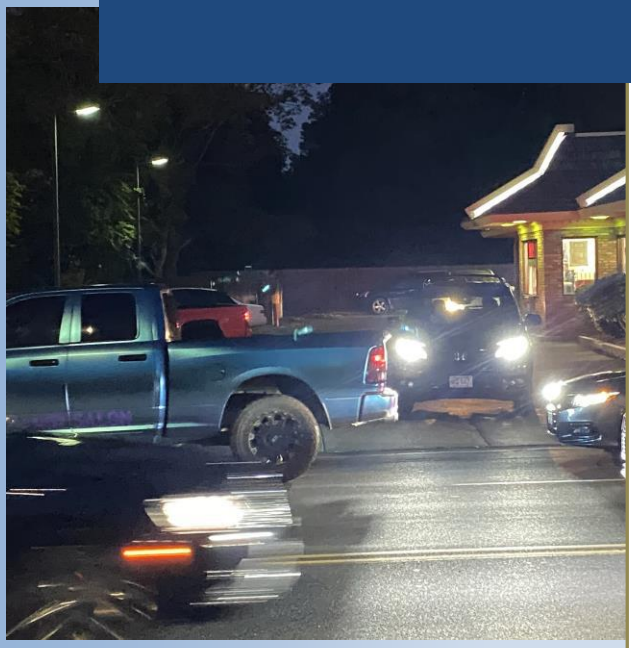
This report—by concerned residents of Reading, MA—responds to the McDonald's-commissioned study concluding that the proposed new double drive-through restaurant at 413 Main Street would have a "negligible" traffic impact. This report finds traffic could double based on the site plan configuration combined with McDonald's restaurant automation technologies, mobile app usage, marketing efforts, and other factors not mentioned in the McDonald's study.



McDonald's: Severe Traffic Impacts from a Double Drive-Through plus Mobile Marketing and AI/Automation Technologies

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1 Executive summary

Through late October, approximately 100 Reading residents had signed a petition asking McDonald's to withdraw its plan to reconstruct a double drive-through restaurant at 413 Main Street. The signers ask that McDonald's partner with the Town and create a lower-traffic mixed-used development appropriate to this site, which sits at the gateway to our walkable downtown just two blocks from the Reading MBTA station. McDonald's can still make profits while aligning with Town goals.

Meanwhile, the existing McDonald's proposal is still active and undergoing site plan reviews before Reading's Community Planning & Development Commission (CPDC).

This report challenges the traffic study commissioned by McDonald's. That study, conducted by McMahon engineering, concluded that the traffic impacts of the project would be less than one additional car every five minutes and that this change would be "negligible." [1] Following public comment on Oct. 16, 2023, the CPDC discussed the need for peer review on this study.

In that spirit, this report

- describes numerous factors, including technological ones, that will drive additional traffic but were not analyzed or mentioned in the McMahon report;
- demonstrates why a doubling of traffic is an apparent objective of McDonald's, and is also likely to occur; and
- provides a data request to McDonald's to help CPDC and the community better understand potential traffic impacts.

The stakes are enormous for downtown Reading.

- Nearby intersections on Main Street are already at a traffic "level of service" of "F," the worst grade, with continual traffic tie-ups at peak times.
- McDonald's may already be the single biggest traffic generator downtown.
- If a doubling occurred, peak weekday midday trips—in one hour—would soar from the McMahon estimate of 173 trips (each in and out visit counts as two trips) to 346 trips.
- This condition could persist for decades.

[1] https://www.readingma.gov/DocumentCenter/View/12025/04---McDonalds-Reading_Traffic-Assessment_2023-04-26-PDF

1.1 The McDonald's traffic study did not analyze the proposed drive-through changes in the site plan or discuss the company's market research data or advances in automation

The study performed by McMahon for McDonald's (referred to here as the McMahon study) did not actually count traffic at the existing McDonald's. It also did not describe how doubling the number of drive-through lanes of the proposed site plan for 413 Main would affect traffic. Instead, it used a reference manual aggregating counts from other jurisdictions, and based estimates of additional traffic based on the modest increase in the square footage of the proposed restaurant.[2] Additionally, the McMahon study:

- did not cite data from comparable McDonald's redevelopment projects with similar drive-through changes, even though such data should be available;
- did not mention that traffic dictions at intersections just north and just south of the restaurant are already at an "F" condition and how this condition might impact restaurant traffic or vice versa; and
- did not include any discussion or analysis of factors and technology trends that will affect traffic flows at 413 Main, including:
    - **Company goals and motivations:** McDonald's objectives are to increase sales, revenue, and customer traffic as it invests $6 billion in restaurant reconstruction.
    - **Marketing data:** McDonald's, the world's largest fast-food chain, has sophisticated marketing strategies. It also has the nation's most-downloaded fast-food app.
    - **Automation data:** McDonald's is devising new strategies to speed and increase vehicle throughput, including via dynamically-changing signs and AI-driven voice ordering.
    - **Delivery services and in-app sales:** Services such as Uber Eats and Door Dash, as well as in-app purchases, create new flows of traffic from drivers who do not need to first stop to make orders.

Section 2 discusses the existing congestion; Section 3 discusses the above factors.

[2] The study's numbers come from the Institute of Transportation Engineers' (ITE) publication, Trip Generation Manual, 11th Edition, published in 2021. Per the McMahon report, this "provides traffic generation information for various land uses compiled from studies conducted by members nationwide. This reference establishes vehicle trip rates (in this case expressed in trips per square foot) based on actual traffic counts conducted at similar types of existing land uses…. vehicle trip generation estimates for the existing and proposed McDonald's sites were developed using Land Use Code 934 (Fast-Food Restaurant with Drive-Through Window)."

2 Existing conditions along Main Street near McDonald's are already badly congested, with restaurant traffic backing up onto Main Street

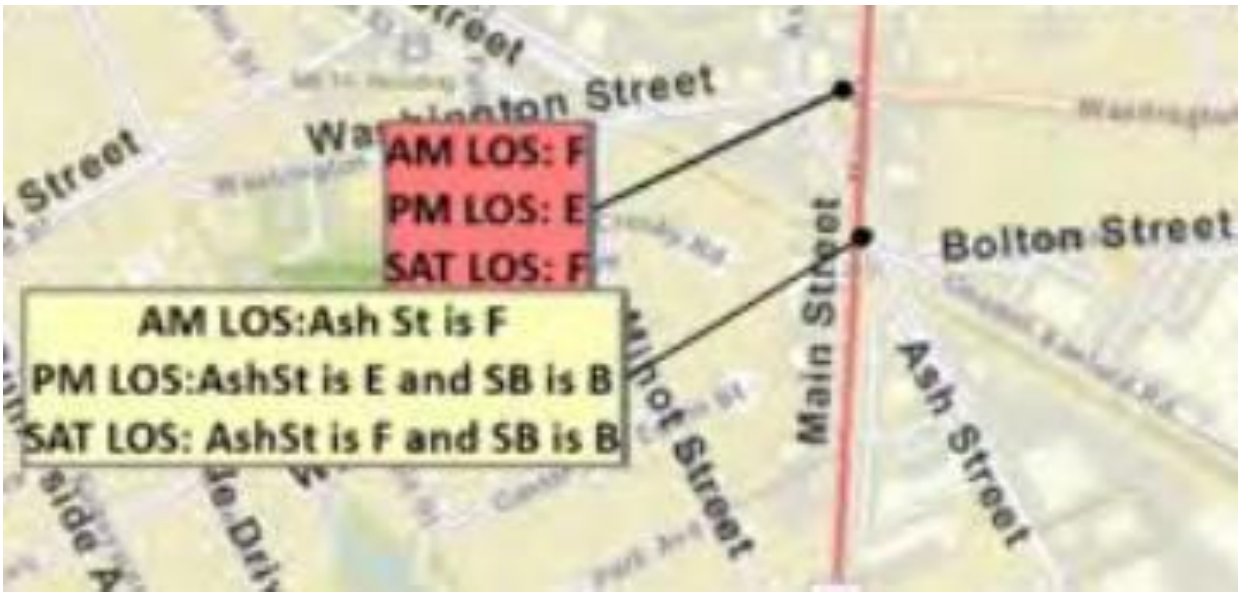
The following two subsections document existing congested conditions and the role of the existing McDonald's restaurant in creating those conditions.

2.1 An earlier report by a Town consultant reported that the "level of service" in this area is already an "F"

A recent Town-commissioned study performed by Green International Associates, and released in 2021, documented that the intersections at Washington and Main, and at Ash and Main – just north and south of McDonald's—are already at an "E" or "F" [3] as shown in the figure below.

Traffic engineers classify traffic conditions on an "A" through "F" scale for the "level of service" (LOS). A site with an LOS of "F" means that every vehicle moves in lockstep with the vehicle in front of it. Roads that face near-constant traffic jams are at a level of service of F.

Figure 1: Existing Traffic at Nearby Intersections are Already at the Worst Level of Traffic Service



During the Oct. 16 public hearing, CPDC Chair John Weston commented that McDonald's is probably the largest traffic generator in downtown Reading. Actual numbers for the existing restaurant are not available to the community or to CPDC.

Given that the restaurant sits directly between two intersections already designated "F," it is reasonable to consider that the restaurant is playing a role in this "F" level traffic. Yet the

[3] https://www.readingma.gov/DocumentCenter/View/7924/Walkers-Brook-Corridor-Analysis--Final-Deliverable-392021-PDF?bidId=

McMahon study did not discuss these current conditions or the possibility that McDonald's contributes to them now or might worsen them in the future.

2.2 McDonald's traffic study reports that existing peak traffic is already backing up onto Main Street

The McMahon study did include some important observations, if not actual traffic counts. The report made the following comments about existing back-ups at Main Street.

- "A five-vehicle pick-up queue occurred multiple times during each of the observation periods, which would obstruct ordering operations until pick-up queues were cleared. ***On one occasion during the Saturday midday peak period, vehicles were queued back to the site driveway on Main Street, briefly obstructing the potential for vehicles to enter the site*.** (emphasis added)
- "During the weekday midday, weekday afternoon, and Saturday midday drive-thru count periods, the vehicle queue on Main Street extending back from the signalized intersection with Washington Street was reviewed. ***The queue was frequently observed to extend past the McDonald's driveway and temporarily obstruct entering and exiting access*.**" (emphasis added).

The McMahon study (quoting the ITE, not actual traffic counts at 413 Main) reported these estimated current traffic flows. (These are vehicle trips, where the entry and exit of one car counts as two trips.) The report noted that some vehicles entering fast-food restaurant drive-throughs are spontaneous visitors who were already passing by.

Existing Traffic to McDonald's During Certain Peak Hours (per McMahon)

Weekday Midday Peak Hour		Total (portion from pass-by traffic)	**Weekday PM Peak Hour**		Total (portion from pass-by traffic)	**Saturday midday Peak Hour**		Total (portion from pass-by traffic)
In	Out		In	Out		In	Out	
88	85	**173 (96)**	58	54	**112 (64)**	96	92	**188 (104)**

3 McDonald's investment plans, site plan, and trends in marketing and AI and automation could drive a doubling of traffic through the site

A number of factors and technologies could double traffic at 413 Main. More data would help improve this analysis.

3.1 McDonald's is investing $6 billion to reconstruct restaurants and naturally wants to drive higher traffic and revenue

Five years ago, McDonald's announced that it would spend $6 billion to renovate most of its 14,000 U.S. restaurants.[4] Some projects are renovations or facelifts; others are complete razing and reconstruction projects. The 413 Main project falls into the latter category.

McDonald's is the world's largest fast-food company. Like any company, McDonald's wants to increase revenue and increase customer visits. McDonald's uses data to drive its decisions. The decision to spend $6 billion presumably resulted from analyses that such an investment would not only achieve a payback, but also significant profits from additional traffic and revenue.

CEO Chris Kempczinski said in a memo earlier this year that the company had created new demand and wanted to "capture" this extra demand through its restaurant program. "We must accelerate the pace of our restaurant openings to fully capture the increased demand we've driven over the past few years," Kempczinski said in the memo.[5]

McDonald's is investing in a variety of efforts designed to increase and speed traffic throughput. This includes site changes, increased drive-through capacity, and menu boards that can change dynamically to speed the passage of cars, as discussed in later subsections.

3.2 The new restaurant is engineered to double vehicle throughput relative to the existing restaurant

The new McDonald's site plan is engineered to process at least twice as many vehicles.

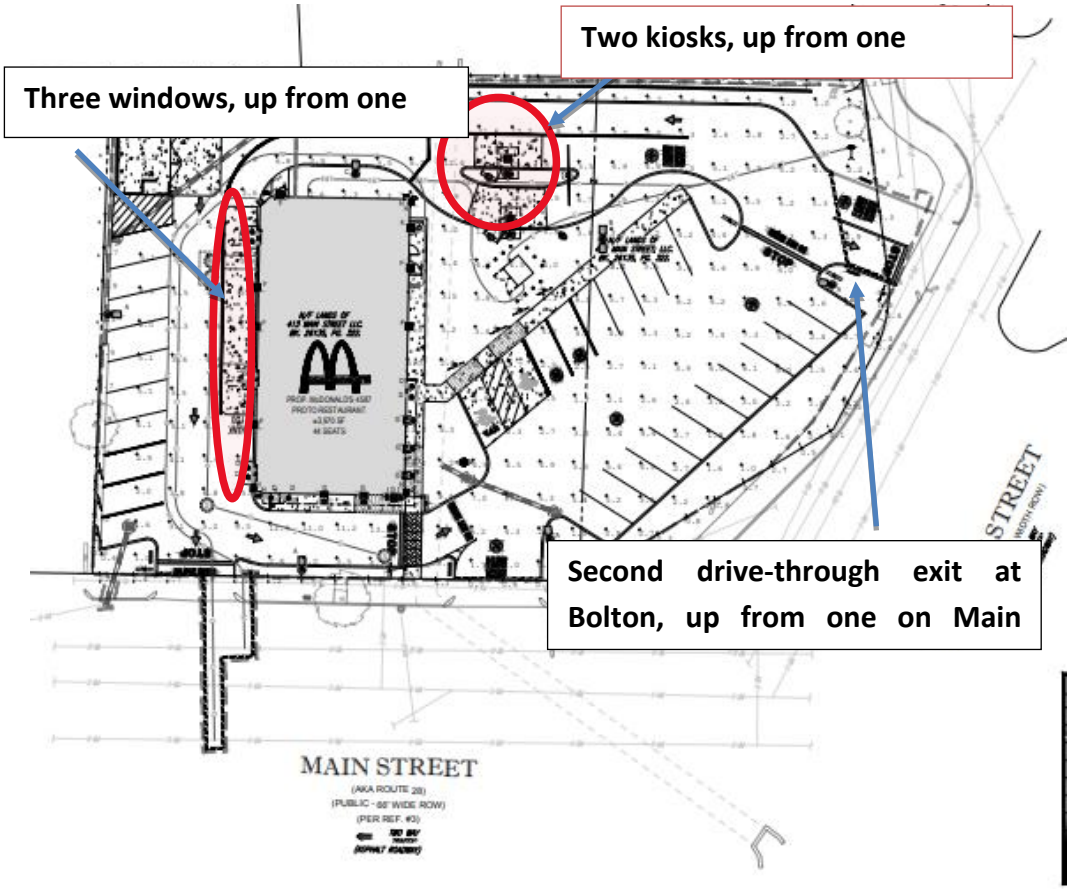
- The existing McDonald's has one ordering kiosk. The new one would have two ordering kiosks**—twice as many**.

[4] McDonald's plans $6 billion makeover of its restaurants - CBS News https://www.cbsnews.com/news/mcdonalds-plans-6-billion-makeover-of-its-restaurants/#:~:text=McDonald%27s%20on%20Tuesday%20announced%20a%20%246%20billion%20plan,allow%20for%20table%20service%20and%20%22refreshed%22%20exterior%20designs.

[5] McDonald's plans reorganization, job cuts as it accelerates restaurant openings (cnbc.com) https://www.cnbc.com/2023/01/06/mcdonalds-plans-reorganization-job-cuts.html

- The existing McDonald's has one window to both pay and pick up food. The new one will have three windows—**three times as many**. (The first will be for payment, which is speedy with credit cards, and the second and third are for food pickup.)
- The existing McDonald's has two entrances but only one exit for drive-through traffic, onto Main Street. The proposed McDonald's would have two drive-through exits—**twice as many**. McDonald's proposes to allow cars to wind around and exit at Bolton.

The Plan is Engineered to Handle Double the Vehicle Traffic



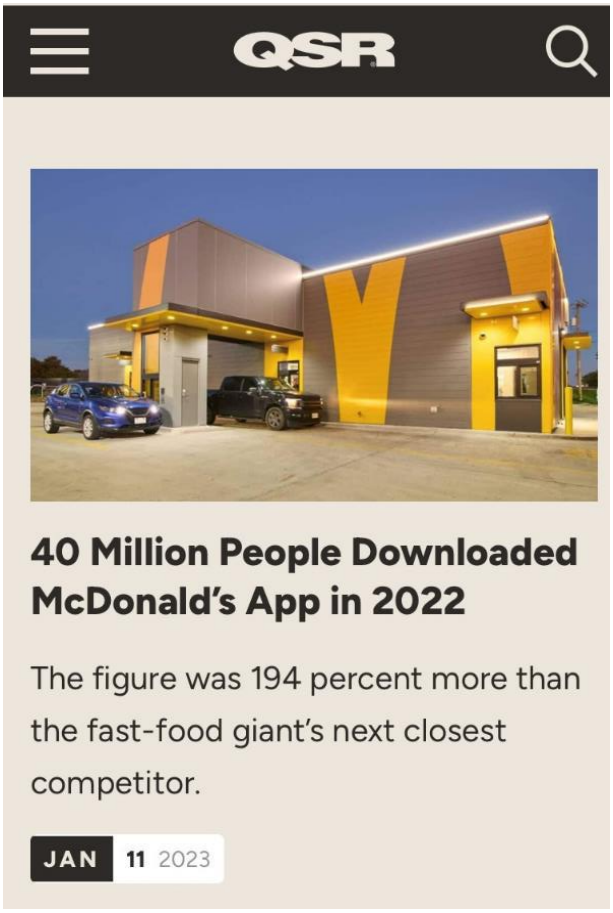
Given the McDonald's consultant's observation that exiting traffic already backs up on Main Street at times, is reasonable to infer that McDonald's foresees the one Main Street exit becoming gridlocked from new traffic, necessitating the second drive-through exit.

It is reasonable to infer that's McDonald's choice to handle double the number of vehicles also reflects the company's actual goal for the site.

3.3 Customer use of fast-food drive-throughs is increasing, and McDonalds is investing heavily in mobile marketing technologies to draw drivers to its restaurants

According to published reports, drive-through visits account for a larger share of fast-food sales than ever before. In some markets, the drive-through business represents 70 percent of McDonalds' sales, and the fast-food giant is seeking to increase throughput rates. [6]

In 2022, McDonald's mobile app was the world's most-downloaded "quick service restaurant" app, with 40 million downloads in the United States alone. That figure roughly corresponds to 20 percent of the U.S. population between ages 16 and 64—and does not include downloads in other years. [7]



It's conservative to assume that one in five cars contains a phone with the McDonald's app installed. Reading's I-93/I-95 interchange sees 375,000 vehicles per day.

It is reasonable to assume that McDonald's is using app data and other market research data to guide investment decisions, including the decision to engineer 413 Main Street to handle twice as many vehicles on the site.

The McDonald's app:

- Provides pop-up notifications (such as with special offers and sales) to users who allow such notifications

[6] The Future of McDonald's Is in the Drive-Thru Lane | WIRED https://www.wired.com/story/mcdonalds-drive-thru-mymcdonalds-app/

[7] 40 Million People Downloaded McDonald's App in 2022 - QSR Magazine https://www.qsrmagazine.com/growth/consumer-trends/40-million-people-downloaded-mcdonalds-app-2022/

- Advises users where to go to find the nearest McDonald's, so long as users enable the app to see their location. For such users, anyone on I-95 can potentially receive guidance to go to 413 Main. Highway billboards also advertise the McDonald's site.
- May offer in-app purchasers a dedicated parking space. This entices drivers ordering from smartphones, such as from area highways, to pick up their pre-paid food as they might do at a highway rest stop.

Billboard before Exit 56B directs drivers to the McDonald's at 413 Main, the only Reading drive-through advertised on I-95

3.4 Beyond a doubling: McDonalds is investing in ways to speed throughput with dynamic signs and AI-based voice ordering

The new restaurant is likely to implement new technologies to speed trips through the site. This speedier pass-through will thus create the potential for traffic to contribute to, or exceed, a doubling.

For example, in 2019, McDonald's bought two AI (artificial intelligence) companies whose technologies are designed to speed vehicle throughput and, as such, total vehicle traffic. [8] The companies are:

- **Dynamic Yield**, which dynamically changes digital menu ordering boards based on what AI models predict customers will want—potentially increasing sales and speeding the process. McDonald's spent $300 million to buy this company. An electronic ordering board is the subject of a special permit application before CPDC. (There would be two of them, because there are two ordering kiosks.) The role of this technology in affecting traffic in downtown Reading has not yet been explored.
- **Apprente,** which builds AI-based voice technology for rapid, reduced-error fast-food order taking. The voice at the kiosk is generated by AI and could result in faster throughputs and, therefore, higher traffic volumes.

[8] McDonald's Acquires Apprente to Double Down on Tech | WIRED https://www.wired.com/story/mcdonalds-acquires-apprente-voice-ai/

3.5 In-app purchases and delivery services such as Uber Eats enable faster throughput and more vehicle trips

Beyond deploying AI to speed throughput, other trends and strategies will allow McDonald's to move vehicles through the site more quickly, thus enabling traffic to theoretically go beyond a doubling.

Two examples:

- Customers who order online or through the app may not have to stop at the ordering or payment windows, speeding their trip.
- Customers who use delivery services like Uber Eats would also indirectly cause faster traffic through the site, because the driver does not have to stop to order or pay.

The McDonald's at 413 Main promotes pickup from mobile app purchases and delivery services

4 Conclusion: Traffic to and through the McDonald's site may double under the proposal, and technology advances may enable traffic to go beyond this doubling

McDonald's seeks to build a restaurant meant to handle twice the number of vehicles and has the means, consumer data, deep bench of app downloads, AI/automation technologies, and the motivation to achieve a doubling of traffic to make ROI and drive profits.

The following table illustrates what numbers would be produced by a doubling during peak hours, and what would happen if a further 20 percent throughput was gained by a combination of AI/automation advances and pre-paid purchases.

Table 1: Traffic Numbers if Site Design Capacity is Met Through McDonald's Marketing

Weekday Midday Peak Hour	**Weekday PM Peak Hour**	**Saturday midday Peak Hour**
Total in/out (portion from pass-by traffic)	Total in/out (portion from pass-by traffic)	Total (portion from pass-by traffic)
Existing **173 (96)**	Existing **112 (64)**	Existing **188/104**
DOUBLING **346/192** If 20% throughput increase from AI/tech: **415/230**	DOUBLING **224/128** If 20% throughput increase from AI/tech: **269/192**	DOUBLING **376/208** If 20% throughput increase from AI/tech: **451/250**

5 Data Request to McDonald's

The McMahon traffic report was written from a reference manual without any examination of what is actually proposed in the site plan before CPDC, any data from McDonald's, or any discussion of the impacts of new technologies.

Concerned residents of Reading are requesting that McDonald's withdraw this proposal and pursue a mixed-use option. Meanwhile we make the following data request to McDonald's:

1. Please provide data on before-and-after drive-through traffic figures from the most recent five restaurants where a 1970s-style single-kiosk, single-window, single-exit restaurant was replaced with a two-kiosk, three-window, and two-exit restaurant with the new dynamic kiosk and AI voice ordering technologies.
2. Provide data on numbers of drive-through visits to the site at 413 Main Street. Please provide all available data from all years.
3. Do you plan to reserve one or more parking spaces for drivers making in-app purchases and/or for delivery service drivers?
4. Overall, what are your predictions and/or objectives for speeding travel time and total traffic for drive-throughs at this site if this proposal is built?
5. From your mobile analytics data, provide data on
    a. how many people are using smartphones—whether through the app or the website--to find 413 Main. Include data on where they are coming from and how many originated on interstate highways. Please provide daily and annual numbers for the past 5 years.
    b. how many people are actually purchasing meals through the app and then driving to 413 Main just for pickup. Please provide daily and annual numbers for the past 5 years and how many are coming from interstate highways.
6. How many purchases are made by delivery services, such as Door Dash and Uber Eats that visit 413 Main? Please provide daily and annual data from all years available.
7. What does your research data show about the effect of dynamic kiosk signage on reducing traffic throughput times and increasing traffic numbers?
8. What does your research data show about the effect of AI-based voice ordering on reducing throughput times and increasing traffic numbers?

9. How long does it take, on average, for a drive-through customer to get through and make a purchase at 413 Main Street? Please provide annual average data from the last 5 years showing any improvements.
10. What promotions do you expect to make for the new restaurant at 413 Main, and what levels of additional traffic do you expect to result from these promotions?

