |
| Permitted Phases        | 4     |       |              | 8     |       |      |       |             |      |            |             |      |
| Detector Phase          | 4     | 4     |              | 8     | 8     |      | 5     | 2           |      | 1          | 6           |      |
| Switch Phase            |       |       |              |       |       |      |       |             |      |            |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |              | 6.0   | 6.0   |      | 6.0   | 30.0        |      | 6.0        | 30.0        |      |
| Minimum Split (s)       | 11.0  | 11.0  |              | 11.0  | 11.0  |      | 12.0  | 36.0        |      | 12.0       | 36.0        |      |
| Total Split (s)         | 25.0  | 25.0  |              | 25.0  | 25.0  |      | 15.0  | 47.0        |      | 18.0       | 50.0        |      |
| Total Split (%)         | 27.8% | 27.8% |              | 27.8% | 27.8% |      | 16.7% | 52.2%       |      | 20.0%      | 55.6%       |      |
| Yellow Time (s)         | 3.0   | 3.0   |              | 3.0   | 3.0   |      | 4.0   | 4.0         |      | 4.0        | 4.0         |      |
| All-Red Time (s)        | 2.0   | 2.0   |              | 2.0   | 2.0   |      | 2.0   | 2.0         |      | 2.0        | 2.0         |      |
| Lost Time Adjust (s)    | 0.0   | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0        | 0.0         |      |
| Total Lost Time (s)     | 5.0   | 5.0   |              | 5.0   | 5.0   |      | 6.0   | 6.0         |      | 6.0        | 6.0         |      |
| Lead/Lag                |       |       |              |       |       |      | Lead  | Lag         |      | Lead       | Lag         |      |
| Lead-Lag Optimize?      |       |       |              |       |       |      | Yes   | Yes         |      | Yes        | Yes         |      |
| Recall Mode             | None  | None  |              | None  | None  |      | None  | C-Max       |      | None       | C-Max       |      |
| Act Effct Green (s)     | 11.7  | 11.7  |              | 11.8  | 11.8  |      | 7.6   | 57.3        |      | 9.9        | 62.0        |      |
| Actuated g/C Ratio      | 0.13  | 0.13  |              | 0.13  | 0.13  |      | 0.08  | 0.64        |      | 0.11       | 0.69        |      |
| v/c Ratio               | 0.06  | 0.21  |              | 0.55  | 0.14  |      | 0.31  | 0.58        |      | 0.52       | 0.40        |      |
| Control Delay           | 32.3  | 17.6  |              | 47.3  | 19.8  |      | 43.7  | 14.7        |      | 47.3       | 9.8         |      |
| Queue Delay             | 0.0   | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0        | 0.0         |      |
| Total Delay             | 32.3  | 17.6  |              | 47.3  | 19.8  |      | 43.7  | 14.7        |      | 47.3       | 9.8         |      |

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|-----------------------------------|-------------|----------|--------------|--------------|------------|------------|------|------|-----|------|------|-----|
| Lane Group                        | EBL         | EBT      | EBR          | WBL          | WBT        | WBR        | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| LOS                               | С           | В        |              | D            | В          |            | D    | В    |     | D    | А    |     |
| Approach Delay                    |             | 19.9     |              |              | 40.2       |            |      | 15.7 |     |      | 13.3 |     |
| Approach LOS                      |             | В        |              |              | D          |            |      | В    |     |      | В    |     |
| Queue Length 50th (ft)            | 5           | 8        |              | 55           | 7          |            | 26   | 252  |     | 54   | 153  |     |
| Queue Length 95th (ft)            | 19          | 38       |              | 99           | 32         |            | 59   | 387  |     | 103  | 239  |     |
| Internal Link Dist (ft)           |             | 124      |              |              | 258        |            |      | 2930 |     |      | 502  |     |
| Turn Bay Length (ft)              |             |          |              |              |            |            | 255  |      |     | 270  |      |     |
| Base Capacity (vph)               | 306         | 402      |              | 309          | 406        |            | 180  | 2253 |     | 231  | 2459 |     |
| Starvation Cap Reductn            | 0           | 0        |              | 0            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn             | 0           | 0        |              | 0            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn               | 0           | 0        |              | 0            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio                 | 0.03        | 0.13     |              | 0.33         | 0.09       |            | 0.26 | 0.58 |     | 0.43 | 0.40 |     |
| Intersection Summary              |             |          |              |              |            |            |      |      |     |      |      |     |
| Area Type:                        | Other       |          |              |              |            |            |      |      |     |      |      |     |
| Cycle Length: 90                  |             |          |              |              |            |            |      |      |     |      |      |     |
| Actuated Cycle Length: 90         |             |          |              |              |            |            |      |      |     |      |      |     |
| Offset: 74 (82%), Reference       | ed to phase | 2:NBT ar | nd 6:SBT,    | , Start of ( | Green      |            |      |      |     |      |      |     |
| Natural Cycle: 60                 |             |          |              |              |            |            |      |      |     |      |      |     |
| Control Type: Actuated-Co         | ordinated   |          |              |              |            |            |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.58           |             |          |              |              |            |            |      |      |     |      |      |     |
| Intersection Signal Delay: 1      | 6.0         |          |              | In           | tersectior | n LOS: B   |      |      |     |      |      |     |
| Intersection Capacity Utilization | ation 64.7% |          |              | IC           | U Level o  | of Service | С    |      |     |      |      |     |
| Analysis Period (min) 15          |             |          |              |              |            |            |      |      |     |      |      |     |
|                                   |             |          |              |              |            |            |      |      |     |      |      |     |

#### Splits and Phases: 1: Washington Street & Thurston Street

| Ø1      |          | Ø2 (R) |  | <u>⊿</u> Ø4    |  |
|---------|----------|--------|--|----------------|--|
| 18 s    |          | 47 s   |  | 25 s           |  |
| ▲<br>Ø5 | <b>↓</b> | Ø6 (R) |  | <b>4</b><br>Ø8 |  |
| 15 s    | 50 s     |        |  | 25 s           |  |

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|-------------------------|-------|-------|--------------|-------|-------|------|----------|-------------|------|----------|-------|-------|
| Lane Group              | EBL   | EBT   | EBR          | WBL   | WBT   | WBR  | NBL      | NBT         | NBR  | SBL      | SBT   | SBR   |
| Lane Configurations     |       | ្ឋ    | 1            |       | 4     |      | <b>5</b> | <b>≜1</b> ⊾ |      | <b>N</b> | **    | 1     |
| Traffic Volume (vph)    | 38    | 0     | 206          | 1     | 1     | 2    | 239      | 1306        | 6    | 3        | 986   | 53    |
| Future Volume (vph)     | 38    | 0     | 206          | 1     | 1     | 2    | 239      | 1306        | 6    | 3        | 986   | 53    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900         | 1900  | 1900  | 1900 | 1900     | 1900        | 1900 | 1900     | 1900  | 1900  |
| Lane Width (ft)         | 12    | 12    | 12           | 12    | 16    | 12   | 12       | 12          | 12   | 12       | 12    | 12    |
| Grade (%)               |       | -5%   |              |       | 2%    |      |          | 2%          |      |          | -4%   |       |
| Storage Length (ft)     | 309   |       | 0            | 0     |       | 0    | 562      |             | 0    | 274      | .,.   | 480   |
| Storage Lanes           | 0     |       | 1            | 0     |       | 0    | 1        |             | 0    | 1        |       | 1     |
| Taper Length (ft)       | 25    |       |              | 25    |       | -    | 25       |             | -    | 25       |       |       |
| Satd. Flow (prot)       | 0     | 1850  | 1592         | 0     | 1963  | 0    | 1769     | 3535        | 0    | 1841     | 3646  | 1615  |
| Flt Permitted           | -     | 0.755 |              | -     | 0.937 | -    | 0.950    |             | -    | 0.950    |       |       |
| Satd. Flow (perm)       | 0     | 1470  | 1592         | 0     | 1862  | 0    | 1769     | 3535        | 0    | 1841     | 3646  | 1615  |
| Right Turn on Red       | -     |       | Yes          | -     |       | Yes  |          |             | Yes  |          |       | Yes   |
| Satd. Flow (RTOR)       |       |       | 38           |       | 2     |      |          | 1           |      |          |       | 202   |
| Link Speed (mph)        |       | 30    |              |       | 30    |      |          | 55          |      |          | 55    |       |
| Link Distance (ff)      |       | 359   |              |       | 496   |      |          | 788         |      |          | 1704  |       |
| Travel Time (s)         |       | 8.2   |              |       | 11.3  |      |          | 9.8         |      |          | 21.1  |       |
| Confl. Peds. (#/hr)     |       | 0.2   |              |       |       |      |          | 0.0         |      |          |       |       |
| Confl Bikes (#/hr)      |       |       |              |       |       |      |          |             |      |          |       |       |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92         | 0.92  | 0.92  | 0.92 | 0.92     | 0.92        | 0.92 | 0.92     | 0.92  | 0.92  |
| Growth Eactor           | 100%  | 100%  | 100%         | 100%  | 100%  | 100% | 100%     | 100%        | 100% | 100%     | 100%  | 100%  |
| Heavy Vehicles (%)      | 0%    | 2%    | 4%           | 0%    | 0%    | 0%   | 1%       | 1%          | 0%   | 0%       | 1%    | 2%    |
| Bus Blockages (#/br)    | 0     | 0     | 0            | 0     | 0     | 0    | 0        | 0           | 0    | 0        | 0     | 0     |
| Parking (#/hr)          | Ű     | Ű     | Ű            | Ű     | Ŭ     | Ű    | Ŭ        | Ű           | Ű    | Ű        | Ű     | Ű     |
| Mid-Block Traffic (%)   |       | 0%    |              |       | 0%    |      |          | 0%          |      |          | 0%    |       |
| Shared Lane Traffic (%) |       | • / • |              |       | • / • |      |          | • / •       |      |          | • / • |       |
| Lane Group Flow (vph)   | 0     | 41    | 224          | 0     | 4     | 0    | 260      | 1427        | 0    | 3        | 1072  | 58    |
| Turn Type               | Perm  | NA    | pt+ov        | Perm  | NA    | -    | Prot     | NA          | -    | Prot     | NA    | Prot  |
| Protected Phases        |       | 4     | 4 5          |       | 8     |      | 5        | 2           |      | 1        | 6     | 6     |
| Permitted Phases        | 4     | -     |              | 8     | -     |      | -        |             |      | · ·      | -     | -     |
| Detector Phase          | 4     | 4     | 4 5          | 8     | 8     |      | 5        | 2           |      | 1        | 6     | 6     |
| Switch Phase            |       |       |              |       |       |      |          |             |      |          |       | -     |
| Minimum Initial (s)     | 6.0   | 6.0   |              | 6.0   | 6.0   |      | 10.0     | 10.0        |      | 6.0      | 10.0  | 10.0  |
| Minimum Split (s)       | 13.0  | 13.0  |              | 13.0  | 13.0  |      | 17.5     | 16.5        |      | 13.0     | 16.5  | 16.5  |
| Total Split (s)         | 30.0  | 30.0  |              | 30.0  | 30.0  |      | 32.0     | 57.0        |      | 13.0     | 38.0  | 38.0  |
| Total Split (%)         | 30.0% | 30.0% |              | 30.0% | 30.0% |      | 32.0%    | 57.0%       |      | 13.0%    | 38.0% | 38.0% |
| Yellow Time (s)         | 4.0   | 4.0   |              | 4.0   | 4.0   |      | 4.5      | 5.0         |      | 4.5      | 5.0   | 5.0   |
| All-Red Time (s)        | 3.0   | 3.0   |              | 3.0   | 3.0   |      | 3.0      | 1.5         |      | 2.5      | 1.5   | 1.5   |
| Lost Time Adjust (s)    |       | 0.0   |              |       | 0.0   |      | 0.0      | 0.0         |      | 0.0      | 0.0   | 0.0   |
| Total Lost Time (s)     |       | 7.0   |              |       | 7.0   |      | 7.5      | 6.5         |      | 7.0      | 6.5   | 6.5   |
| Lead/Lag                |       |       |              |       |       |      | Lead     | Lag         |      | Lead     | Lag   | Lag   |
| Lead-Lag Optimize?      |       |       |              |       |       |      | Yes      | Yes         |      | Yes      | Yes   | Yes   |
| Recall Mode             | None  | None  |              | None  | None  |      | None     | C-Min       |      | None     | C-Min | C-Min |
| Act Effct Green (s)     |       | 12.6  | 38.9         |       | 8.2   |      | 18.7     | 71.3        |      | 6.0      | 47.6  | 47.6  |
| Actuated g/C Ratio      |       | 0.13  | 0.39         |       | 0.08  |      | 0.19     | 0.71        |      | 0.06     | 0.48  | 0.48  |
| v/c Ratio               |       | 0.22  | 0.35         |       | 0.03  |      | 0.79     | 0.57        |      | 0.03     | 0.62  | 0.07  |
| Control Delay           |       | 40.5  | 17.8         |       | 31.5  |      | 50.7     | 11.9        |      | 45.0     | 23.1  | 0.2   |
| Queue Delay             |       | 0.0   | 0.0          |       | 0.0   |      | 0.0      | 0.0         |      | 0.0      | 0.0   | 0.0   |
| Total Delay             |       | 40.5  | 17.8         |       | 31.5  |      | 50.7     | 11.9        |      | 45.0     | 23.1  | 0.2   |

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|                                  | ≯ →               | 7          | *              | •         | *           | •      | 1    | 1   | 1    | Ļ    | ~    |
|----------------------------------|-------------------|------------|----------------|-----------|-------------|--------|------|-----|------|------|------|
| Lane Group                       | EBL EBT           | EBR        | WBL            | WBT       | WBR         | NBL    | NBT  | NBR | SBL  | SBT  | SBR  |
| LOS                              | D                 | В          |                | С         |             | D      | В    |     | D    | С    | A    |
| Approach Delay                   | 21.3              |            |                | 31.5      |             |        | 17.9 |     |      | 21.9 |      |
| Approach LOS                     | С                 |            |                | С         |             |        | В    |     |      | С    |      |
| Queue Length 50th (ft)           | 24                | 80         |                | 1         |             | 168    | 241  |     | 2    | 260  | 0    |
| Queue Length 95th (ft)           | 54                | 115        |                | 11        |             | 244    | 414  |     | 11   | 396  | 0    |
| Internal Link Dist (ft)          | 279               |            |                | 416       |             |        | 708  |     |      | 1624 |      |
| Turn Bay Length (ft)             |                   |            |                |           |             | 562    |      |     | 274  |      | 480  |
| Base Capacity (vph)              | 338               | 728        |                | 429       |             | 433    | 2519 |     | 110  | 1737 | 875  |
| Starvation Cap Reductn           | 0                 | 0          |                | 0         |             | 0      | 0    |     | 0    | 0    | 0    |
| Spillback Cap Reductn            | 0                 | 0          |                | 0         |             | 0      | 0    |     | 0    | 0    | 0    |
| Storage Cap Reductn              | 0                 | 0          |                | 0         |             | 0      | 0    |     | 0    | 0    | 0    |
| Reduced v/c Ratio                | 0.12              | 0.31       |                | 0.01      |             | 0.60   | 0.57 |     | 0.03 | 0.62 | 0.07 |
| Intersection Summary             |                   |            |                |           |             |        |      |     |      |      |      |
| Area Type: Ot                    | her               |            |                |           |             |        |      |     |      |      |      |
| Cycle Length: 100                |                   |            |                |           |             |        |      |     |      |      |      |
| Actuated Cycle Length: 100       |                   |            |                |           |             |        |      |     |      |      |      |
| Offset: 0 (0%), Referenced to    | phase 2:NBT an    | d 6:SBT, S | Start of Yello | ow, Masi  | ter Interse | ection |      |     |      |      |      |
| Natural Cycle: 60                |                   |            |                |           |             |        |      |     |      |      |      |
| Control Type: Actuated-Coord     | inated            |            |                |           |             |        |      |     |      |      |      |
| Maximum v/c Ratio: 0.79          |                   |            |                |           |             |        |      |     |      |      |      |
| Intersection Signal Delay: 19.7  | 7                 |            | Inte           | ersectior | n LOS: B    |        |      |     |      |      |      |
| Intersection Capacity Utilizatio | n 65.0%           |            | ICL            | J Level o | of Service  | С      |      |     |      |      |      |
| Analysis Period (min) 15         |                   |            |                |           |             |        |      |     |      |      |      |
| Splits and Phases: 3: Wash       | ington Street & I | Madison S  | treet          |           |             |        | -    |     |      |      |      |

| Ø1           | Ø2 (R) |          | <b>₽</b> 04 |  |
|--------------|--------|----------|-------------|--|
| 13 s         | 57 s   |          | 30 s        |  |
| <b>\$</b> Ø5 |        | ♥ Ø6 (R) | <b>₩</b> Ø8 |  |
| 32 s         |        | 38 s     | 30 s        |  |

#### Intersection

Int Delay, s/veh

2.3

| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT     | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|---------|------|------|------|------|
| Lane Configurations    |      | \$   |      |      | \$   |      |      | र्ची के |      |      | 4îb  |      |
| Traffic Vol, veh/h     | 0    | 0    | 19   | 11   | 0    | 10   | 12   | 1263    | 57   | 19   | 1030 | 1    |
| Future Vol, veh/h      | 0    | 0    | 19   | 11   | 0    | 10   | 12   | 1263    | 57   | 19   | 1030 | 1    |
| Conflicting Peds, #/hr | 0    | 0    | 1    | 1    | 0    | 0    | 0    | 0       | 1    | 1    | 0    | 0    |
| Sign Control           | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free    | Free | Free | Free | Free |
| RT Channelized         | -    | -    | None | -    | -    | None | -    | -       | None | -    | -    | None |
| Storage Length         | -    | -    | -    | -    | -    | -    | -    | -       | -    | -    | -    | -    |
| Veh in Median Storage, | # -  | 0    | -    | -    | 0    | -    | -    | 0       | -    | -    | 0    | -    |
| Grade, %               | -    | -4   | -    | -    | 1    | -    | -    | -1      | -    | -    | 1    | -    |
| Peak Hour Factor       | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92      | 92   | 92   | 92   | 92   |
| Heavy Vehicles, %      | 2    | 2    | 6    | 0    | 2    | 2    | 0    | 1       | 0    | 0    | 1    | 0    |
| Mvmt Flow              | 0    | 0    | 21   | 12   | 0    | 11   | 13   | 1373    | 62   | 21   | 1120 | 1    |

| Major/Minor          | Minor2 |      | Ν    | Minor1 |      | N    | Major1 |   | Ν | /lajor2 |   |   |  |
|----------------------|--------|------|------|--------|------|------|--------|---|---|---------|---|---|--|
| Conflicting Flow All | 1876   | 2625 | 562  | 2034   | 2594 | 719  | 1121   | 0 | 0 | 1436    | 0 | 0 |  |
| Stage 1              | 1163   | 1163 | -    | 1431   | 1431 | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 713    | 1462 | -    | 603    | 1163 | -    | -      | - | - | -       | - | - |  |
| Critical Hdwy        | 6.74   | 5.74 | 6.62 | 7.7    | 6.74 | 7.04 | 4.1    | - | - | 4.1     | - | - |  |
| Critical Hdwy Stg 1  | 5.74   | 4.74 | -    | 6.7    | 5.74 | -    | -      | - | - | -       | - | - |  |
| Critical Hdwy Stg 2  | 5.74   | 4.74 | -    | 6.7    | 5.74 | -    | -      | - | - | -       | - | - |  |
| Follow-up Hdwy       | 3.52   | 4.02 | 3.36 | 3.5    | 4.02 | 3.32 | 2.2    | - | - | 2.2     | - | - |  |
| Pot Cap-1 Maneuver   | 67     | 42   | 490  | 30     | 21   | 364  | 631    | - | - | 479     | - | - |  |
| Stage 1              | 268    | 346  | -    | 133    | 183  | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 456    | 265  | -    | 443    | 250  | -    | -      | - | - | -       | - | - |  |
| Platoon blocked, %   |        |      |      |        |      |      |        | - | - |         | - | - |  |
| Mov Cap-1 Maneuver   | 55     | 33   | 490  | 24     | 17   | 364  | 631    | - | - | 478     | - | - |  |
| Mov Cap-2 Maneuver   | 55     | 33   | -    | 24     | 17   | -    | -      | - | - | -       | - | - |  |
| Stage 1              | 240    | 306  | -    | 119    | 164  | -    | -      | - | - | -       | - | - |  |
| Stage 2              | 396    | 237  | -    | 375    | 221  | -    | -      | - | - | -       | - | - |  |
|                      |        |      |      |        |      |      |        |   |   |         |   |   |  |

| Approach             | EB   | WB    | NB  | SB  |  |
|----------------------|------|-------|-----|-----|--|
| HCM Control Delay, s | 12.7 | 159.6 | 0.7 | 0.9 |  |
| HCM LOS              | В    | F     |     |     |  |

| Minor Lane/Major Mvmt | NBL   | NBT | NBR | EBLn1V | VBLn1 | SBL   | SBT | SBR |
|-----------------------|-------|-----|-----|--------|-------|-------|-----|-----|
| Capacity (veh/h)      | 631   | -   | -   | 490    | 43    | 478   | -   | -   |
| HCM Lane V/C Ratio    | 0.021 | -   | -   | 0.042  | 0.531 | 0.043 | -   | -   |
| HCM Control Delay (s) | 10.8  | 0.6 | -   | 12.7   | 159.6 | 12.9  | 0.7 | -   |
| HCM Lane LOS          | В     | А   | -   | В      | F     | В     | А   | -   |
| HCM 95th %tile Q(veh) | 0.1   | -   | -   | 0.1    | 1.9   | 0.1   | -   | -   |

|                         | ٦     | -     | $\mathbf{r}$ | -     | +     | •    | 1     | 1           | 1    | 1     | Ļ           | ~    |
|-------------------------|-------|-------|--------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR          | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     | 5     | 1.    |              | 5     | 1.    |      | 5     | <b>A</b> 1. |      | 5     | <b>≜1</b> 4 |      |
| Traffic Volume (vph)    | 42    | 14    | 75           | 114   | 20    | 48   | 29    | 2080        | 36   | 82    | 448         | 5    |
| Future Volume (vph)     | 42    | 14    | 75           | 114   | 20    | 48   | 29    | 2080        | 36   | 82    | 448         | 5    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900         | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Lane Width (ft)         | 12    | 12    | 12           | 12    | 12    | 12   | 12    | 12          | 12   | 12    | 12          | 12   |
| Grade (%)               |       | 2%    |              |       | -3%   |      |       | 0%          |      |       | 0%          |      |
| Storage Length (ft)     | 0     |       | 0            | 0     | - / - | 0    | 255   |             | 0    | 270   |             | 0    |
| Storage Lanes           | 1     |       | 0            | 1     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25    |       |              | 25    |       |      | 25    |             |      | 25    |             | -    |
| Satd, Flow (prot)       | 1787  | 1550  | 0            | 1579  | 1502  | 0    | 1656  | 3482        | 0    | 1805  | 3192        | 0    |
| Flt Permitted           | 0.709 |       | -            | 0.694 |       | -    | 0.950 |             | -    | 0.950 |             | -    |
| Satd, Flow (perm)       | 1334  | 1550  | 0            | 1154  | 1502  | 0    | 1656  | 3482        | 0    | 1805  | 3192        | 0    |
| Right Turn on Red       |       |       | Yes          |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd, Flow (RTOR)       |       | 82    |              |       | 52    |      |       | 3           |      |       | 2           |      |
| Link Speed (mph)        |       | 30    |              |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |       | 204   |              |       | 338   |      |       | 3010        |      |       | 582         |      |
| Travel Time (s)         |       | 4.6   |              |       | 7.7   |      |       | 37.3        |      |       | 7.2         |      |
| Confl. Peds. (#/hr)     |       |       |              |       |       |      |       |             |      |       |             |      |
| Confl. Bikes (#/hr)     |       |       |              |       |       |      |       |             |      |       |             |      |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92         | 0.92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92  | 0.92        | 0.92 |
| Growth Factor           | 100%  | 100%  | 100%         | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%        | 100% |
| Heavy Vehicles (%)      | 0%    | 22%   | 3%           | 16%   | 29%   | 9%   | 9%    | 3%          | 25%  | 0%    | 13%         | 0%   |
| Bus Blockages (#/hr)    | 0     | 0     | 0            | 0     | 0     | 0    | 0     | 0           | 0    | 0     | 0           | 0    |
| Parking (#/hr)          |       |       |              |       |       |      |       |             |      |       |             | -    |
| Mid-Block Traffic (%)   |       | 0%    |              |       | 0%    |      |       | 0%          |      |       | 0%          |      |
| Shared Lane Traffic (%) |       |       |              |       |       |      |       |             |      |       |             |      |
| Lane Group Flow (vph)   | 46    | 97    | 0            | 124   | 74    | 0    | 32    | 2300        | 0    | 89    | 492         | 0    |
| Turn Type               | Perm  | NA    |              | Perm  | NA    |      | Prot  | NA          |      | Prot  | NA          |      |
| Protected Phases        |       | 4     |              |       | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Permitted Phases        | 4     |       |              | 8     |       |      |       |             |      |       |             |      |
| Detector Phase          | 4     | 4     |              | 8     | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Switch Phase            |       |       |              |       |       |      |       |             |      |       |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |              | 6.0   | 6.0   |      | 6.0   | 30.0        |      | 6.0   | 30.0        |      |
| Minimum Split (s)       | 11.0  | 11.0  |              | 11.0  | 11.0  |      | 12.0  | 36.0        |      | 12.0  | 36.0        |      |
| Total Split (s)         | 20.0  | 20.0  |              | 20.0  | 20.0  |      | 12.0  | 67.0        |      | 13.0  | 68.0        |      |
| Total Split (%)         | 20.0% | 20.0% |              | 20.0% | 20.0% |      | 12.0% | 67.0%       |      | 13.0% | 68.0%       |      |
| Yellow Time (s)         | 3.0   | 3.0   |              | 3.0   | 3.0   |      | 4.0   | 4.0         |      | 4.0   | 4.0         |      |
| All-Red Time (s)        | 2.0   | 2.0   |              | 2.0   | 2.0   |      | 2.0   | 2.0         |      | 2.0   | 2.0         |      |
| Lost Time Adjust (s)    | 0.0   | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     | 5.0   | 5.0   |              | 5.0   | 5.0   |      | 6.0   | 6.0         |      | 6.0   | 6.0         |      |
| Lead/Lag                |       |       |              |       |       |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |       |       |              |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None  | None  |              | None  | None  |      | None  | C-Max       |      | None  | C-Max       |      |
| Act Effct Green (s)     | 13.6  | 13.6  |              | 13.6  | 13.6  |      | 6.0   | 65.0        |      | 7.0   | 68.2        |      |
| Actuated g/C Ratio      | 0.14  | 0.14  |              | 0.14  | 0.14  |      | 0.06  | 0.65        |      | 0.07  | 0.68        |      |
| v/c Ratio               | 0.25  | 0.34  |              | 0.79  | 0.30  |      | 0.32  | 1.02        |      | 0.71  | 0.23        |      |
| Control Delay           | 41.6  | 15.2  |              | 74.6  | 19.3  |      | 38.6  | 33.2        |      | 75.9  | 7.3         |      |
| Queue Delay             | 0.0   | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             | 41.6  | 15.2  |              | 74.6  | 19.3  |      | 38.6  | 33.2        |      | 75.9  | 7.3         |      |

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|---|----------------|------------|--------------|--------------|------------|------------|------|-------|-----|------|------|-----|
| Lane Group                                  | EBL            | EBT        | EBR          | WBL          | WBT        | WBR        | NBL  | NBT   | NBR | SBL  | SBT  | SBR |
| LOS   | D              | В          |              | E            | В          |            | D    | С     |     | E    | А    |     |
| Approach Delay                              |                | 23.7       |              |              | 53.9       |            |      | 33.3  |     |      | 17.8 |     |
| Approach LOS                                |                | С          |              |              | D          |            |      | С     |     |      | В    |     |
| Queue Length 50th (ft)                      | 26             | 8          |              | 76           | 12         |            | 20   | ~858  |     | 57   | 67   |     |
| Queue Length 95th (ft)                      | 61             | 54         |              | #166         | 53         |            | m22  | m#908 |     | #135 | 93   |     |
| Internal Link Dist (ft)                     |                | 124        |              |              | 258        |            |      | 2930  |     |      | 502  |     |
| Turn Bay Length (ft)                        |                |            |              |              |            |            | 255  |       |     | 270  |      |     |
| Base Capacity (vph)                         | 200            | 302        |              | 173          | 269        |            | 99   | 2263  |     | 126  | 2176 |     |
| Starvation Cap Reductn                      | 0              | 0          |              | 0            | 0          |            | 0    | 0     |     | 0    | 0    |     |
| Spillback Cap Reductn                       | 0              | 0          |              | 0            | 0          |            | 0    | 0     |     | 0    | 0    |     |
| Storage Cap Reductn                         | 0              | 0          |              | 0            | 0          |            | 0    | 0     |     | 0    | 0    |     |
| Reduced v/c Ratio                           | 0.23           | 0.32       |              | 0.72         | 0.28       |            | 0.32 | 1.02  |     | 0.71 | 0.23 |     |
| Intersection Summary                        |                |            |              |              |            |            |      |       |     |      |      |     |
| Area Type:                                  | Other          |            |              |              |            |            |      |       |     |      |      |     |
| Cycle Length: 100                           |                |            |              |              |            |            |      |       |     |      |      |     |
| Actuated Cycle Length: 100                  | )              |            |              |              |            |            |      |       |     |      |      |     |
| Offset: 45 (45%), Reference                 | ed to phase    | 2:NBT ar   | d 6:SBT,     | , Start of ( | Green      |            |      |       |     |      |      |     |
| Natural Cycle: 90                           |                |            |              |              |            |            |      |       |     |      |      |     |
| Control Type: Actuated-Coc                  | ordinated      |            |              |              |            |            |      |       |     |      |      |     |
| Maximum v/c Ratio: 1.02                     |                |            |              |              |            |            |      |       |     |      |      |     |
| Intersection Signal Delay: 3                | 31.3           |            |              | In           | tersectior | LOS: C     |      |       |     |      |      |     |
| Intersection Capacity Utiliza               | ation 90.3%    |            |              | IC           | U Level o  | of Service | E    |       |     |      |      |     |
| Analysis Period (min) 15                    |                |            |              |              |            |            |      |       |     |      |      |     |
| <ul> <li>Volume exceeds capacity</li> </ul> | ity, queue is  | theoretic  | ally infini  | te.          |            |            |      |       |     |      |      |     |
| Queue shown is maximu                       | um after two   | cycles.    |              |              |            |            |      |       |     |      |      |     |
| # 95th percentile volume                    | exceeds cap    | pacity, qu | eue may      | be longer    | ſ.         |            |      |       |     |      |      |     |
| Queue shown is maximu                       | um after two   | cycles.    |              |              |            |            |      |       |     |      |      |     |
| m Volume for 95th percer                    | ntile queue is | s metereo  | l by upstr   | eam sign     | al.        |            |      |       |     |      |      |     |
| Calita and Dhasaat 4: M/s                   | abinaton Ct    | root 0 TL  | uratan Ct    | reat         |            |            |      |       |     |      |      |     |
| Spills and Phases: 1: Wa                    | ashington St   |            | urston St    | ieet         |            |            |      |       |     |      |      |     |

| Ø1      | 🖡 🕇 Ø2 (R) |             |
|---------|------------|-------------|
| 13 s    | 67 s       | 20 s        |
| ▲<br>Ø5 | ● Ø6 (R)   | <b>√</b> Ø8 |
| 12 s    | 68 s       | 20 s        |

# Wrentham Business Center

2: Washington Street & Hawes Street/Commerce Boulevard

|                         | ≯      | -     | $\mathbf{r}$ | -     | -     | •    | 1     | 1           | 1    | 1     | Ŧ           | -    |
|-------------------------|--------|-------|--------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL    | EBT   | EBR          | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     |        | 4     |              | 5     | ĥ     |      | 5     | <b>≜t</b> ⊾ |      | 5     | <b>≜1</b> 5 |      |
| Traffic Volume (vph)    | 1      | 0     | 12           | 56    | 2     | 118  | 25    | 2069        | 153  | 57    | 596         | 13   |
| Future Volume (vph)     | 1      | 0     | 12           | 56    | 2     | 118  | 25    | 2069        | 153  | 57    | 596         | 13   |
| Ideal Flow (vphpl)      | 1900   | 1900  | 1900         | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Lane Width (ft)         | 12     | 12    | 12           | 12    | 12    | 12   | 12    | 12          | 12   | 12    | 12          | 12   |
| Grade (%)               |        | -4%   |              |       | 1%    |      |       | -1%         |      |       | 1%          |      |
| Storage Length (ft)     | 0      |       | 0            | 0     |       | 0    | 0     |             | 0    | 0     |             | 0    |
| Storage Lanes           | 0      |       | 0            | 1     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25     |       | -            | 25    |       | -    | 25    |             | -    | 25    |             | -    |
| Satd. Flow (prot)       | 0      | 1557  | 0            | 1761  | 1579  | 0    | 1814  | 3458        | 0    | 1761  | 3176        | 0    |
| Flt Permitted           |        | 0.814 | -            | 0.748 |       |      | 0.950 |             |      | 0.950 |             |      |
| Satd, Flow (perm)       | 0      | 1272  | 0            | 1386  | 1579  | 0    | 1808  | 3458        | 0    | 1761  | 3176        | 0    |
| Right Turn on Red       |        |       | Yes          |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd, Flow (RTOR)       |        | 98    |              |       | 99    |      |       | 17          |      |       | 5           |      |
| Link Speed (mph)        |        | 30    |              |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ff)      |        | 141   |              |       | 266   |      |       | 1704        |      |       | 143         |      |
| Travel Time (s)         |        | 3.2   |              |       | 6.0   |      |       | 21.1        |      |       | 1.8         |      |
| Confl. Peds. (#/hr)     |        | 0.2   |              |       | 0.0   |      | 1     |             |      |       |             | 1    |
| Confl Bikes (#/hr)      |        |       |              |       |       |      |       |             |      |       |             | •    |
| Peak Hour Factor        | 0 92   | 0.92  | 0.92         | 0 92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0 92  | 0 92        | 0.92 |
| Growth Factor           | 100%   | 100%  | 100%         | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%        | 100% |
| Heavy Vehicles (%)      | 2%     | 2%    | 9%           | 2%    | 2%    | 2%   | 0%    | 4%          | 2%   | 2%    | 13%         | 0%   |
| Bus Blockages (#/hr)    | 0      | 0     | 0            | 0     | 0     | 0    | 0     | 0           | 0    | 0     | 0           | 0    |
| Parking (#/hr)          | Ŭ      | Ű     | Ű            | Ŭ     | Ű     | Ű    | Ŭ     | Ű           | Ű    | Ŭ     | Ŭ           | Ű    |
| Mid-Block Traffic (%)   |        | 0%    |              |       | 0%    |      |       | 0%          |      |       | 0%          |      |
| Shared Lane Traffic (%) |        | 070   |              |       | 070   |      |       | 070         |      |       | 070         |      |
| Lane Group Flow (vph)   | 0      | 14    | 0            | 61    | 130   | 0    | 27    | 2415        | 0    | 62    | 662         | 0    |
| Turn Type               | Perm   | NA    | Ű            | Perm  | NA    | Ű    | Prot  | NA          | Ű    | Prot  | NA          | Ű    |
| Protected Phases        |        | 4     |              |       | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Permitted Phases        | 4      |       |              | 8     | Ū     |      | •     |             |      | ·     | •           |      |
| Detector Phase          | 4      | 4     |              | 8     | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Switch Phase            | ·      |       |              |       | Ū     |      | •     |             |      | ·     | •           |      |
| Minimum Initial (s)     | 6.0    | 6.0   |              | 6.0   | 6.0   |      | 6.0   | 10.0        |      | 6.0   | 10.0        |      |
| Minimum Split (s)       | 12.0   | 12.0  |              | 12.0  | 12.0  |      | 12.0  | 16.0        |      | 12.0  | 16.0        |      |
| Total Split (s)         | 13.0   | 13.0  |              | 13.0  | 13.0  |      | 12.0  | 75.0        |      | 12.0  | 75.0        |      |
| Total Split (%)         | 13.0%  | 13.0% |              | 13.0% | 13.0% |      | 12.0% | 75.0%       |      | 12.0% | 75.0%       |      |
| Yellow Time (s)         | 4.0    | 4.0   |              | 4.0   | 4.0   |      | 5.0   | 5.0         |      | 5.0   | 5.0         |      |
| All-Red Time (s)        | 2.0    | 2.0   |              | 2.0   | 2.0   |      | 1.0   | 1.0         |      | 1.0   | 1.0         |      |
| Lost Time Adjust (s)    |        | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     |        | 6.0   |              | 6.0   | 6.0   |      | 6.0   | 6.0         |      | 6.0   | 6.0         |      |
| Lead/Lag                |        |       |              | 0.0   |       |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |        |       |              |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None   | None  |              | None  | None  |      | None  | C-Min       |      | None  | C-Min       |      |
| Act Effct Green (s)     | Tionio | 6.8   |              | 6.8   | 6.8   |      | 6.0   | 71.6        |      | 60    | 74 0        |      |
| Actuated g/C Ratio      |        | 0.07  |              | 0.07  | 0.07  |      | 0.06  | 0 72        |      | 0.06  | 0 74        |      |
| v/c Ratio               |        | 0.08  |              | 0.65  | 0.65  |      | 0.25  | 0.97        |      | 0.59  | 0.28        |      |
| Control Delay           |        | 0.00  |              | 76.5  | 31.1  |      | 40.2  | 21.6        |      | 66 1  | 4 1         |      |
| Queue Delay             |        | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delav             |        | 0.8   |              | 76.5  | 31.1  |      | 40.2  | 21.6        |      | 66.1  | 4.1         |      |

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# Wrentham Business Center

2: Washington Street & Hawes Street/Commerce Boulevard

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|--|------------|------------|--------------|--------------|------------|------------|------|------|-----|------|------|-----|
| Lane Group                                   | EBL        | EBT        | EBR          | WBL          | WBT        | WBR        | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| LOS  |            | А          |              | Е            | С          |            | D    | С    |     | Е    | А    |     |
| Approach Delay                               |            | 0.8        |              |              | 45.6       |            |      | 21.8 |     |      | 9.4  |     |
| Approach LOS                                 |            | А          |              |              | D          |            |      | С    |     |      | А    |     |
| Queue Length 50th (ft)                       |            | 0          |              | 39           | 19         |            | 16   | ~234 |     | 40   | 60   |     |
| Queue Length 95th (ft)                       |            | 0          |              | #101         | #94        |            | m20  | #977 |     | m#89 | 75   |     |
| Internal Link Dist (ft)                      |            | 61         |              |              | 186        |            |      | 1624 |     |      | 63   |     |
| Turn Bay Length (ft)                         |            |            |              |              |            |            |      |      |     |      |      |     |
| Base Capacity (vph)                          |            | 180        |              | 97           | 202        |            | 108  | 2480 |     | 105  | 2351 |     |
| Starvation Cap Reductn                       |            | 0          |              | 0            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn                        |            | 0          |              | 0            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn                          |            | 0          |              | 0            | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio                            |            | 0.08       |              | 0.63         | 0.64       |            | 0.25 | 0.97 |     | 0.59 | 0.28 |     |
| Intersection Summary                         |            |            |              |              |            |            |      |      |     |      |      |     |
| Area Type: Oth                               | her        |            |              |              |            |            |      |      |     |      |      |     |
| Cycle Length: 100                            |            |            |              |              |            |            |      |      |     |      |      |     |
| Actuated Cycle Length: 100                   |            |            |              |              |            |            |      |      |     |      |      |     |
| Offset: 25 (25%), Referenced t               | to phase   | 2:NBT ar   | d 6:SBT      | , Start of ( | Green      |            |      |      |     |      |      |     |
| Natural Cycle: 90                            |            |            |              |              |            |            |      |      |     |      |      |     |
| Control Type: Actuated-Coordi                | inated     |            |              |              |            |            |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.97                      |            |            |              |              |            |            |      |      |     |      |      |     |
| Intersection Signal Delay: 20.4              | ļ          |            |              | In           | tersectior | n LOS: C   |      |      |     |      |      |     |
| Intersection Capacity Utilization            | n 81.8%    |            |              | IC           | U Level o  | of Service | D    |      |     |      |      |     |
| Analysis Period (min) 15                     |            |            |              |              |            |            |      |      |     |      |      |     |
| <ul> <li>Volume exceeds capacity,</li> </ul> | queue is   | theoretic  | ally infini  | te.          |            |            |      |      |     |      |      |     |
| Queue shown is maximum                       | after two  | cycles.    |              |              |            |            |      |      |     |      |      |     |
| # 95th percentile volume exc                 | eeds cap   | oacity, qu | eue may      | be longer    | ſ.         |            |      |      |     |      |      |     |
| Queue shown is maximum                       | after two  | cycles.    |              |              |            |            |      |      |     |      |      |     |
| m Volume for 95th percentile                 | e queue is | s meterec  | l by upstr   | ream sign    | al.        |            |      |      |     |      |      |     |
| Splits and Phases: 2: Washi                  | ington St  | reet & Ha  | wes Stre     | et/Comm      | erce Boul  | evard      |      |      |     |      |      |     |

| Ø1   | Ø2 (R) | <br>Ø4      |
|------|--------|-------------|
| 12 s | 75 s   | 13 s        |
| ▲ Ø5 | Ø6 (R) | <b>₩</b> Ø8 |
| 12 s | 75 s   | 13 s        |

|                         | ٦       | -     | $\mathbf{\hat{z}}$ | 4     | -     | *    | 1               | 1           | 1    | 1            | ŧ         | ~            |
|-------------------------|---------|-------|--------------------|-------|-------|------|-----------------|-------------|------|--------------|-----------|--------------|
| Lane Group              | EBL     | EBT   | EBR                | WBL   | WBT   | WBR  | NBL             | NBT         | NBR  | SBL          | SBT       | SBR          |
| Lane Configurations     |         | ្ព    | 1                  |       | 44    |      | ሻ               | <b>4</b> 1. |      | 5            | **        | 1            |
| Traffic Volume (vph)    | 32      | 1     | 207                | 4     | 4     | 11   | 121             | 2177        | 29   | 5            | 624       | 21           |
| Future Volume (vph)     | 32      | 1     | 207                | 4     | 4     | 11   | 121             | 2177        | 29   | 5            | 624       | 21           |
| Ideal Flow (vphpl)      | 1900    | 1900  | 1900               | 1900  | 1900  | 1900 | 1900            | 1900        | 1900 | 1900         | 1900      | 1900         |
| Lane Width (ft)         | 12      | 12    | 12                 | 12    | 16    | 12   | 12              | 12          | 12   | 12           | 12        | 12           |
| Grade (%)               |         | -5%   |                    |       | 2%    |      |                 | 2%          |      |              | -4%       |              |
| Storage Length (ft)     | 309     |       | 0                  | 0     |       | 0    | 562             |             | 0    | 274          | .,.       | 480          |
| Storage Lanes           | 0       |       | 1                  | 0     |       | 0    | 1               |             | 0    | 1            |           | 1            |
| Taper Length (ft)       | 25      |       |                    | 25    |       | -    | 25              |             | -    | 25           |           |              |
| Satd. Flow (prot)       | 0       | 1858  | 1623               | 0     | 1504  | 0    | 1769            | 3430        | 0    | 1534         | 3259      | 1384         |
| Flt Permitted           |         |       |                    | •     | 0.921 |      | 0.950           | • • • • •   | •    | 0.950        | 0200      |              |
| Satd, Flow (perm)       | 0       | 1947  | 1623               | 0     | 1399  | 0    | 1769            | 3430        | 0    | 1534         | 3259      | 1384         |
| Right Turn on Red       |         |       | Yes                | •     |       | Yes  |                 | • • • • •   | Yes  |              | 0200      | Yes          |
| Satd, Flow (RTOR)       |         |       | 225                |       | 12    |      |                 | 3           |      |              |           | 202          |
| Link Speed (mph)        |         | 30    | 220                |       | 30    |      |                 | 55          |      |              | 55        | 202          |
| Link Distance (ft)      |         | 359   |                    |       | 496   |      |                 | 788         |      |              | 1704      |              |
| Travel Time (s)         |         | 82    |                    |       | 11.3  |      |                 | 9.8         |      |              | 21.1      |              |
| Confl Peds (#/hr)       |         | 0.2   |                    |       | 11.0  |      |                 | 0.0         |      |              | 21.1      |              |
| Confl. Bikes (#/hr)     |         |       |                    |       |       |      |                 |             |      |              |           |              |
| Peak Hour Factor        | 0 92    | 0 92  | 0 92               | 0 92  | 0 92  | 0 92 | 0 92            | 0 92        | 0 92 | 0 92         | 0 92      | 0 92         |
| Growth Eactor           | 100%    | 100%  | 100%               | 100%  | 100%  | 100% | 100%            | 100%        | 100% | 100%         | 100%      | 100%         |
| Heavy Vehicles (%)      | 0%      | 0%    | 2%                 | 0%    | 25%   | 40%  | 1%              | 4%          | 4%   | 20%          | 13%       | 19%          |
| Bus Blockages (#/br)    | 0       | 0     | 0                  | 0 /0  | 0     | 0,0+ | 0               | 0           | 0    | 2070         | 0         | 0            |
| Parking (#/hr)          | 0       | U     | U                  | U     | Ū     | U    | U               | U           | U    | Ū            | 0         | Ū            |
| Mid-Block Traffic (%)   |         | 0%    |                    |       | 0%    |      |                 | 0%          |      |              | 0%        |              |
| Shared Lane Traffic (%) |         | 070   |                    |       | 070   |      |                 | 070         |      |              | 070       |              |
| Lane Group Flow (vph)   | 0       | 36    | 225                | 0     | 20    | 0    | 132             | 2398        | 0    | 5            | 678       | 23           |
| Turn Tyne               | Perm    | NA    | nt+ov              | Perm  | NA    | U    | Prot            | NA          | U    | Prot         | NA        | Prot         |
| Protected Phases        | 1 01111 | 4     | 4 5                | i onn | 8     |      | 5               | 2           |      | 1            | 6         | 6            |
| Permitted Phases        | 4       |       | 10                 | 8     | Ű     |      | Ŭ               | <u> </u>    |      |              | Ű         | Ŭ            |
| Detector Phase          | 4       | 4     | 5                  | 8     | 8     |      | 5               | 2           |      | 1            | 6         | 6            |
| Switch Phase            | т       | т     | 0                  | 0     | U     |      | 0               | 2           |      | 1            | 0         | Ū            |
| Minimum Initial (s)     | 6.0     | 6.0   |                    | 6.0   | 6.0   |      | 10.0            | 10.0        |      | 6.0          | 10.0      | 10.0         |
| Minimum Snlit (s)       | 13.0    | 13.0  |                    | 13.0  | 13.0  |      | 17.5            | 16.5        |      | 13.0         | 16.5      | 16.5         |
| Total Split (s)         | 13.0    | 13.0  |                    | 13.0  | 13.0  |      | 23.0            | 74.0        |      | 13.0         | 64.0      | 64.0         |
| Total Split (%)         | 13.0%   | 13.0% |                    | 13.0% | 13.0% |      | 23.0%           | 74 0%       |      | 13.0%        | 64.0%     | 64.0%        |
| Yellow Time (s)         | 4 0     | 4 0   |                    | 4.0   | 4 0   |      | 4 5             | 5.0         |      | 4 5          | 5.0       | 5.0          |
| All-Red Time (s)        | 3.0     | 3.0   |                    | 3.0   | 3.0   |      | 3.0             | 1.5         |      | 2.5          | 1.5       | 1.5          |
| Lost Time Adjust (s)    | 0.0     | 0.0   |                    | 0.0   | 0.0   |      | 0.0             | 0.0         |      | 0.0          | 0.0       | 0.0          |
| Total Lost Time (s)     |         | 7.0   |                    |       | 7.0   |      | 7.5             | 6.5         |      | 7.0          | 6.5       | 6.5          |
| Lead/Lag                |         | 1.0   |                    |       | 1.0   |      | Lead            | l an        |      | l ead        | l an      | 0.0<br>Lan   |
| Lead-Lag Ontimize?      |         |       |                    |       |       |      | Yes             | Yes         |      | Ves          | Ves       | Ves          |
| Recall Mode             | None    | None  |                    | None  | None  |      | None            | C-Min       |      | None         | C-Min     | C-Min        |
| Act Effct Green (s)     |         | 60    | 20.5               | NONE  | 60    |      | 12.2            | 85.7        |      | 60           | 0.36      | 0.33         |
| Actuated a/C Ratio      |         | 0.0   | 0.20               |       | 0.0   |      | 0 12            | 0.86        |      | 0.0          | 0.00      | 0.00<br>99 0 |
| v/c Ratio               |         | 0.00  | 0.20               |       | 0.00  |      | 0.12            | 0.00        |      | 0.00         | 0.00      | 0.00         |
| Control Delay           |         | 52 /  | 6.7                |       | 33.6  |      | <u></u><br>18 0 | 10.02       |      | 44.2         | 10.02     | 0.02         |
|                         |         | 0.0   | 0.7                |       | 0.0   |      | 0.0             | 0.0         |      | 0.0          | 0.4       | 0.0          |
| Total Delay             |         | 52 4  | 6.7                |       | 33.6  |      | <u>48</u> Q     | 10.4        |      | 44.2         | 10.0      | 0.0          |
| . star Boray            |         | VL.T  | 0.1                |       | 00.0  |      | 10.0            | 10.0        |      | (T. <b>4</b> | · • · · · | 0.0          |

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## Wrentham Business Center 3: Washington Street & Madison Street

|                                   | ≯   | -        | $\mathbf{F}$ | 4           | +          | *           | •     | Ť    | 1   | 1    | Ļ    | ~    |
|-----------------------------------|---|----------|--------------|-------------|------------|-------------|-------|------|-----|------|------|------|
| Lane Group                        | EBL   | EBT      | EBR          | WBL         | WBT        | WBR         | NBL   | NBT  | NBR | SBL  | SBT  | SBR  |
| LOS                               |   | D        | А            |             | С          |             | D     | В    |     | D    | В    | A    |
| Approach Delay                    |   | 13.0     |              |             | 33.6       |             |       | 12.4 |     |      | 10.3 |      |
| Approach LOS                      |   | В        |              |             | С          |             |       | В    |     |      | В    |      |
| Queue Length 50th (ft)            |   | 22       | 0            |             | 5          |             | 77    | 609  |     | 3    | 96   | 0    |
| Queue Length 95th (ft)            |   | 55       | 54           |             | 29         |             | m86   | #711 |     | m11  | 137  | m0   |
| Internal Link Dist (ft)           |   | 279      |              |             | 416        |             |       | 708  |     |      | 1624 |      |
| Turn Bay Length (ft)              |   |          |              |             |            |             | 562   |      |     | 274  |      | 480  |
| Base Capacity (vph)               |   | 116      | 557          |             | 95         |             | 274   | 2940 |     | 92   | 2150 | 981  |
| Starvation Cap Reductn            |   | 0        | 0            |             | 0          |             | 0     | 157  |     | 0    | 0    | 0    |
| Spillback Cap Reductn             |   | 0        | 0            |             | 0          |             | 0     | 0    |     | 0    | 0    | 0    |
| Storage Cap Reductn               |   | 0        | 0            |             | 0          |             | 0     | 0    |     | 0    | 0    | 0    |
| Reduced v/c Ratio                 |   | 0.31     | 0.40         |             | 0.21       |             | 0.48  | 0.86 |     | 0.05 | 0.32 | 0.02 |
| Intersection Summary              |   |          |              |             |            |             |       |      |     |      |      |      |
| Area Type: Ot                     | ther  |          |              |             |            |             |       |      |     |      |      |      |
| Cycle Length: 100                 |   |          |              |             |            |             |       |      |     |      |      |      |
| Actuated Cycle Length: 100        |   |          |              |             |            |             |       |      |     |      |      |      |
| Offset: 0 (0%), Referenced to     | phase 2:NE  | 3T and   | 6:SBT, St    | tart of Yel | llow, Mas  | ter Interse | ction |      |     |      |      |      |
| Natural Cycle: 110                |   |          |              |             |            |             |       |      |     |      |      |      |
| Control Type: Actuated-Coord      | linated   |          |              |             |            |             |       |      |     |      |      |      |
| Maximum v/c Ratio: 0.82           |   |          |              |             |            |             |       |      |     |      |      |      |
| Intersection Signal Delay: 12.7   | 1   |          |              | In          | tersectior | LOS: B      |       |      |     |      |      |      |
| Intersection Capacity Utilization | on 89.6%  |          |              | IC          | U Level o  | of Service  | E     |      |     |      |      |      |
| Analysis Period (min) 15          |   |          |              |             |            |             |       |      |     |      |      |      |
| # 95th percentile volume exc      | ceeds capa  | city, qu | eue may      | be longer   | ۲.         |             |       |      |     |      |      |      |
| Queue shown is maximum            | after two c   | ycles.   |              |             |            |             |       |      |     |      |      |      |
| m Volume for 95th percentile      | m Volume for 95th percentile queue is metered by upstream signal. |          |              |             |            |             |       |      |     |      |      |      |
| Splits and Phases: 3: Wash        | inaton Stre   | et & Ma  | dison Str    | reet        |            |             |       |      |     |      |      |      |
|                                   |   |          |              |             |            |             |       |      |     |      |      |      |

| Ø1           | Tø2 (R) |          | • | <i>₩</i> Ø4 |
|--------------|---------|----------|---|-------------|
| 13 s         | 74 s    |          |   | 13 s        |
| <b>\$</b> Ø5 |         | ♥ Ø6 (R) |   | ₩<br>Ø8     |
| 23 s         |         | 64s      |   | 13 s        |

## Wrentham Business Center 6: Washington Street & I-495 Off Ramp

|                         | ✓                 | •     | <b>†</b>  | 1    | 1    | ŧ         |
|-------------------------|-------------------|-------|-----------|------|------|-----------|
| Lane Group              | WBL               | WBR   | NBT       | NBR  | SBL  | SBT       |
| Lane Configurations     |                   | ##    | **        |      | 500  | **        |
| Traffic Volume (vph)    | 0                 | 673   | 1654      | 0    | 0    | 835       |
| Future Volume (vph)     | 0                 | 673   | 1654      | 0    | 0    | 835       |
| Ideal Flow (vphpl)      | 1000              | 1000  | 1004      | 1000 | 1000 | 1000      |
| Lane Width (ff)         | 1300              | 1300  | 1300      | 1300 | 1000 | 1300      |
| Grade (%)               | ۲ <u>۲</u><br>۵۷/ | 12    | 1Z<br>20/ | 12   | 12   | ۲۲<br>/۵۸ |
| Storage Longth (ft)     | 0%                | 0     | Ζ /0      | 0    | 0    | 0 %       |
| Storage Length (II)     | 0                 | 0     |           | 0    | 0    |           |
|                         | 0                 | 2     |           | U    | 0    |           |
| Taper Length (IT)       | 25                | 0707  | 2470      | •    | 25   | 2000      |
| Salu. Flow (prot)       | U                 | 2/0/  | 3470      | U    | U    | 3282      |
| Fit Permitted           |                   | 0707  | 0470      | •    | •    | 2000      |
| Satd. Flow (perm)       | 0                 | 2/0/  | 3470      | 0    | 0    | 3282      |
| Right Lurn on Red       |                   | No    |           | No   |      |           |
| Satd. Flow (RTOR)       |                   |       |           |      |      |           |
| Link Speed (mph)        | 25                |       | 55        |      |      | 50        |
| Link Distance (ft)      | 464               |       | 523       |      |      | 788       |
| Travel Time (s)         | 12.7              |       | 6.5       |      |      | 10.7      |
| Confl. Peds. (#/hr)     |                   |       |           |      |      |           |
| Confl. Bikes (#/hr)     |                   |       |           |      |      |           |
| Peak Hour Factor        | 0.92              | 0.92  | 0.92      | 0.92 | 0.92 | 0.92      |
| Growth Factor           | 100%              | 100%  | 100%      | 100% | 100% | 100%      |
| Heavy Vehicles (%)      | 2%                | 5%    | 3%        | 2%   | 2%   | 10%       |
| Bus Blockages (#/hr)    | 0                 | 0     | 0         | 0    | 0    | 0         |
| Parking (#/hr)          |                   |       |           |      |      |           |
| Mid-Block Traffic (%)   | 0%                |       | 0%        |      |      | 0%        |
| Shared Lane Traffic (%) | <b>C</b> ,3       |       | 0.0       |      |      | 0,0       |
| Lane Group Flow (vph)   | 0                 | 732   | 1798      | 0    | 0    | 908       |
| Turn Type               | J                 | Prot  | NA        | J    | v    | NA        |
| Protected Phases        |                   | 8     | 2         |      |      | 2.8       |
| Permitted Phases        |                   | 0     | 2         |      |      | 20        |
| Detector Phase          |                   | Q     | 2         |      |      |           |
| Switch Phase            |                   | U     | 2         |      |      |           |
| Minimum Initial (a)     |                   | 60    | 10.0      |      |      |           |
| Minimum Chlit (s)       |                   | 0.0   | 10.0      |      |      |           |
| Total Calit (s)         |                   | 11.0  | 10.5      |      |      |           |
| Total Split (S)         |                   | 30.0  | 64.0      |      |      |           |
| Total Split (%)         |                   | 36.0% | 64.0%     |      |      |           |
| Yellow Lime (s)         |                   | 3.5   | 5.0       |      |      |           |
| All-Red Time (s)        |                   | 1.5   | 1.5       |      |      |           |
| Lost Time Adjust (s)    |                   | 0.0   | 0.0       |      |      |           |
| Total Lost Time (s)     |                   | 5.0   | 6.5       |      |      |           |
| Lead/Lag                |                   |       |           |      |      |           |
| Lead-Lag Optimize?      |                   |       |           |      |      |           |
| Recall Mode             |                   | None  | C-Min     |      |      |           |
| Act Effct Green (s)     |                   | 29.4  | 59.1      |      |      | 100.0     |
| Actuated g/C Ratio      |                   | 0.29  | 0.59      |      |      | 1.00      |
| v/c Ratio               |                   | 0.92  | 0.88      |      |      | 0.28      |
| Control Delay           |                   | 52 1  | 24.2      |      |      | 0.3       |
| Oueue Delay             |                   | 0.0   | <u> </u>  |      |      | 0.0       |
| Total Delay             |                   | 52.1  | 2/1 3     |      |      | 0.0       |
| i ulai Delay            |                   | 5Z. I | 24.J      |      |      | 0.3       |