RECEIVED
By Town Clerk GP at 9:18 am, Aug 24, 2023

Town of Reading

16 Lowell Street
Reading, MA 01867-2683
Phone: 781-942-6670
Email: amacnichol@ci.reading.ma.us

Community Planning and Development Commission

NOTICE OF PUBLIC HEARING

Notice is hereby given that, under M.G.L. Ch. 40A §9 and Sections 4.3, 4.4, 4.6, and 8.0 of the Reading Zoning Bylaw, the Community Planning and Development Commission (CPDC) will hold a Public Hearing on **Monday, September 11, 2023 at 7:45 PM, in the Select Board Room at Town Hall, 16 Lowell Street, Reading MA, and through the remote and online measures below,** to hear the Site Plan Review and Special Permit application submitted by McDonald's USA, LLC c/o Bohler, for the property located at **413 Main Street** (Assessors Map 17, Lots 64 & 85). The Applicant is proposing to raze the existing McDonald's restaurant and build a 3,970 SF McDonald's restaurant with new parking, landscaping, and a new side-by-side drive-thru with two lanes. A Special Permit is being sought for proposed signage. A copy of the application and accompanying plans are available to the public at Town Hall by appointment and on the Town website the Thursday prior to the hearing.

Join Zoom Meeting
https://us06web.zoom.us/j/83720541665

Meeting ID: 837 2054 1665

Dial by your location
+1 646 558 8656 US (New York)

Find your local number:
https://us06web.zoom.us/u/kILHjldo5

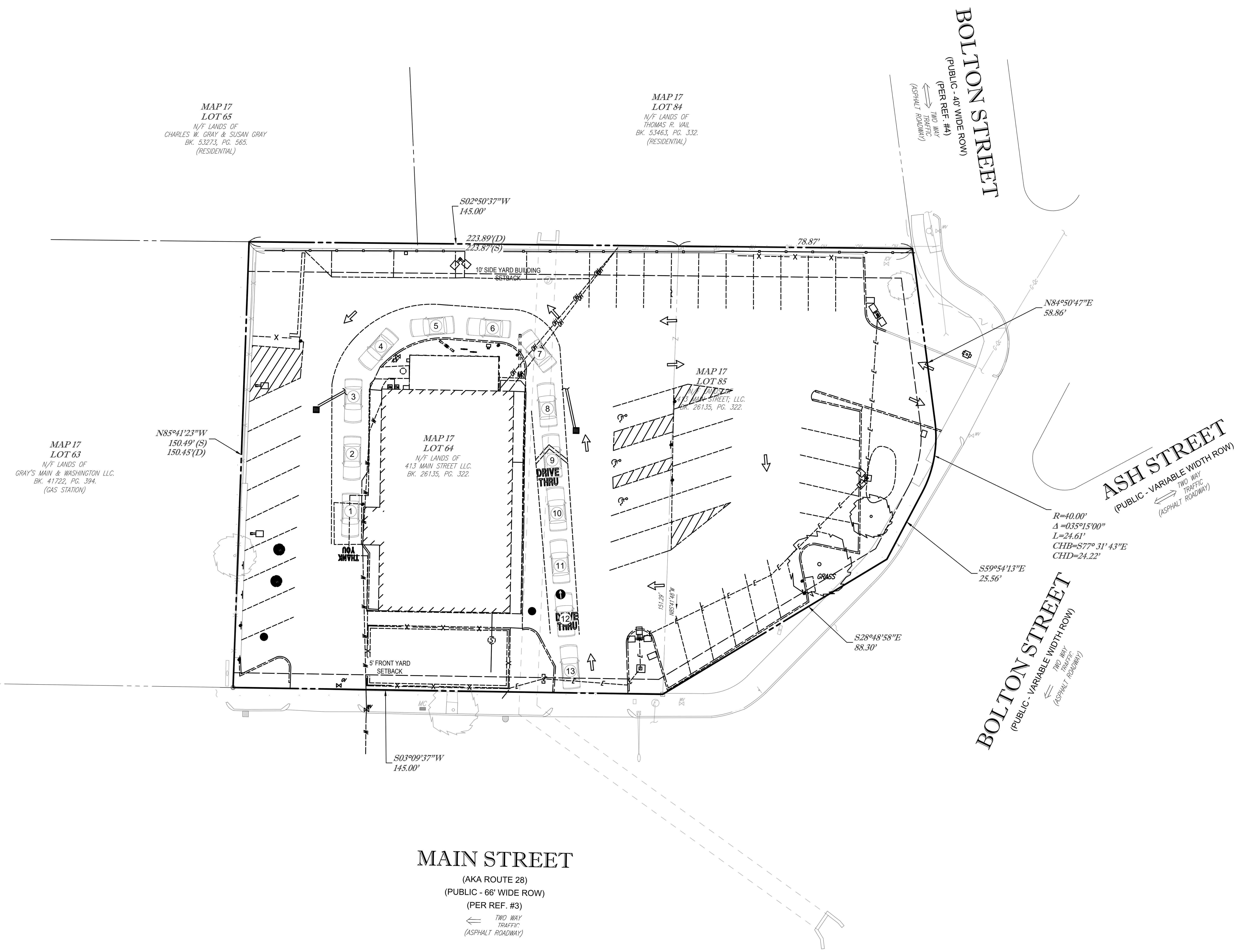
If you have any questions, comments, or difficulty accessing the meeting, please email Community Development Director Andrew MacNichol at amacnichol@ci.reading.ma.us.

Reading Community Planning & Development Commission

SECTION

KEY PLAN

McDonald's	**MCDONALD'S** 413 MAIN STREET, TOWN OF READING, MASSACHUSETTS	**SECTION EXHIBIT** DATE: 10/02/2023 PROJECT #: W222000	M.J. MRVA REGISTERED LANDSCAPE ARCHITECT MASSACHUSETTS No. 1217 RHODE ISLAND No. 419 NEW YORK No. 002359 NEW HAMPSHIRE No. 109 CONNECTICUT No. 1359 MAINE No. 4248 VERMONT No. 01337 OHIO No. 250433 BOHLER 352 TURNPIKE ROAD SOUTHBOROUGH, MA 01772 Phone: (508) 480-9900 www.BohlerEngineering.com



REV	DATE	DESCRIPTION	BY
1	06/12/2023	REV. PER ZBA & ABUTTERS FEEDBACK	CSE
2	08/09/2023	REV. FOR CPDC SUBMITTAL	CSE
3	10/03/2023	REV. FOR CPDC SUBMITTAL	CSE

JOHN A. KUCICH
CIVIL
No. 41530
REGISTERED PROFESSIONAL ENGINEER

McDonald's®

OFFICE: BOSTON REGION
ADDRESS: 110 N CARPENTER ST CHICAGO, IL 60607

PLAN APPROVALS

SIGNATURE	DATE
APPROVED McDONALD'S AGENT	

Know what's **below.** Call before you dig.

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BOHLER//

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

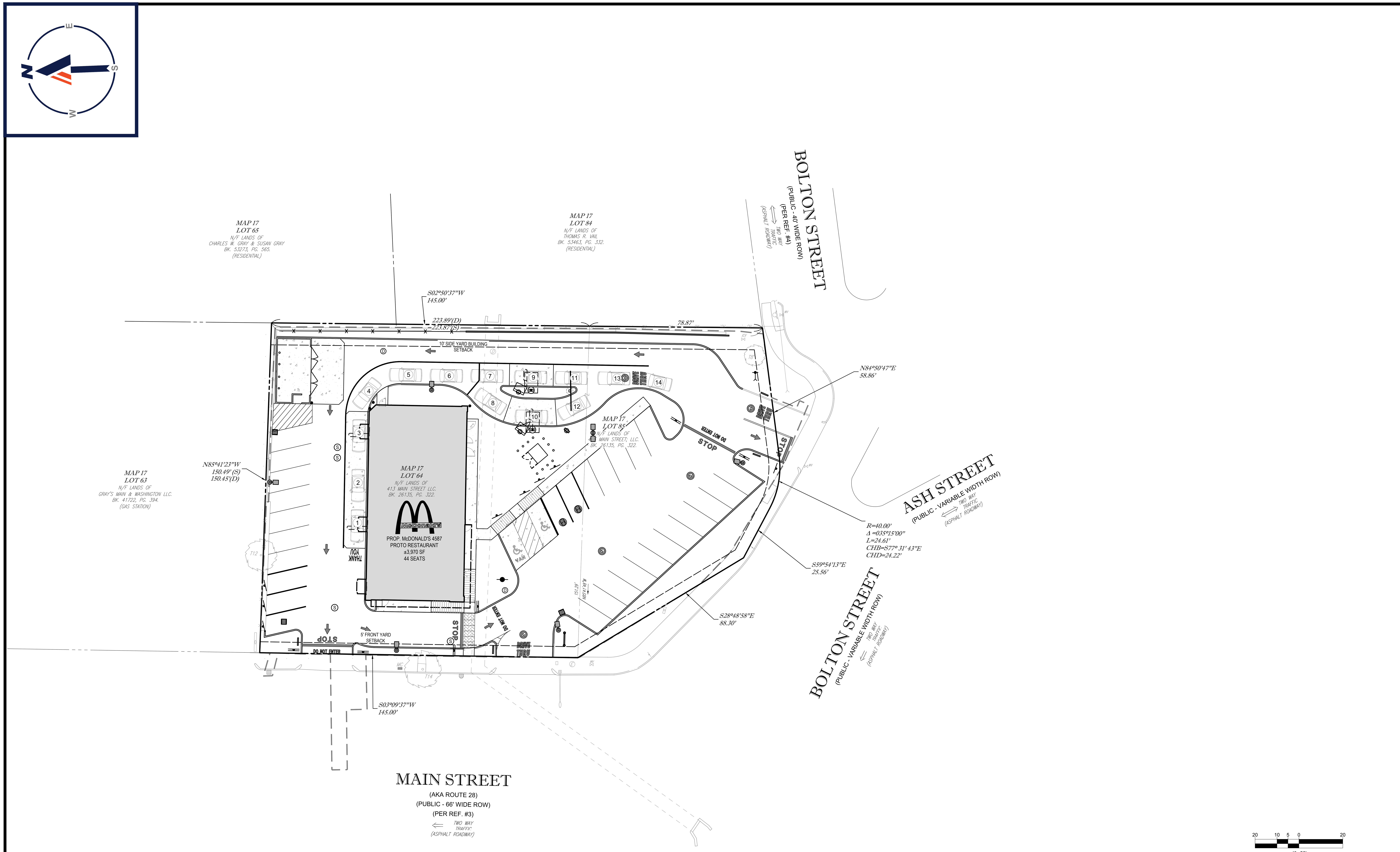
COMPLIANCE CHECK — DATE
CONSTRUCTION CHECK — DATE
CONSTRUCTION CHECK — DATE

PROJECT No.: W222000
CAD I.D. #: W222000-SPPD-3a.dwg

STREET ADDRESS: 413 MAIN STREET
CITY: READING
STATE: MA
COUNTY: MIDDLESEX
SITE I.D.: 20-0015
PLAN DESCRIPTION: **EXISTING DRIVE-THRU STACKING EXHIBIT**

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

SHEET NO. 1 OF 15



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3	10/03/2023	REV. FOR CPDC SUBMITTAL	CSE

JOHN A. KUCICH
CIVIL
No. 41530
REGISTERED PROFESSIONAL ENGINEER

McDonald's®

AND SHALL NOT BE REPRODUCED WITHOUT THEIR WRITTEN PERMISSION. THESE PLANS AND SPECIFICATIONS ARE THE PROPERTY OF McDONALD'S CORPORATION

OFFICE: BOSTON REGION
ADDRESS: 110 N CARPENTER ST, CHICAGO, IL 60607

PLAN APPROVALS
SIGNATURE | DATE
APPROVED McDONALD'S AGENT

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SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

COMPLIANCE CHECK — DATE
CONSTRUCTION CHECK — DATE
CONSTRUCTION CHECK — DATE

PROJECT No.: W222000
CAD I.D. #: W222000-SPPD-3a.dwg

STREET ADDRESS: 413 MAIN STREET
CITY: READING — STATE: MA
COUNTY: MIDDLESEX
SITE I.D.: 20-0015
PLAN DESCRIPTION: ***PROPOSED DRIVE-THRU STACKING EXHIBIT***

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

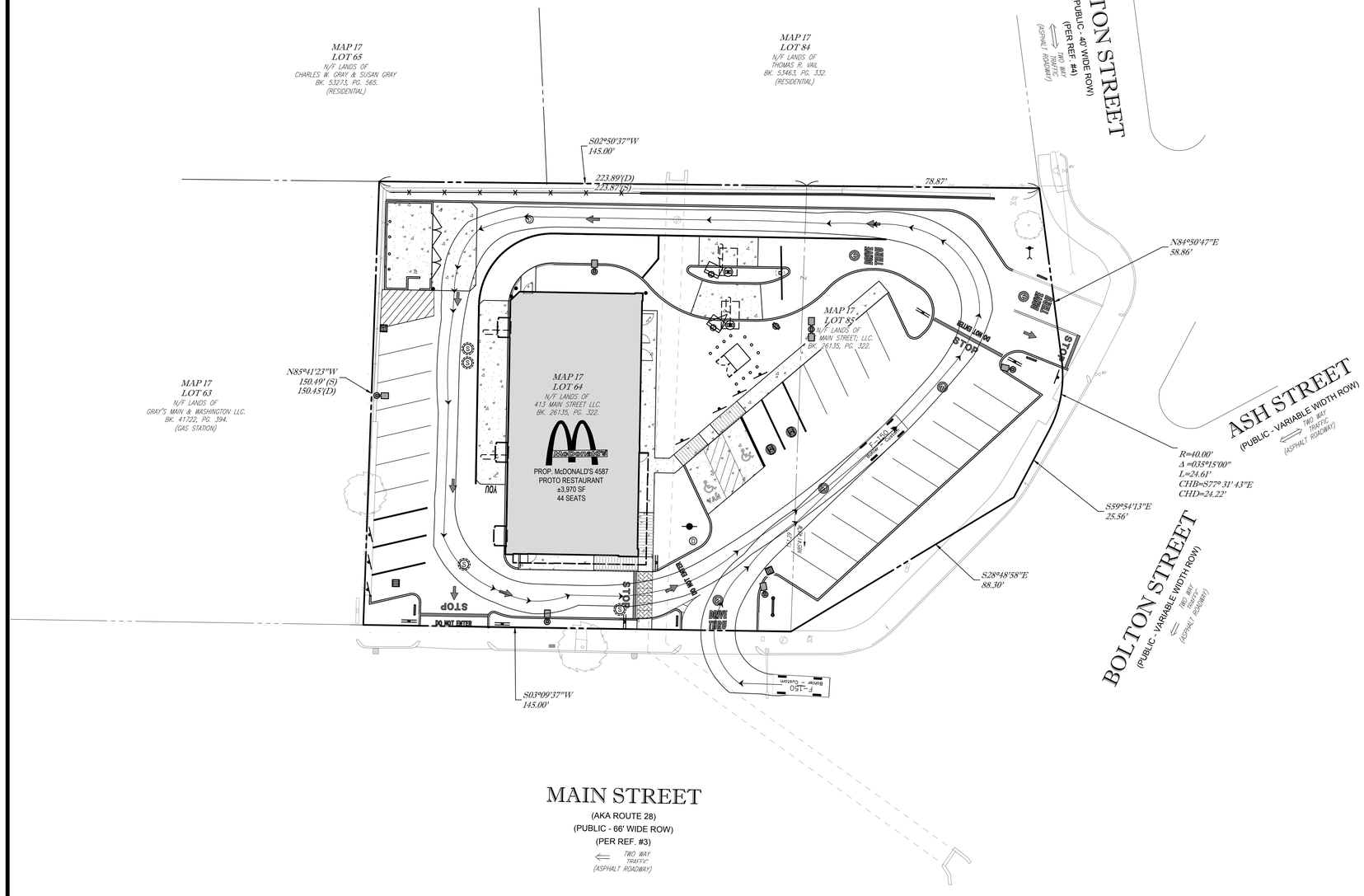
SHEET NO. **1** OF 15

SITE INFORMATION

1. APPLICANT:
   McDONALD'S USA, LLC
   110 N CARPENTER STREET
   CHICAGO, IL 60607

2. OWNER:
   413 MAIN STREET, LLC
   10 JEAN AVE #2
   CHELMSFORD, MA 01824

3. PARCEL:
   MAP 17, LOTS 64 & 85
   413 MAIN STREET
   READING, MA 01867



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COMMONWEALTH OF MASSACHUSETTS
JOHN J. KUCZARSKI
CIVIL
No. 41530
PROFESSIONAL ENGINEER
REGISTERED PROFESSIONAL ENGINEER
NEW HAMPSHIRE LICENSE No. 15424
RHODE ISLAND LICENSE No. 9610
MAINE LICENSE No. 12455

McDonald's

BOSTON REGION
110 N CARPENTER ST
CHICAGO, IL 60607
OFFICE
ADDRESS

PLAN APPROVALS

	DATE
SIGNATURE	
APPROVED McDONALD'S AGENT	

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SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

COMPLIANCE CHECK DATE

CONSTRUCTION CHECK DATE

CONSTRUCTION CHECK DATE

PROJECT No.:
W222000

CAD I.D. #:
W222000-SPPD-3a.dwg

-

STREET ADDRESS
413 MAIN STREET

CITY
READING

STATE
MA

COUNTY
MIDDLESEX

SITE I.D.
20-0015

PLAN DESCRIPTION
F-150 TRUCK TURN EXHIBIT

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

SHEET NO.
1
OF 15

352 Turnpike Road
Southborough, MA 01772
508.480.9900

October 2nd, 2023

Town of Reading
Community Planning & Development Commission
Attn: Andrew MacNichol
16 Lowell Street
Reading, MA 01867

Re: Site Plan Review, Special Permit, & Sign Application
McDonald's Restaurant
413 Main Street
Reading, MA

Dear Mr. MacNichol,

On behalf of McDonald's USA, LLC, please find the enclosed application for Site Plan Review, request for Special Permit for a proposed monument sign, and site signage applications as part of the proposed site improvements of the McDonald's Restaurant located at 413 Main Street. In support of this application, please find enclosed the following documents:

- One (1) copy of the Site Plan Review Application & Check List;
- One (1) copy of the owner authorization letter;
- Two (2) copies of the Project Narrative & Impact statement;
- Two (2) 24"x36" copies of the "Proposed Site Plan Documents" prepared by Bohler Engineering, dated 4/28/2023, revised 8/9/2023;
- Three (3) 11"x17" copies of the "Proposed Site Plan Documents" prepared by Bohler Engineering, dated 4/28/2023, revised 8/9/2023;
- Two (2) 24"x36" copies of the Building Elevations and Floor Plan prepared by AECOM, dated 4/25/2023;
- Three (3) 11"x17" copies of the Building Elevations and Floor Plan prepared by AECOM, dated 4/25/2023;
- Three (3) 11"x17" copies of the Colored Building Elevations;
- Three (3) 11"x17" copies of the Fence Section Rendering;
- Three (3) copies of the Existing and Proposed Stacking Exhibits;
- Three (3) copies of the Truck Circulation Plan;
- Two (2) copies of the Drainage Report, prepared by Bohler dated July 28, 2023;
- Two (2) copies of the Traffic Assessment prepared by McMahon Associates, dated 4/26/2023;
- Seven (7) copies of the sign applications;
- Seven (7) copies of the sign program book;
- Three (3) copies of the Sewer Memo;
- Plain white envelopes labeled with abutters' addresses, postage stamp, & no return address; and
- Check in the amount of $7,500 made out to the Town of Reading for the application fee

McDonald's is proposing a substantial investment into the above-mentioned property to redevelop the existing McDonald's restaurant which has been in existence and operation since 1963. The parcel is located along the easterly side of Main Street in Reading and is identified as Map #17 and Lot #64 and #85 which contains approximately ±0.74 acres of land.

Under existing conditions, the site features a ±3,745 SF restaurant with an outdoor playground area and single lane, single order point drive-thru. The site has a total of three access drives, including one entrance only and one exit only access to Main Street, and one two-way drive to Bolton Street. The proposed redevelopment project consists of a raze and rebuild for a new ±3,970 SF McDonald's restaurant with drive-thru along with new parking areas, landscaping, utilities, and stormwater management improvements.

McDonald's operating hours for indoor dining and drive-thru operations are anticipated to be 6am-12am while the outside drive-thru lane will be closed at 9 pm daily. The lane will be closed by turning off the order speaker and placing a sign in front of the lane which will state this lane closes at 9 PM daily.

In an effort to improve their existing drive-thru operations, which exist today as a single order point and single lane drive-thru, McDonald's is proposing a side-by-side drive-thru layout with two (2) lanes and two (2) order points. The proposed side-by-side layout includes two (2) new digital menu board and one (1) new digital pre-browse boards. To accommodate the proposed layout, the parking count will be reduced by 13 spaces (43 existing vs 30 proposed). A recirculation lane is also proposed at the front of the building which allows vehicles needing to recirculate the site to do so without having to exit out and re-enter the site from the Main Street right-of-way. No changes to the existing site access drives are proposed.

The proposed building layout is similar to the existing as there is a large 4'x6' underground box culvert running east to west across the middle of the property that is proposed to be maintained, constraining potential layouts. A culvert assessment was conducted by Whitestone Associates who completed an inspection of the existing culvert and did not identify any significant issues with the existing condition.

In addition to the Site Plan Review and Special Permit applications the proposed project requires a Zoning Board of Appeals Special Permit to modify the existing non-conforming restaurant with drive-through window use within the Bus B Zoning district and a Variance for the proposed digital drive-through menu boards that are considered electronic signs which are prohibited. This application was submitted and approved by the Zoning Board of Appeals (ZBA) at a 7/25/23 Hearing. During this hearing, a direct abutter at 4 Bolton Street, voiced potential concerns regarding negative impacts to sound pollution on their property. The ZBA approved the site plan with a 12' high Tuf-Barrier Sound Reflective Wall with an STC rating of 31. However, through additional discussions with the abutter after the ZBA approval McDonald's has agreed to upgraded the wall to a Silent Protector Plus (STC-39 rated) model to address the abutters concern. The remaining fence line proposes an 8' high vinyl fence. To provide further mitigation, the layout had been revised to provide an additional landscape buffer in front of the fence containing shrubs and McDonald's will close the outside drive-thru lane at 9 PM. Under existing conditions there is only a 6' wooden fence existing today directly against the existing parking lot and as such the abutter has agreed this should be a significant improvement and did not have any further concerns with the proposed project at the time of the issuance of this letter.

The project will also require a Notice of Intent from the Conservation Commission for work within 100' of an open channel. This application will be submitted concurrently with the CPDC applications.

The Applicant is requesting a Special Permit per Section 8.6 of the Town of Reading Zoning Bylaws to construct a 25 SF monument sign 7' in height. Regulations require the sign to be setback 20' but due to site layout constraints the sign is proposed to be setback 5' from the property line. The majority of quick serve restaurants business come from pass-by traffic. That said having adequate signage is imperative not only to their business but also for matter of safety to ensure vehicles have sufficient time to recognize the restaurant with enough time to safely react and make a safe turning movement to the property. Not having a monument sign as proposed would reduce pass-by customer recognition time of the property and therefore could result in less safe vehicle movements. Pursuant to Section 4.4.5 of the Town of Reading Zoning Bylaw, we believe the proposed site improvements are in line with the required conditions for a Special Permit:

- *4.4.5.1 The proposed use will be suitably located in the neighborhood in which it is proposed and in relation to the entire Town.*

  No changes to the existing use, which has been in existence since 1963, are proposed as it will remain as a restaurant with drive-through service. The proposed monument sign is anticipated to be in consistent character in relation to the entire Town and neighborhood. There are freestanding pole mounted signs which exist for other uses south along Main

Street while the proposed monument sign will be aligned with the sign type preferred by the town.

- *4.4.5.2 The proposed use will be compatible with existing uses and other uses permitted by right in the same district.*

  No changes to the existing use, which has been in existence since 1963, are proposed as it will remain as a restaurant with drive-through service. The proposed monument sign is anticipated to be compatible with the other existing commercial businesses within the Bus B district.

- *4.4.5.3 The proposed use will not constitute a nuisance due to air and water pollution, flood, noise, dust, vibration, lights, or visually offensive structures and accessories.*

  No changes to the existing use of the property are proposed. The proposed monument sign is not anticipated to constitute a nuisance due to air and water pollution, flood, noise, dust, vibration, lights, or visually offensive structures and accessories.

- *4.4.5.4 The proposed use will not be a substantial inconvenience or hazard to abutters, vehicles, or pedestrians.*

  The proposed monument sign is not anticipated to be a substantial inconvenience or hazard to abutters, vehicles, or pedestrians. In fact, the majority of quick serve restaurants business come from pass-by traffic. That said having adequate signage is imperative not only to their business but also for matter of safety to ensure vehicles have sufficient time to recognize the restaurant with enough time to safely react and make a safe turning movement to the property. Not having a monument sign as proposed would reduce pass-by customer recognition time of the property and therefore could result in less safe vehicle movements.