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|                                   | 1           | *          | 1          | 1         | 1          | Ŧ          |   |
|-----------------------------------|-------------|------------|------------|-----------|------------|------------|---|
| Lane Group                        | WBL         | WBR        | NBT        | NBR       | SBL        | SBT        |   |
| LOS                               |             | D          | С          |           |            | А          |   |
| Approach Delay                    | 52.1        |            | 24.3       |           |            | 0.3        |   |
| Approach LOS                      | D           |            | С          |           |            | А          |   |
| Queue Length 50th (ft)            |             | 249        | 498        |           |            | 6          |   |
| Queue Length 95th (ft)            |             | #363       | 625        |           |            | 0          |   |
| Internal Link Dist (ft)           | 384         |            | 443        |           |            | 708        |   |
| Turn Bay Length (ft)              |             |            |            |           |            |            |   |
| Base Capacity (vph)               |             | 839        | 2051       |           |            | 3282       |   |
| Starvation Cap Reductn            |             | 0          | 0          |           |            | 0          |   |
| Spillback Cap Reductn             |             | 0          | 13         |           |            | 0          |   |
| Storage Cap Reductn               |             | 0          | 0          |           |            | 0          |   |
| Reduced v/c Ratio                 |             | 0.87       | 0.88       |           |            | 0.28       |   |
| Intersection Summary              |             |            |            |           |            |            |   |
| Area Type: O                      | other       |            |            |           |            |            |   |
| Cycle Length: 100                 |             |            |            |           |            |            |   |
| Actuated Cycle Length: 100        |             |            |            |           |            |            |   |
| Offset: 61 (61%), Referenced      | l to phase  | 2:NBSB,    | Start of Y | ellow/    |            |            |   |
| Natural Cycle: 90                 |             |            |            |           |            |            |   |
| Control Type: Actuated-Coord      | dinated     |            |            |           |            |            |   |
| Maximum v/c Ratio: 0.92           |             |            |            |           |            |            |   |
| Intersection Signal Delay: 23.    | .9          |            |            | In        | tersection | LOS: C     |   |
| Intersection Capacity Utilization | on 78.8%    |            |            | IC        | CU Level c | of Service | D |
| Analysis Period (min) 15          |             |            |            |           |            |            |   |
| # 95th percentile volume ex       | ceeds cap   | bacity, qu | eue may    | be longer | r.         |            |   |
| Queue shown is maximum            | n after two | cycles.    |            |           |            |            |   |
| Splits and Phases: 6: Wash        | hington St  | reet & I-4 | 95 Off Ra  | amp       |            |            |   |



## Wrentham Business Center 1: Washington Street & Thurston Street

|                         | ≯     | -     | $\mathbf{\hat{z}}$ | 4     | -     | *    | 1     | t           | 1    | 1     | Ŧ           | ~    |
|-------------------------|-------|-------|--------------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR                | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     | 5     | î,    |                    | ሻ     | ĥ     |      | 5     | <b>≜</b> 15 |      | ሻ     | <b>≜</b> 15 |      |
| Traffic Volume (vph)    | 9     | 33    | 52                 | 130   | 27    | 25   | 45    | 899         | 55   | 116   | 1991        | 13   |
| Future Volume (vph)     | 9     | 33    | 52                 | 130   | 27    | 25   | 45    | 899         | 55   | 116   | 1991        | 13   |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900               | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Lane Width (ft)         | 12    | 12    | 12                 | 12    | 12    | 12   | 12    | 12          | 12   | 12    | 12          | 12   |
| Grade (%)               |       | 2%    |                    |       | -3%   |      |       | 0%          |      |       | 0%          |      |
| Storage Length (ft)     | 0     |       | 0                  | 0     |       | 0    | 255   |             | 0    | 270   |             | 0    |
| Storage Lanes           | 1     |       | 0                  | 1     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25    |       |                    | 25    |       |      | 25    |             |      | 25    |             |      |
| Satd, Flow (prot)       | 1581  | 1586  | 0                  | 1832  | 1748  | 0    | 1671  | 3544        | 0    | 1805  | 3536        | 0    |
| Flt Permitted           | 0.720 |       |                    | 0.697 |       |      | 0.950 |             |      | 0.950 |             |      |
| Satd, Flow (perm)       | 1199  | 1586  | 0                  | 1344  | 1748  | 0    | 1671  | 3544        | 0    | 1805  | 3536        | 0    |
| Right Turn on Red       |       |       | Yes                |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd. Flow (RTOR)       |       | 57    |                    |       | 27    |      |       | 11          |      |       | 1           |      |
| Link Speed (mph)        |       | 30    |                    |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |       | 204   |                    |       | 338   |      |       | 3010        |      |       | 582         |      |
| Travel Time (s)         |       | 4.6   |                    |       | 7.7   |      |       | 37.3        |      |       | 7.2         |      |
| Confl. Peds. (#/hr)     |       |       |                    |       |       |      |       |             |      |       |             |      |
| Confl. Bikes (#/hr)     |       |       |                    |       |       |      |       |             |      |       |             | 1    |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92               | 0.92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92  | 0.92        | 0.92 |
| Growth Factor           | 100%  | 100%  | 100%               | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%        | 100% |
| Heavy Vehicles (%)      | 13%   | 12%   | 5%                 | 0%    | 0%    | 5%   | 8%    | 1%          | 0%   | 0%    | 2%          | 0%   |
| Bus Blockages (#/hr)    | 0     | 0     | 0                  | 0     | 0     | 0    | 0     | 0           | 0    | 0     | 0           | 0    |
| Parking (#/hr)          | -     | -     | -                  | -     | -     | -    | -     | -           | -    | -     | -           |      |
| Mid-Block Traffic (%)   |       | 0%    |                    |       | 0%    |      |       | 0%          |      |       | 0%          |      |
| Shared Lane Traffic (%) |       |       |                    |       | - / - |      |       |             |      |       |             |      |
| Lane Group Flow (vph)   | 10    | 93    | 0                  | 141   | 56    | 0    | 49    | 1037        | 0    | 126   | 2178        | 0    |
| Turn Type               | Perm  | NA    |                    | Perm  | NA    |      | Prot  | NA          |      | Prot  | NA          | -    |
| Protected Phases        | -     | 4     |                    | -     | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Permitted Phases        | 4     |       |                    | 8     |       |      |       |             |      |       |             |      |
| Detector Phase          | 4     | 4     |                    | 8     | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Switch Phase            |       |       |                    |       |       |      |       |             |      |       |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |                    | 6.0   | 6.0   |      | 6.0   | 30.0        |      | 6.0   | 30.0        |      |
| Minimum Split (s)       | 11.0  | 11.0  |                    | 11.0  | 11.0  |      | 12.0  | 36.0        |      | 12.0  | 36.0        |      |
| Total Split (s)         | 20.0  | 20.0  |                    | 20.0  | 20.0  |      | 13.0  | 64.0        |      | 16.0  | 67.0        |      |
| Total Split (%)         | 20.0% | 20.0% |                    | 20.0% | 20.0% |      | 13.0% | 64.0%       |      | 16.0% | 67.0%       |      |
| Yellow Time (s)         | 3.0   | 3.0   |                    | 3.0   | 3.0   |      | 4.0   | 4.0         |      | 4.0   | 4.0         |      |
| All-Red Time (s)        | 2.0   | 2.0   |                    | 2.0   | 2.0   |      | 2.0   | 2.0         |      | 2.0   | 2.0         |      |
| Lost Time Adjust (s)    | 0.0   | 0.0   |                    | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     | 5.0   | 5.0   |                    | 5.0   | 5.0   |      | 6.0   | 6.0         |      | 6.0   | 6.0         |      |
| Lead/Lag                |       |       |                    |       |       |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |       |       |                    |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None  | None  |                    | None  | None  |      | None  | C-Max       |      | None  | C-Max       |      |
| Act Effct Green (s)     | 13.6  | 13.6  |                    | 13.6  | 13.6  |      | 6.8   | 59.8        |      | 9.6   | 65.0        |      |
| Actuated g/C Ratio      | 0.14  | 0.14  |                    | 0.14  | 0.14  |      | 0.07  | 0.60        |      | 0.10  | 0.65        |      |
| v/c Ratio               | 0.06  | 0.35  |                    | 0.77  | 0.21  |      | 0.43  | 0.49        |      | 0.73  | 0.95        |      |
| Control Delay           | 37.7  | 21.5  |                    | 68.8  | 25.0  |      | 57.5  | 13.2        |      | 68.4  | 28.5        |      |
| Queue Delay             | 0.0   | 0.0   |                    | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             | 37.7  | 21.5  |                    | 68.8  | 25.0  |      | 57.5  | 13.2        |      | 68.4  | 28.5        |      |

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## Wrentham Business Center 1: Washington Street & Thurston Street

|   | ۶  | -          | $\mathbf{F}$ | 4           | -          | •          | 1    | Ť    | 1   | 1    | ţ    | ~   |
|---|--|------------|--------------|-------------|------------|------------|------|------|-----|------|------|-----|
| Lane Group                                | EBL  | EBT        | EBR          | WBL         | WBT        | WBR        | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| LOS                                       | D  | С          |              | E           | С          |            | E    | В    |     | Е    | С    |     |
| Approach Delay                            |  | 23.1       |              |             | 56.4       |            |      | 15.2 |     |      | 30.7 |     |
| Approach LOS                              |  | С          |              |             | E          |            |      | В    |     |      | С    |     |
| Queue Length 50th (ft)                    | 6  | 20         |              | 86          | 16         |            | 23   | 235  |     | 79   | ~704 |     |
| Queue Length 95th (ft)                    | 21   | 66         |              | #175        | 52         |            | m55  | 312  |     | #164 | #913 |     |
| Internal Link Dist (ft)                   |  | 124        |              |             | 258        |            |      | 2930 |     |      | 502  |     |
| Turn Bay Length (ft)                      |  |            |              |             |            |            | 255  |      |     | 270  |      |     |
| Base Capacity (vph)                       | 179  | 286        |              | 201         | 285        |            | 116  | 2123 |     | 180  | 2298 |     |
| Starvation Cap Reductn                    | 0  | 0          |              | 0           | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn                     | 0  | 0          |              | 0           | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn                       | 0  | 0          |              | 0           | 0          |            | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio                         | 0.06   | 0.33       |              | 0.70        | 0.20       |            | 0.42 | 0.49 |     | 0.70 | 0.95 |     |
| Intersection Summary                      |  |            |              |             |            |            |      |      |     |      |      |     |
| Area Type:                                | Other  |            |              |             |            |            |      |      |     |      |      |     |
| Cycle Length: 100                         |  |            |              |             |            |            |      |      |     |      |      |     |
| Actuated Cycle Length: 100                |  |            |              |             |            |            |      |      |     |      |      |     |
| Offset: 0 (0%), Referenced t              | to phase 2:I   | NBT and    | 6:SBT, St    | tart of Gre | een        |            |      |      |     |      |      |     |
| Natural Cycle: 90                         |  |            |              |             |            |            |      |      |     |      |      |     |
| Control Type: Actuated-Coo                | ordinated  |            |              |             |            |            |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.95                   |  |            |              |             |            |            |      |      |     |      |      |     |
| Intersection Signal Delay: 2              | 7.3  |            |              | In          | tersectior | LOS: C     |      |      |     |      |      |     |
| Intersection Capacity Utiliza             | tion 88.5%   |            |              | IC          | U Level o  | of Service | E    |      |     |      |      |     |
| Analysis Period (min) 15                  |  |            |              |             |            |            |      |      |     |      |      |     |
| <ul> <li>Volume exceeds capaci</li> </ul> | ty, queue is   | theoretic  | ally infinit | te.         |            |            |      |      |     |      |      |     |
| Queue shown is maximu                     | m after two  | cycles.    |              |             |            |            |      |      |     |      |      |     |
| # 95th percentile volume e                | exceeds cap  | bacity, qu | eue may      | be longer   | •          |            |      |      |     |      |      |     |
| Queue shown is maximum after two cycles.  |  |            |              |             |            |            |      |      |     |      |      |     |
| m Volume for 95th percen                  | tile queue is  | s metered  | l by upstr   | eam sign    | al.        |            |      |      |     |      |      |     |
| Splits and Phases: 1: Wa                  | plits and Phases: 1: Washington Street & Thurston Street |            |              |             |            |            |      |      |     |      |      |     |

| Ø1   |          | <br>Ø4  |  |
|------|----------|---------|--|
| 16 s | 64s      | 20 s    |  |
| ▲ ø5 | ₩ Ø6 (R) | ₩<br>Ø8 |  |
| 13 s | 67 s     | 20 s    |  |

## Wrentham Business Center

2: Washington Street & Hawes Street/Commerce Boulevard

|                         | ≯      | -     | $\mathbf{r}$ | 4     | -     | •    | 1     | Ť           | 1    | 1     | Ŧ           | -    |
|-------------------------|--------|-------|--------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL    | EBT   | EBR          | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     |        | 4     |              | 5     | 1.    |      | 5     | <b>≜1</b> . |      | 5     | <b>≜1</b> ⊾ |      |
| Traffic Volume (vph)    | 0      | 1     | 18           | 133   | 0     | 61   | 14    | 928         | 74   | 96    | 2095        | 9    |
| Future Volume (vph)     | 0      | 1     | 18           | 133   | 0     | 61   | 14    | 928         | 74   | 96    | 2095        | 9    |
| Ideal Flow (vphpl)      | 1900   | 1900  | 1900         | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Lane Width (ft)         | 12     | 12    | 12           | 12    | 12    | 12   | 12    | 12          | 12   | 12    | 12          | 12   |
| Grade (%)               |        | -4%   |              |       | 1%    |      |       | -1%         |      |       | 1%          |      |
| Storage Length (ft)     | 0      | .,.   | 0            | 0     | . , • | 0    | 0     | . / •       | 0    | 0     | .,.         | 0    |
| Storage Lanes           | 0      |       | 0            | 1     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25     |       | -            | 25    |       | -    | 25    |             |      | 25    |             | -    |
| Satd. Flow (prot)       | 0      | 1686  | 0            | 1761  | 1575  | 0    | 1680  | 3486        | 0    | 1761  | 3553        | 0    |
| Flt Permitted           | •      |       | •            | 0.744 |       | •    | 0.064 |             | · ·  | 0.204 |             | •    |
| Satd, Flow (perm)       | 0      | 1686  | 0            | 1379  | 1575  | 0    | 113   | 3486        | 0    | 378   | 3553        | 0    |
| Right Turn on Red       | •      |       | Yes          |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd. Flow (RTOR)       |        | 20    |              |       | 196   |      |       | 13          |      |       | 1           |      |
| Link Speed (mph)        |        | 30    |              |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |        | 141   |              |       | 266   |      |       | 1704        |      |       | 143         |      |
| Travel Time (s)         |        | 32    |              |       | 60    |      |       | 21.1        |      |       | 1.8         |      |
| Confl Peds (#/hr)       |        | 0.2   |              |       | 0.0   |      |       |             |      |       | 1.0         |      |
| Confl Bikes (#/hr)      |        |       |              |       |       |      |       |             |      |       |             | 1    |
| Peak Hour Factor        | 0 92   | 0.92  | 0 92         | 0.92  | 0 92  | 0 92 | 0.92  | 0.92        | 0 92 | 0.92  | 0 92        | 0.92 |
| Growth Eactor           | 100%   | 100%  | 100%         | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%        | 100% |
| Heavy Vehicles (%)      | 0%     | 2%    | 0%           | 2%    | 2%    | 2%   | 8%    | 3%          | 2%   | 2%    | 1%          | 0%   |
| Bus Blockages (#/br)    | 0      | 0     | 0            | 2,0   | 0     | 0    | 0     | 0           | 0    | 2,0   | 0           | 0    |
| Parking (#/hr)          | Ŭ      | Ű     | Ū            | Ū     | Ŭ     | Ű    | Ŭ     | Ū           | Ŭ    | Ū     | Ŭ           | Ū    |
| Mid-Block Traffic (%)   |        | 0%    |              |       | 0%    |      |       | 0%          |      |       | 0%          |      |
| Shared Lane Traffic (%) |        | 0,0   |              |       | 0,0   |      |       | 0,0         |      |       | 0,0         |      |
| Lane Group Flow (vph)   | 0      | 21    | 0            | 145   | 66    | 0    | 15    | 1089        | 0    | 104   | 2287        | 0    |
| Turn Type               | Ŭ      | NA    | Ű            | Perm  | NA    | Ű    | pm+pt | NA          | Ű    | pm+pt | NA          | Ű    |
| Protected Phases        |        | 4     |              |       | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Permitted Phases        | 4      |       |              | 8     | Ŭ     |      | 2     | _           |      | 6     | Ŭ           |      |
| Detector Phase          | 4      | 4     |              | 8     | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Switch Phase            |        |       |              | Ū     | •     |      | •     |             |      |       | •           |      |
| Minimum Initial (s)     | 6.0    | 6.0   |              | 6.0   | 6.0   |      | 6.0   | 10.0        |      | 6.0   | 10.0        |      |
| Minimum Split (s)       | 12.0   | 12.0  |              | 12.0  | 12.0  |      | 12.0  | 16.0        |      | 12.0  | 16.0        |      |
| Total Split (s)         | 20.0   | 20.0  |              | 20.0  | 20.0  |      | 12.0  | 62.0        |      | 18.0  | 68.0        |      |
| Total Split (%)         | 20.0%  | 20.0% |              | 20.0% | 20.0% |      | 12.0% | 62.0%       |      | 18.0% | 68.0%       |      |
| Yellow Time (s)         | 4.0    | 4.0   |              | 4.0   | 4.0   |      | 5.0   | 5.0         |      | 5.0   | 5.0         |      |
| All-Red Time (s)        | 2.0    | 2.0   |              | 2.0   | 2.0   |      | 1.0   | 1.0         |      | 1.0   | 1.0         |      |
| Lost Time Adjust (s)    |        | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     |        | 6.0   |              | 6.0   | 6.0   |      | 6.0   | 6.0         |      | 6.0   | 6.0         |      |
| Lead/Lag                |        |       |              |       | 0.0   |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |        |       |              |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None   | None  |              | None  | None  |      | None  | C-Min       |      | None  | C-Min       |      |
| Act Effct Green (s)     | Tionio | 13.2  |              | 13.2  | 13.2  |      | 68.9  | 64 1        |      | 73.2  | 70.0        |      |
| Actuated g/C Ratio      |        | 0.13  |              | 0.13  | 0.13  |      | 0.69  | 0.64        |      | 0.73  | 0.70        |      |
| v/c Ratio               |        | 0.09  |              | 0.80  | 0.18  |      | 0.09  | 0.49        |      | 0.28  | 0.92        |      |
| Control Delay           |        | 17.2  |              | 73.0  | 1.0   |      | 5.6   | 10.3        |      | 2.1   | 9.8         |      |
| Queue Delay             |        | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             |        | 17.2  |              | 73.0  | 1.0   |      | 5.6   | 10.3        |      | 2.1   | 9.8         |      |

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## Wrentham Business Center

2: Washington Street & Hawes Street/Commerce Boulevard

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|-----------------------------------|---|------------|--------------|------------|------------|------------|------|------|-----|------|-------|-----|
| Lane Group                        | EBL   | EBT        | EBR          | WBL        | WBT        | WBR        | NBL  | NBT  | NBR | SBL  | SBT   | SBR |
| LOS                               |   | В          |              | E          | А          |            | А    | В    |     | А    | А     |     |
| Approach Delay                    |   | 17.2       |              |            | 50.5       |            |      | 10.3 |     |      | 9.4   |     |
| Approach LOS                      |   | В          |              |            | D          |            |      | В    |     |      | А     |     |
| Queue Length 50th (ft)            |   | 1          |              | 90         | 0          |            | 3    | 127  |     | 6    | 69    |     |
| Queue Length 95th (ft)            |   | 22         |              | #189       | 0          |            | m7   | 161  |     | m7   | m#913 |     |
| Internal Link Dist (ft)           |   | 61         |              |            | 186        |            |      | 1624 |     |      | 63    |     |
| Turn Bay Length (ft)              |   |            |              |            |            |            |      |      |     |      |       |     |
| Base Capacity (vph)               |   | 253        |              | 193        | 389        |            | 172  | 2239 |     | 448  | 2488  |     |
| Starvation Cap Reductn            |   | 0          |              | 0          | 0          |            | 0    | 0    |     | 0    | 0     |     |
| Spillback Cap Reductn             |   | 0          |              | 0          | 0          |            | 0    | 0    |     | 0    | 0     |     |
| Storage Cap Reductn               |   | 0          |              | 0          | 0          |            | 0    | 0    |     | 0    | 0     |     |
| Reduced v/c Ratio                 |   | 0.08       |              | 0.75       | 0.17       |            | 0.09 | 0.49 |     | 0.23 | 0.92  |     |
| Intersection Summary              |   |            |              |            |            |            |      |      |     |      |       |     |
| Area Type: Of                     | ther  |            |              |            |            |            |      |      |     |      |       |     |
| Cycle Length: 100                 |   |            |              |            |            |            |      |      |     |      |       |     |
| Actuated Cycle Length: 100        |   |            |              |            |            |            |      |      |     |      |       |     |
| Offset: 42 (42%), Referenced      | to phase  | 2:NBTL a   | nd 6:SBT     | L, Start o | of Green   |            |      |      |     |      |       |     |
| Natural Cycle: 90                 |   |            |              |            |            |            |      |      |     |      |       |     |
| Control Type: Actuated-Coord      | linated   |            |              |            |            |            |      |      |     |      |       |     |
| Maximum v/c Ratio: 0.92           |   |            |              |            |            |            |      |      |     |      |       |     |
| Intersection Signal Delay: 12.7   | 1   |            |              | In         | tersection | LOS: B     |      |      |     |      |       |     |
| Intersection Capacity Utilization | on 92.2%  |            |              | IC         | U Level c  | of Service | F    |      |     |      |       |     |
| Analysis Period (min) 15          |   |            |              |            |            |            |      |      |     |      |       |     |
| # 95th percentile volume exe      | ceeds cap   | pacity, qu | eue may      | be longer  | ſ.         |            |      |      |     |      |       |     |
| Queue shown is maximum            | after two   | cycles.    |              |            |            |            |      |      |     |      |       |     |
| m Volume for 95th percentile      | e queue is  | s meterec  | by upstro    | eam sign   | al.        |            |      |      |     |      |       |     |
| Splits and Phases: 2: Wash        | Splits and Phases: 2: Washington Street & Hawes Street/Commerce Boulevard |            |              |            |            |            |      |      |     |      |       |     |

| Ø1   | ↓          | <u>_</u> |  |
|------|------------|----------|--|
| 18 s | 62 s       | 20 s     |  |
| ▲ Ø5 | ₩ 20 € (R) | ₩Ø8      |  |
| 12 s | 68 s       | 20 s     |  |

## Wrentham Business Center 3: Washington Street & Madison Street

| Lane Group         EBL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SBL         SBT         SBF           Lane Configurations         1         1         213         14         1         3         178         976         5         4         2160         65           Future Volume (vph)         37         1         213         14         1         3         178         976         5         4         2160         65           future Volume (vph)         37         1         213         14         1         3         178         976         5         4         2160         65           Ideal Flow (vphpl)         1900            |
|--|
| Lane ConfigurationsIII   |
| Traffic Volume (vph)       37       1       213       14       1       3       178       976       5       4       2160       6         Future Volume (vph)       37       1       213       14       1       3       178       976       5       4       2160       6         Ideal Flow (vph)       1900   |
| Future Volume (vph)       37       1       213       14       1       3       178       976       5       4       2160       65         Ideal Flow (vphpl)       1900   |
| Ideal Flow (vphpl)       1900       1  |
| Lane Width (ft)       12       13       12       12       13       12       13       13       13       13       13       13       13       14 </td  |
| Grade (%)       -5%       2%       2%       2%       -4%         Storage Length (ft)       309       0       0       0       562       0       274       480         Storage Lanes       0       1       0       0       1       0       1       480         Storage Lanes       0       1       0       1       0       1       0       1       480         Taper Length (ft)       25       25       25       25       25       25       25       25       25          |
| Storage Length (ft)       309       0       0       0       562       0       274       480         Storage Lanes       0       1       0       0       1       0       1       0       1 </td   |
| Storage Lanes         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         1         7 <th7< th="">         7         <th7< th=""> <th< td=""></th<></th7<></th7<>  |
| Taper Length (ft)         25         25         25         25           Satd. Flow (prot)         0         1856         1623         0         1715         0         1752         3467         0         1473         3610         1584           Flt Permitted         0.760         0.744         0.950         0.950         0         950         0           Satd. Flow (perm)         0         1480         1623         0         1327         0         1752         3467         0         1473         3610         1584           Right Turn on Red         Yes                |
| Satd. Flow (prot)         0         1856         1623         0         1715         0         1752         3467         0         1473         3610         1584           Flt Permitted         0.760         0.744         0.950         0.950         0.950         0         1884           Satd. Flow (perm)         0         1480         1623         0         1327         0         1752         3467         0         1473         3610         1584           Satd. Flow (perm)         0         1480         1623         0         1327         0         1752         3467         0         1473         3610         1584           Right Turn on Red         Yes         Yes       |
| Fit Permitted       0.760       0.744       0.950       0.950         Satd. Flow (perm)       0       1480       1623       0       1327       0       1752       3467       0       1473       3610       1584         Right Turn on Red       Yes       Yes       Yes       Yes       Yes       Yes       Yes         Satd. Flow (RTOR)       38       3       1       120         Link Speed (mph)       30       30       55       55         Link Distance (ff)       359       496       788       1704  |
| Satd. Flow (perm)         0         1480         1623         0         1327         0         1752         3467         0         1473         3610         1584           Right Turn on Red         Yes         Ye |
| Right Turn on Red         Yes         Yes    |
| Satd. Flow (RTOR)         38         3         1         120           Link Speed (mph)         30         30         55         55           Link Distance (ff)         359         496         788         1704  |
| Link Speed (mph) 30 30 55 55   |
| Link Distance (ff) 359 406 788 1704  |
|  |
| Travel Time (s) 8.2 11.3 9.8 21.1  |
| Confl. Peds. (#/hr)  |
| Confl. Bikes (#/hr)  |
| Peak Hour Factor 0.92 0.92 0.92 0.92 0.92 0.92 0.92 0.92   |
| Growth Factor 100% 100% 100% 100% 100% 100% 100% 100   |
| Heavy Vehicles (%) 0% 0% 2% 15% 0% 33% 2% 3% 0% 25% 2% 4%  |
| Bus Blockages (#/hr) 0 0 0 0 0 0 0 0 0 0 0 0 0 0   |
| Parking (#/hr)   |
| Mid-Block Traffic (%) 0% 0% 0%   |
| Shared Lane Traffic (%)  |
| Lane Group Flow (vph) 0 41 232 0 19 0 193 1066 0 4 2348 73   |
| Turn Type Perm NA pt+ov Perm NA Prot NA Prot NA Prot   |
| Protected Phases 4 4 5 8 5 2 1 6 6   |
| Permitted Phases 4 8   |
| Detector Phase 4 4 5 8 8 5 2 1 6 6   |
| Switch Phase   |
| Minimum Initial (s) 6.0 6.0 6.0 6.0 10.0 10.0 6.0 10.0 10.0  |
| Minimum Split (s) 13.0 13.0 13.0 13.0 17.5 16.5 13.0 16.5 16.5   |
| Total Split (s) 17.0 17.0 17.0 17.0 21.0 69.0 14.0 62.0 62.0   |
| Total Split (%) 17.0% 17.0% 17.0% 17.0% 21.0% 69.0% 14.0% 62.0% 62.0%  |
| Yellow Time (s) 4.0 4.0 4.0 4.0 4.5 5.0 4.5 5.0 5.0  |
| All-Red Time (s) 3.0 3.0 3.0 3.0 3.0 1.5 2.5 1.5 1.5   |
| Lost Time Adjust (s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0   |
| Total Lost Time (s) 7.0 7.0 7.5 6.5 7.0 6.5 6.5  |
| Lead/Lag Lead Lag Lead Lag Lag   |
| Lead-Lag Optimize? Yes Yes Yes Yes Yes Yes   |
| Recall Mode None None None None O-Min None C-Min C-Min   |
| Act Effct Green (s) 7.6 22.8 7.3 12.9 84.1 6.0 63.7 63.7   |
| Actuated g/C Ratio 0.08 0.23 0.07 0.13 0.84 0.06 0.64 0.64   |
| v/c Ratio 0.37 0.58 0.19 0.86 0.37 0.05 1.02 0.07  |
| Control Delay 52.6 32.9 42.2 76.8 3.0 39.0 35.0 1.2  |
| Queue Delay 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.   |
| Total Delay 52.6 32.9 42.2 76.8 3.0 39.0 35.0 1.4  |

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## Wrentham Business Center <u>3: Washington Street & Madison Street</u>