- *4.4.5.5 Adequate and appropriate facilities will be provided for the proper operation of the proposed use.*

  Adequate and appropriate facilities will be provided for the proper operation of the proposed McDonald's restaurant. The proposed monument sign has no moving or digital parts, and landscaping will be maintained on site and in proximity to the proposed monument sign. Therefore, it is anticipated proper operation will be provided for the proposed monument sign.

- *4.4.5.6 Adjoining premises will be reasonably protected against any possible detrimental or offensive uses on the site, including unsightly or obnoxious appearance.*

  Adjoining premises will be reasonably protected against any possible detrimental or offensive uses on it. A 12' high sound wall is proposed along the east property line to provide improved sound mitigation to the abutting property where only a 6' high wooden fence exists today. The proposed monument sign is not anticipated to be unsightly or obnoxious in appearance.

- *4.4.5.7 The proposed use will be in conformance with the sign regulations of Section 8 of the Zoning Bylaw.*

  The proposed monument sign is to have a sign face area of 25 SF and be 7' in height in conformance with the sign regulations of Section 8 of the Zoning Bylaws. Refer to Sheet C-301 of the "Proposed Site Plan Documents" for additional information.

- *4.4.5.8 The proposed use will provide convenient and safe vehicular and pedestrian movement within the site in relation to adjacent streets, property or improvements.*

  The location of the proposed monument sign is outside of the site lines of vehicles entering and exiting the site. Therefore, it is not anticipated that the proposed monument sign will be detrimental to the convenient and safe vehicular and pedestrian movement within the site and in relation to adjacent streets.

- *4.4.5.9 Adequate space will be provided for the off-street loading and unloading of vehicles, goods, products, materials, and equipment incidental to the normal operation of the proposed use.*

  The proposed monument sign is not anticipated to have an effect on off-street loading operations.

- *4.4.5.10 Adequate methods of disposal and storage will be provided for sewage, refuse and other wastes resulting from the proposed uses, and adequate methods of drainage will be provided for surface water.*

  The proposed monument sign is not anticipated to have an effect on methods of disposal and storage of sewage, refuse, and other wastes from the proposed use.

- *4.4.5.11 The proposed uses will ensure protection from flood hazards, considering such factors as elevation of buildings, drainage, adequacy of sewage disposal, erosion and sedimentation control, equipment location, refuse disposal, storage of buoyant materials, extent of paving, effect of fill, roadways, or other encroachments on flood runoff and flow.*

  The proposed monument sign is not anticipated to have an effect on flood hazard protection.

- *4.4.5.12 The proposed use will ensure protection of water quality in both public and private supplies.*

  The proposed monument sign is not anticipated to have an effect on water quality in both public and private supplies.

We trust that the provided information will be sufficient for the Community Planning & Development Commission's review, however, should you have any questions or need additional information, please do not hesitate to contact us at 508-480-9900. Otherwise, we appreciate the Community Planning & Development Commission's consideration of this matter and look forward to discussing this at the next available Community Planning & Development Commission meeting.

Sincerely,

BOHLER ENGINEERING

Eric G. Dubrule, PE

Daniel Allen, PE

April 26, 2023

Eric Dubrule
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772

RE: Traffic Assessment
McDonald's Redevelopment
413 Main Street, Reading, MA

McMahon, a Bowman company, has completed a traffic assessment for the proposed McDonald's redevelopment located at 413 Main Street (Route 28) in Reading, Massachusetts. The proposed redevelopment would demolish the existing McDonald's building and construct a new McDonald's with additional drive-thru queuing space. As part of the redevelopment, 11 parking spaces would be removed to accommodate the additional drive-thru space.

This assessment includes a review of estimated trip generation, drive-thru operations, and internal site circulation with the existing and proposed McDonald's. The findings are summarized below.

Project Description
The project site is located at 413 Main Street in Reading, Massachusetts. Access is provided via three driveways: one enter-only driveway on Main Street, one exit-only driveway on Main Street, and one full-access driveway on Bolton Street. The site is bounded by commercial land uses to the north, Bolton Street to the south, residential properties to the east, and Main Street to the west. The existing drive-thru is a single lane circulating counterclockwise around the McDonald's building from the south of the building to the north. The order board is located to the east of the building, and the pickup window is located at the north of the building. A total of 43 parking spaces are provided on the site. Three spaces are accessible, two parking spaces are marked for mobile order pickup, and two spaces are marked for drive-thru pull-up parking.

The existing building is approximately 3,398 square feet (sf) with a single drive-thru lane. The proposed redevelopment would replace the existing building with an approximately 3,922 sf McDonald's with two order boards and additional drive-thru queueing space. The redeveloped site would provide 32 parking spaces including two accessible spaces, two mobile order pick-up spaces, and two drive-thru pull-up parking spaces. Access to the site is not proposed to be changed significantly with the redevelopment.

Trip Generation
To estimate the number of vehicle trips associated with the proposed redevelopment, the Institute of Transportation Engineers' (ITE) publication, *Trip Generation Manual, 11th Edition*, was referenced. ITE is a national research organization of transportation professionals, and the *Trip Generation Manual, 11th Edition* provides traffic generation information for various land uses compiled from studies conducted by members nationwide. This reference establishes vehicle trip rates (in this case expressed in trips per square foot) based on actual traffic counts conducted at similar types of existing land uses.

Vehicle trip generation estimates for the existing and proposed McDonald's sites were developed using Land Use Code 934 (Fast-Food Restaurant with Drive-Through Window). A summary of the total trips projected to be generated by the existing and proposed McDonald's is presented in Table 1 below.

Table 1: Proposed Trip Generation

		Weekday Midday Peak Hour			Weekday PM Peak Hour			Saturday Midday Peak Hour		
Description	**Size**	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Existing McDonald's Trips[1]	3,398 s.f.	88	85	173	58	54	112	96	92	188
Proposed McDonald's Trips[2]	3,922 s.f.	102	98	200	67	62	129	111	106	217
Additional Site Trips		**14**	**13**	**27**	**9**	**8**	**17**	**15**	**14**	**29**

1 ITE Land Use Code 934 (Fast-Food Restaurant with Drive-Through Window) based on 3,398 square feet.
2 ITE Land Use Code 934 (Fast-Food Restaurant with Drive-Through Window) based on 3,922 square feet.

As shown in Table 1, the proposed McDonald's redevelopment is estimated to generate approximately 27 additional trips (14 entering vehicles and 13 exiting vehicles) during the weekday midday peak period, approximately 17 additional trips (nine entering vehicles and eight exiting vehicles) during the weekday afternoon peak period, and approximately 29 additional trips (15 entering vehicles and 14 exiting vehicles) during the Saturday midday peak period.

Not all trips to land uses like McDonald's are new trips. In fact, a significant portion of the total trips attracted to such land uses are pass-by trips. Since pass-by traffic is already on the adjacent roadways, this portion of the total redevelopment traffic is reflected in the existing, base traffic volumes, and does not represent additional traffic on the roadway network. Therefore, the total traffic volume associated with the proposed redevelopment is reduced by the pass-by volume to estimate the "new" traffic generated by the project. The resulting new project trips for the proposed McDonald's are displayed in Table 2.

Table 2: New Project Trips

		Weekday Midday Peak Hour			Weekday PM Peak Hour			Saturday Midday Peak Hour		
Description	**Size**	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Existing McDonald's Trips	3,398 s.f.	88	85	173	58	54	112	96	92	188
- Pass-by Trips[1]		-48	-48	-96	-31	-31	-62	-52	-52	-104
Proposed McDonald's Trips	3,922 s.f.	102	98	200	67	62	129	111	106	217
- Pass-by Trips[1]		-55	-55	-110	-35	-35	-70	-60	-60	-120
New Project Trips		**7**	**6**	**13**	**5**	**4**	**9**	**7**	**6**	**13**

1 Based on ITE Land Use Code 934 (Fast-Food Restaurant with Drive-Through Window), 55% of weekday PM trips can be attributed to pass-by trips. No weekday midday or Saturday midday pass-by data are available, so the weekday PM percentage was applied to estimate pass-by trips.

As shown in Table 2 above, the proposed McDonald's redevelopment is estimated to result in 13 new trips (seven entering vehicles and six exiting vehicles) during the weekday midday peak hour, nine new

trips (five entering vehicles and four exiting vehicles) during the weekday afternoon peak hour, and 13 new trips (seven entering vehicles and six exiting vehicles) during the Saturday midday peak hour.

Drive-Thru Queue Observations

Queue observations were conducted at the existing McDonald's drive-thru on Saturday, April 1, 2023 from 11:00 AM to 2:00 PM and on Tuesday, April 4, 2023 from 11:30 AM to 1:30 PM and 4:30 PM to 6:30 PM. The queues observed during the study were separated into two categories: order board queues and pick-up queues. Order board queues were vehicles stopped beginning at the order board waiting to place orders, and pick-up queues were vehicles stopped beginning at the pick-up window waiting to pay and/or pick up orders. The total observed queues, consisting of a combination of order board queues and pick-up queues, are summarized in Table 3 below.

Table 3: Drive-Thru Queue Observations

Queue Type	Weekday Midday	Weekday Afternoon	Saturday Midday
Max Queue[1]	9	9	8
Time of Occurrence	12:35 PM	5:35 PM	1:00 PM
Average Queue[2]	4	3	3

1 Maximum observed queue in number of vehicles including pick up and ordering queues

2 Average observed queue per observation period in number of vehicles including pick up and ordering queues

As shown in Table 3 above, the maximum drive-thru queue was observed to be nine vehicles during the weekday midday peak period, nine vehicles during the weekday afternoon peak period, and eight vehicles during the Saturday midday peak period. A five-vehicle pick-up queue occurred multiple times during each of the observation periods, which would obstruct ordering operations until pick-up queues were cleared. On one occasion during the Saturday midday peak period, vehicles were queued back to the site driveway on Main Street, briefly obstructing the potential for vehicles to enter the site. All other observed queues were contained within the available drive-thru stacking space.

Parking Observations

During the weekday midday, weekday afternoon, and Saturday midday drive-thru count periods, periodic parking observations were conducted. During the observation period, the maximum parking occupancy occurred on Saturday at 11:30 AM when the parking lot was approximately 50 percent full with 20 parking spaces occupied. However, of the 20 occupied spaces, three were order pickup spaces. During the weekday midday and weekday afternoon observation periods, the maximum number of occupied parking spaces was 13 and eight, respectively.

Based on the observations conducted, the reduction to 32 total parking spaces is not anticipated to have a significant impact on operations at the site, as 32 parking spaces would be more than adequate for the needs of the site.

Site Access and Circulation

Access to the site is not proposed to be changed significantly with the redevelopment. Access would continue to be provided via an enter-only driveway on Main Street, an exit-only driveway on Main Street, and a full-access driveway on Bolton Street. With the proposed redevelopment, one-way circulation counterclockwise around the site would be accommodated. Parking would continue to be provided on both the north and south sides of the site, with 21 parking spaces on the south of the site and 11 parking spaces on the north of the site.

Vehicles accessing the site from Main Street would continue east to the parking area south of the building or the drive-thru area on the east side of the site and circulate counterclockwise to the pickup window on the north side of the site. Vehicles accessing the site from Bolton Street would continue north to the drive thru area or circulate counterclockwise around the building using the drive-thru bypass lane to the parking area north of the building or on the southern side of the site. Vehicles exiting the drive-thru would either exit directly onto Main Street via the exit-only driveway or circulate counterclockwise around the building to get back to Bolton Street.

The proposed drive-thru would provide one lane along the east side of the site, which then opens to two lanes approaching two order boards before merging to one lane to circulate the building in a counterclockwise manner. The building would provide one payment window and a second pick-up window to improve the overall efficiency of the operation. With the improvements in place, the site would provide stacking space for approximately 13 vehicles, which would be sufficient to contain the queues observed during the field observations.

With the proposed redevelopment, a new circulation lane would be constructed along the western edge of the site to allow for counterclockwise circulation around the site. The circulation would replace the existing playground on the site and would be stop-controlled at its approach to the parking lot and Main Street enter-only driveway. During the field visit, sight distance observations were conducted at the location of the proposed stop bar to ensure circulating vehicles would have adequate sight distance to see approaching southbound left-turning vehicles from Main Street. Based on these observations, the available sight distance at the stop bar is estimated to be approximately 220 feet as a vehicle on site could see back to the Washington Street signal. The site frontage at this entering driveway should be kept clear to provide necessary visibility given the new site configuration.

During the weekday midday, weekday afternoon, and Saturday midday drive-thru count periods, the vehicle queue on Main Street extending back from the signalized intersection with Washington Street was reviewed. The queue was frequently observed to extend past the McDonald's driveway and temporarily obstruct entering and exiting access. Drivers did occasionally leave gaps for access to the McDonald's driveway, but additional improvements on Main Street may be desirable. No significant vehicle delay was observed for vehicles exiting the site and turning left or right onto Main Street. The proposed project would not be expected to appreciably change the site or Main Street operations.

Findings

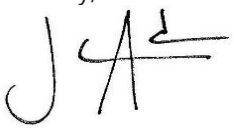
The McDonald's restaurant located at 413 Main Street in Reading, Massachusetts, is proposed to be redeveloped with expanded drive-thru operations. As part of the redevelopment, 11 parking spaces

would be removed to accommodate the additional drive-thru space. Based on parking observations completed during the weekday midday, weekday afternoon and Saturday midday peak periods, the 32 parking spaces provided as part of the redevelopment would serve the parking needs of the McDonald's.

When compared to the existing McDonald's, the proposed redevelopment is estimated to generate approximately 13 new trips (seven entering vehicles and six exiting vehicles) during the weekday midday peak hour and Saturday midday peak hour and nine new trips (five entering vehicles and four exiting vehicles) during the weekday afternoon peak hour. As such, the redevelopment is projected to result in less than one additional new trip every five minutes, and the impact of the project is anticipated to be negligible.

The maximum observed drive-through queues were nine vehicles during the weekday midday and weekday afternoon peak periods and eight vehicles during the Saturday midday peak periods. Under proposed conditions, the expanded drive-thru would allow for increased stacking capacity that would be more than adequate to serve the needs of the restaurant.

Sincerely,



Jason T. Adams, P.E., PTOE
Senior Project Manager

120 Water Street, 4th Floor, Boston, MA 02109
P: 617.556.0020
mcmahonassociates.com | bowman.com

352 Turnpike Road
Southborough, MA 01772
508.480.9900

McDonald's
413 Main Street, Reading, MA
Project Narrative & Impact Statement

Project Narrative:

McDonald's is proposing a substantial investment into the above-mentioned property to redevelop the existing McDonald's restaurant which has been in existence and operation since 1963. The parcel is located along the easterly side of Main Street in Reading and is identified as Map #17 and Lots #64 and #85 which contains approximately ±0.74 acres of land.

Under existing conditions, the site features a ±3,745 SF restaurant with an outdoor playground area and single lane, single order point drive-thru. The site has a total of three access drives, including one entrance only and one exit only access to Main Street, and one two-way drive to Bolton Street. The proposed redevelopment project consists of a raze and rebuild for a new ±3,970 SF McDonald's restaurant with drive-thru along with new parking areas, landscaping, utilities, and stormwater management improvements.

In an effort to improve their existing drive-thru operations, which exist today as a single order point and single lane drive-thru, McDonald's is proposing a side-by-side drive-thru layout with two (2) lanes and two (2) order points. The proposed side-by-side layout includes two (2) new digital menu board and one (1) new digital pre-browse boards. To accommodate the proposed layout, the parking count will be reduced by 13 spaces (43 existing vs 30 proposed). A recirculation lane is also proposed at the front of the building which allows vehicles needing to recirculate the site to do so without having to exit out and re-enter the site from the Main Street right-of-way. No changes to the existing site access drives are proposed.

The proposed building layout is similar to the existing as there is a large 4'x6' underground box culvert running east to west across the middle of the property that is proposed to be maintained, constraining potential layouts. A culvert assessment was conducted by Whitestone Associates who completed an inspection of the existing culvert and did not identify any significant issues with the existing condition.

In addition to the Site Plan Review and Special Permit applications the proposed project requires a Zoning Board of Appeals Special Permit to modify the existing non-conforming restaurant with drive-through window use within the Bus B Zoning district and a Variance for the proposed digital drive-through menu boards that are considered electronic signs which are prohibited. This application was submitted and approved by the Zoning Board of Appeals (ZBA) at a 7/25/23 Hearing. During this hearing, a direct abutter at 4 Bolton Street, voiced potential concerns regarding negative impacts to sound pollution on their property. The ZBA approved the site plan with a 12' high Tuf-Barrier Sound Reflective Wall with an STC rating of 31. However, through additional discussions with the abutter after the ZBA approval McDonald's has agreed to upgraded the wall to a Silent Protector Plus (STC-39 rated) model to address the abutters concern. The remaining fence line proposes an 8' high vinyl fence. To provide further mitigation, the layout had been revised to provide an additional landscape buffer in front of the fence containing shrubs and McDonald's will close the outside drive-thru lane at 9 PM. The lane will be closed by turning off the order speaker and placing a sign in front of the lane which will state this lane closes at 9 PM daily. Indoor dining and the primary drive-thru lane will remain open until 12 am. Under existing conditions there is only a 6' wooden fence existing today directly against the existing parking lot and as such the abutter has agreed this should be a significant improvement and did not have any further concerns with the proposed project at the time of the issuance of this letter.

The project will also require a Notice of Intent from the Conservation Commission for work within 100' of an open channel. This application will be submitted concurrently with the CPDC applications.

Municipal Services:

The site has been operating with an existing McDonald's restaurant since 1963 and no changes to the existing use are proposed as part of the project. Therefore, it is anticipated that the water and sewer demand will not increase under proposed conditions. In addition, the proposed building will have upgraded technology and utilities in the kitchen and bathroom facilities which will be an improvement from existing conditions.

Stormwater runoff generated from the proposed project will also be reduced from pre-development conditions. Under existing conditions, runoff from the majority of the northern portion of the site sheet flows to one of three existing catch basins on-site. These catch basins convey stormwater to an existing underground box culvert which flows West to East through the site. A smaller area at the northwest corner of the property drains to a catch basin which connects directly to the municipal system within Main Street. Stormwater generated under proposed conditions has been designed to drain to deep-sump, hooded catch basins to the maximum extent practicable based on the existing topography and drainage conditions. The catch basins will capture and convey stormwater runoff, via an underground pipe system and drainage manholes, to the existing stormwater management system. Pretreatment of stormwater runoff will be provided to the maximum extent practicable by a combination of the deep-sump and hooded catch basins and a stormwater quality unit prior to discharge into the existing underground culvert and municipal stormwater management system. The existing underground culvert is proposed to be maintained which has constrained the proposed site layout and stormwater management system design. In addition to the stormwater management system improvements, the proposed site improvements result in a reduction of the overall impervious area on the site by approximately 3,775 square feet.

Hours of Operation:

The hours of operation are expected to be maintained with lobby and drive-through open 6:00 AM – 12:00 AM Monday-Friday.

Landscaping and Lighting:

As part of the proposed project, the landscaping will be significantly improved over the existing condition. Under existing conditions, there is very little vegetation on site. The proposed project will reduce the overall impervious area on site by approximately 3,775 square feet, and a total of 40 canopy and evergreen trees and approximately 116 shrubs are proposed as part of the project. Please refer to Sheet C-701 of the "Proposed Site Plan Documents" for additional information.

Lighting will also be improved through the installations of new light poles and dark sky compliant, shielded, LED light fixtures. The project proposes six (6) pole mounted lights at a height of 21-ft. Please refer to Sheet C-703 of the "Proposed Site Plan Documents" for additional information.

Traffic & Parking:

Under existing conditions, the site has one (1) enter only and one (1) exit only driveway along Main street and one (1) full-access driveway along Bolton Street. The project proposes to maintain the existing curb cuts and access with one-way circulation is proposed around the site. To accommodate the proposed layout, the parking count is proposed to be reduced by 13 space (43 existing vs 30 proposed). A recirculation lane is also proposed at the front of the building which allows vehicles needing to recirculate the site to do so without having to exit out to re-enter the site within the Main Street right-of-way.

Please refer to the Traffic Assessment prepared by McMahon Associates included in this submittal Package for additional information.

Trash Removal & Hazardous Materials Storage:

There is an existing trash enclosure at the northeast corner of the property that is proposed to be reconstrued with a new 16'x30' trash enclosure. McDonald's has control over their trash pickup schedules which are designed to happen during off-peak hours to avoid potential impacts to restaurant operations. No hazardous material are anticipated to be stored on the property.

Resource Areas – Wetlands/Rivers/Floodplains/Habitats:

There is an open brook channel which is routed into an underground 4' x 6' concrete culvert at the center of the east property line and flows underground through the middle of the property into another open channel across main street. Based on discussions with the Conservation Agent, the open channel is considered a resource area with a 100' buffer which a large portion of the property is located in.

The existing culvert was inspected by Whitestone Associates who determined that there were no significant concerns with its condition. The culvert is proposed be maintained and protected during construction. Runoff from a portion of the existing site is routed into the existing culvert. Under proposed conditions a portion of the site will continue to drain to the culvert with no increase in flow rates or volumes. Two (2) stormwater quality units are proposed to treat runoff prior to discharge into the culvert at the two proposed locations which will be an improvement over existing conditions. It is notable that the proposed project is anticipated to result in a ±3,210 square foot reduction in impervious area within the 100' resource area buffer. Please refer to sheet C-401 and the Drainage Report for more information.

Construction Impacts & Anticipated Schedule:

All construction activities will be limited to within the parcel limits with the exception of any utility connections and proposed soil erosion and sediment control measures.

Construction is proposed to begin in the Spring of 2024 with a potential restaurant opening in Fall 2024.

Town of Reading
Engineering Division

Memo

To: Andrew MacNichol, Community Development Director
From: Ryan A. Percival, P.E., Town Engineer;
CC: Community Planning and Development Commission;

Date: August 31, 2023
Re: Proposed Site Re-development 413 Main Street - McDonald's

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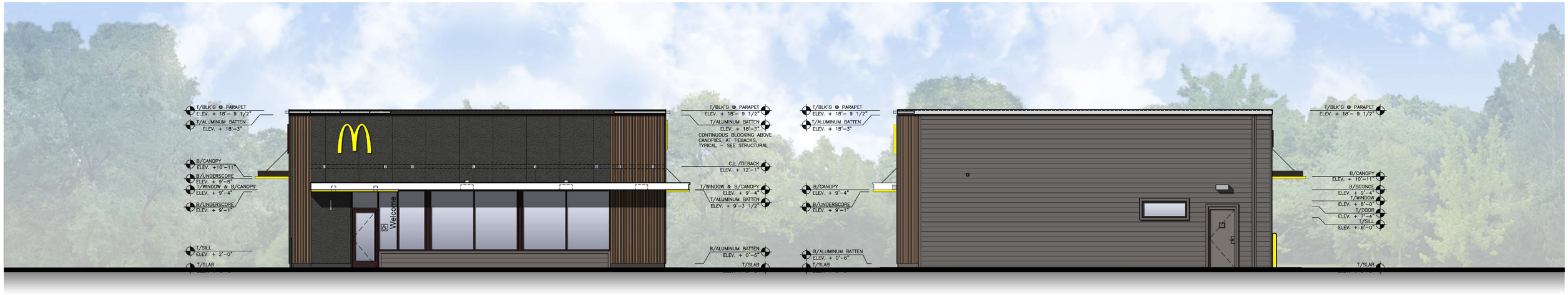
Materials reviewed:

- Proposed Site Plan entitled; "McDonald's – 413 Main Street", 413 Main Street Reading, Massachusetts; prepared by Bohler Engineering; dated April 28, 2023
- Drainage Report; prepared by Bohler Engineering; dated July 28, 2023

The Engineering Division has reviewed the proposed site application for the proposed project and offers the following comments:

- The Town's sidewalk is shown to be within the property lines of the existing site. The Applicant shall confirm layouts and location of the Town's sidewalk and travel way. In the event the property lines are correct the Applicant shall provide either an easement to the Town or give land to the Town so the sidewalk is not on private property.
- The internal traffic patterns appear to send traffic crossing over itself and should be reconsidered. Large trucks will have issues making the turning movements.
- Thought should be given to the placement of the crosswalk in front of the building to provide better protection to pedestrians. The stop bar is after the crosswalk allowing vehicles to stop on the crosswalk, the stop bar and/or crosswalk should be relocated.
- There are three driveways on this site. The applicant should consider closing one of the entrances.
- The drainage report indicates the use of NOAA Atlas 14 Rainfall data and shows a reduction in post-development runoff volumes and flows for the 2, 10, 25 and 100-year storms.
- The site has reduced impervious area by 3,775 square feet but shows very limited water qualities BMP's with only the addition of deep sump catch basins result in in only 33% TSS removal. The applicant shall make an effort to provide more detention and recharge on site and increase TSS removal to 80%, instead of directly discharging into the Towns drainage system. The applicant shall include phosphorus removal calculations.
- The applicant shall CCTV inspect the Town's box culvert prior to construction.
- The size and type of all existing and proposed utilities shall be labeled on the plan.
- Fire flow test shall be performed.
- Sewer flow study shall be performed.
- There should be more of a natural buffer from the properties in the rear. Apllicant should consider plantings to screen the site.
- Trench paving in the Town ROW shall meet Town Standards for this area.
- The site may be subject to a Sewer Connection Fee.
- All utilities shall be approved materials and installed in accordance with the Department of Public Works Standards.
- Engineering Division shall be notified 72 hours in advance to mark out Town utilities.
- All water, sewer, curb cut, street opening, and Jackie's Law excavation permits shall be obtained at the Engineering Division prior to any excavations.
- All site work shall be inspected by the Engineering Division. The Applicant/Owner's contractor shall submit a construction schedule of proposed work. All inspections shall be scheduled 48 hours in advance.
- An approved site as-built shall be submitted to the Engineering Division within 60 days of certificate of occupancy. The as-built shall be submitted in mylar and electronic ACAD format.