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|-------------------------------|---------------|----------------|-----------------------|------------|------------|-------------|--------|------|-----|------|-------|------|
| Lane Group                    | EBL           | EBT            | EBR                   | WBL        | WBT        | WBR         | NBL    | NBT  | NBR | SBL  | SBT   | SBR  |
| LOS                           |               | D              | С                     |            | D          |             | E      | А    |     | D    | D     | A    |
| Approach Delay                |               | 35.8           |                       |            | 42.2       |             |        | 14.3 |     |      | 34.0  |      |
| Approach LOS                  |               | D              |                       |            | D          |             |        | В    |     |      | С     |      |
| Queue Length 50th (ft)        |               | 25             | 101                   |            | 10         |             | 126    | 48   |     | 3    | ~901  | 0    |
| Queue Length 95th (ft)        |               | 59             | 168                   |            | 32         |             | #243   | 138  |     | m3   | #1072 | m0   |
| Internal Link Dist (ft)       |               | 279            |                       |            | 416        |             |        | 708  |     |      | 1624  |      |
| Turn Bay Length (ft)          |               |                |                       |            |            |             | 562    |      |     | 274  |       | 480  |
| Base Capacity (vph)           |               | 148            | 408                   |            | 135        |             | 236    | 2916 |     | 103  | 2299  | 1052 |
| Starvation Cap Reductn        |               | 0              | 0                     |            | 0          |             | 0      | 0    |     | 0    | 0     | 0    |
| Spillback Cap Reductn         |               | 0              | 0                     |            | 0          |             | 0      | 0    |     | 0    | 0     | 0    |
| Storage Cap Reductn           |               | 0              | 0                     |            | 0          |             | 0      | 0    |     | 0    | 0     | 0    |
| Reduced v/c Ratio             |               | 0.28           | 0.57                  |            | 0.14       |             | 0.82   | 0.37 |     | 0.04 | 1.02  | 0.07 |
| Intersection Summary          |               |                |                       |            |            |             |        |      |     |      |       |      |
| Area Type:                    | Other         |                |                       |            |            |             |        |      |     |      |       |      |
| Cycle Length: 100             |               |                |                       |            |            |             |        |      |     |      |       |      |
| Actuated Cycle Length: 100    |               |                |                       |            |            |             |        |      |     |      |       |      |
| Offset: 0 (0%), Referenced t  | to phase 2:N  | <b>IBT</b> and | 6:SBT, S <sup>-</sup> | tart of Ye | llow, Mast | ter Interse | ection |      |     |      |       |      |
| Natural Cycle: 120            |               |                |                       |            |            |             |        |      |     |      |       |      |
| Control Type: Actuated-Coo    | ordinated     |                |                       |            |            |             |        |      |     |      |       |      |
| Maximum v/c Ratio: 1.02       |               |                |                       |            |            |             |        |      |     |      |       |      |
| Intersection Signal Delay: 2  | 7.9           |                |                       | In         | tersection | LOS: C      |        |      |     |      |       |      |
| Intersection Capacity Utiliza | tion 95.0%    |                |                       | IC         | U Level c  | of Service  | F      |      |     |      |       |      |
| Analysis Period (min) 15      |               |                |                       |            |            |             |        |      |     |      |       |      |
| ~ Volume exceeds capaci       | ty, queue is  | theoretic      | ally infinit          | te.        |            |             |        |      |     |      |       |      |
| Queue shown is maximu         | m after two   | cycles.        |                       |            |            |             |        |      |     |      |       |      |
| # 95th percentile volume e    | exceeds cap   | acity, qu      | eue may               | be longer  |            |             |        |      |     |      |       |      |
| Queue shown is maximu         | m after two   | cycles.        |                       |            |            |             |        |      |     |      |       |      |
| m Volume for 95th percen      | tile queue is | metered        | l by upstr            | eam sign   | al.        |             |        |      |     |      |       |      |
| Splits and Phases: 3: Wa      | shington Str  | reet & Ma      | idison Str            | reet       |            |             |        |      |     |      |       |      |



## Wrentham Business Center 6: Washington Street & I-495 Off Ramp

|                         | -    | •     | <b>†</b>  | 1    | 1    | Ŧ            |
|-------------------------|------|-------|-----------|------|------|--------------|
| Lane Group              | WBL  | WBR   | NBT       | NBR  | SBL  | SBT          |
| Lane Configurations     |      | ##    | **        |      | 500  | **           |
| Traffic Volume (vnh)    | 0    | 390   | 769       | 0    | 0    | 2387         |
| Future Volume (vph)     | 0    | 390   | 760       | 0    | 0    | 2387         |
| Ideal Flow (vphpl)      | 1000 | 1000  | 100       | 1900 | 1900 | 1000         |
| Lane Width (ff)         | 1900 | 1300  | 100       | 100  | 100  | 1300         |
|                         | 12   | 12    | ۲۲<br>۵۵/ | 12   | 12   | 12           |
| Storage Longth (ft)     | 0%   | 0     | Z70       | 0    | 0    | 0%           |
| Storage Length (II)     | 0    | 0     |           | 0    | 0    |              |
| Storage Lanes           | 0    | 2     |           | U    | 0    |              |
| Taper Length (π)        | 25   | 0700  | 2504      | 0    | 25   | 2520         |
| Satd. Flow (prot)       | U    | 2760  | 3504      | U    | 0    | 3539         |
| Fit Permitted           |      | 0700  | 0504      | ^    | •    | 0500         |
| Satd. Flow (perm)       | 0    | 2760  | 3504      | 0    | 0    | 3539         |
| Right Turn on Red       |      | No    |           | No   |      |              |
| Satd. Flow (RTOR)       |      |       |           |      |      |              |
| Link Speed (mph)        | 25   |       | 55        |      |      | 50           |
| Link Distance (ft)      | 464  |       | 523       |      |      | 788          |
| Travel Time (s)         | 12.7 |       | 6.5       |      |      | 10.7         |
| Confl. Peds. (#/hr)     |      |       |           |      |      |              |
| Confl. Bikes (#/hr)     |      |       |           |      |      |              |
| Peak Hour Factor        | 0.92 | 0.92  | 0.92      | 0.92 | 0.92 | 0.92         |
| Growth Factor           | 100% | 100%  | 100%      | 100% | 100% | 100%         |
| Heavy Vehicles (%)      | 0%   | 3%    | 2%        | 0%   | 2%   | 2%           |
| Bus Blockages (#/hr)    | 0    | 0     | 0         | 0    | 0    | 0            |
| Parking (#/hr)          | •    | Ţ     | •         | •    | •    | · ·          |
| Mid-Block Traffic (%)   | 0%   |       | 0%        |      |      | 0%           |
| Shared Lane Traffic (%) | 0,0  |       | 0 /0      |      |      | 0 /0         |
| Lane Group Flow (vph)   | Λ    | 121   | 836       | 0    | Ο    | 2505         |
|                         | U    | Prot  | NΔ        | U    | U    | 2000<br>NA   |
| Protected Phases        |      | ρ     | אוז<br>ר  |      |      | אוז<br>2 פ ר |
|                         |      | 0     | 2         |      |      | 20           |
| Permilleu Pridses       |      | 0     | 0         |      |      |              |
| Delector Phase          |      | 8     | 2         |      |      |              |
| Switch Phase            |      | 0.0   | 40.0      |      |      |              |
| Minimum Initial (s)     |      | 6.0   | 10.0      |      |      |              |
| Minimum Split (s)       |      | 11.0  | 16.5      |      |      |              |
| Total Split (s)         |      | 40.0  | 60.0      |      |      |              |
| Total Split (%)         |      | 40.0% | 60.0%     |      |      |              |
| Yellow Time (s)         |      | 3.5   | 5.0       |      |      |              |
| All-Red Time (s)        |      | 1.5   | 1.5       |      |      |              |
| Lost Time Adjust (s)    |      | 0.0   | 0.0       |      |      |              |
| Total Lost Time (s)     |      | 5.0   | 6.5       |      |      |              |
| Lead/Lag                |      |       |           |      |      |              |
| Lead-Lag Optimize?      |      |       |           |      |      |              |
| Recall Mode             |      | None  | C-Min     |      |      |              |
| Act Effct Green (s)     |      | 20.0  | 68.5      |      |      | 100.0        |
| Actuated g/C Ratio      |      | 0.20  | 0.68      |      |      | 1 00         |
| v/c Ratio               |      | 0.20  | 0.00      |      |      | 0.72         |
| Control Delay           |      | 17 0  | 7.5       |      |      | 5.2          |
|                         |      | 41.Z  | C.1       |      |      | 5.Z          |
| Queue Delay             |      | 0.0   | 0.0       |      |      | 0.0          |
| I otal Delay            |      | 47.2  | 7.5       |      |      | 5.2          |

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|-------------------------------|---------------|------------|------------|----------|------------|--------------|--|
| Lane Group                    | WBL           | WBR        | NBT        | NBR      | SBL        | SBT          |  |
| LOS                           |               | D          | А          |          |            | А            |  |
| Approach Delay                | 47.2          |            | 7.5        |          |            | 5.2          |  |
| Approach LOS                  | D             |            | А          |          |            | А            |  |
| Queue Length 50th (ft)        |               | 146        | 102        |          |            | 118          |  |
| Queue Length 95th (ft)        |               | 190        | 162        |          |            | m139         |  |
| Internal Link Dist (ft)       | 384           |            | 443        |          |            | 708          |  |
| Turn Bay Length (ft)          |               |            |            |          |            |              |  |
| Base Capacity (vph)           |               | 966        | 2401       |          |            | 3539         |  |
| Starvation Cap Reductn        |               | 0          | 0          |          |            | 0            |  |
| Spillback Cap Reductn         |               | 0          | 0          |          |            | 0            |  |
| Storage Cap Reductn           |               | 0          | 0          |          |            | 0            |  |
| Reduced v/c Ratio             |               | 0.44       | 0.35       |          |            | 0.73         |  |
| Intersection Summary          |               |            |            |          |            |              |  |
| Area Type:                    | Other         |            |            |          |            |              |  |
| Cycle Length: 100             |               |            |            |          |            |              |  |
| Actuated Cycle Length: 100    |               |            |            |          |            |              |  |
| Offset: 71 (71%), Reference   | ed to phase   | 2:NBSB,    | Start of Y | 'ellow   |            |              |  |
| Natural Cycle: 40             |               |            |            |          |            |              |  |
| Control Type: Actuated-Coo    | ordinated     |            |            |          |            |              |  |
| Maximum v/c Ratio: 0.77       |               |            |            |          |            |              |  |
| Intersection Signal Delay: 10 | 0.3           |            |            | In       | tersection | n LOS: B     |  |
| Intersection Capacity Utiliza | tion 71.4%    |            |            | IC       | U Level o  | of Service C |  |
| Analysis Period (min) 15      |               |            |            |          |            |              |  |
| m Volume for 95th percent     | tile queue is | s metered  | l by upstr | eam sign | al.        |              |  |
| Splits and Phases: 6: Was     | shington Sti  | reet & I-4 | 95 Off Ra  | amp      |            |              |  |

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| 60 s |   | 40 | ls l      |

## Wrentham Business Center 1: Washington Street & Thurston Street

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|-------------------------|-------|-------|--------------|-------|-------|------|-------|-------------|------|------------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR          | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL        | SBT         | SBR  |
| Lane Configurations     | 5     | î,    |              | 5     | 1.    |      | 5     | <b>≜1</b> 5 |      | 5          | <b>≜1</b> 5 |      |
| Traffic Volume (vph)    | 9     | 15    | 35           | 94    | 13    | 19   | 45    | 1162        | 59   | 92         | 918         | 9    |
| Future Volume (vph)     | 9     | 15    | 35           | 94    | 13    | 19   | 45    | 1162        | 59   | 92         | 918         | 9    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900         | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900       | 1900        | 1900 |
| Lane Width (ft)         | 12    | 12    | 12           | 12    | 12    | 12   | 12    | 12          | 12   | 12         | 12          | 12   |
| Grade (%)               |       | 2%    |              |       | -3%   |      |       | 0%          |      |            | 0%          |      |
| Storage Length (ft)     | 0     |       | 0            | 0     |       | 0    | 255   |             | 0    | 270        |             | 0    |
| Storage Lanes           | 1     |       | 0            | 1     |       | 0    | 1     |             | 0    | 1          |             | 0    |
| Taper Length (ft)       | 25    |       |              | 25    |       |      | 25    |             |      | 25         |             |      |
| Satd. Flow (prot)       | 1787  | 1682  | 0            | 1832  | 1755  | 0    | 1805  | 3537        | 0    | 1736       | 3571        | 0    |
| Flt Permitted           | 0.734 |       |              | 0.722 |       |      | 0.950 |             |      | 0.950      |             |      |
| Satd. Flow (perm)       | 1381  | 1682  | 0            | 1392  | 1755  | 0    | 1805  | 3537        | 0    | 1736       | 3571        | 0    |
| Right Turn on Red       |       |       | Yes          |       |       | Yes  |       |             | Yes  |            |             | Yes  |
| Satd. Flow (RTOR)       |       | 38    |              |       | 21    |      |       | 7           |      |            | 2           |      |
| Link Speed (mph)        |       | 30    |              |       | 30    |      |       | 55          |      |            | 55          |      |
| Link Distance (ft)      |       | 204   |              |       | 338   |      |       | 3010        |      |            | 582         |      |
| Travel Time (s)         |       | 4.6   |              |       | 7.7   |      |       | 37.3        |      |            | 7.2         |      |
| Confl. Peds. (#/hr)     |       |       |              |       |       |      |       |             |      |            |             |      |
| Confl. Bikes (#/hr)     |       |       |              |       |       |      |       |             |      |            |             |      |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92         | 0.92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92       | 0.92        | 0.92 |
| Growth Factor           | 100%  | 100%  | 100%         | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%       | 100%        | 100% |
| Heavy Vehicles (%)      | 0%    | 0%    | 0%           | 0%    | 0%    | 0%   | 0%    | 1%          | 8%   | 4%         | 1%          | 0%   |
| Bus Blockages (#/hr)    | 0     | 0     | 0            | 0     | 0     | 0    | 0     | 0           | 0    | 0          | 0           | 0    |
| Parking (#/hr)          |       |       |              |       |       |      |       |             |      |            |             |      |
| Mid-Block Traffic (%)   |       | 0%    |              |       | 0%    |      |       | 0%          |      |            | 0%          |      |
| Shared Lane Traffic (%) |       |       |              |       |       |      |       |             |      |            |             |      |
| Lane Group Flow (vph)   | 10    | 54    | 0            | 102   | 35    | 0    | 49    | 1327        | 0    | 100        | 1008        | 0    |
| Turn Type               | Perm  | NA    |              | Perm  | NA    |      | Prot  | NA          |      | Prot       | NA          |      |
| Protected Phases        |       | 4     |              |       | 8     |      | 5     | 2           |      | 1          | 6           |      |
| Permitted Phases        | 4     |       |              | 8     |       |      |       |             |      |            |             |      |
| Detector Phase          | 4     | 4     |              | 8     | 8     |      | 5     | 2           |      | 1          | 6           |      |
| Switch Phase            |       |       |              |       |       |      |       |             |      |            |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |              | 6.0   | 6.0   |      | 6.0   | 30.0        |      | 6.0        | 30.0        |      |
| Minimum Split (s)       | 11.0  | 11.0  |              | 11.0  | 11.0  |      | 12.0  | 36.0        |      | 12.0       | 36.0        |      |
| Total Split (s)         | 25.0  | 25.0  |              | 25.0  | 25.0  |      | 15.0  | 47.0        |      | 18.0       | 50.0        |      |
| Total Split (%)         | 27.8% | 27.8% |              | 27.8% | 27.8% |      | 16.7% | 52.2%       |      | 20.0%      | 55.6%       |      |
| Yellow Time (s)         | 3.0   | 3.0   |              | 3.0   | 3.0   |      | 4.0   | 4.0         |      | 4.0        | 4.0         |      |
| All-Red Time (s)        | 2.0   | 2.0   |              | 2.0   | 2.0   |      | 2.0   | 2.0         |      | 2.0        | 2.0         |      |
| Lost Time Adjust (s)    | 0.0   | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0        | 0.0         |      |
| Total Lost Time (s)     | 5.0   | 5.0   |              | 5.0   | 5.0   |      | 6.0   | 6.0         |      | 6.0        | 6.0         |      |
| Lead/Lag                |       |       |              |       |       |      | Lead  | Lag         |      | Lead       | Lag         |      |
| Lead-Lag Optimize?      |       |       |              |       |       |      | Yes   | Yes         |      | Yes        | Yes         |      |
| Recall Mode             | None  | None  |              | None  | None  |      | None  | C-Max       |      | None       | C-Max       |      |
| Act Effct Green (s)     | 11.7  | 11.7  |              | 11.9  | 11.9  |      | 7.7   | 57.2        |      | 9.9        | 61.9        |      |
| Actuated g/C Ratio      | 0.13  | 0.13  |              | 0.13  | 0.13  |      | 0.09  | 0.64        |      | 0.11       | 0.69        |      |
| v/c Ratio               | 0.06  | 0.21  |              | 0.56  | 0.14  |      | 0.32  | 0.59        |      | 0.52       | 0.41        |      |
| Control Delay           | 32.2  | 17.2  |              | 47.3  | 19.8  |      | 30.2  | 19.5        |      | 47.3       | 10.0        |      |
| Queue Delay             | 0.0   | 0.0   |              | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0        | 0.0         |      |
| Total Delay             | 32.2  | 17.2  |              | 47.3  | 19.8  |      | 30.2  | 19.5        |      | 47.3       | 10.0        |      |

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## Wrentham Business Center 1: Washington Street & Thurston Street

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|--|----------------|-----------|--------------|--------------|------------|----------|------|------|-----|------|------|-----|
| Lane Group   | EBL            | EBT       | EBR          | WBL          | WBT        | WBR      | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| LOS  | С              | В         |              | D            | В          |          | С    | В    |     | D    | А    |     |
| Approach Delay   |                | 19.6      |              |              | 40.3       |          |      | 19.8 |     |      | 13.3 |     |
| Approach LOS   |                | В         |              |              | D          |          |      | В    |     |      | В    |     |
| Queue Length 50th (ft)   | 5              | 8         |              | 55           | 7          |          | 28   | 171  |     | 54   | 157  |     |
| Queue Length 95th (ft)   | 19             | 39        |              | 100          | 32         |          | m39  | 448  |     | 103  | 245  |     |
| Internal Link Dist (ft)  |                | 124       |              |              | 258        |          |      | 2930 |     |      | 502  |     |
| Turn Bay Length (ft)   |                |           |              |              |            |          | 255  |      |     | 270  |      |     |
| Base Capacity (vph)  | 306            | 403       |              | 309          | 406        |          | 180  | 2251 |     | 231  | 2458 |     |
| Starvation Cap Reductn   | 0              | 0         |              | 0            | 0          |          | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn  | 0              | 0         |              | 0            | 0          |          | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn  | 0              | 0         |              | 0            | 0          |          | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio  | 0.03           | 0.13      |              | 0.33         | 0.09       |          | 0.27 | 0.59 |     | 0.43 | 0.41 |     |
| Intersection Summary   |                |           |              |              |            |          |      |      |     |      |      |     |
| Area Type:   | Other          |           |              |              |            |          |      |      |     |      |      |     |
| Cycle Length: 90   |                |           |              |              |            |          |      |      |     |      |      |     |
| Actuated Cycle Length: 90                                      |                |           |              |              |            |          |      |      |     |      |      |     |
| Offset: 49 (54%), Referenc                                     | ed to phase    | 2:NBT ar  | nd 6:SBT,    | , Start of ( | Green      |          |      |      |     |      |      |     |
| Natural Cycle: 60  |                |           |              |              |            |          |      |      |     |      |      |     |
| Control Type: Actuated-Co                                      | ordinated      |           |              |              |            |          |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.59  |                |           |              |              |            |          |      |      |     |      |      |     |
| Intersection Signal Delay: 1                                   | 18.2           |           |              | In           | tersectior | n LOS: B |      |      |     |      |      |     |
| Intersection Capacity Utilization 65.1% ICU Level of Service C |                |           |              |              |            |          |      |      |     |      |      |     |
| Analysis Period (min) 15                                       |                |           |              |              |            |          |      |      |     |      |      |     |
| m Volume for 95th percer                                       | ntile queue is | s metereo | l by upstr   | eam sign     | al.        |          |      |      |     |      |      |     |

### Splits and Phases: 1: Washington Street & Thurston Street

| Ø1        |         | <br>Ø4         |
|-----------|---------|----------------|
| 18 s      | 47 s    | 25 s           |
| ▲ ø5      | ♥Ø6 (R) | <b>↓</b><br>Ø8 |
| 15 s 50 s | S       | 25 s           |

## Wrentham Business Center

2: Washington Street & Hawes Street/Commerce Boulevard

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|-------------------------|-------|-------|---------------|-------|-------|------|-------|-------------|------|-------|-------------|------|
| Lane Group              | EBL   | EBT   | EBR           | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT         | SBR  |
| Lane Configurations     |       | 44    |               | 5     | ĥ     |      | 5     | <b>≜t</b> ⊾ |      | 5     | <b>≜</b> 16 |      |
| Traffic Volume (vph)    | 0     | 1     | 18            | 71    | 0     | 75   | 12    | 1213        | 130  | 78    | 989         | 1    |
| Future Volume (vph)     | 0     | 1     | 18            | 71    | 0     | 75   | 12    | 1213        | 130  | 78    | 989         | 1    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900          | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900        | 1900 |
| Lane Width (ft)         | 12    | 12    | 12            | 12    | 12    | 12   | 12    | 12          | 12   | 12    | 12          | 12   |
| Grade (%)               |       | -4%   |               |       | 1%    |      |       | -1%         |      |       | 1%          |      |
| Storage Length (ft)     | 0     |       | 0             | 0     |       | 0    | 0     |             | 0    | 0     |             | 0    |
| Storage Lanes           | 0     |       | 0             | 1     |       | 0    | 1     |             | 0    | 1     |             | 0    |
| Taper Length (ft)       | 25    |       |               | 25    |       |      | 25    |             |      | 25    |             |      |
| Satd. Flow (prot)       | 0     | 1574  | 0             | 1796  | 1575  | 0    | 1814  | 3538        | 0    | 1796  | 3556        | 0    |
| Flt Permitted           |       |       |               | 0.744 |       |      | 0.950 |             |      | 0.950 |             |      |
| Satd. Flow (perm)       | 0     | 1574  | 0             | 1403  | 1575  | 0    | 1814  | 3538        | 0    | 1795  | 3556        | 0    |
| Right Turn on Red       |       |       | Yes           |       |       | Yes  |       |             | Yes  |       |             | Yes  |
| Satd. Flow (RTOR)       |       | 20    |               |       | 157   |      |       | 20          |      |       |             |      |
| Link Speed (mph)        |       | 30    |               |       | 30    |      |       | 55          |      |       | 55          |      |
| Link Distance (ft)      |       | 141   |               |       | 266   |      |       | 1704        |      |       | 143         |      |
| Travel Time (s)         |       | 3.2   |               |       | 6.0   |      |       | 21.1        |      |       | 1.8         |      |
| Confl. Peds. (#/hr)     |       |       | 1             | 1     |       |      |       |             | 1    | 1     |             |      |
| Confl. Bikes (#/hr)     |       |       |               |       |       |      |       |             |      |       |             |      |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92          | 0.92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92  | 0.92        | 0.92 |
| Growth Factor           | 100%  | 100%  | 100%          | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%        | 100% |
| Heavy Vehicles (%)      | 2%    | 2%    | 6%            | 0%    | 2%    | 2%   | 0%    | 1%          | 0%   | 0%    | 1%          | 0%   |
| Bus Blockages (#/hr)    | 0     | 0     | 0             | 0     | 0     | 0    | 0     | 0           | 0    | 0     | 0           | 0    |
| Parking (#/hr)          |       |       |               |       |       |      |       |             |      |       |             |      |
| Mid-Block Traffic (%)   |       | 0%    |               |       | 0%    |      |       | 0%          |      |       | 0%          |      |
| Shared Lane Traffic (%) |       |       |               |       |       |      |       |             |      |       |             |      |
| Lane Group Flow (vph)   | 0     | 21    | 0             | 77    | 82    | 0    | 13    | 1459        | 0    | 85    | 1076        | 0    |
| Turn Type               |       | NA    |               | Perm  | NA    |      | Prot  | NA          |      | Prot  | NA          |      |
| Protected Phases        |       | 4     |               |       | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Permitted Phases        | 4     |       |               | 8     |       |      |       |             |      |       |             |      |
| Detector Phase          | 4     | 4     |               | 8     | 8     |      | 5     | 2           |      | 1     | 6           |      |
| Switch Phase            |       |       |               |       |       |      |       |             |      |       |             |      |
| Minimum Initial (s)     | 6.0   | 6.0   |               | 6.0   | 6.0   |      | 6.0   | 10.0        |      | 6.0   | 10.0        |      |
| Minimum Split (s)       | 12.0  | 12.0  |               | 12.0  | 12.0  |      | 12.0  | 16.0        |      | 12.0  | 16.0        |      |
| Total Split (s)         | 18.0  | 18.0  |               | 18.0  | 18.0  |      | 12.0  | 56.0        |      | 16.0  | 60.0        |      |
| Total Split (%)         | 20.0% | 20.0% |               | 20.0% | 20.0% |      | 13.3% | 62.2%       |      | 17.8% | 66.7%       |      |
| Yellow Time (s)         | 4.0   | 4.0   |               | 4.0   | 4.0   |      | 5.0   | 5.0         |      | 5.0   | 5.0         |      |
| All-Red Time (s)        | 2.0   | 2.0   |               | 2.0   | 2.0   |      | 1.0   | 1.0         |      | 1.0   | 1.0         |      |
| Lost Time Adjust (s)    |       | 0.0   |               | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Lost Time (s)     |       | 6.0   |               | 6.0   | 6.0   |      | 6.0   | 6.0         |      | 6.0   | 6.0         |      |
| Lead/Lag                |       |       |               |       |       |      | Lead  | Lag         |      | Lead  | Lag         |      |
| Lead-Lag Optimize?      |       |       |               |       |       |      | Yes   | Yes         |      | Yes   | Yes         |      |
| Recall Mode             | None  | None  |               | None  | None  |      | None  | C-Min       |      | None  | C-Min       |      |
| Act Effct Green (s)     |       | 9.2   |               | 9.2   | 9.2   |      | 6.0   | 60.5        |      | 8.3   | 70.0        |      |
| Actuated g/C Ratio      |       | 0.10  |               | 0.10  | 0.10  |      | 0.07  | 0.67        |      | 0.09  | 0.78        |      |
| v/c Ratio               |       | 0.12  |               | 0.54  | 0.27  |      | 0.11  | 0.61        |      | 0.51  | 0.39        |      |
| Control Delay           |       | 17.2  |               | 51.8  | 2.2   |      | 49.2  | 6.2         |      | 41.4  | 10.0        |      |
| Queue Delay             |       | 0.0   |               | 0.0   | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0         |      |
| Total Delay             |       | 17.2  |               | 51.8  | 2.2   |      | 49.2  | 6.2         |      | 41.4  | 10.0        |      |

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## Wrentham Business Center

2: Washington Street & Hawes Street/Commerce Boulevard

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|--|-------------|-----------|--------------|------------|------------|--------|------|------|-----|------|------|-----|
| Lane Group   | EBL         | EBT       | EBR          | WBL        | WBT        | WBR    | NBL  | NBT  | NBR | SBL  | SBT  | SBR |
| LOS  |             | В         |              | D          | А          |        | D    | А    |     | D    | В    |     |
| Approach Delay   |             | 17.2      |              |            | 26.2       |        |      | 6.6  |     |      | 12.3 |     |
| Approach LOS   |             | В         |              |            | С          |        |      | А    |     |      | В    |     |
| Queue Length 50th (ft)   |             | 1         |              | 42         | 0          |        | 8    | 68   |     | 47   | 204  |     |
| Queue Length 95th (ft)   |             | 22        |              | 85         | 1          |        | m16  | 70   |     | 94   | 273  |     |
| Internal Link Dist (ft)  |             | 61        |              |            | 186        |        |      | 1624 |     |      | 63   |     |
| Turn Bay Length (ft)   |             |           |              |            |            |        |      |      |     |      |      |     |
| Base Capacity (vph)  |             | 227       |              | 187        | 346        |        | 120  | 2384 |     | 199  | 2766 |     |
| Starvation Cap Reductn   |             | 0         |              | 0          | 0          |        | 0    | 0    |     | 0    | 0    |     |
| Spillback Cap Reductn  |             | 0         |              | 0          | 0          |        | 0    | 0    |     | 0    | 0    |     |
| Storage Cap Reductn  |             | 0         |              | 0          | 0          |        | 0    | 0    |     | 0    | 0    |     |
| Reduced v/c Ratio  |             | 0.09      |              | 0.41       | 0.24       |        | 0.11 | 0.61 |     | 0.43 | 0.39 |     |
| Intersection Summary   |             |           |              |            |            |        |      |      |     |      |      |     |
| Area Type: 0   | Other       |           |              |            |            |        |      |      |     |      |      |     |
| Cycle Length: 90   |             |           |              |            |            |        |      |      |     |      |      |     |
| Actuated Cycle Length: 90                                      |             |           |              |            |            |        |      |      |     |      |      |     |
| Offset: 45 (50%), Reference                                    | d to phase  | 2:NBT ar  | nd 6:SBT,    | Start of ( | Green      |        |      |      |     |      |      |     |
| Natural Cycle: 60  |             |           |              |            |            |        |      |      |     |      |      |     |
| Control Type: Actuated-Coor                                    | dinated     |           |              |            |            |        |      |      |     |      |      |     |
| Maximum v/c Ratio: 0.61  | -           |           |              |            |            |        |      |      |     |      |      |     |
| Intersection Signal Delay: 10                                  | .2          |           |              | In         | tersectior | LOS: B | _    |      |     |      |      |     |
| Intersection Capacity Utilization 68.3% ICU Level of Service C |             |           |              |            |            |        |      |      |     |      |      |     |
| Analysis Period (min) 15                                       |             |           |              |            |            |        |      |      |     |      |      |     |
| m Volume for 95th percent                                      | ile queue i | s meterec | l by upstr   | eam sign   | al.        |        |      |      |     |      |      |     |