Front Elevation

Rear Elevation

Non-Drive-Thru Side Elevation

Drive-Thru Side Elevation

SCHEME: STEEL

Materials Legend:

- Fiber Cement Panel: Hardie Plank by James Hardie Aged Pewter
- Feature Wall: EIFS/Stuco - SW 7069 "Iron Ore"
- Drive-Thru - Metal Panel: Alpolic Metal Panel by Alpolic RAL 7022
- 2x2 Aluminum Battens
- Gold Underscore
- Aluminum Canopy (Metal)
- Glazing (Windows + Storefront)
- Bronze Metal (Coping)
- Metal (Coping)
- Radial Sconce Light Fixture Color: Platinum Silver
- Sherwin Williams SW-7019 Color: Gauntlet Gray

AECOM

06 SEPT 2023

Proposed McDonald's Restaurant

Rendered Elevations

020-0015 - Reading, MA

352 Turnpike Road
Southborough, MA 01772
508.480.9900

September 8, 2023

McDonald's USA, LLC
110 N Carpenter Street
Chicago, IL 60607

Re: **McDonald's Restaurant**
413 Main Street
Reading, MA
Sewer Impact Memo

Dear Mr. Cahoon:

Please find below, an analysis of the anticipated impacts of the proposed redevelopment for a new ±3,970 square-foot McDonald's restaurant with Drive-Through connecting to the existing sewer main in Main Street. The new building is considered a fast food restaurant use with 44 seats, resulting in a slight decrease in sewage discharge per 310 CMR 15 as outlined in the calculations below:

Daily Flow Rate Calculations:

Existing McDonald's Restaurant with Drive-thru Use:

- Fast Food Restaurant Use (McDonald's) – 20 GPD per Seat (1,000 GPD Min) = (20 GPD / 1 Seat) x 62 Seats = **1,240 GPD**

Proposed McDonald's Restaurant with Drive-thru Use:

- Fast Food Restaurant Use (McDonald's) – 20 GPD per Seat (1,000 GPD Min) = (20 GPD / 1 Seat) x 44 Seats = 880 GPD = **1,000 GPD**

Per the above calculations, the proposed restaurant improvements is anticipated to result in a 240 GPD decrease in sewage flow into the municipal system, but design flows will be maintained at the minimum 1,000 GPD.

Should you have any questions or need additional information, please do not hesitate to contact either of us at 508-480-9900.

Sincerely,

BOHLER

Daniel Allen, PE

352 Turnpike Road
Southborough, MA 01772
508.480.9900

October 3rd, 2023

Town of Reading
Community Planning & Development Commission
Attn: Andrew MacNichol
16 Lowell Street
Reading, MA 01867

Re: Response to Comments Letter
McDonald's Restaurant
413 Main Street
Reading, MA

Dear Mr. MacNichol,

Please find below our responses to Planning Division comments provided via email from Mary Benedetto, Senior Planner, on August 23, 2023 and a Memo provided by the Town of Reading Engineering Division dated August 31, 2023. For clarity, the comments are in italics, while our responses are directly below in normal font. This response letter references plans by Bohler Engineering revised through 8/15/2023.

Planning Division comments via email dated August 23rd, 2023

Comment 1: ***Parcels:*** *The project site is actually two lots, Map 17, Lots 64 & 85. Please revise this information in your cover letter and project narrative.*

Response 1: The cover letter, project narrative, and plans have been revised to include Map 17, Lots 64 & 85.

Comment 2: ***Parking:*** *Please include the parking calculation information for the 32 new spaces proposed. How many seats are proposed inside the restaurant and what will be a max employee count?*

- *Please revise your documents to consistently refer to the parking as 43 current and 32 proposed spaces in your cover letter and project narrative, we consider the handicapped spaces part of the total.*
- *Please clarify if the loading/unloading spaces included in your parking total? None are indicated on the site layout plan.*

Response 2: Parking calculations have been provided in the Zoning Analysis Table on Sheet C-301 of the "Proposed Site Plan Documents". 44 Seats are proposed within the restaurant and the max employee count is 12 employees. Based on the required parking for a restaurant use (1 space per 4 seats plus 1 space per employee on the max shift), the minimum required parking is calculated as 23 spaces. 30 parking spaces are proposed as part of the redevelopment project and is reflected in the cover letter, project narrative, and plans accordingly.

There is no designated loading space proposed on the plan or included in the total parking calculation. McDonald's has control over their loading operations where delivery times are schedule during off-peak and non-business hours, to avoid impacts to business operations, where loading vehicles will pull around the building and into the row of parking on the North side of the building.

Comment 3: ***Drive-thru stacking capacity:*** *Please provide the total lane stacking capability in feet of both the existing drive-thru and the new proposed dual order point. Our bylaw requires 198ft in length, of which at least 90ft are for ordering and transacting, and at least 54ft stacking capacity exiting onto the road.*

- *Separately, under current conditions approximately how many cars could stack up behind the order point in the drive-thru lane before running out onto the road, has this changed under the new proposed layout?*

Response 3: The total lane stacking capacity for the existing drive-thru is 105 FT (approx. 6 vehicles) from the present window to the order point, and 137 FT (approx. 8 vehicles) from the order point to drive-thru lane entrance at the Main Street ROW. The distance between the existing present window and the exit drive is 55.2 FT.

Under proposed conditions, the stacking capacity for the side-by-side drive-thru layout is to be 187 FT (approx. 10 vehicles) from the present window to the order points and 108 FT (approx. 6 vehicles) from the order points to the drive-thru lane entrance. It is notable there is an additional 225 LF of stacking to the Bolton Street and Main Street ROW (approx. 10 vehicles). The distance between the proposed present window exit and the roadway is 58.4 FT. The zoning analysis table on sheet C-301 has been updated with this information and existing and proposed drive-thru stacking exhibits have also been included as part of this resubmittal.

Comment 4: **Elevations / Renderings:** Please provide renderings of all sides of the building.

Response 4: Elevations and rendering of all sides of the building have been included as part of this resubmittal.

Comment 5: ***Screening:*** *Please provide images, samples, or renderings of the proposed screening on the east side abutting the residential neighbor. Particularly given that the fencing will transition between two types, please provide a mock-up of what that will look like, ideally with the proposed landscaping in front of it.*

Response 5: Renderings of the proposed screening along the east property line showing the proposed fence types and landscaping has been included as part of this resubmittal

Comment 6: ***Lighting Plan:*** *The lighting plan doesn't include the photometric information out over the landscaped areas of the site, please include it. It also doesn't seem to include any lighting on the building. In the sign package there is an LED light in the canopy fascia and potentially what looks like other lights at the top of the building that should all be included in the lighting/photometric plan and info if they are indeed lights.*

Response 6: The lighting plan has been updated to include building lighting and the photometric information over the landscaped areas of the site. Please refer to Sheet C-703 of the "Proposed Site Plan Documents" for additional information.

Comment 7: ***Hours of Operation:*** *The hours are listed as being fully open until midnight even though you state that the operator will not use the outside drive-thru lane past 9pm. Please clarify the hours in the cover letter and please explain how they plan to "close" the outside drive-thru lane.*

Response 7: The cover letter has been updated to clarify that the McDonald's restaurant will be open until midnight, and only the outside drive-thru lane will close at 9 PM daily. The outside

lane will be closed by turning off the speaker in the lane, and the outside lane will have of a freestanding sign in front of the lane which will state this lane closes at 9 PM daily. The outside lane is being closed at 9pm as offered by the applicant through the Zoning Board application process and issued Decision.

Comment 8: ***Sign Package:*** *Please see attached memo for comments and revise and resubmit the sign application and program book, only including the wall mounted and free-standing signs that require CPDC approval.*

Response 8: The proposed sign package and permit application has been revised per the comments included in the staff memo. Please refer to the "Sign Program Book" prepared by Persona for additional information.

Comment 9: ***Sidewalk treatment****: Should the front recirculation lane be maintained, the outstanding comment from the DRT that a stronger treatment of the crosswalk that crosses that front circulation lane will be required before approval. The stop bar should be located before the crosswalk.*

Response 9: The plans have been updated to show that the proposed crosswalk within the recirculation lane will be treated with red stamped asphalt in contrast to the asphalt surface previously proposed. The stop bar has also been relocated prior to the crosswalk. Please refer to the "Proposed Site Plan Documents" for additional information.

Comment 10: ***Drainage:*** *We'll defer to the Town Engineer for forthcoming detailed comments, but unless I missed it I do not see the pre-treatment infrastructure noted on the plan sheet?*

Response 10: Two (2) stormwater quality pre-treatment units (CDS-1515-3) are proposed along each of the two drainage lines prior to discharge of stormwater into the underground culvert. Labels have been updated to "SWQU-1/2" on sheet C-401 for clarity.

Comment 11: ***TIA:*** *Please provide data from a site with a similar context to Reading for pre- and post-addition of a second drive-thru lane. We'd like to know what level of induced demand there is for a dual lane when built.*

Response 11: McDonald's customer transaction data is proprietary information of McDonald's and we do not have any available traffic study data from a site following the implementation of a side-by-side drive-thru. A traffic assessment, prepared by Traffic Engineering Consultant McMahon Associates, for the proposed McDonald's redevelopment was submitted with the application. Their findings were based on current Institute of Transportation Engineers' (ITE) publication, Trip Generation Manual, 11th Edition which establishes trip rates based on traffic counts conducted at similar types of existing land uses. In the case of a fast-food restaurant with drive-thru use, demand is driven by building square footage, seating, and pass by traffic, not how many menu boards or order points are on a site. As seen in the report, the proposed redevelopment is anticipated to result in up to 13 additional trips during peak hours, but a significant portion of these are pass-by trips from traffic already on the roadway**.** The proposed redevelopment is not anticipated to significantly generate additional vehicular demand to the site and is more intended to better manage the existing volume of traffic with more efficient drive-thru operations resulting in reduced customer wait times.

Comment 12: ***Lot Line Adjustment:*** *We would ask that the Applicant consider an 81X, or other plan as necessary, to adjust the lot lines so that the property limits are not extended into the Town sidewalk. This would be a benefit for both parties.*

Response 12: McDonald's is agreeable to adjusting the lot lines and transferring the area of the property extending into the Town sidewalk through an 81X plan or other similar process with the City.

Comment 13: ***Sustainability:*** *Please provide a statement from McDonald's on how this redevelopment achieves its sustainability goals. Especially in relation to the company's Net Zero 2050 initiative and how this building, and the traffic generated that will idle in a downtown with residential use, is achieved. While many of the company's goals are focused on its food and package processing this auto-centric development is seemingly at odds with current and future Town objectives of pedestrian centered development, reduction of single-vehicle traffic generation, and GHG emission reduction.*

Response 13: The proposed project will result in a brand new restaurant facility with new energy efficient systems including LED lighting, refrigeration and heating, and ventilation and air conditioning systems. McDonald's has been investing in building and site improvements across their footprint from 2019–2023. As these new and remodeled restaurants become operational, the energy generated is expected to contribute to a 33% reduction in GHG emissions associated with their U.S. restaurant electricity usage from their 2015 baseline. McDonald's portion of these renewable energy projects is expected to help prevent approximately 3,500,000 metric tons of CO2e emissions annually.

Relative to the site improvements the new side-by-side drive thru is not intended to generate more vehicle traffic to the site but instead to better manage their existing traffic. The dual order point configuration, second drive-thru window, and new kitchen equipment will optimize the drive-thru efficiency resulting in reduced customer wait time and reduced vehicle idling time. As it exists today there is only a single order point and a single window for payment/order pickup. Under proposed conditions the second order point will allow for drive-thru orders to continue processing should a patrons be taking time for a larger order or reviewing the menu.

McDonald's has been operating their business since the restaurant was first constructed in 1963 and with drive-thru operations since 1994 which has become the preference for the majority of their customer base to complete transactions through. Furthermore given the impact of the COVID-19 pandemic more customers have chosen to stay in their vehicle in the drive-thru for safety and contact purposes which is why the drive-thru layouts have been critical to the businesses success through the pandemic. The proposed modifications and improvements to the existing restaurant are important because of the protection they will continue to provide to public health, safety, and welfare concerns.

Town of Reading Engineering Division Memo dated August 31st, 2023

Comment 1: *The Town's sidewalk is shown to be within the property lines of the existing site. The Applicant shall confirm layouts and location of the Town's sidewalk and travel way. In the event the property lines are correct the Applicant shall provide either an easement to the Town or give land to the Town so the sidewalk is not on private property.*

Response 1: McDonald's is agreeable to adjusting the lot lines and transferring the area of the property extending into the Town sidewalk through an 81X plan or other similar process with the City.

Comment 2: *The internal traffic patterns appear to send traffic crossing over itself and should be reconsidered. Large trucks will have issues making the turning movements.*

Response 2: The recirculation lane allows vehicles entering from the Bolton Street driveway to access the parking area on the South side of the building without having to exit onto Main Street and turn back into the Main Street entrance driveway. The recirculation lane is a significant aspect operationally for McDonald's to allow for customer's circulating the restaurant to stay on site and is a design priority for new and redevelopment sites. Larger passenger vehicles can make this maneuver as seen in the vehicle turning exhibit modeling a F-150 truck included in this resubmittal. Loading vehicle will not make this maneuver through the recirculation lane and instead will exit out the Main Street Exit only driveway.

Comment 3: *Thought should be given to the placement of the crosswalk in front of the building to provide better protection to pedestrians. The stop bar is after the crosswalk allowing vehicles to stop on the crosswalk, the stop bar and/or crosswalk should be relocated.*

Response 3: The crosswalk location has been proposed in order to provide an accessible connection from the public sidewalk as required by ADA/AAB regulations and also the furthest point away from vehicles making the turn into the recirculation lane. The plans have been revised to relocate the stop bar and signage before the pedestrian crosswalk and the crosswalk will be treated with red stamped asphalt in contrast to the asphalt surface for improved visibility. A "Pedestrian Warning" for vehicles is also now proposed prior to the crosswalk. Please refer to Sheet C-301 of the "Proposed Site Plan Documents".

Comment 4: *There are three driveways on this site. The applicant should consider closing one of the entrances.*

Response 4: The three (3) driveways on site is an existing condition and McDonald's would prefer as proposed that these driveways be maintained for business operations. The entrance-only and exit-only driveways to Main Street allow for more efficient vehicles movements accessing and egressing the site while the full access driveway to Bolton Street allows vehicles to avoid having to turn to/from Main Street.

Comment 5: *The drainage report indicates the use of NOAA Atlas 14 Rainfall data and shows a reduction in post-development runoff volumes and flows for the 2, 10, 25 and 100-year storms.*

Response 5: Comment acknowledged.

Comment 6: *The site has reduced impervious area by 3,775 square feet but shows very limited water qualities BMP's with only the addition of deep sump catch basins result in in only 33% TSS removal. The applicant shall make an effort to provide more detention and recharge on site and increase TSS removal to 80%, instead of directly discharging into the Towns drainage system. The applicant shall include phosphorus removal calculations.*

Response 6: In addition to the deep-sump and hooded catch basin, two (2) stormwater quality pre-treatment units (CDS-1515-3) are proposed along each of the two drainage lines prior to discharge of stormwater into the underground culvert. Labels have been updated to "SWQU-1/2" on sheet C-401 for clarity. Due to the existing topography, lot configuration, and proposing to maintain the underground culvert a portion of the property is proposed to continue to sheet flow to Bolton while TSS removal has been implemented to the maximum extent practicable to treat stormwater being captured and routed on-site.

The proposed redevelopment project is anticipated to result in less the 1 acre of disturbance and therefor will not require a stormwater management permit which phosphorus removal is required for. As such, the stormwater management system has been designed to meet the MADEP stormwater regulations to the maximum extent practicable for a redevelopment and no phosphorus treatment proposed as part of the stormwater management infrastructure.

Comment 7: *The applicant shall CCTV inspect the Town's box culvert prior to construction.*

Response 7: A culvert assessment was conducted by Whitestone Associates who completed a CCTV inspection of the existing culvert and did not identify any significant issues with the existing condition.

Comment 8: *The size and type of all existing and proposed utilities shall be labeled on the plan.*

Response 8: Size and type of all available existing utility information and proposed have been labeled on the plan. Please refer to Sheet C-401 and C-501 of the "Proposed Site Plan Documents" for additional information.

Comment 9: *Fire flow test shall be performed.*

Response 9: There is an existing domestic water line servicing the current building. A fire service line is not proposed as part of this project nor is it required for the proposed building. As such, we would respectfully request that a fire flow test not be required.

Comment 10: *Sewer flow study shall be performed.*

Response 10: Please refer to the "Sewer Memo" prepared by Bohler, dated 9/8/2023 which is included as part of this resubmittal.

Comment 11: *There should be more of a natural buffer from the properties in the rear. Applicant should consider plantings to screen the site.*

Response 11: Under existing conditions, the area along the easterly property line has been previously developed and consists primarily of a paved parking area, drive-aisle, concrete retaining wall, light pole, and stockade fence with no natural buffer. The project proposed to replace the existing fence along the property line a portion go which will be a 12' high sound barrier wall and providing a 3'-4' landscape buffer with plantings which is a significant improvement upon existing conditions. A rendering of this area illustrating the improvements has been included in the resubmittal. It is notable the project is anticipated to result in a 3,775 square-feet reduction of impervious area on-site.

Comment 12: *Trench paving in the Town ROW shall meet Town Standards for this area.*

Response 12: Comment acknowledged. Plans have been revised to specify trenching within ROW shall meet Town standard as seen on the Plan sheets C-301 and C-501.

Comment 13: *The site may be subject to a Sewer Connection Fee.*

Response 13: Comment acknowledged.

Comment 14: *All utilities shall be approved materials and installed in accordance with the Department of Public Works Standards.*

Response 14: Comment acknowledged.

Comment 15: *Engineering Division shall be notified 72 hours in advance to mark out Town utilities.*

Response 15: Comment acknowledged.

Comment 16: *All water, sewer, curb cut, street opening, and Jackie's Law excavation permits shall be obtained at the Engineering Division prior to any excavations.*

Response 16: Comment acknowledged.

Comment 17: *All site work shall be inspected by the Engineering Division. The Applicant/Owner's contractor shall submit a construction schedule of proposed work. All inspections shall be scheduled 48 hours in advance.*

Response 17: Comment acknowledged.

Comment 18: *An approved site as-built shall be submitted to the Engineering Division within 60 days of certificate of occupancy. The as-built shall be submitted in mylar and electronic ACAD format.*

Response 18: Comment acknowledged.

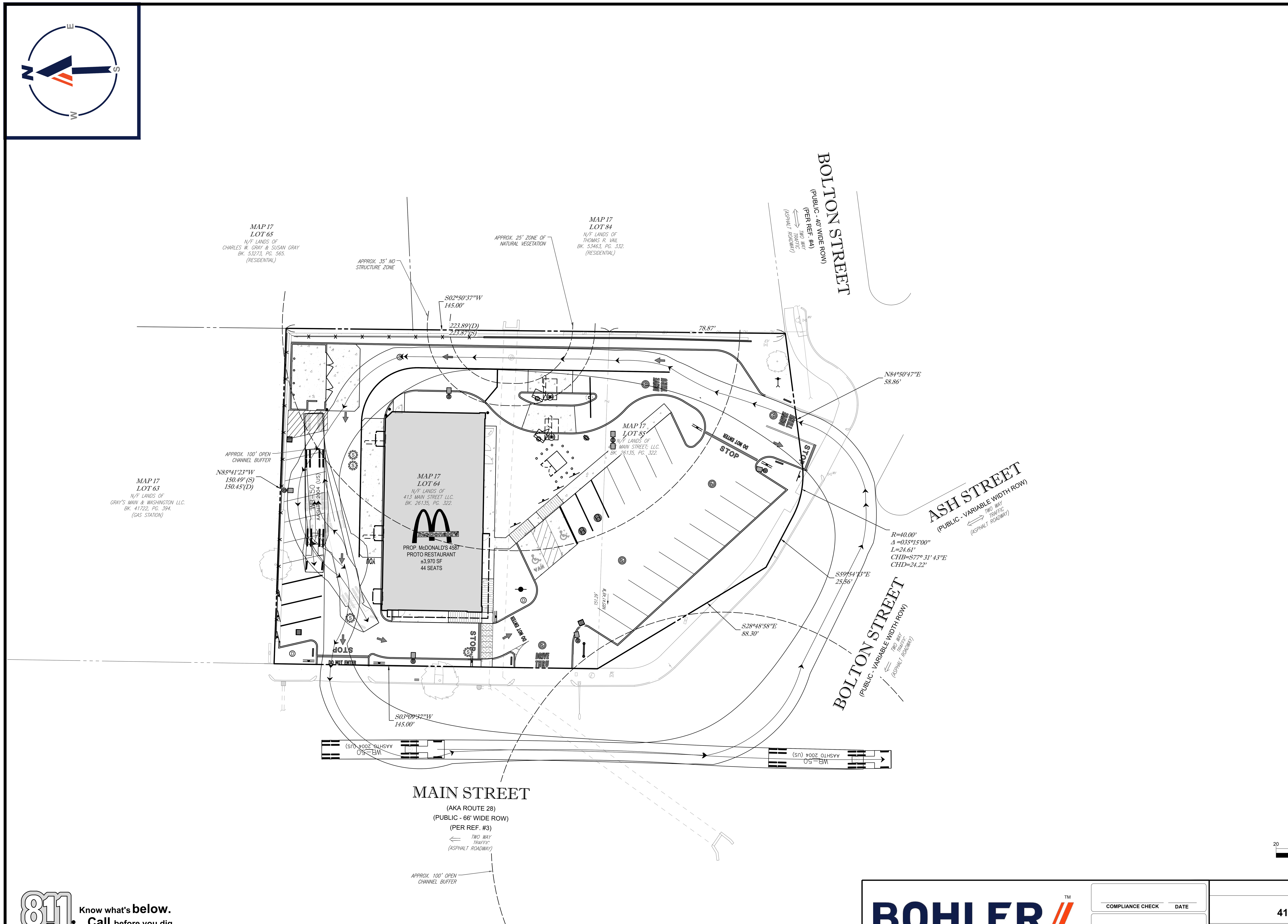
We trust the provided information is sufficient for your needs at this time and look forward to discussing the project at the October 16th Community Planning & Development Commission Meeting. Should you have any questions or require additional information, please do not hesitate to contact either of us at 508-480-9900.