### Splits and Phases: 2: Washington Street & Hawes Street/Commerce Boulevard

| Ø1   |      |             |  |
|------|------|-------------|--|
| 16 s | 56 s | 18 s        |  |
| ▲ ø5 | ↓    | <b>₩</b> Ø8 |  |
| 12 s | 60 s | 18 s        |  |

## Wrentham Business Center 3: Washington Street & Madison Street

|                         | ۶     | -     | $\mathbf{\hat{z}}$ | 4     | -     | *    | 1     | 1           | 1    | 1     | Ŧ     | ~     |
|-------------------------|-------|-------|--------------------|-------|-------|------|-------|-------------|------|-------|-------|-------|
| Lane Group              | EBL   | EBT   | EBR                | WBL   | WBT   | WBR  | NBL   | NBT         | NBR  | SBL   | SBT   | SBR   |
| Lane Configurations     |       | ្ត    | 1                  |       | 4     |      | 5     | <b>4</b> 1. |      | 5     | **    | 1     |
| Traffic Volume (vph)    | 40    | 0     | 206                | 1     | 1     | 2    | 239   | 1327        | 6    | 3     | 1003  | 54    |
| Future Volume (vph)     | 40    | 0     | 206                | 1     | 1     | 2    | 239   | 1327        | 6    | 3     | 1003  | 54    |
| Ideal Flow (vphpl)      | 1900  | 1900  | 1900               | 1900  | 1900  | 1900 | 1900  | 1900        | 1900 | 1900  | 1900  | 1900  |
| Lane Width (ft)         | 12    | 12    | 12                 | 12    | 16    | 12   | 12    | 12          | 12   | 12    | 12    | 12    |
| Grade (%)               |       | -5%   |                    |       | 2%    |      |       | 2%          |      |       | -4%   |       |
| Storage Length (ft)     | 309   |       | 0                  | 0     |       | 0    | 562   | _,,         | 0    | 274   | .,.   | 480   |
| Storage Lanes           | 0     |       | 1                  | 0     |       | 0    | 1     |             | 0    | 1     |       | 1     |
| Taper Length (ft)       | 25    |       |                    | 25    |       | -    | 25    |             | -    | 25    |       |       |
| Satd. Flow (prot)       | 0     | 1850  | 1592               | 0     | 1963  | 0    | 1769  | 3535        | 0    | 1841  | 3646  | 1615  |
| Flt Permitted           | -     |       |                    | -     | 0.901 | -    | 0.950 |             | -    | 0.950 |       |       |
| Satd. Flow (perm)       | 0     | 1947  | 1592               | 0     | 1790  | 0    | 1769  | 3535        | 0    | 1841  | 3646  | 1615  |
| Right Turn on Red       | •     |       | Yes                | •     |       | Yes  |       |             | Yes  |       |       | Yes   |
| Satd. Flow (RTOR)       |       |       | 42                 |       | 2     |      |       | 1           |      |       |       | 224   |
| Link Speed (mph)        |       | 30    | .=                 |       | 30    |      |       | 55          |      |       | 55    |       |
| Link Distance (ft)      |       | 359   |                    |       | 496   |      |       | 788         |      |       | 1704  |       |
| Travel Time (s)         |       | 82    |                    |       | 11.3  |      |       | 9.8         |      |       | 21.1  |       |
| Confl Peds (#/hr)       |       | 0.2   |                    |       | 11.0  |      |       | 0.0         |      |       |       |       |
| Confl Bikes (#/hr)      |       |       |                    |       |       |      |       |             |      |       |       |       |
| Peak Hour Factor        | 0.92  | 0.92  | 0.92               | 0.92  | 0.92  | 0.92 | 0.92  | 0.92        | 0.92 | 0.92  | 0.92  | 0.92  |
| Growth Factor           | 100%  | 100%  | 100%               | 100%  | 100%  | 100% | 100%  | 100%        | 100% | 100%  | 100%  | 100%  |
| Heavy Vehicles (%)      | 0%    | 2%    | 4%                 | 0%    | 0%    | 0%   | 1%    | 1%          | 0%   | 0%    | 1%    | 2%    |
| Bus Blockages (#/br)    | 0     | 0     | 0                  | 0     | 0     | 0    | 0     | 0           | 0    | 0     | 0     | 0     |
| Parking (#/hr)          | Ű     | Ŭ     | Ű                  | Ŭ     | Ŭ     | Ű    | Ŭ     | Ű           | Ű    | Ű     | Ű     | Ű     |
| Mid-Block Traffic (%)   |       | 0%    |                    |       | 0%    |      |       | 0%          |      |       | 0%    |       |
| Shared Lane Traffic (%) |       | 0,0   |                    |       | 0,0   |      |       | 0,0         |      |       | 0,0   |       |
| Lane Group Flow (vph)   | 0     | 43    | 224                | 0     | 4     | 0    | 260   | 1449        | 0    | 3     | 1090  | 59    |
| Turn Type               | Perm  | NA    | pt+ov              | Perm  | NA    | Ū    | Prot  | NA          | •    | Prot  | NA    | Prot  |
| Protected Phases        |       | 4     | 4 5                |       | 8     |      | 5     | 2           |      | 1     | 6     | 6     |
| Permitted Phases        | 4     |       |                    | 8     | •     |      | •     |             |      |       | Ū     |       |
| Detector Phase          | 4     | 4     | 5                  | 8     | 8     |      | 5     | 2           |      | 1     | 6     | 6     |
| Switch Phase            |       |       | Ū                  | Ţ     | •     |      | •     |             |      |       | Ū.    |       |
| Minimum Initial (s)     | 6.0   | 6.0   |                    | 6.0   | 6.0   |      | 10.0  | 10.0        |      | 6.0   | 10.0  | 10.0  |
| Minimum Split (s)       | 13.0  | 13.0  |                    | 13.0  | 13.0  |      | 17.5  | 16.5        |      | 13.0  | 16.5  | 16.5  |
| Total Split (s)         | 13.0  | 13.0  |                    | 13.0  | 13.0  |      | 31.0  | 64.0        |      | 13.0  | 46.0  | 46.0  |
| Total Split (%)         | 14.4% | 14.4% |                    | 14.4% | 14.4% |      | 34.4% | 71.1%       |      | 14.4% | 51.1% | 51.1% |
| Yellow Time (s)         | 4.0   | 4.0   |                    | 4.0   | 4.0   |      | 4.5   | 5.0         |      | 4.5   | 5.0   | 5.0   |
| All-Red Time (s)        | 3.0   | 3.0   |                    | 3.0   | 3.0   |      | 3.0   | 1.5         |      | 2.5   | 1.5   | 1.5   |
| Lost Time Adjust (s)    |       | 0.0   |                    |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0   | 0.0   |
| Total Lost Time (s)     |       | 7.0   |                    |       | 7.0   |      | 7.5   | 6.5         |      | 7.0   | 6.5   | 6.5   |
| Lead/Lag                |       |       |                    |       |       |      | Lead  | Lag         |      | Lead  | Lag   | Lag   |
| Lead-Lag Optimize?      |       |       |                    |       |       |      | Yes   | Yes         |      | Yes   | Yes   | Yes   |
| Recall Mode             | None  | None  |                    | None  | None  |      | None  | C-Min       |      | None  | C-Min | C-Min |
| Act Effct Green (s)     |       | 6.0   | 25.7               |       | 6.0   |      | 17.4  | 75.7        |      | 6.0   | 50.8  | 50.8  |
| Actuated g/C Ratio      |       | 0.07  | 0.29               |       | 0.07  |      | 0.19  | 0.84        |      | 0.07  | 0.56  | 0.56  |
| v/c Ratio               |       | 0.33  | 0.46               |       | 0.03  |      | 0.76  | 0.49        |      | 0.02  | 0.53  | 0.06  |
| Control Delay           |       | 47.5  | 22.2               |       | 33.2  |      | 53.2  | 4.3         |      | 40.3  | 9.8   | 0.3   |
| Queue Delav             |       | 0.0   | 0.0                |       | 0.0   |      | 0.0   | 0.0         |      | 0.0   | 0.0   | 0.0   |
| Total Delay             |       | 47.5  | 22.2               |       | 33.2  |      | 53.2  | 4.3         |      | 40.3  | 9.8   | 0.3   |

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## Wrentham Business Center 3: Washington Street & Madison Street

|                                | ۶             | <b>→</b> | $\mathbf{F}$ | 4           | +          | *           | 1      | Ť    | ۲   | 1    | Ļ    | ~    |
|--------------------------------|---------------|----------|--------------|-------------|------------|-------------|--------|------|-----|------|------|------|
| Lane Group                     | EBL           | EBT      | EBR          | WBL         | WBT        | WBR         | NBL    | NBT  | NBR | SBL  | SBT  | SBR  |
| LOS                            |               | D        | С            |             | С          |             | D      | А    |     | D    | А    | A    |
| Approach Delay                 |               | 26.2     |              |             | 33.3       |             |        | 11.8 |     |      | 9.4  |      |
| Approach LOS                   |               | С        |              |             | С          |             |        | В    |     |      | А    |      |
| Queue Length 50th (ft)         |               | 24       | 76           |             | 1          |             | 158    | 169  |     | 2    | 69   | 0    |
| Queue Length 95th (ft)         |               | 57       | 123          |             | 12         |             | 234    | 205  |     | m3   | 161  | 2    |
| Internal Link Dist (ft)        |               | 279      |              |             | 416        |             |        | 708  |     |      | 1624 |      |
| Turn Bay Length (ft)           |               |          |              |             |            |             | 562    |      |     | 274  |      | 480  |
| Base Capacity (vph)            |               | 129      | 589          |             | 121        |             | 461    | 2973 |     | 122  | 2057 | 1008 |
| Starvation Cap Reductn         |               | 0        | 0            |             | 0          |             | 0      | 0    |     | 0    | 0    | 0    |
| Spillback Cap Reductn          |               | 0        | 0            |             | 0          |             | 0      | 0    |     | 0    | 0    | 0    |
| Storage Cap Reductn            |               | 0        | 0            |             | 0          |             | 0      | 0    |     | 0    | 0    | 0    |
| Reduced v/c Ratio              |               | 0.33     | 0.38         |             | 0.03       |             | 0.56   | 0.49 |     | 0.02 | 0.53 | 0.06 |
| Intersection Summary           |               |          |              |             |            |             |        |      |     |      |      |      |
| Area Type: 0                   | Other         |          |              |             |            |             |        |      |     |      |      |      |
| Cycle Length: 90               |               |          |              |             |            |             |        |      |     |      |      |      |
| Actuated Cycle Length: 90      |               |          |              |             |            |             |        |      |     |      |      |      |
| Offset: 0 (0%), Referenced to  | o phase 2:NI  | BT and   | 6:SBT, Si    | tart of Yel | low, Mast  | ter Interse | ection |      |     |      |      |      |
| Natural Cycle: 60              |               |          |              |             |            |             |        |      |     |      |      |      |
| Control Type: Actuated-Coor    | dinated       |          |              |             |            |             |        |      |     |      |      |      |
| Maximum v/c Ratio: 0.76        |               |          |              |             |            |             |        |      |     |      |      |      |
| Intersection Signal Delay: 12  | 2             |          |              | Int         | tersection | LOS: B      |        |      |     |      |      |      |
| Intersection Capacity Utilizat | ion 66.0%     |          |              | IC          | U Level c  | of Service  | С      |      |     |      |      |      |
| Analysis Period (min) 15       |               |          |              |             |            |             |        |      |     |      |      |      |
| m Volume for 95th percent      | ile queue is  | metered  | l by upstr   | eam signa   | al.        |             |        |      |     |      |      |      |
| Splits and Phases: 3: Was      | shington Stre | et & Ma  | adison Str   | eet         |            |             |        |      |     |      |      |      |

| Ø1           | ∮ø₂ (R)         | • | <i>↓</i> <sub>Ø4</sub> |
|--------------|-----------------|---|------------------------|
| 13 s         | 64 s            |   | 13 s                   |
| <b>\$</b> Ø5 | <b>↓</b> Ø6 (R) | • | ₩ø8                    |
| 31 s         | 46 s            |   | 13 s                   |

| 4             | ×  | 1  | ۲   | 5  | Ļ   |
|---------------|--|--|---|--|---|
| WRI           | WRR  | NRT  | NRR   | SBI  | SBT   |
|               | ##   |  | RDI   |  |   |
| 0             | 501  | 081  | ٥   | 0  | 1211  |
| 0             | 501  | 0.001  | 0   | 0  | 1211  |
| 1000          | 1000   | 1000   | 1000  | 1000   | 1000  |
| 1900          | 1900   | 1900   | 1900  | 1900   | 1900  |
| 12            | IZ   | 12   | IZ  | IZ   | 12  |
| 0%            | 0  | 2%   | 0   | 0  | 0%  |
| 0             | 0  |  | 0   | 0  |   |
| 0             | 2  |  | 0   | 0  |   |
| 25            |  |  |   | 25   |   |
| 0             | 2814   | 3539   | 0   | 0  | 3539  |
|               |  |  |   |  |   |
| 0             | 2814   | 3539   | 0   | 0  | 3539  |
|               | No   |  | No  |  |   |
|               |  |  |   |  |   |
| 25            |  | 55   |   |  | 50  |
| 464           |  | 523  |   |  | 788   |
| 12.7          |  | 6.5  |   |  | 10.7  |
|               |  |  |   |  |   |
|               |  |  |   |  |   |
| 0.92          | 0 92   | 0 92   | 0 02  | 0 02   | 0.92  |
| 100%          | 100%   | 100%   | 100%  | 100%   | 100%  |
| 100 /0<br>20/ | 100 /0   | 100 /0   | 20/   | 20/  | 100 /o<br>20/   |
| 2%            | 1%   | 170  | 2%  | 2%   | 2%  |
| 0             | 0  | 0  | 0   | 0  | 0   |
| 0.01          |  | 00/  |   |  | 0.0/  |
| 0%            |  | 0%   |   |  | 0%  |
|               |  |  |   |  |   |
| 0             | 642  | 1066   | 0   | 0  | 1316  |
|               | Prot   | NA   |   |  | NA  |
|               | 8  | 2  |   |  | 28  |
|               |  |  |   |  |   |
|               | 8  | 2  |   |  |   |
|               |  |  |   |  |   |
|               | 6.0  | 10.0   |   |  |   |
|               | 11.0   | 16.5   |   |  |   |
|               | 39.0   | 51.0   |   |  |   |
|               | 43.3%  | 56.7%  |   |  |   |
|               | -0.070<br>2 5  | 5.0  |   |  |   |
|               | 1.5  | 1.5  |   |  |   |
|               | 1.0  | C.T  |   |  |   |
|               | 0.0  | 0.0  |   |  |   |
|               | 5.0  | 6.5  |   |  |   |
|               |  |  |   |  |   |
|               |  |  |   |  |   |
|               | None   | C-Min  |   |  |   |
|               | 25.3   | 53.2   |   |  | 90.0  |
|               | 0.28   | 0.59   |   |  | 1.00  |
|               | 0.81   | 0.51   |   |  | 0.37  |
|               | 0.01   |  |   |  |   |
|               | 38.7   | 12.6   |   |  | 0.5   |
|               | 38.7<br>0.0  | 12.6<br>0.0  |   |  | 0.5<br>0.0  |
|               | WBL         0         1900         12         0%         0         25         0         25         464         12.7         0.92         100%         2%         0.92         100%         2%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0         0%         0%         0%         0%         0%         0%         1%         1%         1% | WBL         WBR           0         591           0         591           0         591           0         1900           1900         1900           12         12           0%         0           0         0           0         2814           0         2814           0         2814           0         2814           0         2814           0         2814           0         2814           0         2814           0         2814           0         2814           0         2814           0         2814           0         0.92           100%         100%           2%         1%           0         0           0%         0           0%         0           0%         0           0%         0           0%         0           0%         0           0%         0           0%         0           0%         0           0% | WBL         WBR         NBT           0         591         981           0         591         981           0         591         981           0         591         981           1900         1900         1900           12         12         12           0%         2%         0           0         0         2%           0         0         2%           0         0         2%           0         0         2%           0         2814         3539           0         2814         3539           0         2814         3539           0         2814         3539           0         2814         3539           0         2814         3539           0         2814         3539           0         2814         3539           0         2814         3539           12.7         6.5         55           464         523         10%           0         0         0         0           0%         0%         0%         0%     < | WBL         WBR         NBT         NBR           0         591         981         0           0         591         981         0           0         591         981         0           1900         1900         1900         1900           1900         1900         1900         1900           12         12         12         12           0%         2%         0         0           0         0         2%         0           0         2814         3539         0           0         2814         3539         0           0         2814         3539         0           0         2814         3539         0           0         2814         3539         0           10         2814         3539         0           12         -         -         -           10         2814         3539         0           12.7         6.5         -         -           0.92         0.92         0.92         0.92           100%         100%         100%           2% | WBL         WBR         NBT         NBR         SBL           Image: Sele strain of the sele strain |

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|                                | 1           | •          | 1           | 1   | 1           | .↓           |   |
|--------------------------------|-------------|------------|-------------|-----|-------------|--------------|---|
| Lane Group                     | WBL         | WBR        | NBT         | NBR | SBL         | SBT          |   |
| LOS                            |             | D          | В           |     |             | А            |   |
| Approach Delay                 | 38.7        |            | 12.6        |     |             | 0.5          |   |
| Approach LOS                   | D           |            | В           |     |             | А            |   |
| Queue Length 50th (ft)         |             | 192        | 172         |     |             | 9            |   |
| Queue Length 95th (ft)         |             | 238        | 266         |     |             | 0            |   |
| Internal Link Dist (ft)        | 384         |            | 443         |     |             | 708          |   |
| Turn Bay Length (ft)           |             |            |             |     |             |              |   |
| Base Capacity (vph)            |             | 1063       | 2093        |     |             | 3539         |   |
| Starvation Cap Reductn         |             | 0          | 0           |     |             | 0            |   |
| Spillback Cap Reductn          |             | 0          | 0           |     |             | 0            |   |
| Storage Cap Reductn            |             | 0          | 0           |     |             | 0            |   |
| Reduced v/c Ratio              |             | 0.60       | 0.51        |     |             | 0.37         |   |
| Intersection Summary           |             |            |             |     |             |              |   |
| Area Type:                     | Other       |            |             |     |             |              |   |
| Cycle Length: 90               |             |            |             |     |             |              |   |
| Actuated Cycle Length: 90      |             |            |             |     |             |              |   |
| Offset: 1 (1%), Referenced t   | o phase 2:  | NBSB, St   | art of Yell | ow  |             |              |   |
| Natural Cycle: 50              |             |            |             |     |             |              |   |
| Control Type: Actuated-Cool    | rdinated    |            |             |     |             |              |   |
| Maximum v/c Ratio: 0.81        |             |            |             |     |             |              |   |
| Intersection Signal Delay: 12  | 2.9         |            |             | Ir  | itersection | LOS: B       |   |
| Intersection Capacity Utilizat | tion 57.4%  |            |             | IC  | CU Level o  | of Service E | } |
| Analysis Period (min) 15       |             |            |             |     |             |              |   |
| Splits and Phases: 6: Was      | shinaton St | reet & I-4 | 95 Off Ra   | amp |             |              |   |
|                                | <u> </u>    |            |             | ľ   |             |              | 3 |

Appendix C Greenhouse Gas Analysis Appendices A – C for Wrentham Business Center Lots 1 & 3, August 2023, Tech Environmental

## **APPENDIX** A

## EQUEST MODEL OUTPUT





Heat Rejection

Space Cooling

#### Electric Consumption (kWh x000)

Task Lighting

Misc. Equipment

|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul    | Aug    | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.05  | 1.23  | 12.00 | 28.37 | 48.05  | 42.01  | 24.38 | 4.81  | 0.68  | 0.19  | 161.77 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -      | -      | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -      | -      | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -      | -      | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -      | -      | -     | -     | -     | -     | -      |
| Hot Water     | 12.60 | 11.78 | 13.07 | 12.44 | 12.00 | 10.80 | 10.42  | 9.97   | 9.61  | 10.32 | 10.68 | 11.86 | 135.55 |
| Vent. Fans    | 4.81  | 4.34  | 4.71  | 4.49  | 4.62  | 4.47  | 4.62   | 4.62   | 4.47  | 4.62  | 4.50  | 4.78  | 55.05  |
| Pumps & Aux.  | 0.94  | 0.85  | 0.94  | 0.90  | 0.91  | 0.87  | 0.90   | 0.90   | 0.87  | 0.91  | 0.90  | 0.94  | 10.84  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -      | -      | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11   | 3.11   | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -      | -      | -     | -     | -     | -     | -      |
| Area Lights   | 39.79 | 35.94 | 39.79 | 38.51 | 39.79 | 38.51 | 39.79  | 39.79  | 38.51 | 39.79 | 38.51 | 39.79 | 468.55 |
| Total         | 61.26 | 55.72 | 61.68 | 60.58 | 72.44 | 86.03 | 106.90 | 100.41 | 80.86 | 63.57 | 58.29 | 60.67 | 868.43 |

Pumps & Aux.

Ventilation Fans

Ht Pump Supp.

Space Heating

|               | Jan   | Feb   | Mar   | Apr   | Мау  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 772.7 | 652.4 | 545.7 | 288.0 | 47.9 | 0.2 | -   | -   | 1.2 | 73.4 | 376.0 | 632.9 | 3,390.3 |
| HP Supp.      | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 772.7 | 652.4 | 545.7 | 288.0 | 47.9 | 0.2 | -   | -   | 1.2 | 73.4 | 376.0 | 632.9 | 3,390.3 |



Misc. Equipment



Heat Rejection

Space Cooling

#### Electric Consumption (kWh x000)

|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.05  | 1.02  | 9.77  | 21.85 | 34.99 | 31.73 | 19.78 | 4.42  | 0.53  | 0.20  | 124.34 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 9.44  | 8.83  | 9.80  | 9.33  | 9.00  | 8.10  | 7.82  | 7.48  | 7.21  | 7.74  | 8.01  | 8.88  | 101.62 |
| Vent. Fans    | 4.50  | 4.06  | 4.48  | 4.33  | 4.47  | 4.33  | 4.47  | 4.47  | 4.33  | 4.47  | 4.33  | 4.49  | 52.72  |
| Pumps & Aux.  | 0.90  | 0.82  | 0.90  | 0.87  | 0.87  | 0.84  | 0.87  | 0.87  | 0.84  | 0.88  | 0.87  | 0.90  | 10.42  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 18.13 | 16.37 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 213.45 |
| Total         | 36.09 | 32.90 | 36.47 | 36.10 | 45.36 | 55.67 | 69.39 | 65.79 | 52.71 | 38.74 | 34.29 | 35.72 | 539.23 |

Ventilation Fans

Ht Pump Supp.

Space Heating

|               | Jan   | Feb   | Mar   | Apr   | Мау  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 393.8 | 325.2 | 259.9 | 120.5 | 17.0 | -   | -   | -   | -   | 22.7 | 186.5 | 325.4 | 1,651.1 |
| HP Supp.      | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 393.8 | 325.2 | 259.9 | 120.5 | 17.0 | -   | -   | -   | -   | 22.7 | 186.5 | 325.4 | 1,651.1 |



# Gas Consumption (Btu) 400 300 200 100 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Refrigeration

Heat Rejection

Space Cooling

#### Electric Consumption (kWh x000)

|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.05  | 1.02  | 9.77  | 21.83 | 34.92 | 31.69 | 19.79 | 4.44  | 0.53  | 0.20  | 124.25 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 9.44  | 8.83  | 9.80  | 9.33  | 9.00  | 8.10  | 7.82  | 7.48  | 7.21  | 7.74  | 8.00  | 8.88  | 101.62 |
| Vent. Fans    | 4.50  | 4.06  | 4.48  | 4.33  | 4.47  | 4.33  | 4.47  | 4.47  | 4.33  | 4.47  | 4.33  | 4.49  | 52.71  |
| Pumps & Aux.  | 0.90  | 0.82  | 0.90  | 0.87  | 0.87  | 0.84  | 0.87  | 0.87  | 0.84  | 0.88  | 0.87  | 0.90  | 10.42  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 18.13 | 16.37 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 213.45 |
| Total         | 36.09 | 32.89 | 36.47 | 36.10 | 45.36 | 55.65 | 69.32 | 65.75 | 52.72 | 38.76 | 34.29 | 35.72 | 539.12 |

|               | Jan   | Feb   | Mar   | Apr   | May  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -     | -    | -   |     | -   | -   | -    | -     |       | -       |
| Heat Reject.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 379.2 | 312.3 | 248.8 | 113.9 | 15.4 | -   | -   | -   | -   | 20.6 | 177.5 | 312.3 | 1,580.0 |
| HP Supp.      | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 379.2 | 312.3 | 248.8 | 113.9 | 15.4 | -   | -   | -   | -   | 20.6 | 177.5 | 312.3 | 1,580.0 |





Refrigeration

Heat Rejection

Space Cooling

#### Electric Consumption (kWh x000)

|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.05  | 1.03  | 9.79  | 21.86 | 34.96 | 31.73 | 19.79 | 4.43  | 0.53  | 0.20  | 124.38 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 9.44  | 8.83  | 9.80  | 9.33  | 9.00  | 8.10  | 7.82  | 7.48  | 7.21  | 7.74  | 8.01  | 8.88  | 101.62 |
| Vent. Fans    | 4.50  | 4.06  | 4.48  | 4.33  | 4.47  | 4.33  | 4.47  | 4.47  | 4.33  | 4.47  | 4.33  | 4.49  | 52.72  |
| Pumps & Aux.  | 0.90  | 0.82  | 0.90  | 0.87  | 0.87  | 0.84  | 0.87  | 0.87  | 0.84  | 0.88  | 0.87  | 0.90  | 10.42  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 18.13 | 16.37 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 213.45 |
| Total         | 36.09 | 32.90 | 36.47 | 36.10 | 45.38 | 55.68 | 69.36 | 65.78 | 52.72 | 38.76 | 34.29 | 35.72 | 539.27 |

|               | Jan   | Feb   | Mar   | Apr   | May  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 383.1 | 315.2 | 251.3 | 114.9 | 15.6 | -   | -   | -   | -   | 21.0 | 180.0 | 315.7 | 1,597.0 |
| HP Supp.      | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 383.1 | 315.2 | 251.3 | 114.9 | 15.6 | -   | -   | -   | -   | 21.0 | 180.0 | 315.7 | 1,597.0 |



|               | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.04  | 0.94  | 8.96  | 20.13 | 32.24 | 29.28 | 18.27 | 4.10  | 0.49  | 0.19  | 114.64 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 9.44  | 8.83  | 9.80  | 9.33  | 9.00  | 8.10  | 7.82  | 7.48  | 7.21  | 7.74  | 8.01  | 8.88  | 101.62 |
| Vent. Fans    | 4.17  | 3.77  | 4.16  | 4.02  | 4.15  | 4.02  | 4.15  | 4.15  | 4.02  | 4.15  | 4.02  | 4.17  | 48.93  |
| Pumps & Aux.  | 0.83  | 0.75  | 0.83  | 0.79  | 0.80  | 0.77  | 0.79  | 0.79  | 0.77  | 0.80  | 0.79  | 0.82  | 9.52   |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 18.13 | 16.37 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 213.45 |
| Total         | 35.69 | 32.53 | 36.07 | 35.63 | 44.15 | 53.56 | 66.24 | 62.94 | 50.82 | 38.03 | 33.87 | 35.31 | 524.84 |

|               | Jan   | Feb   | Mar   | Apr  | May  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 327.3 | 271.1 | 212.8 | 94.1 | 10.4 | -   | -   | -   | -   | 11.0 | 142.5 | 264.9 | 1,334.1 |
| HP Supp.      | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 327.3 | 271.1 | 212.8 | 94.1 | 10.4 | -   | -   | -   | -   | 11.0 | 142.5 | 264.9 | 1,334.1 |



|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.04  | 0.89  | 8.10  | 18.29 | 29.61 | 26.84 | 16.59 | 3.63  | 0.47  | 0.18  | 104.63 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 9.44  | 8.83  | 9.80  | 9.33  | 9.00  | 8.10  | 7.82  | 7.48  | 7.21  | 7.74  | 8.01  | 8.88  | 101.64 |
| Vent. Fans    | 4.04  | 3.65  | 4.02  | 3.88  | 4.01  | 3.88  | 4.01  | 4.01  | 3.88  | 4.01  | 3.89  | 4.03  | 47.33  |
| Pumps & Aux.  | 0.79  | 0.72  | 0.79  | 0.76  | 0.76  | 0.73  | 0.76  | 0.76  | 0.73  | 0.77  | 0.76  | 0.79  | 9.14   |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 18.13 | 16.37 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 213.45 |
| Total         | 35.52 | 32.38 | 35.90 | 35.42 | 43.12 | 51.57 | 63.44 | 60.34 | 48.98 | 37.39 | 33.68 | 35.13 | 512.86 |

|               | Jan   | Feb   | Mar   | Apr   | Мау  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 335.1 | 289.8 | 243.9 | 133.5 | 28.0 | 0.3 | -   | -   | -   | 25.6 | 155.5 | 271.3 | 1,483.0 |
| HP Supp.      | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 335.1 | 289.8 | 243.9 | 133.5 | 28.0 | 0.3 | -   | -   | -   | 25.6 | 155.5 | 271.3 | 1,483.0 |



Misc. Equipment



Heat Rejection

Space Cooling

#### Electric Consumption (kWh x000)

|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.05  | 1.02  | 9.77  | 21.85 | 34.99 | 31.73 | 19.78 | 4.42  | 0.53  | 0.20  | 124.34 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | 0.28  | 0.24  | 0.22  | 0.14  | 0.02  | -     | -     | -     | -     | 0.03  | 0.18  | 0.26  | 1.38   |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 9.44  | 8.83  | 9.80  | 9.33  | 9.00  | 8.10  | 7.82  | 7.48  | 7.21  | 7.74  | 8.01  | 8.88  | 101.62 |
| Vent. Fans    | 4.50  | 4.06  | 4.48  | 4.33  | 4.47  | 4.33  | 4.47  | 4.47  | 4.33  | 4.47  | 4.33  | 4.49  | 52.72  |
| Pumps & Aux.  | 1.02  | 0.92  | 1.02  | 0.98  | 0.99  | 0.95  | 0.98  | 0.98  | 0.95  | 1.00  | 0.98  | 1.02  | 11.81  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 18.13 | 16.37 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 213.45 |
| Total         | 36.49 | 33.25 | 36.81 | 36.36 | 45.50 | 55.79 | 69.50 | 65.91 | 52.82 | 38.90 | 34.59 | 36.10 | 542.00 |

Ventilation Fans

Ht Pump Supp.