Sincerely,

BOHLER

Eric G. Dubrule , PE

Daniel Allen, PE



SITE INFORMATION

1. APPLICANT:
   McDONALD'S USA, LLC
   110 N CARPENTER STREET
   CHICAGO, IL 60607

2. OWNER:
   413 MAIN STREET, LLC
   10 JEAN AVE #2
   CHELMSFORD, MA 01824

3. PARCEL:
   MAP 17, LOTS 64 & 85
   413 MAIN STREET
   READING, MA 01867

REV	DATE	DESCRIPTION	BY
1	06/12/2023	REV. PER ZBA & ABUTTERS FEEDBACK	CSE
2	08/09/2023	REV. FOR CPDC SUBMITTAL	CSE
3	10/03/2023	REV. FOR CPDC SUBMITTAL	CSE
4	10/18/2023	REV. FOR CPDC COMMENTS	CSE

JOHN A. KUCICH
CIVIL
No. 41530
REGISTERED PROFESSIONAL ENGINEER

McDonald's

AND SHALL NOT BE REPRODUCED WITHOUT THEIR WRITTEN PERMISSION. THESE PLANS AND SPECIFICATIONS ARE THE PROPERTY OF McDONALD'S CORPORATION

OFFICE: BOSTON REGION

ADDRESS: 110 N CARPENTER ST, CHICAGO, IL 60607

PLAN APPROVALS — DATE — SIGNATURE — APPROVED McDONALD'S AGENT

20 10 5 0 20
1"= 20'

811 Know what's below. Call before you dig.

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

COMPLIANCE CHECK — DATE
CONSTRUCTION CHECK — DATE
CONSTRUCTION CHECK — DATE

PROJECT No.: W222000

CAD I.D. #: W222000-SPPD-4a.dwg

-

STREET ADDRESS: 413 MAIN STREET

CITY: READING — STATE: MA

COUNTY: MIDDLESEX

SITE I.D.: 20-0015

PLAN DESCRIPTION: **WB-50 LOADING EXHIBIT**

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

SHEET NO. 1 OF 15

352 Turnpike Road
Southborough, MA 01772
508.480.9900

November 27th, 2023

Town of Reading
Community Planning & Development Commission
Attn: Andrew MacNichol
16 Lowell Street
Reading, MA 01867

Re: Site Plan Review, Special Permit, & Sign Application
McDonald's Restaurant
413 Main Street
Reading, MA

Dear Mr. MacNichol,

Following discussions at the 10/16 Community Planning and Development Commission Meeting, site plan documents and material have been revised to address feedback that was received from the Board and Planning Staff. In support of the resubmittal please find the following documents as well as responses to the summarized meeting comments in the email prepared by Mary Benedetto, dated 10/18. For clarification the comments are in italicized text with our responses in bold below:

1. *Per the long discussion on traffic, we do want to move forward with a more comprehensive traffic study. While CPDC brought up the point of having a new third party do it, staff's view on it is that we can't do a third party review if it hasn't already been completed by the applicant. We can again ask a consultant that a study of newly developed dual order drive-thru's be conducted to determine rate of real growth seen at a site. We also want to determine which directions are customers of McDonald's currently coming from and going to as they enter and leave the restaurant? Is the recirculation lane necessary to redirect traffic? Frankly, CPDC will not approve this application without that information so we'd like to move forward with having you provide that detail with McMahon or from a 3rd party that CPDC authorizes.*

   An updated traffic report has been provided following a second round of traffic observations and analysis to obtain additional traffic information as requested by the CPDC and Town Staff. Please refer to the traffic report for additional details.

2. *Remove the signage that is in the plan set on page C-902 and C-904. We would also ask you to remove all directional signage from the sign program book and application. We can approve that internally administratively and would like CPDC to stay focused on just the wall and free-standing signage that they need to approve. Per CPDC's comments please also revise the sign permit application to reflect that you do not have an approved Master Signage Plan—that's a separate item on our end, different from just having a corporate sign plan.*

   Sign details have been removed from sheets C-902 and C-904 of the "Proposed Site Plan Documents" with the exception of free-standing signage and wall signage. Similar updates have been made to the sign program book and sign applications. Sign applications have been revised to clarify there is no master signage plan.

3. *Per the discussion on the loading zone, please provide more detail on what the operator does currently for deliveries. How do they schedule them, what are the hours, what size trucks, where do they park? We would advise simply putting a temporary loading zone in the rear in the drive-thru bypass lane for use during the early mornings.*

   Site plans have been updated to provide one (1) proposed temporary loading area as seen on sheet C-301 and a WB-50 Loading Exhibit has also been included to demonstrate the truck movement and loading operations. Loading is proposed to occur within the

perimeter row of parking on the north side of the building where seven (7) spaces will be coned off for deliveries. These parking spaces are anticipated to be utilized less by patrons than those located on the east side of the building. Deliveries are typically made before 10 AM prior the lunch hour rush. Loading is similarly conducted under existing conditions today where the parking spaces along the east perimeter of the site are coned off during delivery times. McDonald's is comfortable with this strategy as they would not want to negatively impact their restaurant and drive-thru operations given the significant investment that is being proposed.

4. *Can you clarify if the chain link fence on the north side of the property between McDonald's and Chase Bank is owned by McDonald's? I see some chain link fencing as remaining on the plans but not the full length of it.*

   The existing chain link fence along the northerly property line is owned by McDonald's. Site Plans have been revised to remove the existing fence and a new chain link fence is now proposed.

5. *We would strongly suggest you reconsider your response to the Town Engineer's comments regarding stormwater management and see if there are additional ways to improve the stormwater management over the existing.*

   A third proposed proprietary stormwater quality unit has been added at the front corner of the property providing stormwater treatment prior to discharging to the Main Street system. As a result, the weighted TSS removal has been improved to 45%. Refer to Sheet C-401 of the "Proposed Site Plan Documents" and drainage report for additional details.

   Total Phosphorus removal calculations have also been included within Appendix F of the Drainage Report revised through 10/18/2023 to which the proposed redevelopment is anticipated to provide an 11.3% phosphorus removal rate and the overall phosphorus load reduced by 20.1% compared to the existing conditions.

6. *It sounded like the CPDC would like additional justification for both the dual order point in general and that closing the lane closest to the abutter will actually provide the best sound dampening vs. closing the inner lane.*

   The closing of the exterior drive-thru lane was specifically conditioned in the Zoning Board of Appeals Variance approval as agreed upon with the abutting property owner Thomas Vail for sound mitigation. This was in addition to providing a 12' tall sound wall barrier that was requested by the abutter and incorporated into the proposed plans. Overall the proposed layout is anticipated to provide an improvement over the existing conditions as only a 6' stockade fence exists along the property line today.

   The dual order point configuration allows McDonald's to improve drive-thru efficiency. This configuration eases drive-thru stacking capacity issues compared to the existing single lane order point. Under existing conditions 8 vehicles can stack from the order point to the right-of-way, while under proposed conditions 16 vehicles can stack from the proposed order points to the right of way. The dual order point configuration will limit the potential issue of vehicle stacking to the right of way. Additionally, the dual order point allows customers who order more quickly to bypass cars that order more slowly. This in turn reduces drive-thru stacking behind the order point and reduces customer wait times. .

   Limiting the site to one order point would result in a sub-optimal drive-thru design. It would result in longer drive-thru stacking behind the order points and increased wait times and vehicle idling.

   Please refer to the traffic report for additional information.

On behalf of McDonald's USA, LLC and in accordance with section 4.6.3.3 of the Town of Reading Massachusetts Zoning Bylaws, we would like to respectfully request a waiver from the following requirements:

- *Section 9.1.1.7 - One [loading] space 0-2000 square feet of floor area; two spaces - 2001-4000 square feet of floor area; three spaces – over 4000 square feet of floor area.*

  Site Plan regulations require two loading spaces for the proposed ±3,970 square-foot restaurant while only one (1) loading space is provided as illustrated on sheet C-307 of the "Proposed Site Plan Documents" for delivery trucks. The one (1) temporary loading space is sufficient for the proposed McDonald's operations which is consistent with other restaurant locations across their footprint. As such, we would respectfully request a waiver be granted from providing the required two (2) loading spaces.

We trust that the provided information will be sufficient for the Community Planning & Development Commission's review, however, should you have any questions or need additional information, please do not hesitate to contact us at 508-480-9900. Otherwise, we appreciate the Community Planning & Development Commission's consideration of this matter and look forward to discussing this at the next available Community Planning & Development Commission meeting.

Sincerely,

BOHLER ENGINEERING

Eric G. Dubrule, PE

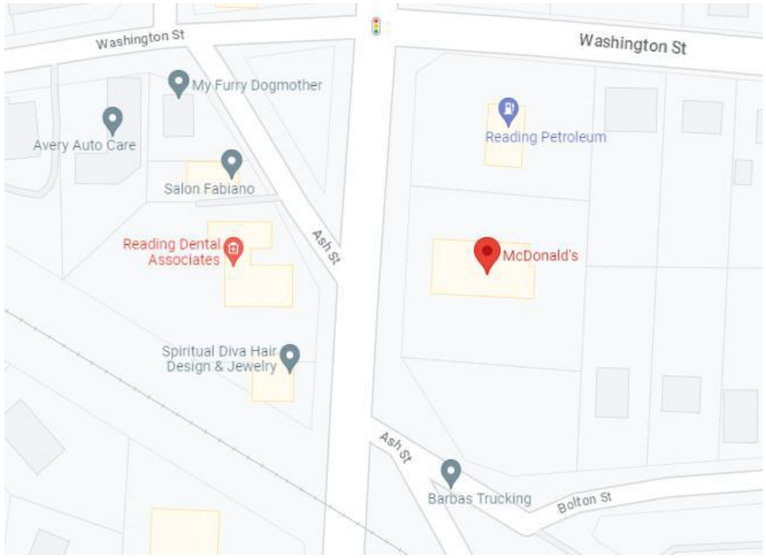
Daniel Allen, PE

1

McDonald's

413 MAIN ST - READING, MA 01867

SIGN PROGRAM BOOK



VICINITY MAP
NTS

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Location: READING, MA	*Prepared By:* QP/VC	
File Name: 396498 - R8 - 413 MAIN ST, READING - READING, MA	*Date:* 11/21/23	*Revision:* 8

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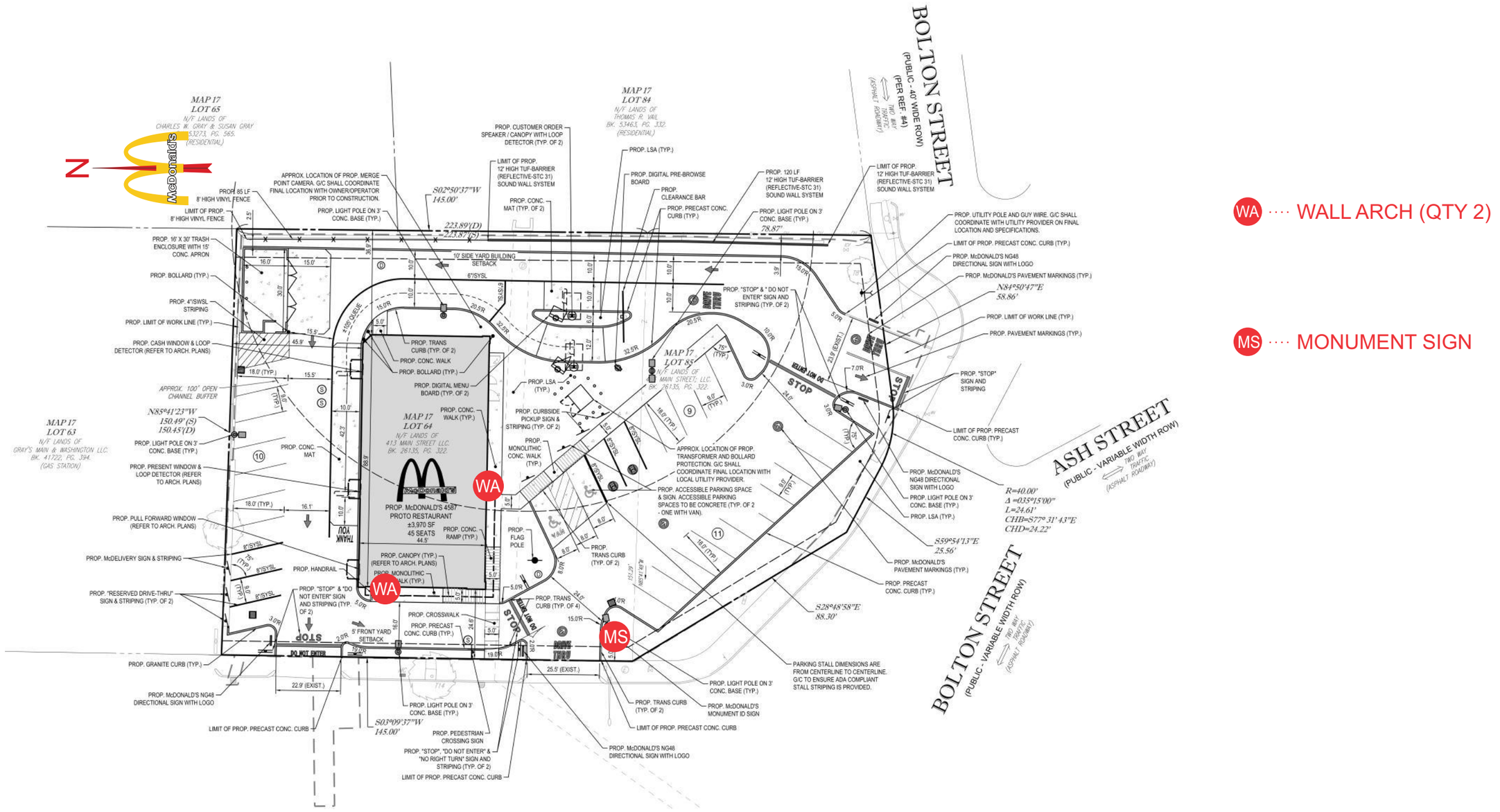

WA ···· WALL ARCH (QTY 2)

MS ···· MONUMENT SIGN

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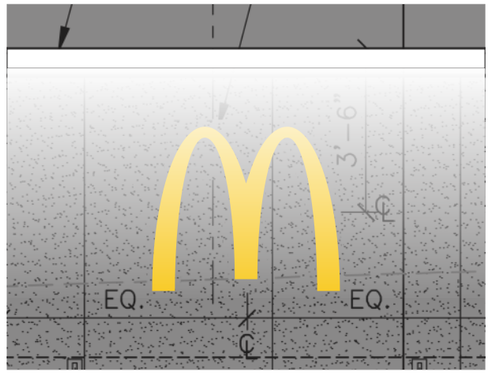
3

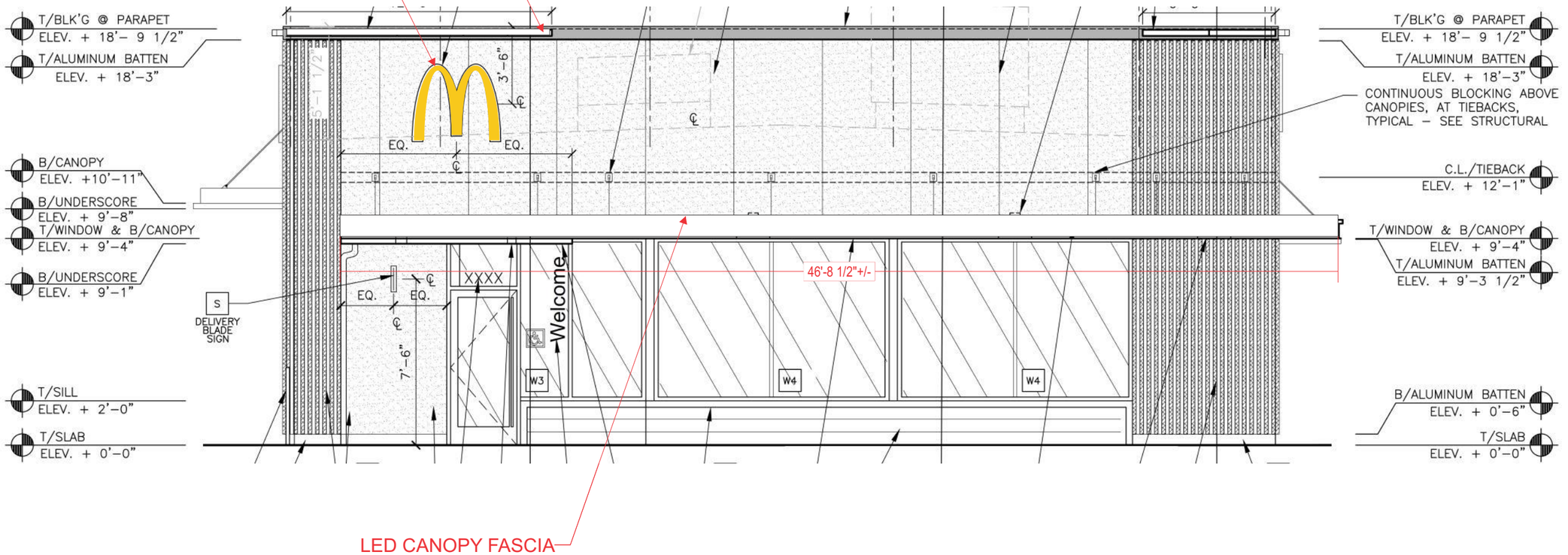
WEST (FRONT) ELEVATION
SCALE: 3/16" = 1'-0"

NIGHT VIEW - NTS



LED LIGHT CHANNEL
(PROVIDED BY OTHERS)

42" WALL ARCH WA



LED CANOPY FASCIA

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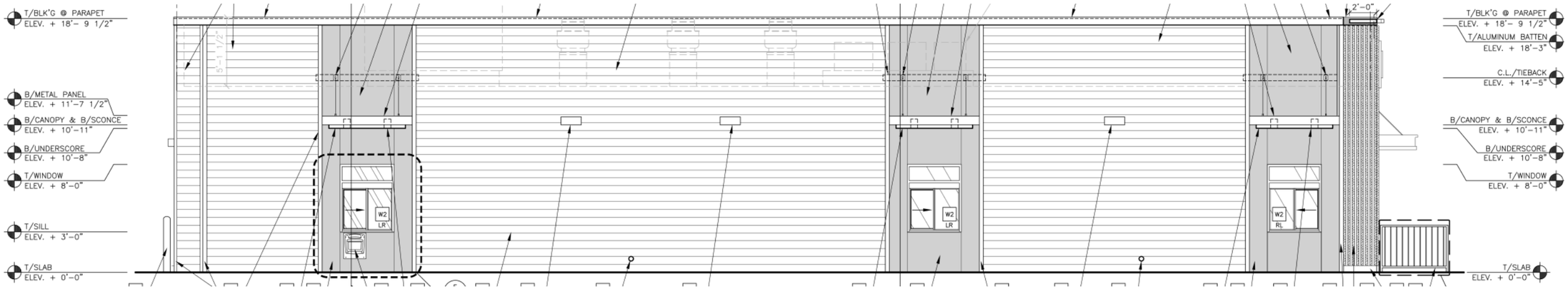
File Name: **396498 - R8 - 413 MAIN ST, READING - READING, MA**	*Date:* **11/21/23**	*Revision:* **8**	

4

SOUTH (DRIVE-THRU) ELEVATION

SCALE: 1/8" = 1'-0"



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Location: **READING, MA**	*Prepared By:* **QP/JR/CTM/VC**		
File Name: **396498 - R8 - 413 MAIN ST, READING - READING, MA**	*Date:* **11/27/23**	*Revision:* **8**	

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5

EAST (NON DRIVE-THRU) ELEVATION

SCALE: 1/8" = 1'-0"

NIGHT VIEW - NTS

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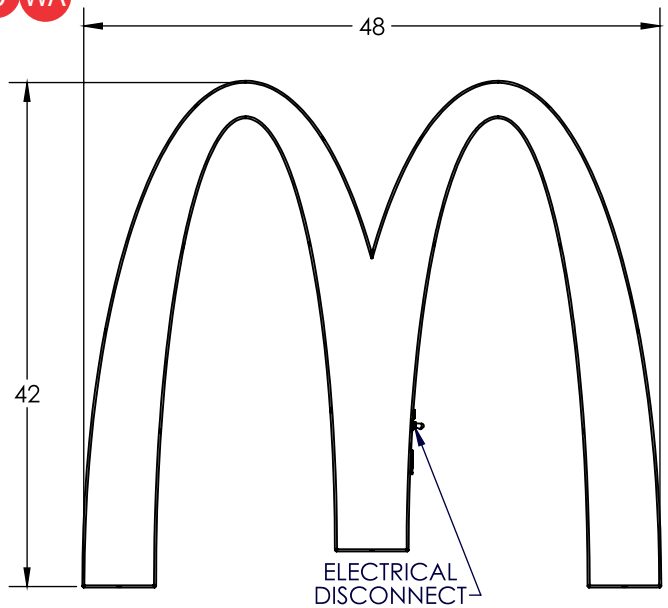
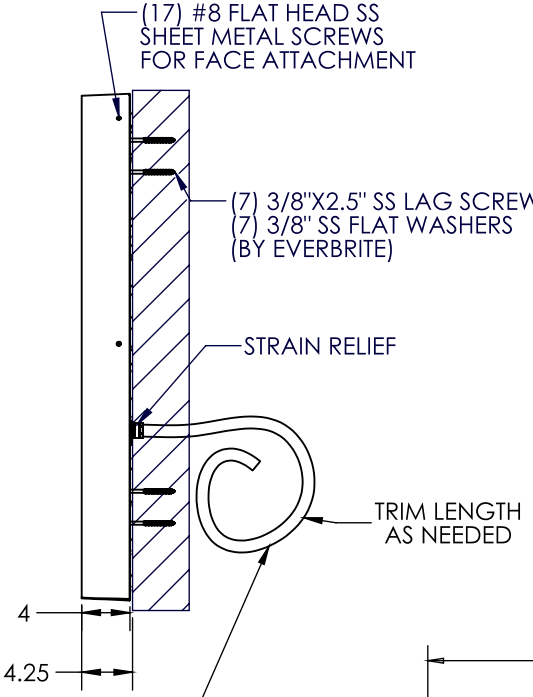
Location: **READING, MA**	*Prepared By:* **QP/JR/VC**		*Approval Date:*
File Name: **396498 - R8 - 413 MAIN ST, READING - READING, MA**	*Date:* **11/21/23**	*Revision:* **8**	

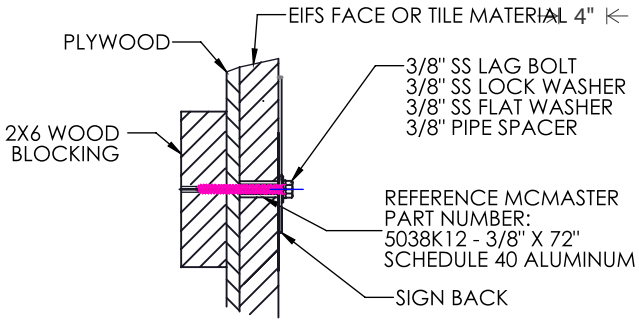
6 WA



MOUNTING HOLE PATTERN



UL LISTED CONDUIT AND 120VAC PRIMARY POWER TO CONNECT TO PROVIDED CONDUIT AND WIRING BY ELECTRICAL CONTRACTOR PER LOCAL AND NATIONAL CODES



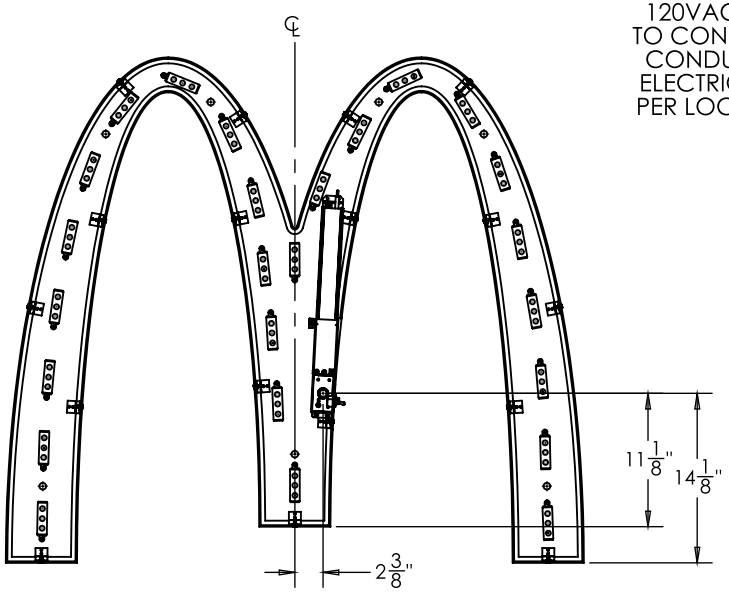
INPUT: 120 VAC, 60Hz, 0.8 AMPS MAX

OUTPUT: 12VDC, VOLTAGE REGULATED, 20.5 WATT, APPROX 1.7 AMP. OPERATING ENVIRONMENT: WET, DAMP, DAY -35 DEG C TO +70 DEC C

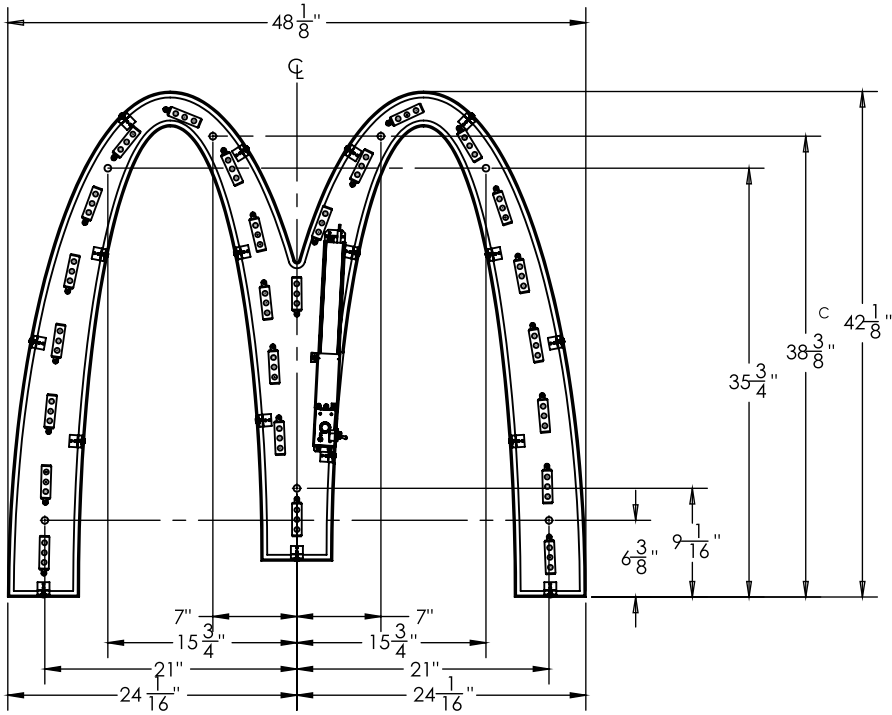
WIRING: SIGN IS TO BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF ARTICLE 600 OF THE NATIONAL ELECTRICAL CODE AND ALL OTHER APPLICABLE LOCAL CODES. THIS INCLUDES THE PROPER GROUNDING OF THE SIGN.

SQUARE FOOT AREA: ACTUAL: 5 SQ FT. BOXED: 14SQ FT.

DESIGNED WINDLOAD: 150 MPH WIND SPEED 3-SECOND GUST EXPOSURE. COMPLIANT



ELECTRICAL INPUT LOCATION D



MOUNTING HOLE LOCATIONS D

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File Name: 396498 - R8 - 413 MAIN ST, READING - READING, MA		Date: 11/21/23	Revision: 8

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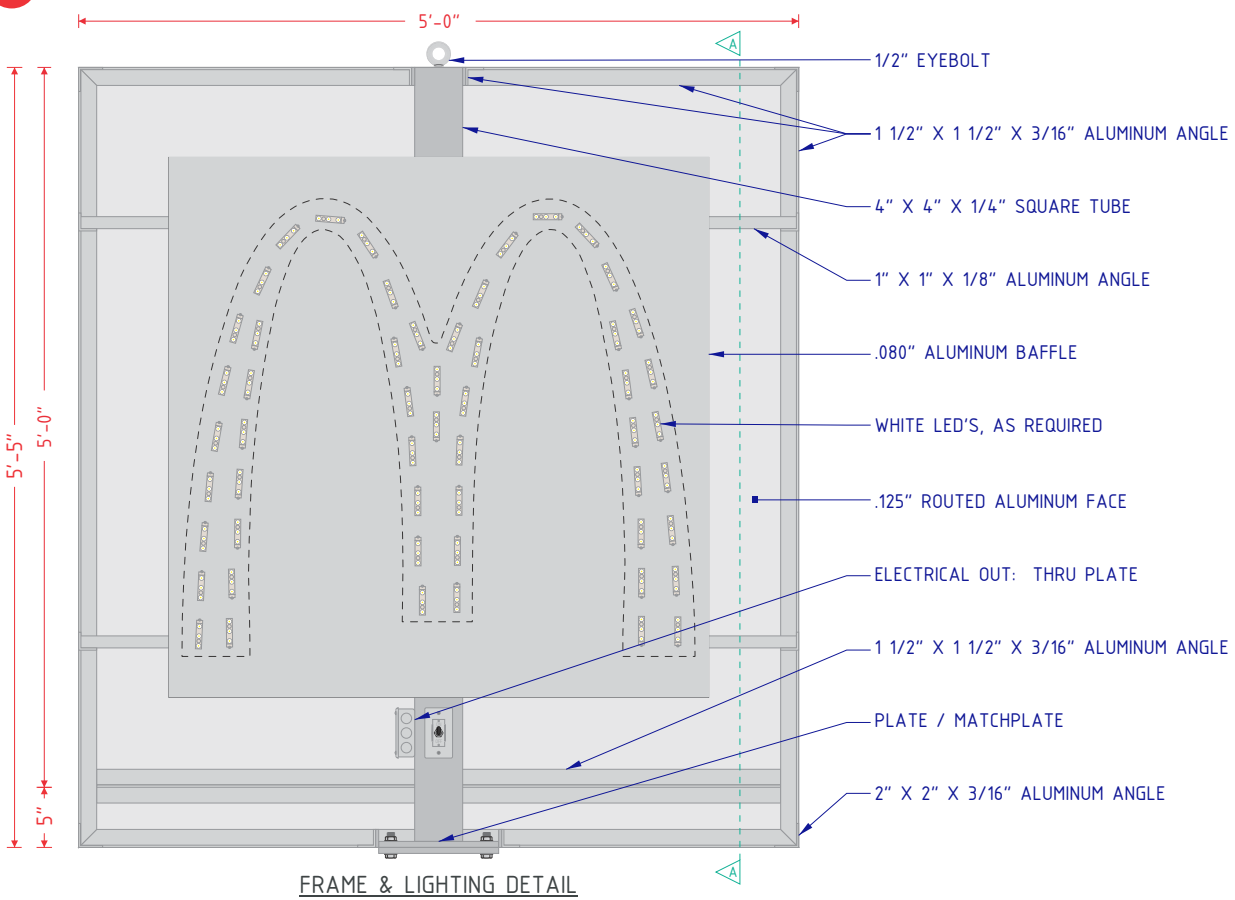
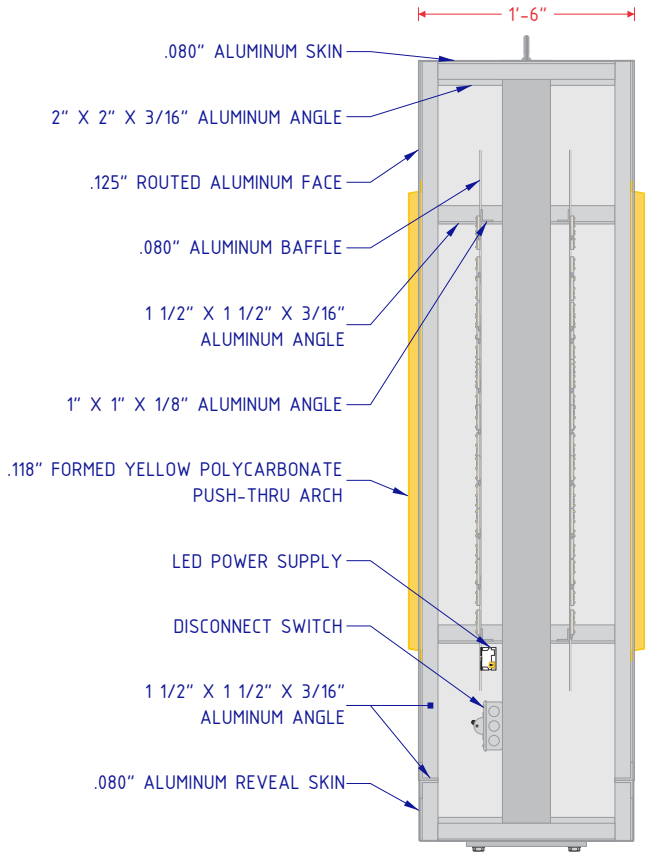
8 MS



FRAME & LIGHTING DETAIL
SCALE: 3/4" = 1'-0"

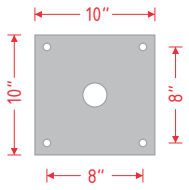


CROSS SECTION A-A
SCALE: 3/4" = 1'-0"

FRAME DETAILS
DESIGN FACTOR: TBD
1 1/2" X 3/16" ALUMINUM ANGLE FRAME
BLEED FACE, NO VISIBLE FASTENERS
EXTERIOR FINISH:
FRAME - MATCH NG RED
REVEAL - MATCH NG SILVER
INTERIOR FINISH: REFLECTIVE WHITE
SKINS REMOVABLE FOR SERVICE
U.L. LISTED
ELECTRICAL: 120 VOLTS / 0.65 AMPS
SQUARE FOOTAGE: 25.00

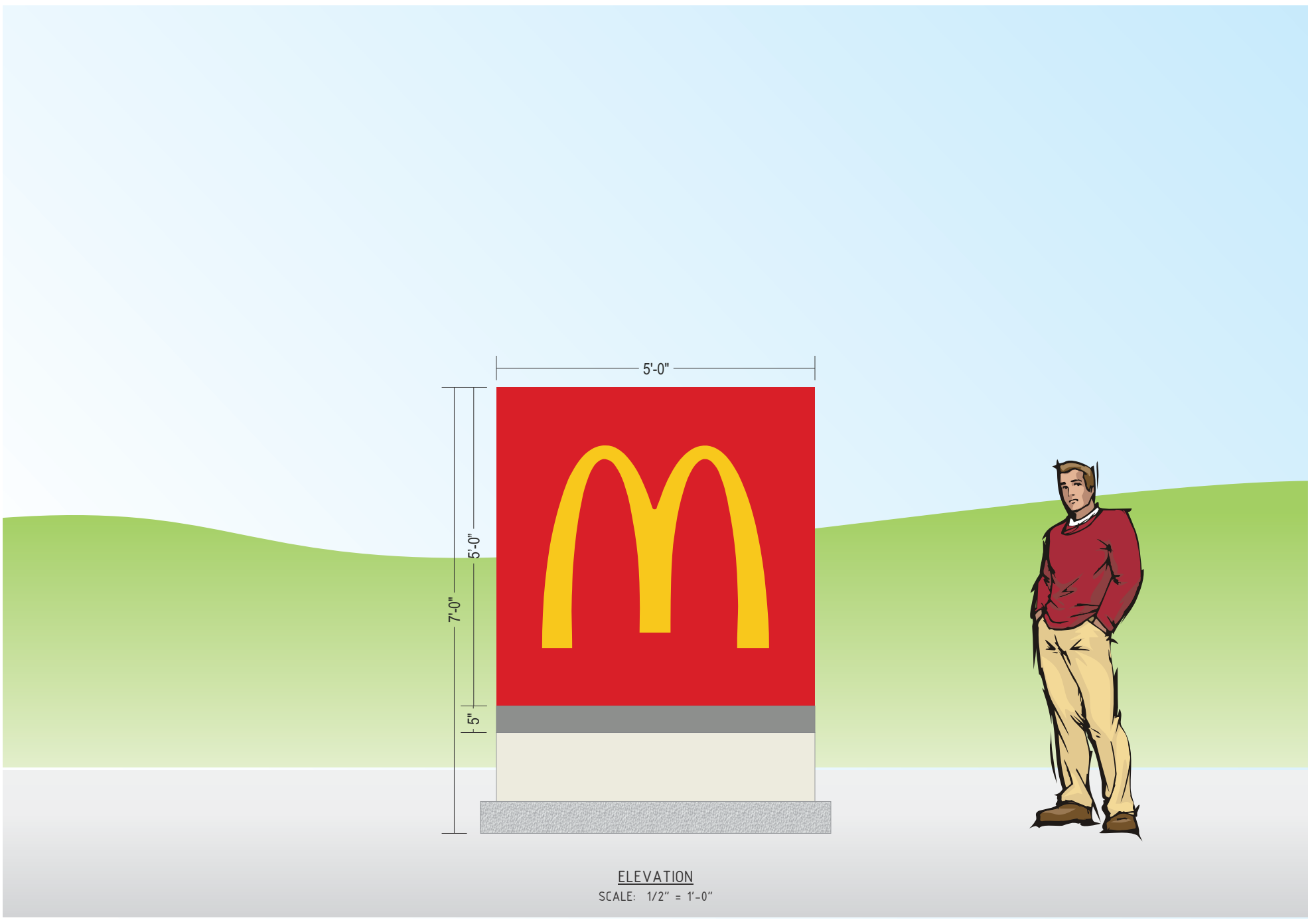
FACE DETAILS
.125" ROUTED ALUMINUM PAINTED TO MATCH NG RED
.118" FORMED NG YELLOW POLYCARBONATE PUSH-THRU ARCH

GRAPHIC DETAIL
SCALE: 3/8" = 1'-0"



1/2" X 10" X 10" PLATES
5/8" HOLES
1/2" A325 BOLTS
PLATE WILL ACCEPT:
8" PIPE
6" TUBE

PLATE DETAIL
SCALE: 3/4" = 1'-0"



ELEVATION
SCALE: 1/2" = 1'-0"

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Location: READING, MA	Prepared By: QP		
File Name: 396498 - R8 - 413 MAIN ST, READING - READING, MA	Date: 11/21/23	Revision: 8	

Customer Approval (Please Initial):

Approval Date:

DRAINAGE REPORT

For

PROPOSED

413 Main Street
Reading, Massachusetts
Middlesex County

Prepared by:

BOHLER ENGINEERING
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900 TEL.

John A. Kucich
Massachusetts P.E. Lic. #41530

July 28, 2023
Revised: October 18, 2023
#W222000

BOHLER

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the proposed redevelopment for a raze and rebuild of an existing McDonald's Restaurant with Drive-Thru located at 413 Main Street in the Town of Reading, Massachusetts. The site, which consists of approximately 0.74 acres of land, contains an existing McDonald's restaurant with a playground area, drive-thru, existing paved parking areas, on-site utilities, and landscaping. The site is located within 100' of an existing open channel, however, no existing wetlands are present on-site. Furthermore, the entirety of the existing site is outside of all mapped areas of Estimated Habitat of Rare Wetlands Wildlife and Priority Habitats of Rare Species.

The proposed project includes the construction of a new ±3,970 SF McDonald's Restaurant with Drive-Thru along with new paved parking areas, landscaping, storm water management components and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at three (3) "design points" where stormwater runoff currently drains to under existing conditions. These design points are described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards to the maximum extent practicable for a redevelopment as detailed herein.

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP#1	1.00	0.92	**-0.08**	1.64	1.53	**-0.11**	2.03	1.91	**-0.12**	2.63	2.49	**-0.14**
DP#2	0.35	0.22	**-0.13**	0.56	0.37	**-0.19**	0.69	0.46	**-0.23**	0.90	0.59	**-0.31**
DP#3	1.02	0.76	**-0.26**	1.71	1.42	**-0.29**	2.13	1.84	**-0.29**	2.78	2.47	**-0.31**

**Flows are represented in cubic feet per second (cfs)*

II. EXISTING SITE CONDITIONS

Existing Site Description

The site consists of approximately 0.74 acres of land located at 413 East Main Street in the Town of Reading, Massachusetts. The site contains an existing McDonald's restaurant, with a playground area, drive-thru, paved parking areas, on-site utilities, and landscaping. No existing wetlands are present on-site. It is notable that there is a 4'x6' underground concrete box culvert which runs east to west through the center of the property and converts into an open channel at the east property boundary. Refer to **Appendix A** for the FEMA FIRM panel.

On-Site Soil Information

Soils within the analyzed area consist of the following as classified by the Natural Resource Conservation Service (NRCS):

Table 2.1: Existing Soil Information

Soil Unit Symbol	Soil Name / Description	Hydrologic Soil Group (HSG)
602	Urban Land	C
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A

Refer to **Appendix C** for additional information.

Existing Collection and Conveyance

Under existing conditions, runoff from the majority of the northern portion of the site sheet flows to one of three existing catch basins on-site. These catch basins convey stormwater to an existing underground box culvert which flows West to East through the site. A smaller area at the northwest corner of the property drains to a catch basin which connects directly to the municipal system within Main Street. The remaining area on the south side of the site sheet flows off-site out to Bolton Street and eventually into the existing stormwater system within Bolton Street. Slopes on the site range from 1%-8% with on-site elevations ranging from 95 adjacent to Bolton Street to 98.5 at the northeasterly portion of the property.

Existing Watersheds and Design Point Information

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at three (3) "design points" as described below where stormwater runoff currently drains to under existing conditions. The existing site was subdivided into three (3) sub catchments, as

described below, to analyze existing and proposed flow rates at each design point. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Design Point #1 (DP#1) is the existing underground culvert flowing West to East through the site that changes into on open channel past the east property boundary. Under existing conditions, this design point receives stormwater flows from approximately 0.34 acres of land, designated as watershed "EX-1". Refer to Table 2.2 below for additional detail.

Design Point #2 (DP#2) is existing municipal stormwater management system in Main Street. Under existing conditions, this design point receives stormwater flows from approximately 0.10 acres of land, designated as watershed "EX-2". Refer to Table 2.2 below for additional detail.

Design Point #3 (DP#3) is Bolton Street along the southerly property line. Under existing conditions, this design point receives stormwater flows from approximately 0.31 acres of land, designated as watershed "EX-3". Refer to Table 2.2 below for additional detail.

Table 2.2: Existing Sub-Catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)
EX-1	0.34±	Rooftops, paved parking, grass	95	6.0
EX-2	0.10±	Rooftops, paved parking, grass	96	6.0
EX-3	0.31±	Paved parking, grass	93	6.0

Refer to **Table 1.1 and Table 5.1** for the existing conditions peak rates of runoff. Refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project consists of a raze and rebuild for a new 3,970 SF McDonald's Restaurant with Drive-Thru including paved parking areas, landscaping, associated utilities, and new stormwater management system. The site has been designed to drain to deep-sump, hooded catch basins to the maximum extent practicable based on the existing topography and drainage conditions. The catch basins will capture and convey stormwater runoff, via an underground pipe system and drainage manholes, to the existing stormwater management system. Pretreatment of stormwater runoff will be provided to the maximum extent practicable by a combination of the deep-sump and hooded catch basins and a stormwater quality unit prior to discharge into the existing underground culvert and municipal stormwater management system. The existing underground culvert is proposed to be maintained which has constrained the proposed site layout and stormwater management system design.

Proposed Development Collection and Conveyance

Deep sump hooded catch basins are proposed to collect and route runoff from the paved parking areas to the existing surface basins. Pipes have been designed for the 25-year storm using Rational Method and Pipe sizing calculations are included in **Appendix F**.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet the standards set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards for a redevelopment to the maximum extent practicable. Refer to **Section V** for additional information.

Proposed Watersheds and Design Point Information

The project has been designed to generally maintain the drainage patterns that existing on site today, with the same design points described in **Section II** above. The site was subdivided into five (5) separate sub catchments for the proposed conditions as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP#1, the underground culvert, receives stormwater flows from approximately 0.32 acres of land, designated as watershed "P-1", "P-4", and "P-5". Refer to Table 3.1 below for additional detail.

Under proposed conditions DP#2, the municipal system within Main Street, receives stormwater flows from approximately 0.08 acres of land, designated as watershed "P-2". Refer to Table 3.1 below for additional detail.

Under proposed conditions DP#3, the drainage system within Bolton Street, receives stormwater flows from approximately 0.34 acres of land, designated as watershed "P-3". Refer to Table 3.1 below for additional detail.

Table 3.1: Proposed Sub-catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)	Hydrologic Routing
P-1	0.10±	Paved parking, grass, landscaped areas	94	6.0	DP#1
P-2	0.08±	paved parking, grass, landscaped areas	94	6.0	DP#2
P-3	0.34±	paved parking, grass, landscaped areas	86	6.0	DP#3
P-4	0.13±	paved parking, grass, landscaped areas	90	6.0	DP#1
P-5	0.09±	Rooftops	98	6.0	DP#1

Refer to **Table 1.1 and Table 5.1** for the calculated proposed conditions peak rates of runoff. For additional hydrologic information, refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of the Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in table 4.1 below for stormwater calculations is based on NOAA. Refer to **Appendix F** for more information.

Table 4.1: NOAA Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.31	5.21	6.40	8.23

*Values derived from NOAA ATLAS on 03/28/2023

The proposed stormwater management as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year design storm events. Additionally, the proposed project meets, or exceeds, the MADEP Stormwater Management standards. Compliance with these standards is described further below.

V. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

The proposed redevelopment is anticipated to result in a reduction of approximately 3,775± square feet of impervious coverage and no new untreated discharges are expected with the existing drainage patterns will generally be maintained.

Standard #2: Peak Rate Attenuation

As outlined in **Table 1.1** and **Table 5.1**, the redevelopment of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points.

Standard #3: Recharge

The proposed project is a redevelopment and is required to meet Standard 3 to the maximum extent practicable. The project as proposed will reduce the overall impervious area on the site by approximately 3,775± square feet. As such, the annual recharge under post development conditions will exceed the annual recharge under predevelopment conditions.

Standard #4: Water Quality

The proposed redevelopment is anticipated to result in a reduction of approximately 3,775± square feet of impervious coverage. To the maximum extent practicable, water quality treatment is provided via deep-sump and hooded catch basins and proprietary water quality treatment units prior to being discharged. Stormwater runoff generated that is being routed to the existing underground culvert will be treated by one of three water quality treatment units prior to discharge. Due to the design constraints based on the existing topography, intent to maintain the existing underground culvert, and lot configuration, a 14,980± square foot area will continue to sheet flow to Bolton Street through the full access driveway as it does under existing conditions today. The proposed stormwater management system for the redevelopment is anticipated to obtain a weighted TSS removal of ±45%. TSS removal calculations are included in **Appendix F** of this report.

The project is classified as a redevelopment; therefore, the project is required to meet the minimum requirement for Total Phosphorus (TP) removal to the maximum extent practicable. Under existing conditions, the site produces a phosphorus load export rate of 1.21 lbs/year. The

proposed redevelopment will result in a reduction of approximately 3,775± square feet of impervious coverage and will provide three (3) stormwater quality units. As such, the proposed redevelopment is anticipated to produce a phosphorus load export rate of 0.96 lbs/year. The three (3) proposed CDS-1515 stormwater quality units provide a 20% phosphorus removal rate for the paved areas conveyed to the proposed units and is calculated to remove 0.09 lbs/year of TP. The proposed redevelopment also receives phosphorus reduction credits for selected enhanced non-structural BMPs such as sweeping, catch basin cleaning, and enhanced organic waste and leaf litter collection resulting in an additional 0.03 lbs/year of TP being removed under post-development conditions. As a result, the proposed total weighted phosphorous removal rate is 11.3%. The reduction of Total Phosphorus from pre- to post-development conditions is 20.1%. Phosphorus removal calculations are included in **Appendix F** of this report.

Standard #5: Land Use with Higher Potential Pollutant Loads

The proposed project involves a "Land Use with Higher Potential Pollutant Loads". The existing drainage patterns are proposed to be generally maintained and the redevelopment is anticipated to result in a reduction of approximately 3,775± square feet of impervious coverage. The project will also implement a stormwater Operations and Maintenance Plan for ongoing cleaning and parking lot sweeping to further ensure water quality standards are met for this redevelopment project to the maximum extent practicable.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

The project is a redevelopment and has been designed to meet the Massachusetts Stormwater Management regulations to the maximum extent practicable.

Standard #8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets.

Standard #9: Operation and Maintenance Plan (O&M Plan)

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included in **Appendix G** of this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties and an estimated budget for inspections and maintenance.

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in **Appendix G** of this report.

VI. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development stormwater discharge comparisons are contained in **Table 5.1** below:

Table 5.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP#1	1.00	0.92	**-0.08**	1.64	1.53	**-0.11**	2.03	1.91	**-0.12**	2.63	2.49	**-0.14**
DP#2	0.35	0.22	**-0.13**	0.56	0.37	**-0.19**	0.69	0.46	**-0.23**	0.90	0.59	**-0.31**
DP#3	1.02	0.76	**-0.26**	1.71	1.42	**-0.29**	2.13	1.84	**-0.29**	2.78	2.47	**-0.31**

**Flows are represented in cubic feet per second (cfs)*

As outlined in the table above, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year storm events. Additionally, the project meets or exceeds the MADEP Stormwater Management Standards as described further herein. The redevelopment project as proposed will reduce the overall impervious area on the site by approximately 3,775 square feet and has been designed to meet the Massachusetts Stormwater Management standards the maximum extent practicable for a redevelopment.