Space Heating

|               | Jan   | Feb   | Mar   | Apr  | Мау  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 340.9 | 279.5 | 217.3 | 95.4 | 12.0 | -   | -   | -   | -   | 15.7 | 153.1 | 278.2 | 1,392.1 |
| HP Supp.      | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 340.9 | 279.5 | 217.3 | 95.4 | 12.0 | -   | -   | -   | -   | 15.7 | 153.1 | 278.2 | 1,392.1 |





Refrigeration

Heat Rejection

Space Cooling

#### Electric Consumption (kWh x000)

|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.05  | 1.02  | 9.68  | 21.68 | 34.74 | 31.49 | 19.59 | 4.36  | 0.53  | 0.20  | 123.35 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 9.44  | 8.83  | 9.80  | 9.33  | 9.00  | 8.10  | 7.82  | 7.48  | 7.21  | 7.74  | 8.01  | 8.88  | 101.63 |
| Vent. Fans    | 4.50  | 4.06  | 4.48  | 4.32  | 4.47  | 4.32  | 4.47  | 4.47  | 4.32  | 4.47  | 4.33  | 4.49  | 52.70  |
| Pumps & Aux.  | 0.90  | 0.82  | 0.90  | 0.87  | 0.87  | 0.84  | 0.87  | 0.87  | 0.84  | 0.88  | 0.87  | 0.90  | 10.41  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 15.48 | 13.98 | 15.48 | 14.98 | 15.48 | 14.98 | 15.48 | 15.48 | 14.98 | 15.48 | 14.98 | 15.48 | 182.21 |
| Total         | 33.44 | 30.50 | 33.82 | 33.53 | 42.62 | 52.93 | 66.48 | 62.89 | 49.96 | 36.03 | 31.72 | 33.07 | 506.98 |

|               | Jan   | Feb   | Mar   | Apr   | May  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 403.2 | 334.3 | 269.7 | 129.6 | 19.5 | -   | -   | -   | -   | 26.9 | 196.7 | 335.8 | 1,715.7 |
| HP Supp.      | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 403.2 | 334.3 | 269.7 | 129.6 | 19.5 | -   | -   | -   | -   | 26.9 | 196.7 | 335.8 | 1,715.7 |



|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.05  | 1.02  | 9.77  | 21.85 | 34.99 | 31.73 | 19.78 | 4.42  | 0.53  | 0.20  | 124.34 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 4.65  | 4.23  | 4.68  | 4.50  | 4.58  | 4.36  | 4.46  | 4.43  | 4.28  | 4.46  | 4.38  | 4.59  | 53.60  |
| Vent. Fans    | 4.50  | 4.06  | 4.48  | 4.33  | 4.47  | 4.33  | 4.47  | 4.47  | 4.33  | 4.47  | 4.33  | 4.49  | 52.72  |
| Pumps & Aux.  | 0.90  | 0.82  | 0.90  | 0.87  | 0.87  | 0.84  | 0.87  | 0.87  | 0.84  | 0.88  | 0.87  | 0.90  | 10.42  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 18.13 | 16.37 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 18.13 | 17.54 | 18.13 | 17.54 | 18.13 | 213.45 |
| Total         | 31.30 | 28.30 | 31.35 | 31.28 | 40.93 | 51.94 | 66.02 | 62.74 | 49.78 | 35.47 | 30.67 | 31.43 | 491.21 |

|               | Jan   | Feb   | Mar   | Apr   | May  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 393.8 | 325.2 | 259.9 | 120.5 | 17.0 | -   | -   | -   | -   | 22.7 | 186.5 | 325.4 | 1,651.1 |
| HP Supp.      | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -     | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 393.8 | 325.2 | 259.9 | 120.5 | 17.0 | -   | -   | -   | -   | 22.7 | 186.5 | 325.4 | 1,651.1 |



|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | 0.04  | 0.88  | 7.94  | 17.89 | 28.87 | 26.16 | 16.18 | 3.56  | 0.46  | 0.17  | 102.15 |
| Heat Reject.  | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | 0.22  | 0.20  | 0.19  | 0.15  | 0.05  | 0.01  | 0.00  | 0.00  | 0.00  | 0.04  | 0.15  | 0.20  | 1.22   |
| HP Supp.      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Hot Water     | 4.65  | 4.23  | 4.68  | 4.50  | 4.58  | 4.37  | 4.47  | 4.43  | 4.29  | 4.47  | 4.38  | 4.59  | 53.64  |
| Vent. Fans    | 3.99  | 3.60  | 3.97  | 3.84  | 3.96  | 3.84  | 3.96  | 3.96  | 3.84  | 3.96  | 3.84  | 3.98  | 46.74  |
| Pumps & Aux.  | 0.88  | 0.80  | 0.88  | 0.85  | 0.85  | 0.82  | 0.85  | 0.85  | 0.82  | 0.86  | 0.85  | 0.88  | 10.20  |
| Ext. Usage    | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 15.48 | 13.98 | 15.48 | 14.98 | 15.48 | 14.98 | 15.48 | 15.48 | 14.98 | 15.48 | 14.98 | 15.48 | 182.21 |
| Total         | 28.33 | 25.62 | 28.35 | 28.21 | 35.99 | 44.92 | 56.75 | 54.00 | 43.12 | 31.48 | 27.68 | 28.42 | 432.84 |

|               | Jan   | Feb   | Mar   | Apr  | May  | Jun | Jul | Aug | Sep | Oct  | Nov   | Dec   | Total   |
|---------------|-------|-------|-------|------|------|-----|-----|-----|-----|------|-------|-------|---------|
| Space Cool    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Heat Reject.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Refrigeration | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Space Heat    | 264.8 | 230.3 | 188.6 | 99.1 | 20.8 | 2.9 | 1.5 | 0.7 | 0.1 | 15.0 | 114.1 | 211.7 | 1,149.5 |
| HP Supp.      | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Hot Water     | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Vent. Fans    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Pumps & Aux.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Ext. Usage    | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Misc. Equip.  | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Task Lights   | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Area Lights   | -     | -     | -     | -    | -    | -   | -   | -   | -   | -    | -     | -     | -       |
| Total         | 264.8 | 230.3 | 188.6 | 99.1 | 20.8 | 2.9 | 1.5 | 0.7 | 0.1 | 15.0 | 114.1 | 211.7 | 1,149.5 |



|               | Let a | E a la | N 4   | A     | N4    | Le com | L. d  | A     | C     | 0-+   | NUT   | Dee   | Tatal  |
|---------------|-------|--------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|               | Jan   | гер    | war   | Apr   | way   | Jun    | Jui   | Aug   | Sep   | Oct   | NOV   | Dec   | Total  |
| Space Cool    | -     | -      | -     | -     | -     | -      | -     | -     | -     | -     | -     | -     | -      |
| Heat Reject.  | -     | -      | -     | -     | -     | -      | -     | -     | -     | -     | -     | -     | -      |
| Refrigeration | -     | -      | -     | -     | -     | -      | -     | -     | -     | -     | -     | -     | -      |
| Space Heat    | 26.46 | 22.22  | 17.97 | 5.88  | 0.25  | -      | -     | -     | -     | -     | 7.06  | 18.43 | 98.28  |
| HP Supp.      | 6.21  | 5.77   | 2.74  | 0.35  | 0.01  | -      | -     | -     | -     | -     | 0.85  | 8.42  | 24.35  |
| Hot Water     | 4.64  | 4.22   | 4.67  | 4.50  | 4.54  | 4.29   | 4.39  | 4.36  | 4.22  | 4.42  | 4.37  | 4.58  | 53.20  |
| Vent. Fans    | 7.12  | 6.43   | 7.12  | 6.89  | 7.12  | 6.89   | 7.12  | 7.12  | 6.89  | 7.12  | 6.89  | 7.12  | 83.84  |
| Pumps & Aux.  | 0.01  | 0.01   | 0.01  | 0.02  | 0.01  | -      | -     | -     | 0.00  | 0.01  | 0.02  | 0.01  | 0.11   |
| Ext. Usage    | -     | -      | -     | -     | -     | -      | -     | -     | -     | -     | -     | -     | -      |
| Misc. Equip.  | 3.11  | 2.81   | 3.11  | 3.01  | 3.11  | 3.01   | 3.11  | 3.11  | 3.01  | 3.11  | 3.01  | 3.11  | 36.67  |
| Task Lights   | -     | -      | -     | -     | -     | -      | -     | -     | -     | -     | -     | -     | -      |
| Area Lights   | 15.48 | 13.98  | 15.48 | 14.98 | 15.48 | 14.98  | 15.48 | 15.48 | 14.98 | 15.48 | 14.98 | 15.48 | 182.21 |
| Total         | 63.03 | 55.45  | 51.10 | 35.63 | 30.53 | 29.18  | 30.10 | 30.07 | 29.10 | 30.14 | 37.18 | 57.16 | 478.66 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |





Heat Rejection

Space Cooling

#### Electric Consumption (kWh x000)

|               | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | 0.01 | 0.10 | 0.88 | 1.82 | 2.80 | 2.57 | 1.68 | 0.43 | 0.06 | 0.02 | 10.35 |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| HP Supp.      | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Hot Water     | 0.72 | 0.67 | 0.74 | 0.71 | 0.68 | 0.61 | 0.59 | 0.57 | 0.55 | 0.59 | 0.61 | 0.67 | 7.72  |
| Vent. Fans    | 0.30 | 0.27 | 0.29 | 0.27 | 0.28 | 0.27 | 0.28 | 0.28 | 0.27 | 0.28 | 0.27 | 0.29 | 3.34  |
| Pumps & Aux.  | 0.12 | 0.11 | 0.12 | 0.11 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.11 | 0.12 | 1.19  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.79 | 1.61 | 1.79 | 1.73 | 1.79 | 1.73 | 1.79 | 1.79 | 1.73 | 1.79 | 1.73 | 1.79 | 21.04 |
| Total         | 3.10 | 2.83 | 3.13 | 3.10 | 3.90 | 4.69 | 5.72 | 5.47 | 4.48 | 3.36 | 2.96 | 3.08 | 45.82 |

Ht Pump Supp.

Space Heating

|               | Jan   | Feb   | Mar   | Apr   | Мау   | Jun  | Jul  | Aug  | Sep   | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|-------|------|------|------|-------|-------|-------|-------|--------|
| Space Cool    | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Heat Reject.  | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Space Heat    | 60.55 | 51.47 | 48.15 | 34.37 | 18.92 | 9.66 | 6.42 | 7.30 | 10.62 | 21.42 | 40.48 | 54.08 | 363.43 |
| HP Supp.      | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Hot Water     | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Vent. Fans    | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Pumps & Aux.  | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Ext. Usage    | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Misc. Equip.  | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Task Lights   | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Area Lights   | -     | -     | -     | -     | -     | -    | -    | -    | -     | -     | -     | -     | -      |
| Total         | 60.55 | 51.47 | 48.15 | 34.37 | 18.92 | 9.66 | 6.42 | 7.30 | 10.62 | 21.42 | 40.48 | 54.08 | 363.43 |

Refrigeration Heat Rejection

Space Cooling



#### Electric Consumption (kWh x000)

|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.42 | 1.18 | 1.65 | 1.54 | 1.09 | 0.27 | 0.00 | -    | 6.15  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.69 | 2.23 | 1.90 | 0.99 | 0.15 | -    | -    | -    | -    | 0.10 | 1.28 | 2.12 | 11.46 |
| HP Supp.      | 0.74 | 0.62 | 0.36 | 0.04 | -    | -    | -    | -    | -    | 0.00 | 0.11 | 0.74 | 2.62  |
| Hot Water     | 0.54 | 0.50 | 0.56 | 0.53 | 0.51 | 0.46 | 0.44 | 0.42 | 0.41 | 0.44 | 0.46 | 0.51 | 5.78  |
| Vent. Fans    | 0.42 | 0.38 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 4.90  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.01 | 0.01 | 0.10  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.04 | 0.94 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 12.24 |
| Total         | 5.62 | 4.84 | 4.48 | 3.16 | 2.73 | 3.23 | 3.74 | 3.61 | 3.09 | 2.46 | 3.46 | 5.02 | 45.44 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



Refrigeration Heat Rejection Space Cooling

#### Electric Consumption (kWh x000)

|               | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.43 | 1.18 | 1.64 | 1.53 | 1.10 | 0.30 | 0.00 | -    | 6.18  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.56 | 2.12 | 1.80 | 0.92 | 0.13 | -    | -    | -    | -    | 0.08 | 1.19 | 2.00 | 10.80 |
| HP Supp.      | 0.67 | 0.56 | 0.33 | 0.04 | -    | -    | -    | -    | -    | 0.00 | 0.10 | 0.68 | 2.38  |
| Hot Water     | 0.54 | 0.50 | 0.56 | 0.53 | 0.51 | 0.46 | 0.44 | 0.42 | 0.41 | 0.44 | 0.46 | 0.51 | 5.78  |
| Vent. Fans    | 0.42 | 0.38 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 4.90  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.02 | 0.01 | 0.10  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.04 | 0.94 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 12.24 |
| Total         | 5.42 | 4.68 | 4.34 | 3.10 | 2.72 | 3.23 | 3.72 | 3.60 | 3.10 | 2.47 | 3.36 | 4.84 | 44.58 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |

Refrigeration Heat Rejection

Space Cooling



#### Electric Consumption (kWh x000)

|               | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.00 | 0.51 | 1.23 | 1.64 | 1.55 | 1.16 | 0.39 | 0.01 | -    | 6.50  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.21 | 1.81 | 1.50 | 0.68 | 0.07 | -    | -    | -    | -    | 0.04 | 0.96 | 1.71 | 8.98  |
| HP Supp.      | 0.52 | 0.43 | 0.24 | 0.03 | -    | -    | -    | -    | -    | 0.00 | 0.08 | 0.55 | 1.85  |
| Hot Water     | 0.54 | 0.50 | 0.56 | 0.53 | 0.51 | 0.46 | 0.44 | 0.42 | 0.41 | 0.44 | 0.46 | 0.51 | 5.78  |
| Vent. Fans    | 0.41 | 0.37 | 0.41 | 0.40 | 0.41 | 0.40 | 0.41 | 0.41 | 0.40 | 0.41 | 0.40 | 0.41 | 4.83  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | -    | -    | -    | 0.00 | 0.01 | 0.02 | 0.02 | 0.11  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.04 | 0.94 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 12.24 |
| Total         | 4.92 | 4.24 | 3.95 | 2.85 | 2.74 | 3.27 | 3.73 | 3.61 | 3.15 | 2.52 | 3.10 | 4.42 | 42.49 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |


|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.38 | 1.09 | 1.52 | 1.42 | 1.03 | 0.26 | -    | -    | 5.69  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.37 | 1.98 | 1.69 | 0.88 | 0.12 | -    | -    | -    | -    | 0.06 | 1.09 | 1.85 | 10.04 |
| HP Supp.      | 0.64 | 0.54 | 0.32 | 0.03 | -    | -    | -    | -    | -    | 0.00 | 0.10 | 0.64 | 2.27  |
| Hot Water     | 0.54 | 0.50 | 0.56 | 0.53 | 0.51 | 0.46 | 0.44 | 0.42 | 0.41 | 0.44 | 0.46 | 0.51 | 5.78  |
| Vent. Fans    | 0.38 | 0.34 | 0.38 | 0.36 | 0.38 | 0.36 | 0.38 | 0.38 | 0.36 | 0.38 | 0.36 | 0.38 | 4.44  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.02 | 0.01 | 0.10  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.04 | 0.94 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 12.24 |
| Total         | 5.16 | 4.48 | 4.19 | 3.01 | 2.62 | 3.10 | 3.56 | 3.45 | 2.99 | 2.37 | 3.21 | 4.62 | 42.76 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.17 | 0.83 | 1.29 | 1.20 | 0.80 | 0.06 | -    | -    | 4.35  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.53 | 2.18 | 1.94 | 1.16 | 0.28 | -    | -    | -    | -    | 0.15 | 1.28 | 2.00 | 11.51 |
| HP Supp.      | 0.72 | 0.61 | 0.42 | 0.07 | -    | -    | -    | -    | -    | 0.00 | 0.13 | 0.73 | 2.66  |
| Hot Water     | 0.54 | 0.50 | 0.56 | 0.53 | 0.51 | 0.46 | 0.44 | 0.43 | 0.41 | 0.44 | 0.46 | 0.51 | 5.78  |
| Vent. Fans    | 0.35 | 0.32 | 0.35 | 0.34 | 0.35 | 0.34 | 0.35 | 0.35 | 0.34 | 0.35 | 0.34 | 0.35 | 4.11  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.01 | 0.01 | 0.09  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.04 | 0.94 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 12.24 |
| Total         | 5.37 | 4.73 | 4.50 | 3.29 | 2.54 | 2.81 | 3.31 | 3.20 | 2.73 | 2.23 | 3.40 | 4.82 | 42.93 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.25 | 0.70 | 0.98 | 0.92 | 0.65 | 0.16 | 0.00 | -    | 3.65  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 1.98 | 1.64 | 1.40 | 0.71 | 0.11 | -    | -    | -    | -    | 0.07 | 0.94 | 1.54 | 8.39  |
| HP Supp.      | 1.08 | 0.87 | 0.54 | 0.07 | -    | -    | -    | -    | -    | 0.00 | 0.16 | 1.01 | 3.73  |
| Hot Water     | 0.54 | 0.50 | 0.56 | 0.53 | 0.51 | 0.46 | 0.44 | 0.42 | 0.41 | 0.44 | 0.46 | 0.51 | 5.78  |
| Vent. Fans    | 0.42 | 0.38 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 4.90  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.01 | 0.01 | 0.09  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.04 | 0.94 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 12.24 |
| Total         | 5.25 | 4.51 | 4.15 | 2.92 | 2.51 | 2.75 | 3.07 | 2.98 | 2.65 | 2.32 | 3.16 | 4.71 | 40.98 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.38 | 1.13 | 1.61 | 1.50 | 1.04 | 0.24 | -    | -    | 5.90  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.75 | 2.28 | 1.96 | 1.04 | 0.18 | -    | -    | -    | -    | 0.13 | 1.35 | 2.17 | 11.86 |
| HP Supp.      | 0.77 | 0.64 | 0.38 | 0.04 | -    | -    | -    | -    | -    | 0.00 | 0.12 | 0.77 | 2.73  |
| Hot Water     | 0.54 | 0.50 | 0.56 | 0.53 | 0.51 | 0.46 | 0.44 | 0.42 | 0.41 | 0.44 | 0.46 | 0.51 | 5.78  |
| Vent. Fans    | 0.42 | 0.38 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 4.89  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.01 | 0.01 | 0.10  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.81 | 0.73 | 0.81 | 0.79 | 0.81 | 0.79 | 0.81 | 0.81 | 0.79 | 0.81 | 0.79 | 0.81 | 9.56  |
| Total         | 5.49 | 4.71 | 4.33 | 3.00 | 2.49 | 2.96 | 3.47 | 3.34 | 2.82 | 2.23 | 3.30 | 4.87 | 43.02 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |





|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.42 | 1.18 | 1.65 | 1.54 | 1.09 | 0.27 | 0.00 | -    | 6.15  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.69 | 2.23 | 1.90 | 0.99 | 0.15 | -    | -    | -    | -    | 0.10 | 1.28 | 2.12 | 11.46 |
| HP Supp.      | 0.74 | 0.62 | 0.36 | 0.04 | -    | -    | -    | -    | -    | 0.00 | 0.11 | 0.74 | 2.62  |
| Hot Water     | 0.35 | 0.32 | 0.36 | 0.34 | 0.34 | 0.32 | 0.32 | 0.32 | 0.31 | 0.32 | 0.32 | 0.34 | 3.98  |
| Vent. Fans    | 0.42 | 0.38 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 0.42 | 0.40 | 0.42 | 0.40 | 0.42 | 4.90  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.01 | 0.01 | 0.10  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.04 | 0.94 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 | 1.04 | 1.01 | 1.04 | 12.24 |
| Total         | 5.44 | 4.66 | 4.28 | 2.97 | 2.56 | 3.09 | 3.62 | 3.50 | 2.99 | 2.35 | 3.32 | 4.86 | 43.63 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | -    | 0.11 | 0.50 | 0.72 | 0.69 | 0.51 | 0.11 | -    | -    | 2.63  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 1.32 | 1.14 | 0.99 | 0.57 | 0.08 | -    | -    | -    | -    | 0.01 | 0.56 | 1.01 | 5.68  |
| HP Supp.      | 0.64 | 0.53 | 0.38 | 0.06 | -    | -    | -    | -    | -    | 0.00 | 0.09 | 0.56 | 2.26  |
| Hot Water     | 0.35 | 0.32 | 0.35 | 0.34 | 0.34 | 0.32 | 0.32 | 0.32 | 0.31 | 0.32 | 0.32 | 0.34 | 3.97  |
| Vent. Fans    | 0.34 | 0.31 | 0.34 | 0.33 | 0.34 | 0.33 | 0.34 | 0.34 | 0.33 | 0.34 | 0.33 | 0.34 | 4.05  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.02 | 0.01 | 0.10  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.19 | 0.17 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 0.19 | 0.18 | 0.19 | 0.18 | 0.19 | 2.19  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.81 | 0.73 | 0.81 | 0.79 | 0.81 | 0.79 | 0.81 | 0.81 | 0.79 | 0.81 | 0.79 | 0.81 | 9.56  |
| Total         | 3.67 | 3.21 | 3.08 | 2.28 | 1.88 | 2.12 | 2.39 | 2.35 | 2.11 | 1.80 | 2.29 | 3.26 | 30.44 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.01 | 0.27 | 0.92 | 1.63 | 1.37 | 0.72 | 0.06 | 0.00 | -    | 4.97  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.90 | 2.42 | 2.26 | 1.27 | 0.25 | 0.00 | -    | -    | 0.01 | 0.35 | 1.52 | 2.20 | 13.19 |
| HP Supp.      | 1.65 | 1.37 | 0.63 | 0.08 | 0.00 | -    | -    | -    | -    | 0.00 | 0.24 | 1.63 | 5.61  |
| Hot Water     | 0.61 | 0.57 | 0.64 | 0.61 | 0.59 | 0.53 | 0.51 | 0.49 | 0.47 | 0.50 | 0.52 | 0.58 | 6.61  |
| Vent. Fans    | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.96  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.01 | 0.01 | 0.05  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.97  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.95 | 0.86 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 11.15 |
| Total         | 6.46 | 5.53 | 4.81 | 3.22 | 2.39 | 2.68 | 3.42 | 3.14 | 2.44 | 2.20 | 3.53 | 5.70 | 45.51 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |





|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.02 | 0.53 | 1.15 | 1.64 | 1.46 | 1.01 | 0.31 | 0.01 | -    | 6.14  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 1.68 | 1.40 | 1.14 | 0.46 | 0.03 | -    | -    | -    | -    | 0.01 | 0.59 | 1.18 | 6.49  |
| HP Supp.      | 0.36 | 0.33 | 0.17 | 0.03 | 0.00 | -    | -    | -    | -    | 0.00 | 0.06 | 0.53 | 1.48  |
| Hot Water     | 0.61 | 0.57 | 0.64 | 0.61 | 0.58 | 0.53 | 0.51 | 0.49 | 0.47 | 0.50 | 0.52 | 0.58 | 6.61  |
| Vent. Fans    | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.96  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | -    | -    | -    | 0.00 | 0.01 | 0.02 | 0.01 | 0.08  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.97  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.95 | 0.86 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 11.15 |
| Total         | 3.94 | 3.47 | 3.24 | 2.37 | 2.43 | 2.92 | 3.43 | 3.23 | 2.72 | 2.11 | 2.43 | 3.58 | 35.87 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.01 | 0.16 | 0.54 | 0.97 | 0.81 | 0.43 | 0.03 | 0.00 | -    | 2.95  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 1.93 | 1.66 | 1.61 | 0.94 | 0.18 | 0.00 | -    | -    | 0.01 | 0.25 | 1.12 | 1.52 | 9.21  |
| HP Supp.      | 2.85 | 2.18 | 1.19 | 0.14 | 0.00 | -    | -    | -    | -    | 0.00 | 0.42 | 2.27 | 9.05  |
| Hot Water     | 0.61 | 0.57 | 0.64 | 0.61 | 0.59 | 0.53 | 0.51 | 0.49 | 0.47 | 0.50 | 0.52 | 0.58 | 6.61  |
| Vent. Fans    | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.96  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | -    | -    | -    | 0.00 | 0.00 | 0.01 | 0.01 | 0.04  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.97  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.95 | 0.86 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 11.15 |
| Total         | 6.68 | 5.57 | 4.72 | 2.94 | 2.21 | 2.31 | 2.76 | 2.58 | 2.14 | 2.08 | 3.30 | 5.66 | 42.95 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.01 | 0.23 | 0.85 | 1.55 | 1.30 | 0.65 | 0.04 | -    | -    | 4.64  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.95 | 2.47 | 2.32 | 1.33 | 0.28 | 0.00 | -    | 0.00 | 0.01 | 0.41 | 1.59 | 2.26 | 13.62 |
| HP Supp.      | 1.76 | 1.44 | 0.67 | 0.09 | 0.00 | -    | -    | -    | -    | 0.00 | 0.26 | 1.70 | 5.94  |
| Hot Water     | 0.61 | 0.57 | 0.64 | 0.61 | 0.59 | 0.53 | 0.51 | 0.49 | 0.47 | 0.50 | 0.52 | 0.58 | 6.61  |
| Vent. Fans    | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.96  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | -    | -    | -    | 0.00 | 0.00 | 0.01 | 0.01 | 0.04  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.97  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.68 | 0.61 | 0.68 | 0.65 | 0.68 | 0.65 | 0.68 | 0.68 | 0.65 | 0.68 | 0.65 | 0.68 | 7.96  |
| Total         | 6.34 | 5.41 | 4.65 | 3.02 | 2.11 | 2.36 | 3.07 | 2.80 | 2.11 | 1.97 | 3.35 | 5.55 | 42.75 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.01 | 0.27 | 0.92 | 1.63 | 1.37 | 0.72 | 0.06 | 0.00 | -    | 4.97  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 2.90 | 2.42 | 2.26 | 1.27 | 0.25 | 0.00 | -    | -    | 0.01 | 0.35 | 1.52 | 2.20 | 13.19 |
| HP Supp.      | 1.65 | 1.37 | 0.63 | 0.08 | 0.00 | -    | -    | -    | -    | 0.00 | 0.24 | 1.63 | 5.61  |
| Hot Water     | 0.22 | 0.20 | 0.23 | 0.22 | 0.22 | 0.20 | 0.21 | 0.20 | 0.20 | 0.21 | 0.21 | 0.22 | 2.53  |
| Vent. Fans    | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.96  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | -    | -    | -    | 0.00 | 0.01 | 0.01 | 0.01 | 0.05  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.97  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.95 | 0.86 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 0.95 | 0.92 | 0.95 | 0.92 | 0.95 | 11.15 |
| Total         | 6.07 | 5.15 | 4,40 | 2.83 | 2.02 | 2.36 | 3.11 | 2.85 | 2.16 | 1.91 | 3.22 | 5.34 | 41.43 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.01 | 0.14 | 0.50 | 0.91 | 0.77 | 0.40 | 0.03 | -    | -    | 2.76  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | 1.92 | 1.65 | 1.59 | 0.94 | 0.18 | 0.00 | -    | -    | 0.00 | 0.26 | 1.10 | 1.51 | 9.15  |
| HP Supp.      | 2.64 | 2.03 | 1.10 | 0.13 | 0.00 | -    | -    | -    | -    | 0.00 | 0.39 | 2.14 | 8.41  |
| Hot Water     | 0.22 | 0.20 | 0.22 | 0.21 | 0.21 | 0.20 | 0.20 | 0.20 | 0.19 | 0.20 | 0.20 | 0.21 | 2.47  |
| Vent. Fans    | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.96  |
| Pumps & Aux.  | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | -    | -    | -    | 0.00 | 0.00 | 0.01 | 0.01 | 0.04  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.97  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 0.68 | 0.61 | 0.68 | 0.65 | 0.68 | 0.65 | 0.68 | 0.68 | 0.65 | 0.68 | 0.65 | 0.68 | 7.96  |
| Total         | 5.79 | 4.79 | 3.93 | 2.27 | 1.55 | 1.68 | 2.13 | 1.98 | 1.57 | 1.51 | 2.67 | 4.87 | 34.73 |

|               | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Space Cool    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Heat Reject.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Refrigeration |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Space Heat    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| HP Supp.      |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Hot Water     |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Vent. Fans    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Pumps & Aux.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Ext. Usage    |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Misc. Equip.  |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Task Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Area Lights   |     |     |     |     |     |     |     |     |     |     |     |     |       |
| Total         |     |     |     |     |     |     |     |     |     |     |     |     |       |



Misc. Equipment



Heat Rejection

Space Cooling

### Electric Consumption (kWh x000)

|               | Jan  | Feb  | Mar  | Apr  | Мау  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Space Cool    | -    | -    | -    | 0.02 | 0.28 | 0.96 | 1.92 | 1.56 | 0.66 | 0.04 | 0.00 | -    | 5.44  |
| Heat Reject.  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Refrigeration | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Space Heat    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| HP Supp.      | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Hot Water     | 0.42 | 0.39 | 0.44 | 0.42 | 0.40 | 0.36 | 0.35 | 0.33 | 0.32 | 0.34 | 0.36 | 0.40 | 4.53  |
| Vent. Fans    | 0.48 | 0.44 | 0.48 | 0.47 | 0.48 | 0.47 | 0.48 | 0.48 | 0.47 | 0.48 | 0.47 | 0.48 | 5.67  |
| Pumps & Aux.  | 0.04 | 0.03 | 0.03 | 0.03 | 0.01 | -    | -    | -    | 0.00 | 0.01 | 0.03 | 0.03 | 0.22  |
| Ext. Usage    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Misc. Equip.  | 0.17 | 0.15 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 1.97  |
| Task Lights   | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     |
| Area Lights   | 1.69 | 1.53 | 1.69 | 1.64 | 1.69 | 1.64 | 1.69 | 1.69 | 1.64 | 1.69 | 1.64 | 1.69 | 19.91 |
| Total         | 2.80 | 2.54 | 2.81 | 2.73 | 3.03 | 3.59 | 4.61 | 4.23 | 3.25 | 2.73 | 2.65 | 2.77 | 37.73 |

Ventilation Fans

Ht Pump Supp.