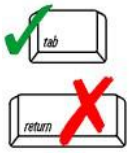
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

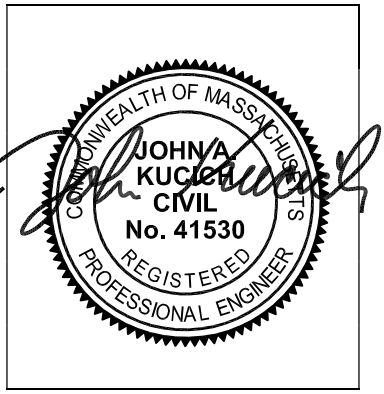
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



07/28/2023

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☒ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☒ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☒ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

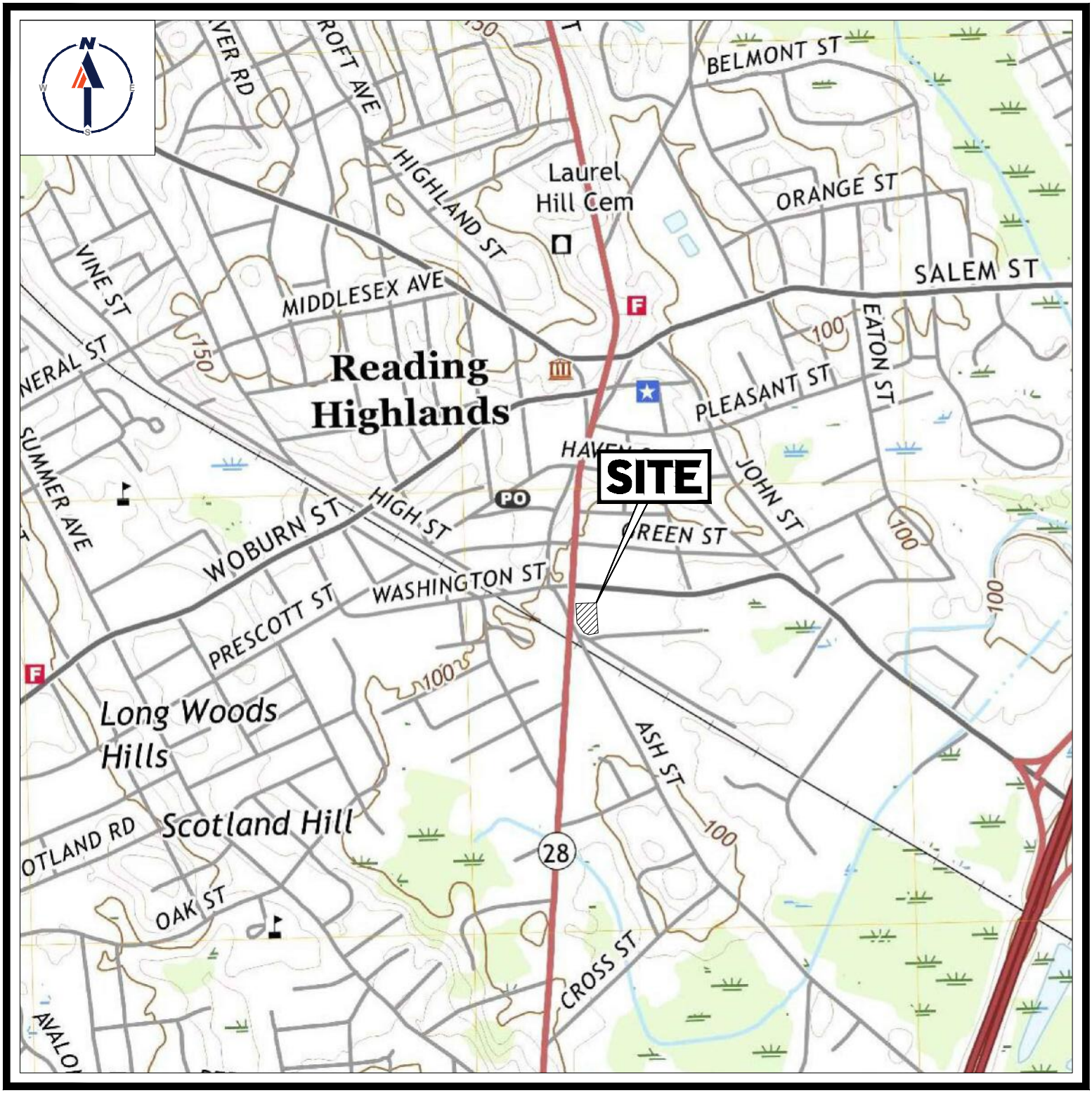
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX B: PROJECT LOCATION MAPS

- *USGS MAP*
- *FEMA FIRMETTE*



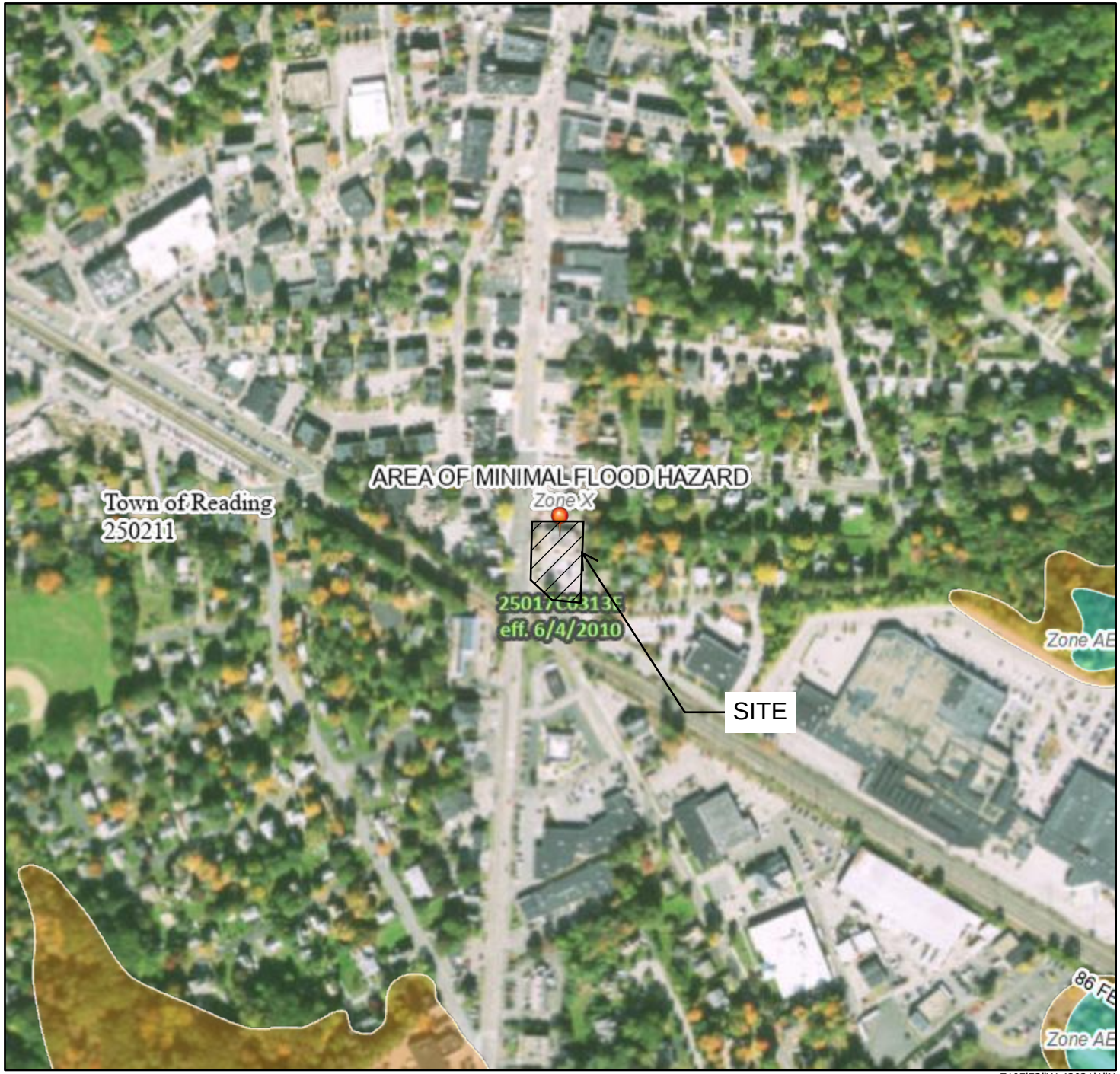
USGS MAP

SCALE: 1" = 1,000'
SOURCE: USGS READING
QUADRANGLE

National Flood Hazard Layer FIRMette

FEMA

71°6'29"W 42°31'27"N



71°5'52"W 42°31'1"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

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

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

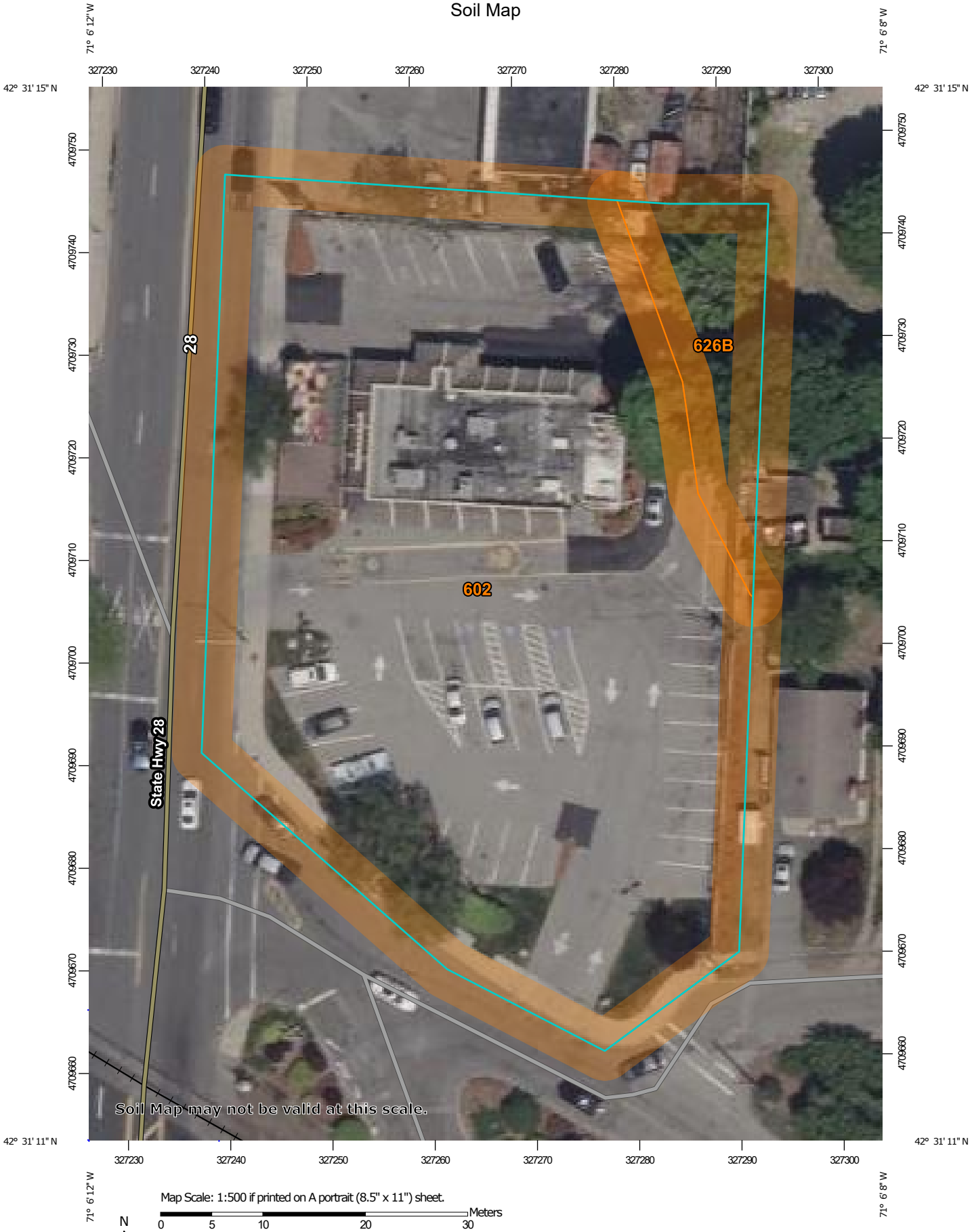
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/28/2023 at 10:19 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*

Custom Soil Resource Report
Soil Map



Map Scale: 1:500 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	0.9	92.3%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.1	7.7%
Totals for Area of Interest		**1.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

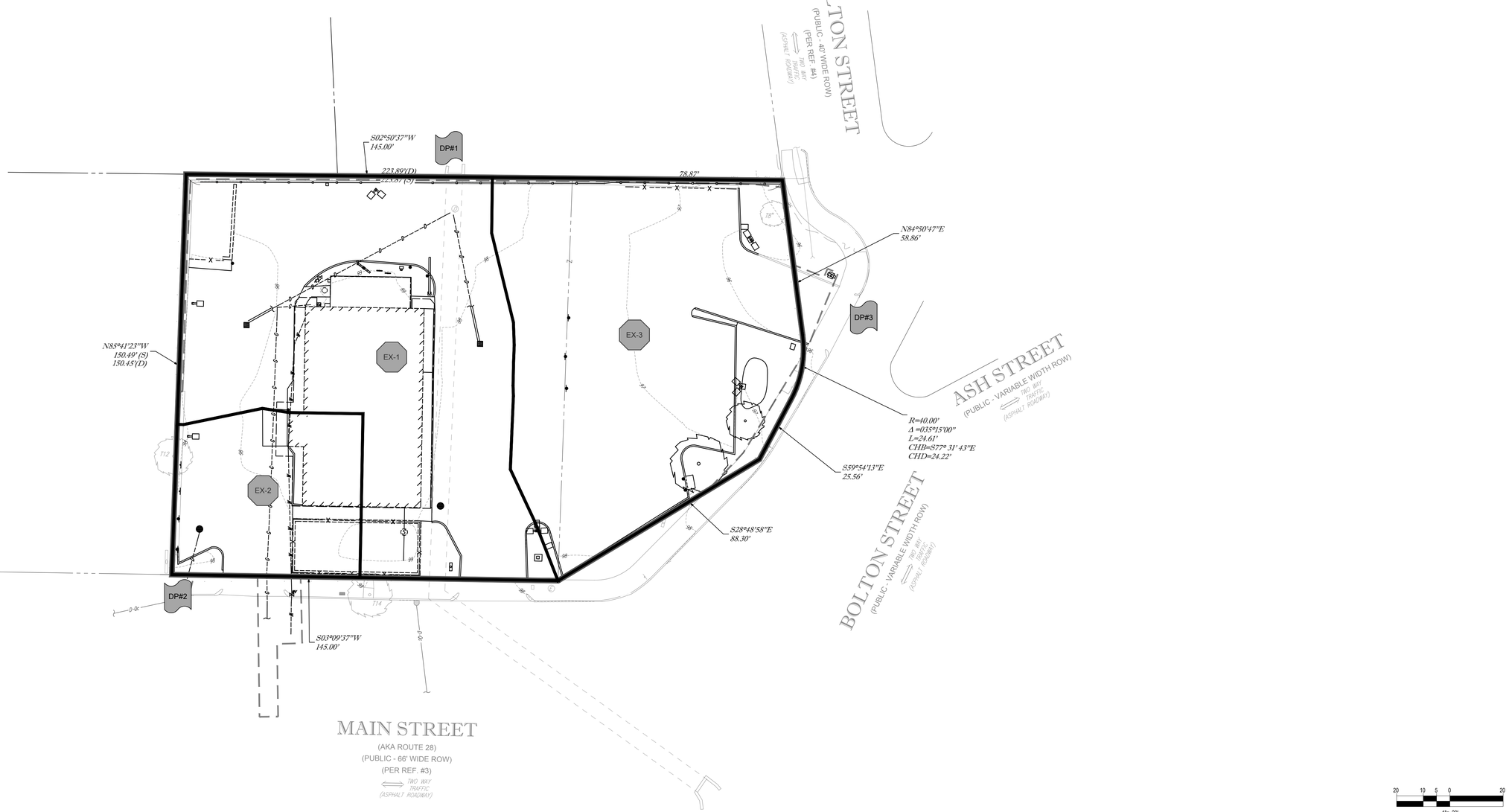
Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

- *EXISTING CONDITIONS DRAINAGE MAP*
- *EXISTING CONDITIONS HYDROCAD COMPUTATIONS*



LEGEND

- DP# — DESIGN POINT
- EX-# — EXISTING SUBCATCHMENT
- OVERALL ANALYSIS BOUNDARY
- SUBCATCHMENT BOUNDARY

20 10 5 0 20

1"= 20'

REV	DATE	DESCRIPTION	BY
1	06/12/2023	REV. PER ZBA & ABUTTERS FEEDBACK	CSE

J.A. KUCICH

PROFESSIONAL ENGINEER

MASSACHUSETTS LICENSE No. 41539
NEW HAMPSHIRE LICENSE No. 15426
CONNECTICUT LICENSE No. 29127
RHODE ISLAND LICENSE No. 9616
MAINE LICENSE No. 12553

McDonald's

BOSTON REGION
110 N CARPENTER ST
CHICAGO, IL 60607

OFFICE
ADDRESS

PLAN APPROVALS

SIGNATURE	DATE	APPROVED McDONALD'S AGENT

BOHLER™

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

COMPLIANCE CHECK — DATE

CONSTRUCTION CHECK — DATE

CONSTRUCTION CHECK — DATE

PROJECT No.: W222000

CAD I.D. #: W222000-SPPD-1b.dwg

-

STREET ADDRESS
413 MAIN STREET

CITY: READING
STATE: MA

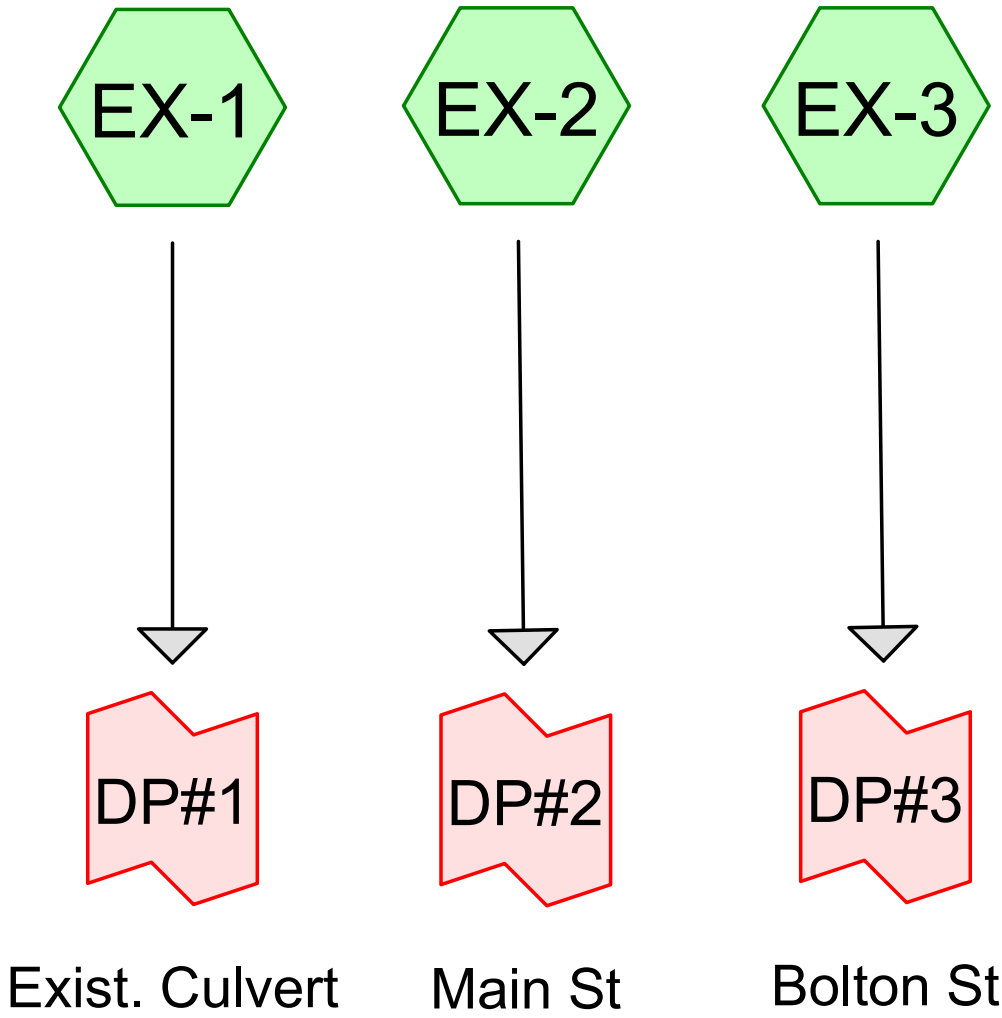
COUNTY
MIDDLESEX

SITE I.D.
20-0015

PLAN DESCRIPTION
EXISTING CONDITIONS DRAINAGE AREA MAP

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

SHEET NO.
EXDAM
OF 14



Subcat Reach Pond Link

Routing Diagram for Pre-Development Analysis
Prepared by Bohler Engineering, Printed 4/25/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.073	61	>75% Grass cover, Good, HSG B (EX-1, EX-2, EX-3)
0.592	98	Paved parking, HSG B (EX-1, EX-2, EX-3)
0.078	98	Roofs, HSG B (EX-1, EX-2)
0.743	**94**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.743	HSG B	EX-1, EX-2, EX-3
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.743		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.073	0.000	0.000	0.000	0.073	>75% Grass cover, Good	EX-1, EX-2, EX-3
0.000	0.592	0.000	0.000	0.000	0.592	Paved parking	EX-1, EX-2, EX-3
0.000	0.078	0.000	0.000	0.000	0.078	Roofs	EX-1, EX-2
0.000	**0.743**	**0.000**	**0.000**	**0.000**	**0.743**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=95 Runoff=1.00 cfs 0.077 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=2.86"
Tc=0.0 min CN=96 Runoff=0.35 cfs 0.023 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=2.55"
Tc=0.0 min CN=93 Runoff=1.02 cfs 0.066 af

Link DP#1: Exist. Culvert Inflow=1.00 cfs 0.077 af
Primary=1.00 cfs 0.077 af

Link DP#2: Main St Inflow=0.35 cfs 0.023 af
Primary=0.35 cfs 0.023 af

Link DP#3: Bolton St Inflow=1.02 cfs 0.066 af
Primary=1.02 cfs 0.066 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.166 af Average Runoff Depth = 2.68"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 1.00 cfs @ 12.09 hrs, Volume= 0.077 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment EX-2:

Runoff = 0.35 cfs @ 12.00 hrs, Volume= 0.023 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 1.02 cfs @ 12.00 hrs, Volume= 0.066 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 2.75" for 2 Year event
Inflow = 1.00 cfs @ 12.09 hrs, Volume= 0.077 af
Primary = 1.00 cfs @ 12.09 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 2.86" for 2 Year event
Inflow = 0.35 cfs @ 12.00 hrs, Volume= 0.023 af
Primary = 0.35 cfs @ 12.00 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 2.55" for 2 Year event
Inflow = 1.02 cfs @ 12.00 hrs, Volume= 0.066 af
Primary = 1.02 cfs @ 12.00 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=4.63"
Tc=6.0 min CN=95 Runoff=1.64 cfs 0.130 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=4.74"
Tc=0.0 min CN=96 Runoff=0.56 cfs 0.039 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=4.40"
Tc=0.0 min CN=93 Runoff=1.71 cfs 0.113 af

Link DP#1: Exist. Culvert Inflow=1.64 cfs 0.130 af
Primary=1.64 cfs 0.130 af

Link DP#2: Main St Inflow=0.56 cfs 0.039 af
Primary=0.56 cfs 0.039 af

Link DP#3: Bolton St Inflow=1.71 cfs 0.113 af
Primary=1.71 cfs 0.113 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.282 af Average Runoff Depth = 4.55"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 1.64 cfs @ 12.09 hrs, Volume= 0.130 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment EX-2:

Runoff = 0.56 cfs @ 12.00 hrs, Volume= 0.039 af, Depth= 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 1.71 cfs @ 12.00 hrs, Volume= 0.113 af, Depth= 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 4.63" for 10 Year event
Inflow = 1.64 cfs @ 12.09 hrs, Volume= 0.130 af
Primary = 1.64 cfs @ 12.09 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 4.74" for 10 Year event
Inflow = 0.56 cfs @ 12.00 hrs, Volume= 0.039 af
Primary = 0.56 cfs @ 12.00 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 4.40" for 10 Year event
Inflow = 1.71 cfs @ 12.00 hrs, Volume= 0.113 af
Primary = 1.71 cfs @ 12.00 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=5.81"
Tc=6.0 min CN=95 Runoff=2.03 cfs 0.163 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=5.93"
Tc=0.0 min CN=96 Runoff=0.69 cfs 0.048 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=5.58"
Tc=0.0 min CN=93 Runoff=2.13 cfs 0.143 af

Link DP#1: Exist. Culvert Inflow=2.03 cfs 0.163 af
Primary=2.03 cfs 0.163 af

Link DP#2: Main St Inflow=0.69 cfs 0.048 af
Primary=0.69 cfs 0.048 af

Link DP#3: Bolton St Inflow=2.13 cfs 0.143 af
Primary=2.13 cfs 0.143 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.355 af Average Runoff Depth = 5.73"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 2.03 cfs @ 12.09 hrs, Volume= 0.163 af, Depth= 5.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment EX-2:

Runoff = 0.69 cfs @ 12.00 hrs, Volume= 0.048 af, Depth= 5.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 2.13 cfs @ 12.00 hrs, Volume= 0.143 af, Depth= 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 5.81" for 25 Year event
Inflow = 2.03 cfs @ 12.09 hrs, Volume= 0.163 af
Primary = 2.03 cfs @ 12.09 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 5.93" for 25 Year event
Inflow = 0.69 cfs @ 12.00 hrs, Volume= 0.048 af
Primary = 0.69 cfs @ 12.00 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 5.58" for 25 Year event
Inflow = 2.13 cfs @ 12.00 hrs, Volume= 0.143 af
Primary = 2.13 cfs @ 12.00 hrs, Volume= 0.143 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=7.63"
Tc=6.0 min CN=95 Runoff=2.63 cfs 0.215 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=7.75"
Tc=0.0 min CN=96 Runoff=0.90 cfs 0.063 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=7.39"
Tc=0.0 min CN=93 Runoff=2.78 cfs 0.190 af