Space Heating

### Gas Consumption (Btu x000,000)

|               | Jan   | Feb   | Mar   | Apr   | May  | Jun  | Jul | Aug | Sep  | Oct   | Nov   | Dec   | Total  |
|---------------|-------|-------|-------|-------|------|------|-----|-----|------|-------|-------|-------|--------|
| Space Cool    | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Heat Reject.  | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Refrigeration | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Space Heat    | 73.24 | 62.23 | 55.94 | 34.72 | 8.83 | 0.55 | -   | -   | 0.71 | 13.23 | 40.95 | 61.79 | 352.19 |
| HP Supp.      | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Hot Water     | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Vent. Fans    | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Pumps & Aux.  | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Ext. Usage    | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Misc. Equip.  | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Task Lights   | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Area Lights   | -     | -     | -     | -     | -    | -    | -   | -   | -    | -     | -     | -     | -      |
| Total         | 73.24 | 62.23 | 55.94 | 34.72 | 8.83 | 0.55 | -   | -   | 0.71 | 13.23 | 40.95 | 61.79 | 352.19 |

# **APPENDIX B**

# TRANSPORTATION EMISSION CALCULATIONS

### TABLE B-1 Vehicle Miles Traveled (VMT) in the Traffic Study Area Wrentham Business Park Lots 1 and 3

|              | Link             |   | Average Da       | aily Traffic (ADT)                   | (vehicles/day)                      | Vehicle Miles Traveled (VMT) (miles/day) |                                      |                                     |  |
|--------------|------------------|---|------------------|--------------------------------------|-------------------------------------|--|--------------------------------------|-------------------------------------|--|
| Link<br>I.D. | Length<br>(feet) | Link Descriptor   | 2030<br>No-Build | 2030<br>Full Build<br>w/o mitigation | 2030<br>Full Build<br>w/mitigation* | 2030<br>No-Build                         | 2030<br>Full Build<br>w/o mitigation | 2030<br>Full Build<br>w/mitigation* |  |
| 1            | 565              | Site Driveway   | 300              | 3,650                                | 3,583                               | 32.1                                     | 390.6                                | 383.4                               |  |
| 2            | 1,775            | Washington Street between Site Driveway and<br>Madison Street | 31,640           | 32,500                               | 32,483                              | 10,636.6                                 | 10,925.7                             | 10,919.9                            |  |
| 3            | 3,500            | Washington Street between Site Driveway and Thurston Street   | 31,430           | 31,890                               | 31,881                              | 20,834.3                                 | 21,139.2                             | 21,133.1                            |  |
| 4            | 1,250            | Thurston Street between Washington Street and Hawes Street    | 1,720            | 1,790                                | 1,789                               | 407.2                                    | 423.8                                | 423.4                               |  |
|              |                  |   |                  | VMT (mil                             | es/day):                            | 31,910.1                                 | 32,879.2                             | 32,859.8                            |  |

\*Mitigation assumes an 2% reduction in the project traffic due to the implementation of TDMs.

## TABLE B-2 Mesoscale Study Area Total Daily Carbon Dioxide (CO<sub>2</sub>) Emissions Wrentham Business Park Lots 1 & 3

|      | CO₂ Emission<br>Rate | Vehicle Mile | es Traveled (VMT)               | (miles/day)        | Mesos    | cale CO <sub>2</sub> Emission | ns (kg/day)        |
|------|----------------------|--------------|---------------------------------|--------------------|----------|-------------------------------|--------------------|
| Link | (grams/mile)         | 2030         | 2030<br>Full Build              | 2028<br>Full Build | 2030     | 2030<br>Full Build            | 2030<br>Full Build |
| I.D. |                      | No-Build     | w/o mitigation                  | w/mitigation*      | No-Build | w/o mitigation                | w/mitigation*      |
| 1    | 292.66               | 32           | 391                             | 383                | 9.4      | 114.3                         | 112.2              |
| 2    | 292.66               | 10,637       | 10,926                          | 10,920             | 3,112.9  | 3,197.5                       | 3,195.8            |
| 3    | 292.66               | 20,834       | 21,139                          | 21,133             | 6,097.4  | 6,186.6                       | 6,184.8            |
| 4    | 292.66               | 407          | 424                             | 423                | 119.2    | 124.0                         | 123.9              |
|      |                      | Т            | otal Daily CO <sub>2</sub> Emis | sions              |          |                               |                    |
|      |                      |              | (kg/day):                       |                    | 9,338.82 | 9,622.43                      | 9,616.76           |

\*Mitigation assumes an 2% reduction in the total project-generated traffic due to the implementation of proposed TDMs.

## **APPENDIX C**

## **PV COST CALCULATION SPREADSHEETS**



Disclaimer: This Unofficial Cash Flow Model is intended to provide non-residential entities that are considering the purchase and installation of solar energy equipment with a general understanding of possible financial implications of such purchase and installation. Those entities interested in learning more about the financial implications of the purchase and installation of solar energy equipment are urged to consult their own tax and financial experts. The information contained in the Unofficial Cash Flow Model may not be relied on by anyone for any purposes. Furthermore, the information contained in the necessarily reflect the views of the Department of Energy Resources or the Commonwealth of Massachusetts, and reference to any specific method does not constitute an implied or expressed recommendation or endorsement of I. Neither the Department of Energy Resources or the Commonwealth of Massachusetts make any warranties or representations, expressed or implied, as to the usefulness, completeness, or accuracy of any processes, methods or other information contained, described, or refered to in this model. Finally, neither the Department of Energy Resources nor the Commonwealth of Massachusetts makes any representation that the use of any product, apparatus, process, method, or other information contained, the use of information contained, described, disclosed, or referred to in this model. Cash Flow Model.

| Solar Photovoltaic Project Simple Financial I<br>PRO FORMA AND PRODUCTION | Model               |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
|---|---------------------|----------------|----------------|----------------|----------------------------|--------------|---------------|--------------|--------------|--------------|--------------|--------------|---------------|--------------|-------------|-----------|
|   |                     | Start-Up       | Year           | Year           | Year                       | Year         | Year          | Year         | Year         | Year         | Year         | Year         | Year          | Year         | Year        | Year      |
| Project Output  |                     | 0              | 1              | 2              | 3                          | 4            | 5             | 6            | 7            | 8            | 9            | 10           | 11            | 12           | 13          | 14        |
| Annual Generation (kWh)   |                     |                | 1,739,386      | 1,730,689      | 1,722,035                  | 1,713,425    | 1,704,858     | 1,696,334    | 1,687,852    | 1,679,413    | 1,671,016    | 1,662,661    | 1,654,347     | 1,646,076    | 1,637,845   | 1,629,656 |
| FINANCIAL SCHEDULES   |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| INCOME STATEMENT  |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| Electricity Revenue (Avoided Cost)  |                     | \$             | 238,209 \$     | 237,018 \$     | 235,833 \$                 | 234,654 \$   | 233,480 \$    | 232,313 \$   | 231,151 \$   | 229,996 \$   | 228,846 \$   | 227,701 \$   | 226,563 \$    | 225,430 \$   | 224,303 \$  | 223,181   |
| CEC Rebate  | \$                  |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| SREC Auction Revenue  |                     | \$             | - S            | - S            | - S                        | - \$         | - \$          | - S          | - S          | - \$         | - S          | - S          | - S           | - \$         | - \$        |           |
| SREC Contract Revenue   |                     | \$             | - \$           | - S            | - S                        | - \$         | - \$          | - S          | - S          | - \$         | - \$         | - S          | - S           | - \$         | - S         | -         |
| Total Revenue (Avoided Costs)   | \$                  | - \$           | 238,209 \$     | 237,018 \$     | 235,833 \$                 | 234,654 \$   | 233,480 \$    | 232,313 \$   | 231,151 \$   | 229,996 \$   | 228,846 \$   | 227,701 \$   | 226,563 \$    | 225,430 \$   | 224,303 \$  | 223,181   |
| Replace Inverter?   |                     | No             | No             | No             | No                         | No           | No            | No           | No           | No           | No           | Yes          | No            | No           | No          | No        |
| Operations & Maintenance Costs  |                     | s              | (27,740) \$    | (28.572) \$    | (29,429) \$                | (30.312) \$  | (31.222) \$   | (32,158) \$  | (33,123) \$  | (34,117) \$  | (35,140) \$  | (36,194) \$  | (37,280) \$   | (38,399) \$  | (39.551) \$ | (40,737)  |
| Inverter Replacement Cost   |                     | s              | - S            | - S            | - S                        | - S          | - \$          | - S          | - S          | - S          | - S          | (730.000) \$ | - S           | - \$         | - S         | -         |
| Total Operating Expenses  | S                   | - \$           | (27,740) \$    | (28.572) \$    | (29,429) \$                | (30.312) \$  | (31.222) \$   | (32,158) \$  | (33,123) \$  | (34,117) \$  | (35,140) \$  | (766,194) \$ | (37,280) \$   | (38,399) \$  | (39.551) \$ | (40,737)  |
| FBITDA  | s                   | - \$           | 210.469 \$     | 208.446 \$     | 206.403 \$                 | 204.341 \$   | 202.259 \$    | 200.155 \$   | 198.028 S    | 195.879 \$   | 193,705 \$   | (538 493) \$ | 189,283 \$    | 187.031 \$   | 184 752 \$  | 182 444   |
| Federal Depreciation Expense  | •                   | ŝ              | (608,090) \$   | (972,944) \$   | (583,766) \$               | (350,260) \$ | (350,260) \$  | (175,130) \$ | - S          | - S          | - S          | - S          | - S           | - S          | - \$        | -         |
| EBIT  | \$                  | - \$           | (397.621) \$   | (764,498) \$   | (377,363) \$               | (145,919) \$ | (148.001) \$  | 25.025 \$    | 198.028 \$   | 195.879 \$   | 193,705 \$   | (538 493) \$ | 189.283 \$    | 187.031 \$   | 184.752 \$  | 182 444   |
| Interest Expense  | Ŧ                   | ŝ              |                |                |                            |              |               |              |              | . \$         | - 5          |              |               | . \$         |             |           |
| EBT   | s                   | - 5            | (397.621) \$   | (764 498) \$   | (377.363) \$               | (145.919) \$ | (148.001) \$  | 25.025 \$    | 198.028 \$   | 195.879 \$   | 193,705 \$   | (538 493) \$ | 189.283 \$    | 187.031 \$   | 184 752 \$  | 182 444   |
| Enderal taxes saved/(naid)  | ŝ                   |                | 146 534 \$     | 274 870 \$     | 139 301 \$                 | 58 223 \$    | 58.879 \$     | (1 753) \$   | (62 379) \$  | (61,702) \$  | (61.017) \$  | 188 473 \$   | (59,624) \$   | (58 915) \$  | (58 197) \$ | (57 470)  |
| State taxes equed/(noid) [can not deduct federal depreciation expense]    | ę                   |                | (21.047) \$    | (20.845) \$    | (20,640) \$                | (20,424) \$  | (20,226) \$   | (20.015) \$  | (10,803) \$  | (10,588) \$  | (10.371) \$  | 53 840 \$    | (18 028) \$   | (18 703) \$  | (18,475) \$ | (18 244)  |
| Net Income  | š                   |                | (272 134) \$   | (510 473) \$   | (258 702) \$               | (108 129) \$ | (109 348) \$  | 3 256 \$     | 115 847 \$   | 114 589 \$   | 113 318 \$   | (296 171) \$ | 110 730 \$    | 109.413 \$   | 108.080 \$  | 106 730   |
|   | Ŷ                   | •              | (212,104) \$   | (010,410) \$   | (200,702) \$               | (100,120) \$ | (100,040) ¢   | 0,200 0      |              | 114,000 \$   | 110,010 \$   | (200,111) \$ |               | 100,410 \$   | 100,000 \$  | 100,100   |
| CASH FLOW STATEMENT   |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| Cash From Operations  |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| Net Income  | e                   |                | (272 124) \$   | (510 473) \$   | (258 702) \$               | (108 120) \$ | (100.348) \$  | 3 256 \$     | 115 947 \$   | 114 590 \$   | 112 218 \$   | (206 171) \$ | 110 720 \$    | 100 413 \$   | 108.080 \$  | 106 730   |
| Federal Depresiation Evenese  | Ф<br>е              | - 4            | (272,134) \$   | 072.044 €      | (230,702) \$<br>593,766 \$ | 250,260 \$   | (103,340) \$  | 175 120 8    | 113,047 \$   | r14,505 \$   | 113,310 \$   | (230,171) \$ | 110,750 \$    | 103,413 \$   | 100,000 \$  | 100,750   |
| Cash Elow Erom Operations   | ÷                   |                | 335.056 \$     | 462 471 \$     | 325.064 \$                 | 242 121 \$   | 240.012 \$    | 179 396 \$   | 115 847 \$   | 11/ 580 \$   | 112 218 \$   | (206 171) \$ | 110 720 \$    | 100 / 12 \$  | 108.080 \$  | 106 730   |
| Cash Flow Flow Operations   | Ψ                   | - ψ            | 355,830 Ø      | 402,471 \$     | 323,004 Q                  | 242,131 φ    | 240,312 \$    | 170,000 \$   | 115,047 \$   | 114,303 φ    | 115,510 \$   | (230,171) \$ | 110,750 \$    | 103,415 Q    | 100,000 \$  | 100,750   |
| Cash From Investing   |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| Installed DV Cost   | e                   | (2 577 000)    |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| One Time State Selar Investment Tax Deduction (Actual Cook Value)         | э<br>с              | (3,377,000)    |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| One Time State Solar Investment Tax Deduction (Actual Cash Value)         | \$                  | 250,390        |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| Cook Flow From Investment Tax Credit                                      | \$                  | (2.252.510) \$ | \$             | e              | e                          | ¢            | ¢             | 6            | e            | \$           | \$           | e            | e             | ¢            | ¢           |           |
| Cash Flow From Investing  | φ                   | (2,203,010) \$ |                |                |                            |              |               | - 3          |              |              |              |              |               |              |             | -         |
| Cook From Eineneing   |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
|   |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| Loan Disbursement   | \$                  |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |
| Loan Repayment (Principle)  |                     | \$             | - \$           | - \$           | - \$                       | - \$         | - \$          | - \$         | - \$         | - \$         | - \$         | - \$         | - \$          | - \$         | - \$        |           |
| Cash Flow From Financing  | \$                  | - \$           | - \$           | - \$           | - \$                       | - \$         | - \$          | - 5          | - \$         | - \$         | - \$         | - \$         | - \$          | - \$         | - \$        |           |
| Annual Cash Flow  | •                   | (2.253.510) \$ | 335.956 \$     | 462.471 \$     | 325.064 \$                 | 242.131 \$   | 240.912 \$    | 178.386 \$   | 115.847 \$   | 114.589 \$   | 113.318 \$   | (296.171) \$ | 110.730 \$    | 109.413 \$   | 108.080 \$  | 106.730   |
| Cumulative Cash Flow  | ŝ                   | (2,253,510) \$ | (1.917.554) \$ | (1.455.083) \$ | (1.130.019) \$             | (887,888) \$ | (646.976) \$  | (468,590) \$ | (352,744) \$ | (238,154) \$ | (124.837) \$ | (421.008) \$ | (310,278) \$  | (200.864) \$ | (92,784) \$ | 13,946    |
|   | ·                   | (_,)(10) \$    | (.,,           | (.,,           | (.,,010) ¢                 | (111,000) \$ | (2.12,010) \$ | (,000) ¢     | (,-++) •     | () •         | ()001) •     | (,000) ¢     | (2.12,210) \$ | (,004) *     | (==,104) \$ | 10,040    |
| Simple Payback  |                     | \$             | 1 \$           | 2 \$           | 3 \$                       | 4 \$         | 5 \$          | 6 5          | 7 \$         | 8 \$         | 9 8          | 10 \$        | 11 \$         | 12 \$        | 13 \$       | 14        |
| Net Investment  | ¢                   | (2 253 510)    | (1 917 554) \$ | (1 455 083) \$ | (1 130 019) \$             | (887 888) \$ | (646.976)     | (468 590) \$ | (352 744) \$ | (238 154)    | (124 837) \$ | (421.008) \$ | (310 278) \$  | (200.864) \$ | (92 784) \$ | 13 046    |
|   | Simple Payback Year | 14             | (1,011,001) \$ | (1,100,000) \$ | (1,100,010) \$             | (007,000) Φ  | (0.0,0.0) \$  | (100,000) \$ | (002,111) \$ | (200,104) \$ | (121,001) \$ | (121,000) \$ | (010,210) \$  | (200,004) Φ  | (02,101) 0  | 14        |
|   |                     |                |                |                |                            |              |               |              |              |              |              |              |               |              |             |           |

Appendix D Response to FEIR Comments

## SUPPLEMENTAL FINAL ENVIRONMENTAL IMPACT REPORT Wrentham Business Center EOEA No. 15765

## **Response to Comments**

### MassDOT Memorandum, November 9, 2022

- **Comment:** Access and egress to the site is proposed via an existing access driveway (Commerce Boulevard) onto Route 1 opposite Hawes Street. As part of the DEIR, the Proponent proposed to redesign and signalize the intersection to address impacts associated with the increase in site traffic. The DEIR included a traffic signal warrant analysis (TSWA) based on the 2009 Manual on Uniform Traffic Control Devices (MTUCD). MassDOT specifically commented that future volumes were not to be used to conduct the TSWA and justify the installation of a traffic signal. The TSWA was revised in the FEIR, but it is still based on 2028 Build volume projections on Route 1 instead of Route 1 traffic volumes at site occupancy.
- **Response:** An updated traffic signal warrant analysis has been included in the SFEIR which used turning movement counts obtained in April 2023, with only the proposed exiting trips from Commerce Boulevard associated with the development of Lot 1 and Lot 3 of the proposed Wrentham Business Center project added. Based on this analysis, the intersection of Route 1 at Hawes Street/Commerce Boulevard is projected to meet the requirements for eight-hour and four-hour signal warrants with 2023 volumes on Route 1 and the trips associated with the full Wrentham Business Center project (now including a proposed gas station on Lot 1).
- **Reference:** SFEIR, Section 4.4.3
- **Comment:** MassDOT indicated that Phase 2 was unlikely to generate enough site traffic to meet the signal warrants and justify the installation of the traffic signal. As per the FEIR, the Proponent did not offer a clear timeline to advance the Phase 3 component of the Project. In the DEIR comment letter, MassDOT requested that an interim access plan be provided that did not include the traffic signal. This is not addressed in the FEIR
- **Response:** What was previously identified as Phase 2 and Phase 3 of the project (development of Lot 3 and Lot 1, respectively) are being considered to be more closely represent a single phase of development. The applicant considers the signalization of the Commerce Boulevard/Hawes Street intersection to be integral to the project, and would not construct the proposed warehouse without the construction of the signal. The proposed gas station on Lot 1 has been filed with

the Town of Wrentham Planning Board in June 2023 in order to arrive on the same level of local approval to be able to move the development of both Lots 1 and 3 forward more simultaneously. For this reason, interim access plans have not been provided as part of the SFEIR filing.

- **Reference:** SFEIR, Section 4.4.6
- **Comment:** The Proponent has indicated that properties south of the site along Route 1 could be provided access to the proposed traffic signal at their site driveway via an internal shared roadway connection. This would allow traffic from these sites, particularly the Truck Turnpike site, the ability to safely reverse direction towards Route 1 southbound to access I-495. The Proponent has accounted for the trips associated with the facility in the TSWA and the capacity analysis for the Route 1 intersection with the Project site driveway. However, the Proponent was vague on any arrangement with the owner of the Truck Turnpike site to facilitate or implement this connection. The Proponent should incorporate the shared access into their site plan and document initial approval or formal arrangement to justify these volumes in their analysis. Additionally, the site driveway of the Truck Turnpike site may need to be modified to ensure it operates as right-in, right-out driveway to prevent unsafe maneuvers on Route 1.
- **Response:** Since the filing of the FEIR, the proposed development on Lot 1 has been changed to a gas station and convenience store. With that modification to the proposed development, an easement area over Lot 1 has been reserved in order to accommodate potential future shared access, but no specific development or access plans have been finalized with the abutter to the south. As such, no trips associated with the Turnpike Truck Parts have been included in the revised capacity or signal warrant analyses provided in the SFEIR. Based on discussions with MassDOT District 5, access to properties along Route 1 will be evaluated as part of the Route 1 corridor project which is currently in the pre-25% design phase. The Wrentham Business Center project team intends to continue to coordinate with MassDOT through the permitting process to not preclude potential design elements to be implemented as part of their Route 1 corridor project.
- **Reference:** SFEIR, Section 4.3.1
- **Comment:** The Proponent should continue working with MassDOT to revise the TSWA, review access management along the Route 1 corridor in the vicinity of the site and document any agreement/arrangement in place to facilitate the implementation of an access management plan. The Proponent should submit a revised commitment letter to MassDOT once these details have been finalized. The Draft Section 61 Finding will be the basis for MassDOT to issue a final Section 61 Finding for the project.

- **Response:** The project team has been coordinating with MassDOT since the filing of the FEIR to review and update relevant methodologies for filing in the SFEIR. The local review of the Lot 1 development is currently ongoing. An easement area over Lot 1 has been reserved in order to accommodate potential future shared access, but no specific development or access plans have been finalized with the abutter to the south.
- **Reference:** SFEIR, Sections 4.3.1 and 4.4.3
- **Comment:** The Proponent should provide an update of the local permitting processes for the proposed Project, particularly with respect to Phase 3 and any transportation issues being discussed. We strongly encourage the Proponent to consult with MassDOT before any transportation issues are discussed in local meetings or hearings.
- **Response:** The proposed warehouse portion of the Wrentham Business Center has been reviewed by the Town of Wrentham Planning Board and received its special permit and site plan approval on August 17, 2022. The proposed gas station on Lot 1 has filed with the Town of Wrentham Planning Board in June 2023 in order to be able to move the development of both Lots 1 and Lot 3 forward more simultaneously.
- **Reference:** SFEIR, Section 4.4.6

### Commonwealth of Massachusetts DOER, November 11, 2022 & MEPA FEIR Certificate

- **Comment:** Provide a revised analysis of the warehouse energy use with heating end use in the order of 15 kBtu/sf-yr consistent with other warehouse buildings in our climate zone.
- **Response:** The Base Case and Appendix G Baseline eQUEST models for the warehouse space have been modified to increase heating demand slightly above 15 kBtu/sf-yr. See the revised GHG report section 1.1 for more details. The revised GHG analysis used these corrected models.
- **Reference:** SFEIR, Section 5.1
- **Comment:** Evaluate hybrid electric/propane heating system consisting of an ASHP system sized to 20% of the space peak heating.

- **Response:** The warehouse space will use a Hybrid ASHP/Gas heating system with the ASHP equipment sized to 20% of peak heating demand. This Proposed Design is used in the revised GHG report.
- **Reference:** SFEIR, Section 5.5.1
- **Comment:** There appears to be an error in the submission which leads to underestimating space heating consumption.
- **Response:** The Base Case and Appendix G Baseline eQUEST models for the warehouse space have been modified to increase heating demand slightly above 15 kBtu/sf-yr. See the revised GHG report section 1.1 for more details. The revised GHG analysis used these corrected models.
- **Reference:** SFEIR, Section 5.5.1
- **Comment:** If the next submission is not committing to hybrid electric/propane space heating as described above [a 20% ASHP/100% propane hybrid system],we recommend the next submission contain the following ...".
- **Response:** The warehouse space will use a Hybrid ASHP/Gas heating system with the ASHP equipment sized to 20% of peak heating demand. This Proposed Design is used in the revised GHG report.
- **Reference:** SFEIR, Section 5.5.1

## Andrew Gordon, Turnpike Truck Parts, Email dated 11/7/2022

- **Comment:** As we read through the logic and data in the DEIR justifying the current traffic volumes and conditions at the site, we noticed a number of inconsistencies that indicate the volume at the site is more than 30% higher than the measurements used in the DEIR. There are numerous pieces of data both within the DEIR and from traffic reports of local projects that support that the traffic volume at the site is significantly higher than what is used in the DEIR.
- **Response:** The vehicle volumes utilized in the SFEIR analysis, including the volume of vehicles entering and exiting Commerce Boulevard, are based on new traffic volume counts conducted in April 2023, as coordinated with MassDOT.

**Reference:** SFEIR, Section 4.2.2

- **Comment:** The Madison St intersection regularly backs up over 2000+ feet. While the traffic volumes might be lower today than they were before the installation of the Madison/Washington St stoplight, the stoplight has caused a significant delay to the travel time on the route due to the system being over-capacity. McMahon and Associated investigated this situation during their Planning Board application, and found that this was in part due to pedestrian crossings, driveway access/egress friction, and inefficient phasing of the Madison St right-turns. The proposed signal adjustment would hopefully help alleviate some of these massive real-world queues that are not shown in the modeling software.
- **Response:** McMahon conducted observations of southbound queueing on Washington Street (Route 1) from the Madison Street signal from approximately 3:00 PM to 6:30 PM on four weekdays in May 2022. Based on these observations, southbound vehicle queues were observed to extend beyond Hawes Street (approximately 1,680 feet north of Madison Street) on one to two instances per day, usually for a period of five to ten minutes. Overall, the analysis presented in the DEIR and the SFEIR are considered to capture the relative impact of the proposed project on the surrounding roadway network. Additionally, proposed modifications to the signal timing and coordination at the Madison Street intersection are intended to help mitigate some of the existing queuing at that location.
- **Reference:** SFEIR, Section 4.4.5
- **Comment:** Based on feedback about how the stoplight design was restricting turning movements into and out of properties, the stoplight was redesigned with updated island locations and an additional phase for Interstate Travel Plaza. This was a large step forward that protects the important access of local businesses, but there are still a number of flaws that exist in the contemplated design.

Numerous queues exceeded their travel lanes. For example on page 370 of the FEIR, the 2028 Build With Improvements plan for Weekday Afternoon travel shows that the 95th percentile Left turn from Commerce Blvd to Route 1 has a 139 ft queue inside a 100 ft turning bay. It does not look like the stoplight design incorporates the merge from the "slower vehicles" travel lane northbound as vehicles come up the hill. Page 47 from the FEIR describes the traffic light, however it does not appear to include the merge from the "slower vehicles" lane. The image of the traffic queue on page 409 of the FEIR shows this merge lane and has been include in Exhibit E along with a few images from Google Maps showing the lane.

- .Response: The drawings of the proposed traffic signal provided in the DEIR and the SFEIR are intended to provide a conceptual understanding of the proposed improvements at the intersection of Washington Street (Route 1) and Hawes Street/Commerce Boulevard. Specific design elements of the proposed signal such as the length of the provided turn lanes, connection to the existing northbound lane reduction, and final signal phasing would be determined in conjunction with MassDOT as part of the more detailed design completed as part of the access permit for the project.
- **Reference:** SFEIR, Section 4.4.5
- **Comment:** Today, we have full access along Washington St without encumbrances. Traffic never blocks the driveway, and traffic is allowed to take a left-in, left-out from the Southbound side of Washington St. The updated design dramatically changes this such that it will be dangerous and difficult to access our property, and the entire frontage of our driveway would often be completely blocked by traffic during peak volumes.
- **Response:** The proposed traffic signal at Washington Street (Route 1) at Hawes Street/Commerce Boulevard is proposed to be timed to coordinate with adjacent signals as much as feasible, to manage the maximum queue which would be regularly expected to occur at the northbound approach to the intersection. With the currently ongoing local review of Lot 1, an easement area over Lot 1 has been reserved in order to accommodate future shared access, but no development plans have been proposed by the abutter to the south.

**Reference:** SFEIR, Section 4.4.7

## Jonathan Silverstein, Letter dated 11/7/2022

- **Comment:** Central to the applicant's proposal is the installation of a new traffic signal at the intersection of Washington Street and Hawes Street. This will undoubtedly assist the applicant's business plan, since tractor trailers leaving the site will now be able, easily to turn left onto Route 1 from Commerce Boulevard, but it will also have the effect of significantly increasing traffic on Hawes Street, which is not of sufficient width and construction to safely accommodate this increased use.
- **Response:** The presence of a signal at Washington Street (Route 1) at Hawes Street is not projected to significantly increase the volume of vehicle traffic utilizing Hawes

Street. Because of its narrow, residential nature, Hawes Street is not anticipated to be viewed as a desirable cut-through route for vehicles traveling between Washington Street (Route 1) and Thurston Street, as any potential time savings via this route is expected to be minimal. Access for vehicles entering and exiting Hawes Street from and to Washington Street (Route 1) would be limited under signalization as vehicles would be required to wait for a green indication to complete their movement, likely resulting in more delay for those movements than under the existing unsignalized condition. Lastly, the existing volume of traffic that was counted to travel between Washington Street (Route 1) and Thurston Street via Washington Street (Route 1) is shown to be less than 50 vehicles in each direction during the peak hours, limiting the overall demand for utilizing Hawes Street as an alternative route.

- **Reference:** SFEIR, Section 4.2.3
- **Comment:** In addition to the impacts of increased traffic on Hawes Street, the queuing on Washington Street that will result from the signalization of the intersection will adversely impact all of my clients' properties. Left turns out of these properties will no longer be possible as a result of these queues.
- **Response:** The queues projected under the future year Build condition are not anticipated to be continuous standing queues on Washington Street (Route 1) during the peak hours or over the course of a typical weekday. Queues will form on Washington Street (Route 1) at the proposed signalized intersection while left-turning and side street movements receive their green indications. However, the queues would be expected to clear out during each phase under typical conditions. The timing and coordination changes proposed to the Washington Street (Route 1) corridor are also intended to minimize the queues to the extent practicable while providing more protected, signalized access for movements at Hawes Street and Commerce Boulevard.

As noted in Kimley Horn's letter, an alternate location north of Hawes Street for the proposed traffic signal has been discussed as part of the local review process. Based on a review of the conditions along Route 1, it has been determined that it is not a viable solution for the Wrentham Business Center project. A traffic signal located to the north may encourage noncompliance at right-in, right-out Commerce Boulevard connection to Route 1 since people would need travel north to the signal to ultimately travel south on Route 1. Distancing access from a more direct connection to Lot 1/ Supercharged via Commerce Boulevard to a more northern signal may cause confusion when vehicles arrive at Commerce Boulevard and are unable to turn left into Commerce Boulevard, resulting in unintended left-turns and safety issues. The potential access roadway to the more northern signal location would be located in an area of proposed extensive landscaping, which is a benefit to the Town and is consistent with the design guidelines in the zoning bylaw. Lastly, in order to locate the signal further to the north, it would require 3 additional landowners to become involved in the signal design. The future development plans of the three subject parcels are currently unknown and would require additional local and MassDOT permitting as part of a signal design and approval which would then require additional coordination of legal ownership, maintenance, and the construction of new roadways. This would be a time-consuming undertaking, and could involve conflicting interests between involved parties.

- **Reference:** SFEIR, Section 4.4.1
- **Comment:** It is my understanding that that the warrant for signalizing the Hawes Street intersection is not met by this project unless both: (a) right turns out of Commerce Boulevard are counted and (b) the so-called "Phase 3" of the project is considered. My clients respectfully submit that right turns out of the project site should not count toward satisfying the warrant for a signal.
- **Response:** Given the high-speed and high-volume nature of Route 1 traffic, it is expected that the opportunity for right turns to occur during red phases would be constrained at times. Thereby, the signal is expected to be necessary to allow for at least a portion of the right-turning movements from Commerce Boulevard to be completed. In order to address the idea of some right-turning vehicles not required a signal to make their movement, the signal warrant analysis performed for the SFEIR also included an analysis with the right-turning volume reduced by 50%, which found that the 4- and 8-hour vehicle volume warrants were met with the volume reduction in place. As outlined in the SFEIR, and development of Lot 1 and Lot 3, in addition to the existing supercharged facility, would be necessary to fulfill the traffic signal warrants.

**Reference:** SFEIR, Section 4.4.3

Appendix E Mitigation Measures

## **SFEIR Mitigation Measures**

| Mitigation Measure   | Estimated<br>Cost/Value | Responsible Party         | Estimated Completion<br>Date                   |  |  |
|--|-------------------------|---------------------------|--|--|--|
| Transportation   |                         |                           |  |  |  |
| - Design and construct the roadway and intersection<br>improvements at the intersection of Route 1,<br>Commerce Boulevard, and Hawes Street  |                         | National Development      | Prior to occupancy of any<br>proposed building |  |  |
| - Design and implement an optimal traffic signal timing<br>and phasing plan at Route 1 and Commerce Blvd<br>coordinating with the existing signals along<br>Washington Street at Thurston Street, Madison Street,<br>and the existing pedestrian crossing signal |                         | National Development      | Prior to occupancy of any proposed building    |  |  |
| - Design and construct sidewalk on Washington Street<br>for the entire site frontage, replacing the existing<br>walkway area on the northern part of the site  | \$1.4 million           | National Development      | Prior to occupancy of any proposed building    |  |  |
| - Provide signalized crossings and crosswalks along<br>the north side and east side of the intersection of<br>Washington Street, Hawes Street and Commerce Blvd  | ψT. <del>4</del> minon  | National Development      | Prior to occupancy of any proposed building    |  |  |
| <ul> <li>Design and construct sidewalk access directly from<br/>proposed warehouse to existing pedestrian crossing</li> </ul>  |                         | National Development      | Prior to occupancy of any<br>proposed building |  |  |
| - Construct a crosswalk across Commerce Blvd<br>approximately 100' east of the Washington Street to<br>provide access between the Wrentham Business<br>Center land uses.   |                         | National Development      | Prior to occupancy of any proposed building    |  |  |
| Construct a sidewalk on the north side of Commerce<br>Blvd between the warehouse site driveways and<br>Washington Street   |                         | National Development      | Prior to occupancy of any proposed building    |  |  |
| Wastewater and Water Supply  |                         |                           |  |  |  |
| - Loop water main from Commerce Boulevard through<br>Lot 3 to Washington Street  | \$90,000                | National Development      | Prior to occupancy of Lot 3                    |  |  |
| - Recharge of wastewater on site through the use of leaching systems for individual lots   | \$175,000               | Lot Owners                | Prior to occupancy of building<br>on lot       |  |  |
| <ul> <li>Recharge of runoff on site through the use of<br/>leaching systems for roof runoff from all buildings</li> </ul>  | \$175,000               | Lot Owners                | Prior to occupancy of building on lot          |  |  |
| -Development and implementation of a Long Term<br>Operation and Maintenance Plan for storm water<br>system   |                         | Design team and<br>Owners | On-going and throughout life of facility       |  |  |
| - Removal from Zone A of existing storm water basin<br>on Lot 3 and reconstruct outside of Zone A and size so<br>that no runoff will occur up to the 1% annual storm<br>event  | \$25,000                | National Development      | Prior to occupancy of building on lot          |  |  |

## **SFEIR Mitigation Measures**

| Mitigation Measure   | Estimated<br>Cost/Value | Responsible Party                   | Estimated Completion<br>Date   |  |  |
|--|-------------------------|-------------------------------------|--|--|--|
| Air Quality  |                         |                                     |  |  |  |
| - Mobile source impacts are mitigated by the overall<br>predicted decrease in motor vehicle VOC emission<br>rates, the traffic management plan and the<br>infrastructure improvements proposed                         |                         | Owners/Tenants                      | Throughout all phases of the<br>project and as part of<br>operation of facility  |  |  |
| - Development of a Construction Pollution Prevention<br>Plan that will control dust during construction  | \$2,500                 | Owners design and construction team | Being updated for Ph. 3 – to<br>be completed in conjunction<br>with filing of permits with Town<br>of Wrentham and to be<br>continuously updated |  |  |
| - Use of higher efficiency building envelopes for<br>warehouse and convenience store that exceed stretch<br>code standard by 11%-32%   |                         | Owners                              | Prior to issuance of occupancy permit.   |  |  |
| - Use of higher efficiency heating, cooling, and hot<br>water systems to include in warehouse a hybrid<br>ASHP/Gas heating equipment w/ASHP sized to 20%<br>of peak demand   | \$500,000               | Owners                              | Prior to issuance of occupancy permit.   |  |  |
| - Warehouse will be heated but not air-conditioned   |                         | Owners                              | Prior to issuance of occupancy permit.   |  |  |
| <ul> <li>High efficiency convenience store refrigeration<br/>equipment</li> </ul>  |                         | Owners                              | Prior to issuance of occupancy permit.   |  |  |
| - High efficiency LED lighting in both buildings   |                         | Owners                              | Prior to issuance of occupancy permit.   |  |  |
| - Water conservation fixtures  |                         | Owners                              | Prior to issuance of occupancy permit.   |  |  |
| - Use of construction equipment manufactured to federal Tier 4 emission standards  |                         | Owner                               | During construction  |  |  |
| - Pursuing design support and customer incentives from NGRID   |                         | Owners                              | Ongoing throughout design<br>and construction process  |  |  |
| Noise  |                         |                                     |  |  |  |
| - Signage notifying trucks to not idle more than 15 minutes  | \$500                   | Owners/<br>Contractors              | Ongoing and throughout all phases of the project.  |  |  |
| - Trucks accessing the site will be encouraged to enter<br>from Route 1 and avoid the residential areas of<br>Thurston Street, Madison Street and Hawes Street.<br>Trucks will be monitored for operating mufflers     |                         | Owners/<br>Contractors              | Ongoing and throughout all phases of the project.  |  |  |
| Historic and Architectural Resources   |                         |                                     |  |  |  |
| - There are no historical or architectural resources on<br>the Project. Any items that are found that are of<br>historical significance will be brought to the attention of<br>the Massachusetts Historical Commission |                         | Owner                               | Ongoing and throughout all phases of construction.   |  |  |
| Pollution Prevention   |                         |                                     |  |  |  |
| - The site will be balanced to the maximum feasible<br>extent so that material will not be imported or exported<br>unless necessary.   |                         | Owner design team                   | Design phase of each lot   |  |  |
| - Provide solid waste storage areas throughout the site<br>such that recyclable materials are segregated. Ensure<br>that lessees develop a system to manage recyclable<br>material                                     |                         | Owners/Tenants                      | Ongoing and throughout all phases of construction and occupation.  |  |  |

Appendix F Draft Section 61 Findings

## MASSACHUSETTS DEPARTMENT OF TRANSPORTATION DRAFT SECTION 61 FINDING PURSUANT TO M.G.L. CHAPTER 30, SECTION 61

| PROJECT NAME:      | Wrentham Business Center |
|--------------------|--------------------------|
| PROJECT LOCATION:  | Wrentham, MA             |
| PROJECT PROPONENT: | ND Acquisitions, LLC     |
| EEA NUMBER:        | 15765                    |

## I. <u>PROJECT DESCRIPTION</u>

The Wrentham Business Center (WBC or Project) located on Commerce Boulevard and Washington Street in Wrentham, MA on 31.2 acres of land currently subdivided into 3 lots. The Project consists of a mixed-use commercial development to include: a 116,000 sf indoor recreation facility (already constructed), a 180,000 sf warehouse, and a gas station and convenience store. Access to all facilities will be provided through Commerce Boulevard.

The Proponent will Apply to the Massachusetts Department of Transportation – Highway Division (MassDOT) for a vehicular access permit for physical modifications to the existing commercial driveway (Commerce Boulevard) at its intersection with the state highway layout (Route 1).

## II. MASSACHUSETTS ENVIRONMENTAL POLICY ACT HISTORY

An Expanded Environmental Notification Form (EENF) for the warehouse and retail development was prepared and submitted, pursuant to the Massachusetts Environmental Policy Act (MEPA) (G.L., c. 30, ss. 61-62I) and Sections 11.03 of the MEPA regulations (301 CMR 11.00), to the Executive Office of Energy and Environmental Affairs (EEA) in November 2017. The Secretary of Energy and Environmental Affairs issued a Certificate on the ENF on November 29, 2017, approving a Phase I waiver prior to the completion of a Draft Environmental Impact Report (DEIR) for the remaining phases of the Project.

This Section 61 Finding is accordingly based on information disclosed and discussed in the MEPA process.

## III. OVERALL PROJECT IMPACTS

The next phase of development for the proposed project is estimated to generate approximately 382 vehicle trips (207 entering vehicles and 175 exiting vehicles) during the weekday morning peak hour, approximately 335 vehicle trips (152 entering vehicles and 183 exiting vehicles) during the weekday afternoon peak hour, approximately 258 vehicle trips (133 entering vehicles and 125

exiting vehicles) during the Saturday midday peak hour, and approximately 3,514 trips (1,757 entering vehicles and 1,757 exiting vehicles) during a typical weekday.

## IV. SPECIFIC PROJECT RELATED IMPACTS AND MITIGATION MEASURES

The Proponent has analyzed the impacts to delay and queueing within the study area due to the proposed project and has determined that the mitigation measures outlined below are required to minimize the traffic impacts of this development.

## Site Access Improvements

The Proponent will construct a total of four site driveways on Commerce Boulevard to provide access to the proposed warehouse and gas station/convenience store uses. Proposed pedestrian access within the site and along Commerce Boulevard is discussed below.

## Off-Site Traffic Improvements

As part of the proposed signalization of Washington and Hawes Street/Commerce Boulevard, the proposed project would update the traffic signal timing and coordination along Washington Street (Route 1) including Thurston Street, the signalized pedestrian crossing to the north of the site, Hawes Street/Commerce Boulevard, and Madison Street, as appropriate and feasible. As part of the installation of a new traffic signal at the intersection of Washington Street (Route 1) and Hawes Street/Commerce Boulevard, Washington Street (Route 1) would be restriped to include exclusive left-turn lanes for both the northbound and southbound approaches. The intersection phasing would include a protected left-turn phase for Washington Street (Route 1) northbound and southbound traffic followed by northbound and southbound general traffic, an exclusive pedestrian phase activated upon push-button only, and the Hawes Street and Commerce Boulevard eastbound and westbound general traffic.

## **Bicycle and Pedestrian Improvements**

In order to address MassDOT's Health Transportation Policy Directive, a review of the feasibility of implementing pedestrian and bicycle accommodations on Washington Street (Route 1) was completed. There are currently no bicycle or pedestrian facilities along Washington Street (Route 1) between the I-495 Interchange located approximately 4,000 feet south of the site and the Foxborough townline, located over two miles north of the site. The available right-of-way on Washington Street (Route 1) between the curbline on the west side of the roadway and the state highway layout line on the east side (site side) of the roadway is approximately 73 feet wide. After accommodating the four existing 12-foot-wide travel lines and one proposed 11-foot wide left-turn lane, approximately 14 feet remain available within the cross-section. The remaining 14 feet would be able to provide a five-foot wide sidewalk on the east side (site side) of Washington Street (Route 1) and four- to five-foot-wide shoulders on each side of the roadway.

The following pedestrian facilities are included to help aid in circulation in and around the project site:

• Maintain existing sidewalk on the south side of Commerce Boulevard for pedestrian traffic traveling between uses on Commerce Boulevard and Washington Street (Route 1).

- Construct sidewalk on the north side of Commerce Boulevard connecting to Washington Street (Route 1).
- Construct sidewalk on Washington Street (Route 1) for the entire site frontage, replacing the existing walkway area on the northern end of the project site.
- Provide sidewalk access directly from the proposed warehouse to the existing signalized pedestrian crossing across Washington Street (Route 1).
- Provide signalized crossings and crosswalks along the north side and east side of the intersection of Washington Street (Route 1) at Hawes Street/Commerce Boulevard.
- Construct a crosswalk across Commerce Boulevard east of Washington Street (Route 1) to provide access between the proposed restaurants and warehouse land uses.

## Transportation Demand Management (TDM)

The proposed project will implement a Transportation Demand Management (TDM) program to encourage the use of alternative modes of transportation to reduce single occupancy vehicles (SOV) trips to the site. As part of the project's commitment to supporting alternative transportation measures, elements such as those described below would be implemented as part of the project's TDM once final tenants have been identified:

- Establish TDM Coordinator The project would establish a TDM coordinator to oversee site-related transportation demand management, provide central commuter information centers within the site to assist employees, including posting local bus schedules at central points.
- Employee Scheduling Site operations will be designed to stagger employee shifts to minimize peak arrival and departure at the site. Employees will be scheduled to minimize arrival and departure during peak hours to minimize the impacts to traffic operations on the surrounding roadways and intersections.
- Truck Deliveries Truck deliveries and service vehicles will serve the site during the offpeak hours whenever possible to minimize the impacts to traffic operations on the surrounding roadways and intersections.
- Public Transit Commerce Boulevard would be maintained, including sidewalks and turnaround area, to provide the opportunity for potential future fixed route service to and from the site as deemed by GATRA. Continued coordination with GATRA will identify additional specific needs for potential future fixed route on-site service. GATRA Go ondemand service would continue to be provided to the project site.
- Bicycle Storage On-site bicycle racks will be installed to promote bicycle use by employees and customers.
- Pedestrian Access No sidewalks currently exist along Washington Street (Route 1) or Hawes Street in the vicinity of the project site. However, the proposed signal at the project site driveway would provide a pedestrian crossing phase for pedestrians crossing Washington Street (Route 1) at Commerce Boulevard. The proposed project would

construct a sidewalk along Washington Street (Route 1) for the entire project site frontage. Pedestrian access and sidewalks would also be provided on site to provide safe circulation between parking areas and buildings.

- Car sharing/Carpooling The development will provide information on State resources available for carpools, taxis, and on-demand ride-hailing services. Mass.gov provides information on various resources for trips, ranging from carpool and vanpool options, to help finding local taxi service, to information on local transportation provides by cities and towns, including:
  - Bay State Commute: Employees should be encouraged to join this free, state program that rewards people who choose to walk, bike, telecommute, carpool, vanpool, or use transit. The program can also help members find a carpool or vanpool to join. When members record their green trips, they are able to track elements such as money saved, calories burned, emissions prevented, and earn Bay State Commute points. Points can be redeemed for restaurant coupons, retailer discounts, or tickets to shows and attractions.
  - RideMatch: An online searchable directory open to the public to find public, private and accessible transportation options. The providers listed for Wrentham are Wrentham Council on Aging which provides medical/healthcare, recreation and shopping trips for seniors and people with disabilities and Executive Coach which provides airport service and recreation trips for the general public.
- Transportation Monitoring Program The Proponent would conduct an annual traffic monitoring program for a period of five years, beginning six months after occupancy of the full-build project. It would include:
  - Simultaneous automatic traffic recorder (ATR) counts at Commerce Boulevard and Hawes Street for a continuous 24-hour period on a typical weekday;
  - Travel survey of employees and patrons at the site (to be administered by the Transportation Coordinator); and
  - Weekday morning and weekday afternoon peak hour turning movement counts and capacity analysis at the intersections of Washington Street (Route 1) with Thurston Street, with Hawes Street/Commerce Boulevard, and with Madison Street.

The proponent is committed to achieving the introduction and maintenance of these TDM measurements by lease agreements, funding commitments or other appropriate measures. As tenants are identified, the proponent will work with the tenants to achieve the TDM measures identified above.

The proponent will conduct a transportation monitoring program beginning at full occupancy of the project and continuing for a period of five years.

## Greenhouse Gas (GHG) Commitment

At the completion of construction, the Proponent will provide a certification to the MEPA Office, signed by an appropriate professional. The certification will identify either of the following: 1) all of the energy efficiency mitigation measures adopted by the Project as part of the Mitigation Alternative have been implemented; or 2) an equivalent set of energy efficiency
mitigation measures, which together are designed to achieve the same percentage reduction in CO<sub>2</sub> emissions as the Mitigation Alternative, when compared to the Base Case, based on the same modeling assumptions in this report, have been adopted.

## V. <u>FINDINGS</u>

For the reasons stated above, MassDOT hereby finds that, with implementation by the Proponent and MassDOT of the mitigation measures described above, all practical means and measures will be taken to avoid or minimize adverse traffic and related impacts to the environment resulting from the proposed Wrentham Business Center. Appropriate conditions will be included in the access permits to be issued by MassDOT to describe more fully and ensure implementation of said measures.

## MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION DRAFT SECTION 61 FINDING PURSUANT TO M.G.L. CHAPTER 30, SECTION 61-62I

## PROJECT NAME: PROJECT LOCATION: PROJECT PROPONENT: EEA NUMBER:

Wrentham Business Center Commerce Boulevard Wrentham ND Acquisitions, LLC 15765

These Findings for the *Wrentham Business Center* have been prepared in accordance with the provisions of M.G.L.c.30, Section 6-62I and 301 CMR 11.00. On [date] the Secretary of Environmental Affairs issued a Certificate stating that the project's Final Environmental Impact Report (FEIR), dated [date] complied with the MEPA statute and regulations.

A description of the potential impacts and mitigation measures associated with the project as currently proposed are described in Table 1.

Based upon its review of the MEPA documents, the permit applications submitted to date, and the Department's regulations, the Department finds that the terms and conditions to be incorporated into the permits required for this project will constitute all feasible measures to avoid damage to the environment and will minimize and mitigate such damage to the maximum extent practicable for those impacts subject to the Department's authority. Implementation of the mitigation measures will occur in accordance with the terms and conditions set forth in the permits.

| EIR        |                               |                                | Responsible  |                        |
|------------|-------------------------------|--------------------------------|--------------|------------------------|
| Category   | Impact                        | Mitigation                     | Party        | Mitigation Schedule    |
| Wetlands   | Construction of Project will  | Maintenance of a 50' No-       | Owner        | During all phases of   |
|            | require work within the       | disturb zone around all        |              | construction and post- |
|            | buffer zone to a bordering    | resource areas where no        |              | construction.          |
|            | vegetated wetlands            | activity will be allowed       |              |                        |
|            |                               | Erection of erosion control    | Owner        | Before start of        |
|            |                               | barriers around limits of work |              | construction and       |
|            |                               | within 100 feet of resource    |              | maintained until site  |
|            |                               | areas                          |              | has heen stahilized    |
|            |                               | Development of short-term      | Owner/Tenant | Developed prior to     |
|            |                               | and long-term pollution        |              | construction and       |
|            |                               | prevention plans and           |              | implemented during all |
|            |                               | Operation & Maintenance Plan   |              | phases of construction |
|            |                               | for BMPs                       |              | and during facility    |
|            |                               |                                |              | operation.             |
|            | Existing stormwater basin     | Basin B1 will be removed from  | Owner        | During construction    |
|            | located within a Zone A       | within the Zone A              |              |                        |
| Land       | Construction will result in   | A 50' No-disturb zone will be  | Owner/Tenant | During all phases of   |
| Alteration | creation of 11.4 acres of new | maintained around all wetland  |              | construction and post- |
|            | impervious area on the 31.2   | resource areas.                |              | construction.          |
|            | acre site                     | Approximately 17 acres (54%)   | Owner        | During all phases of   |
|            |                               | of the site will consist of    |              | construction and post- |
|            |                               | vegetated green space, which   |              | construction.          |
|            |                               | includes wetlands and buffer   |              |                        |
|            |                               | 70nes                          |              |                        |
|            |                               | Installation of a stormwater   | Owner        | During construction    |
|            |                               | management system that         |              |                        |
|            |                               | exceeds the standards of the   |              |                        |
|            |                               | DEP Stormwater Standards and   |              |                        |
|            |                               | local hylaws                   |              |                        |
| Climate    | Future climate conditions     | An analysis using the Climate  | Owner        | During construction    |
| Change     | may affect the project site.  | Resilience Design Standards    |              |                        |
|            |                               | Tool was developed to identify |              |                        |
|            |                               | potential climate conditions   |              |                        |
|            |                               | that may affect the site. The  |              |                        |
|            |                               | Project design storm exceeds   |              |                        |
|            |                               | the recommended value in the   |              |                        |
|            |                               | tool. The elevation of the     |              |                        |
|            |                               | building is such that riverine |              |                        |
|            |                               | flooding is not an issue       |              |                        |
|            |                               | noouling is not all issue.     |              |                        |

## Table 1 – Potential Impacts and Mitigation Measures

| EIR        |                             |   | Responsible  |                          |
|------------|-----------------------------|---|--------------|--------------------------|
| Category   | Impact                      | Mitigation                                  | Party        | Mitigation Schedule      |
| Greenhouse | Generation of emissions due | Use of higher efficiency                    | Owner        | During design and        |
| Gas        | to stationary sources.      | building envelopes for                      |              | construction.            |
| Emissions  |                             | warehouse and convenience                   |              |                          |
|            |                             | store that exceed stretch code              |              |                          |
|            |                             | standard bv 11%-32%                         |              |                          |
|            |                             | Two EV charging stations will               | Owner        | During design and        |
|            |                             | be installed and EV conduit will            |              | construction.            |
|            |                             | be installed an additional 10               |              |                          |
|            |                             | spaces for both the warehouse               |              |                          |
|            |                             | building and the restaurants.               |              |                          |
|            |                             |   |              |                          |
|            |                             | - Use of higher efficiency                  | Owner        | During design and        |
|            |                             | heating, cooling, and hot water             |              | construction.            |
|            |                             | systems to include in                       |              |                          |
|            |                             | warehouse a hybrid ASHP/Gas                 |              |                          |
|            |                             | heating equipment w/ASHP                    |              |                          |
|            |                             | sized to 20% of peak demand                 |              |                          |
|            |                             | - Warehouse will be heated                  | Owner        | During design and        |
|            |                             | but not air-conditioned                     | Owner        | construction             |
|            |                             |   | Owner        | During design and        |
|            |                             | - High efficiency convenience               |              | construction.            |
|            |                             | store refrigeration equipment               |              |                          |
|            |                             | - High efficiency LED lighting in           | Owner        | During design and        |
|            |                             | both buildings                              |              | construction.            |
|            |                             | - Water conservation fixtures               | Owner        | During design and        |
|            |                             | Dura da | -            | construction.            |
|            |                             | - Pursuing design support and               | Owner        | During design and        |
|            |                             | NCRID                                       |              | construction.            |
|            | Generation of emissions due | Mohile source impacts are                   | Owner/Tenant | During design            |
|            | to mobile sources           | mitigated by the TDM program                | Owner/Tenant | construction and         |
|            | to mobile sources.          |   |              | operation                |
|            |                             | Construction equipment used                 | Owner        | During construction      |
|            |                             | will have engines                           |              |                          |
|            |                             | manufactured to Tier 4 federal              |              |                          |
|            |                             | emission standards                          |              |                          |
| Storm      | Storm water runoff during   | Preparation of a storm water                | Owner        | During design,           |
| Water      | construction and building   | management design in                        |              | permitting, construction |
|            | operations.                 | compliance with the DEP                     |              | and operation            |
|            |                             | Stormwater Standards and                    |              |                          |
|            |                             | Removal of an existing storm                | Owner        | During construction      |
|            |                             | water basin located within a                | o which      |                          |
|            |                             | Zone A on Lot 3                             |              |                          |
|            |                             | Construction and on-going                   | Owner/Tenant | During construction and  |
|            |                             | operation of a multi-stage                  |              | operation                |
|            |                             | storm water system that will                |              |                          |
|            |                             | exceed the DEP and local                    |              |                          |
|            |                             | standards for TSS removal and               |              |                          |
|            |                             |   | 0            | During design            |
|            |                             | Development and                             | Owner/Tenant | During design,           |
|            |                             | Operation and Maintenance                   |              | construction and         |
|            |                             | Dian for storm water sustain                |              |                          |
|            |                             | Plan for storm water system                 |              |                          |
|            |                             | Construction and                            | Owner/Tenant | During design,           |
|            |                             | implementation of Low Impact                |              | construction and         |
|            |                             | Development elements within                 |              | operation.               |
|            |                             | storm water system                          |              |                          |
|            |                             | ,   |              |                          |

Appendix G Filing and Circulation List Massachusetts Environmental Policy Act Office (MEPA) 100 Cambridge Street, Suite 900 Boston, MA 02144 <u>MEPA@mass.gov</u>

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Massachusetts Historical Commission The MA Archives Building 220 Morrissey Blvd Boston, MA 02125

Metropolitan Area Planning Council 60 Temple Place, 6<sup>th</sup> floor Boston, MA 02111 <u>mpillsbury@mapc.org</u> <u>afelix@mapc.org</u> Wrentham Board of Selectmen Wrentham Town Hall 80 South Street Wrentham, MA 02081 bos@wrentham.ma.us

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