Link DP#1: Exist. Culvert Inflow=2.63 cfs 0.215 af
Primary=2.63 cfs 0.215 af

Link DP#2: Main St Inflow=0.90 cfs 0.063 af
Primary=0.90 cfs 0.063 af

Link DP#3: Bolton St Inflow=2.78 cfs 0.190 af
Primary=2.78 cfs 0.190 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.467 af Average Runoff Depth = 7.55"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 2.63 cfs @ 12.09 hrs, Volume= 0.215 af, Depth= 7.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment EX-2:

Runoff = 0.90 cfs @ 12.00 hrs, Volume= 0.063 af, Depth= 7.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 2.78 cfs @ 12.00 hrs, Volume= 0.190 af, Depth= 7.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 7.63" for 100 Year event
Inflow = 2.63 cfs @ 12.09 hrs, Volume= 0.215 af
Primary = 2.63 cfs @ 12.09 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 7.75" for 100 Year event
Inflow = 0.90 cfs @ 12.00 hrs, Volume= 0.063 af
Primary = 0.90 cfs @ 12.00 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

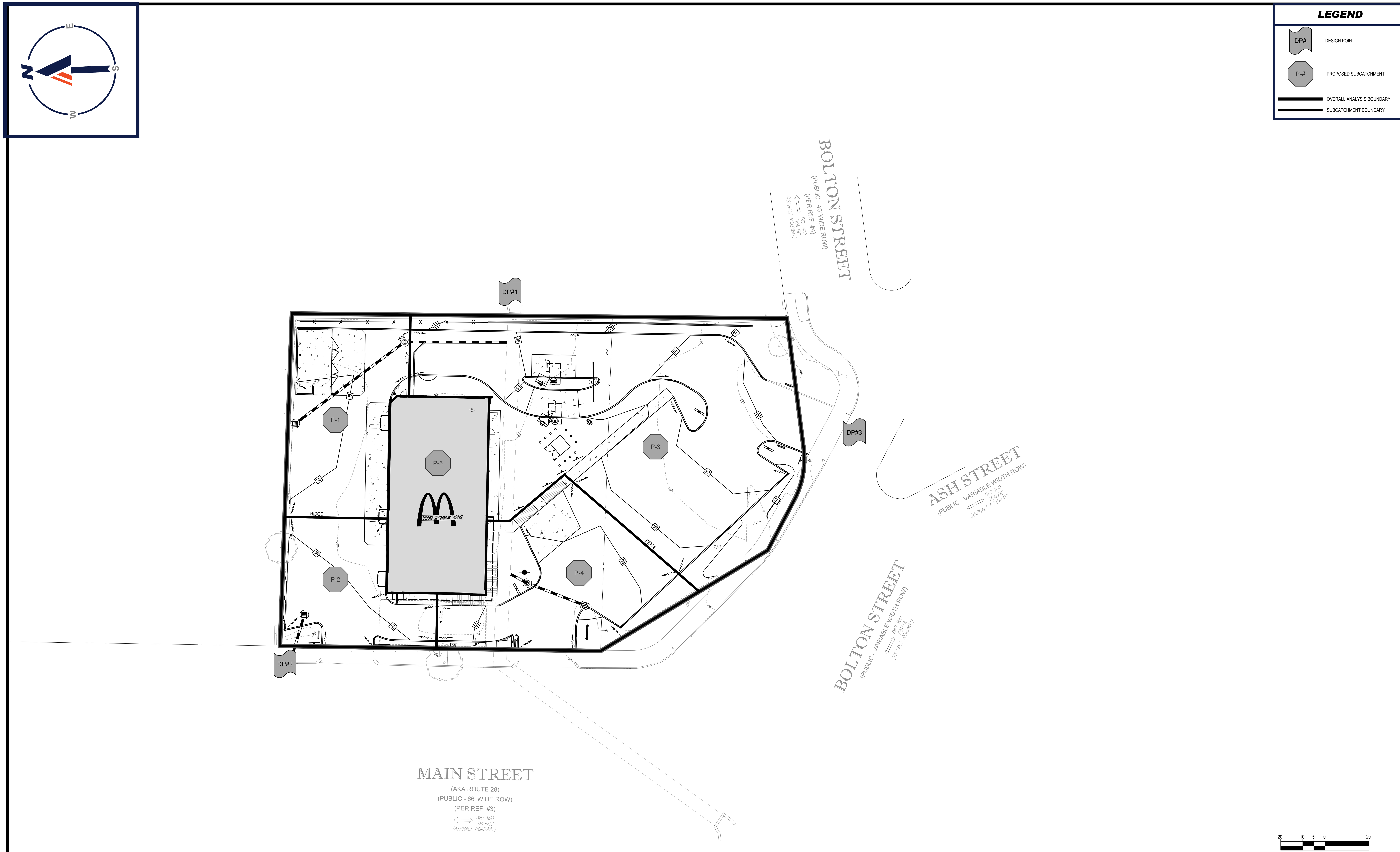
Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 7.39" for 100 Year event
Inflow = 2.78 cfs @ 12.00 hrs, Volume= 0.190 af
Primary = 2.78 cfs @ 12.00 hrs, Volume= 0.190 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*



REV	DATE	DESCRIPTION	BY
1	06/12/2023	REV. PER ZBA & ABUTTERS FEEDBACK	CSE

J.A. KUCICH
PROFESSIONAL ENGINEER

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OFFICE: BOSTON REGION
ADDRESS: 110 N CARPENTER ST, CHICAGO, IL 60607

PLAN APPROVALS — SIGNATURE — DATE — APPROVED McDONALD'S AGENT

BOHLER //

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

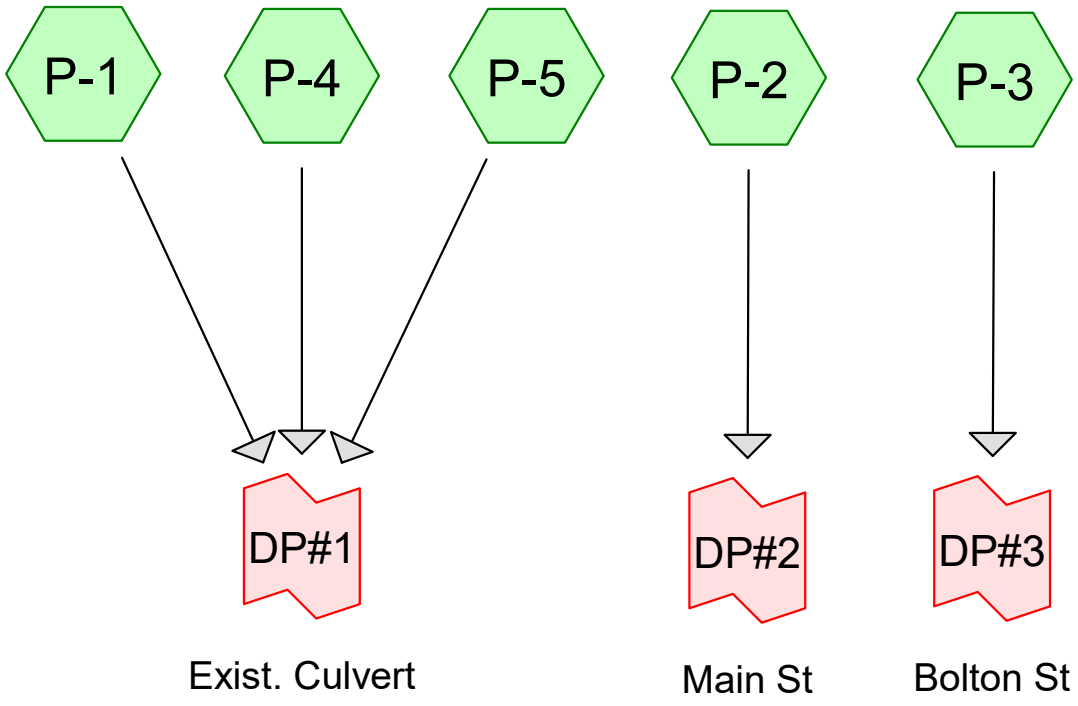
COMPLIANCE CHECK — DATE
CONSTRUCTION CHECK — DATE
CONSTRUCTION CHECK — DATE

PROJECT No.: W222000
CAD I.D. #: W222000-SPPD-1b.dwg

-
STREET ADDRESS: 413 MAIN STREET
CITY: READING
STATE: MA
COUNTY: MIDDLESEX
SITE I.D.: 20-0015
PLAN DESCRIPTION: **PROPOSED CONDITIONS DRAINAGE AREA MAP**

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

SHEET NO.
PRDAM



Subcat Reach Pond Link

Routing Diagram for Post-Development Analysis
Prepared by Bohler Engineers, Printed 7/28/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.160	61	>75% Grass cover, Good, HSG B (P-1, P-2, P-3, P-4)
0.492	98	Paved parking, HSG B (P-1, P-2, P-3, P-4)
0.091	98	Roofs, HSG B (P-5)
0.743	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.743	HSG B	P-1, P-2, P-3, P-4, P-5
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.743		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.160	0.000	0.000	0.000	0.160	>75% Grass cover, Good	P-1, P-2, P-3, P-4
0.000	0.492	0.000	0.000	0.000	0.492	Paved parking	P-1, P-2, P-3, P-4
0.000	0.091	0.000	0.000	0.000	0.091	Roofs	P-5
0.000	**0.743**	**0.000**	**0.000**	**0.000**	**0.743**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=2.65"
Tc=6.0 min CN=94 Runoff=0.30 cfs 0.023 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=2.65"
Tc=6.0 min CN=94 Runoff=0.22 cfs 0.017 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=1.93"
Tc=6.0 min CN=86 Runoff=0.76 cfs 0.055 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=2.27"
Tc=6.0 min CN=90 Runoff=0.33 cfs 0.024 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=3.08"
Tc=6.0 min CN=98 Runoff=0.29 cfs 0.023 af

Link DP#1: Exist. Culvert Inflow=0.92 cfs 0.071 af
Primary=0.92 cfs 0.071 af

Link DP#2: Main St Inflow=0.22 cfs 0.017 af
Primary=0.22 cfs 0.017 af

Link DP#3: Bolton St Inflow=0.76 cfs 0.055 af
Primary=0.76 cfs 0.055 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.143 af Average Runoff Depth = 2.31"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.023 af, Depth= 2.65"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2:

Runoff = 0.22 cfs @ 12.09 hrs, Volume= 0.017 af, Depth= 2.65"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3:

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 1.93"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4:

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 0.024 af, Depth= 2.27"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-5:

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 0.023 af, Depth= 3.08"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 2.62" for 2 Year event
Inflow = 0.92 cfs @ 12.09 hrs, Volume= 0.071 af
Primary = 0.92 cfs @ 12.09 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 2.65" for 2 Year event
Inflow = 0.22 cfs @ 12.09 hrs, Volume= 0.017 af
Primary = 0.22 cfs @ 12.09 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 1.93" for 2 Year event
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 0.055 af
Primary = 0.76 cfs @ 12.09 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=4.52"
Tc=6.0 min CN=94 Runoff=0.50 cfs 0.039 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=4.52"
Tc=6.0 min CN=94 Runoff=0.37 cfs 0.029 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=3.66"
Tc=6.0 min CN=86 Runoff=1.42 cfs 0.105 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=4.08"
Tc=6.0 min CN=90 Runoff=0.57 cfs 0.043 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=4.97"
Tc=6.0 min CN=98 Runoff=0.45 cfs 0.038 af

Link DP#1: Exist. Culvert Inflow=1.53 cfs 0.120 af
Primary=1.53 cfs 0.120 af

Link DP#2: Main St Inflow=0.37 cfs 0.029 af
Primary=0.37 cfs 0.029 af

Link DP#3: Bolton St Inflow=1.42 cfs 0.105 af
Primary=1.42 cfs 0.105 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.254 af Average Runoff Depth = 4.10"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.039 af, Depth= 4.52"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2:

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 0.029 af, Depth= 4.52"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3:

Runoff = 1.42 cfs @ 12.09 hrs, Volume= 0.105 af, Depth= 3.66"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4:

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 4.08"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-5:

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.038 af, Depth= 4.97"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 4.47" for 10 Year event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.120 af
Primary = 1.53 cfs @ 12.09 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 4.52" for 10 Year event
Inflow = 0.37 cfs @ 12.09 hrs, Volume= 0.029 af
Primary = 0.37 cfs @ 12.09 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 3.66" for 10 Year event
Inflow = 1.42 cfs @ 12.09 hrs, Volume= 0.105 af
Primary = 1.42 cfs @ 12.09 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=5.69"
Tc=6.0 min CN=94 Runoff=0.62 cfs 0.050 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=5.69"
Tc=6.0 min CN=94 Runoff=0.46 cfs 0.036 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=4.79"
Tc=6.0 min CN=86 Runoff=1.84 cfs 0.137 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=5.24"
Tc=6.0 min CN=90 Runoff=0.72 cfs 0.055 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=0.56 cfs 0.047 af

Link DP#1: Exist. Culvert Inflow=1.91 cfs 0.152 af
Primary=1.91 cfs 0.152 af

Link DP#2: Main St Inflow=0.46 cfs 0.036 af
Primary=0.46 cfs 0.036 af

Link DP#3: Bolton St Inflow=1.84 cfs 0.137 af
Primary=1.84 cfs 0.137 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.326 af Average Runoff Depth = 5.25"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.050 af, Depth= 5.69"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2:

Runoff = 0.46 cfs @ 12.09 hrs, Volume= 0.036 af, Depth= 5.69"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3:

Runoff = 1.84 cfs @ 12.09 hrs, Volume= 0.137 af, Depth= 4.79"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4:

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 5.24"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-5:

Runoff = 0.56 cfs @ 12.09 hrs, Volume= 0.047 af, Depth= 6.16"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 5.65" for 25 Year event
Inflow = 1.91 cfs @ 12.09 hrs, Volume= 0.152 af
Primary = 1.91 cfs @ 12.09 hrs, Volume= 0.152 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 5.69" for 25 Year event
Inflow = 0.46 cfs @ 12.09 hrs, Volume= 0.036 af
Primary = 0.46 cfs @ 12.09 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 4.79" for 25 Year event
Inflow = 1.84 cfs @ 12.09 hrs, Volume= 0.137 af
Primary = 1.84 cfs @ 12.09 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=7.51"
Tc=6.0 min CN=94 Runoff=0.81 cfs 0.066 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=7.51"
Tc=6.0 min CN=94 Runoff=0.59 cfs 0.048 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=6.55"
Tc=6.0 min CN=86 Runoff=2.47 cfs 0.188 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=7.03"
Tc=6.0 min CN=90 Runoff=0.95 cfs 0.074 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=7.99"
Tc=6.0 min CN=98 Runoff=0.72 cfs 0.061 af

Link DP#1: Exist. Culvert Inflow=2.49 cfs 0.201 af
Primary=2.49 cfs 0.201 af

Link DP#2: Main St Inflow=0.59 cfs 0.048 af
Primary=0.59 cfs 0.048 af

Link DP#3: Bolton St Inflow=2.47 cfs 0.188 af
Primary=2.47 cfs 0.188 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.436 af Average Runoff Depth = 7.05"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.81 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 7.51"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2:

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.048 af, Depth= 7.51"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3:

Runoff = 2.47 cfs @ 12.09 hrs, Volume= 0.188 af, Depth= 6.55"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4:

Runoff = 0.95 cfs @ 12.09 hrs, Volume= 0.074 af, Depth= 7.03"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-5:

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.061 af, Depth= 7.99"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 7.46" for 100 Year event
Inflow = 2.49 cfs @ 12.09 hrs, Volume= 0.201 af
Primary = 2.49 cfs @ 12.09 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 7.51" for 100 Year event
Inflow = 0.59 cfs @ 12.09 hrs, Volume= 0.048 af
Primary = 0.59 cfs @ 12.09 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 6.55" for 100 Year event
Inflow = 2.47 cfs @ 12.09 hrs, Volume= 0.188 af
Primary = 2.47 cfs @ 12.09 hrs, Volume= 0.188 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #4 –TSS REMOVAL*
- *WEIGHTED TOTAL PHOSPHORUS REMOVAL RATE*
- *CONTINUOUS DEFLECTIVE SEPARATOR (CDS) STORMWATER TREATMENT DEVICE DEQ LETTER*
- *MA MS4 GENERAL PERMIT APPENDIX F ATTACHMENT 2*
- *NOAA RAINFALL DATA*
- *PIPE AND INLET SIZING*

McDonald's
413 Main Street
Reading, MA
Bohler Job Number: W222000
October 18, 2023

MA DEP Standard 4: Weighted TSS Removal Rate

Design Point - Treatment Train Description(s)	TSS Removal (%)	Treated Imp. Area* (ac)	TSS Removal (%)	Untreated Imp. Area (ac)	Total Area
Deep-sump hooded CB to Water Quality Units	85	0.261	0	0.231	0.492
Weighted TSS Removal Rate	**45**				

*Excludes roof runoff

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

McDonald's
413 Main Street
Reading, MA
Bohler Job Number: W222000
November 20, 2023

Weighted Total Phosphorus Removal Rate

Phosphorus Loading Summary - Existing Conditions

Land Use	Area (Acres)	Phosphorus Loading (lbs/year)
Commercial	0.670	1.19
Developed Land - HSG C/D	0.073	0.02
Total	**0.743**	**1.21**

Phosphorus Loading Summary - Proposed Conditions

Land Use	Area (Acres)	Phosphorus Loading (lbs/year)
Commercial	0.583	1.04
Developed Land - HSG C/D	0.160	0.05
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
Total	**0.743**	**1.08**

Structural BMP Phosphorus Removal

Credit	TP Removal (lbs/year)
Credit #1: CDS-1515 Stormwater Quality Units	0.09
Total	**0.09**

Non-Structural BMP Phosphorus Removal

Credit	TP Removal (lbs/year)
Credit #2: Enhanced Sweeping Program	0.00
Credit #3: Catch Basin Cleaning	0.01
Credit #4: No Application of Fertilizers Containing Phosphorus	0.00
Credit #5: Enhanced Organic Waste and Leaf Litter Collection Program	0.02
Total	**0.03**

Adjusted Proposed Phosphorus Loading (lbs/year)	**0.96**

Proposed Total Weighted Phosphorous Removal Rate	**11.3%**

Proposed Weighted Total Phosphorus reduction vs. Existing Conditions	**20.1% (0.25 lbs/yr)**

Notes:
1. Land Use phosphorus load export rates obtained from MA MS4 General Permit Appendix F Attachment 2 (enclosed for reference).
2. Non-structural BMP phosphorous removal efficincies obtained from MA MS4 General Permit Appendix F Attachment 2 (enclosed for reference).
3. Please refer to supporting calculations included with this document for additional information with respect to the calculated TP removal rates.
4. Mechanical treatment phosphorus removal efficiencies obtained from the enclosed department of environmental Quality (DEQ) CDS Phosphorus removal efficiencies for total phosphorus, continuous deflector separator stormwater treatment device

Prepared By: BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Phosphorus Reduction Credits for Selected Enhanced Structural BMPs in the Watershed

Credit #1: CDS-1515 Stormwater Quality Units

Credit $_{CB}$ = IA $_{CB}$ * PLE * PRF $_{CB}$

Credit $_{CB}$ =	Amount of phosphorus load removed by catch basin cleaning (lb/yr)
IA $_{CB}$ =	Impervious area to catch basins (acres)
PLE =	PLER from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
PRF $_{CB}$ =	Phosphorus reduction factor (PRF) for catch basin cleaning as seen in DEQ Letter

IA $_{CB}$ =	0.26	(Impervious paved area flowing to SWQUs - does not include roof)
PLE =	1.78	(Commercial)
PRF $_{CB}$ =	0.2	(Semi-annual CB Cleaning)

Credit $_{CB}$ =	0.09	lb/yr phosphorus removed

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Phosphorus Reduction Credits for Selected Enhanced Non-Structural BMPs in the Watershed

Credit #2: Enhanced Sweeping Program

Credit (Sweeping) = $IA_{sweeping} * PLE * PRF_{sweeping} * AF$

$Credit_{sweeping}$ =	Amount of phosphorus load removed by enhanced sweeping (lb/yr)
$IA_{sweeping}$ =	Impervious Area swept (acres)
PLE =	PLE/R from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
$PRF_{sweeping}$ =	Phosphorus reduction factor (PRF) for sweeping base on sweeping frequency as seen in Table 2-3
AF =	Annual frequency of sweeping or months per year streets are swept (Ex: 3 mo./12 mo. = 0.25)

$IA_{sweeping}$ =	0.49	(Total impervious paved area - excluding roof)
PLE =	1.78	(Commercial)
$PRF_{sweeping}$ =	0.02	(Mechanical Broom, 2/year)
AF =	0.17	(2 Months - Spring & Fall)

$Credit_{sweeping}$ =	0.00	lb/yr phosphorus removed

Credit #3: Catch Basin Cleaning

Credit $_{CB} = IA_{CB} * PLE * PRF_{CB}$

$Credit_{CB}$ =	Amount of phosphorus load removed by catch basin cleaning (lb/yr)
IA_{CB} =	Impervious area to catch basins (acres)
PLE =	PLER from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
PRF_{CB} =	Phosphorus reduction factor (PRF) for catch basin cleaning as seen in Table 2-4

IA_{CB} =	0.26	(Impervious paved area flowing to onsite CBs to be maintained - does not include roof)
PLE =	1.78	(Commercial)
PRF_{CB} =	0.02	(Semi-annual CB Cleaning)

$Credit_{CB}$ =	0.01	lb/yr phosphorus removed

Credit #4: No Application of Fertilizers Containing Phosphorus

$Credit_{fertilizer}$ =	0.00	lb/yr phosphorus removed

Credit #5: Enhanced Organic Waste and Leaf Litter Collection Program

Credit $_{leaf\ litter} = IA_{swept} * PLE * PRF_{sweeping}$

$Credit_{leaf\ litter}$ =	Amount of phosphorus load removed by collection of organic waste and leaf little collection (lb/yr)
$IA_{sweeping}$ =	Impervious Area swept (acres)
PLE =	PLER from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
$PRF_{sweeping}$ =	Phosphorus reduction factor (PRF) for sweeping base on sweeping frequency as seen in Table 2-3

$IA_{sweeping}$ =	0.49	(Total impervious paved area - excluding roof)
PLE =	1.78	(Commercial)
$PRF_{sweeping}$ =	0.02	(Mechanical Broom, 2/year)

$Credit_{leaf\ litter}$ =	0.02	lb/yr phosphorus removed

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

1111 E. Main Street, Suite 1400, Richmond, Virginia 23219
P.O. Box 1105, Richmond, Virginia 23218
(800) 592-5482 FAX (804) 698-4178
www.deq.virginia.gov

Travis A. Voyles
Acting Secretary of Natural and Historic Resources

Michael S. Rolband, PE, PWD, PWS Emeritus
Director
(804) 698-4020

April 20, 2022

Mr. Jacob Dorman
Contech Engineered Solutions LLC
7037 Ridge Road, Suite 350
Hanover, MD 21076

Transmitted electronically jdorman@conteches.com

Re: Assignment of Percent Removal Efficiencies for Total Phosphorus
Continuous Deflective Separator (CDS) Stormwater Treatment Device

Dear Mr. Dorman:

The Department of Environmental Quality (Department or DEQ) received the Proprietary Best Management Practice (BMP) Registration Statement and supporting documentation for the **Continuous Deflective Separator (CDS) Stormwater Treatment Device** on December 29, 2021. The Department has reviewed the application and supporting documentation in accordance with § 62.1-44.15:28 of the Code of Virginia, 9VAC25-870-65 D of the Virginia Stormwater Management Program (VSMP) Regulation, and DEQ Guidance Memo No. 21-2006.

Section 65 D 2 of the VSMP Regulation states, "Any proprietary BMP approved for use after July 1, 2020, must meet the requirements of § 62.1-44.15:28 A 9 of the Code of Virginia." The Department received the current general use level designation (GULD) certificate from Washington State's Technology Assessment Protocol – Ecology (TAPE) program or the current certification from the New Jersey Department of Environmental Protection (NJDEP) for the **Continuous Deflective Separator (CDS) Stormwater Treatment Device**.

The **Continuous Deflective Separator (CDS) Stormwater Treatment Device** is approved for use in Virginia to meet the VSMP water quality design criteria requirements and has been assigned a total phosphorus pollutant removal efficiency of **20%**. This information will be posted on the Virginia Stormwater BMP Clearinghouse website. This device and the assigned removal efficiency can be manually added into the Virginia Runoff Reduction Method spreadsheet to demonstrate compliance with VSMP water quality design criteria requirements.

If you have any questions regarding this letter, please contact Robert E. Cooper, P.E. at (804) 965-4875 or e-mail at Robert.Cooper@deq.virginia.gov.

Sincerely

Erin Ervin Belt

Erin Ervin Belt
Office of Stormwater Management

ATTACHMENT 2 TO APPENDIX F

Phosphorus and Nitrogen Reduction Credits for Selected Enhanced Non-Structural BMPs

The permittee shall use the following methods to calculate phosphorus and nitrogen (nutrients) load reduction credits for the following enhanced non-structural control practices implemented in the Watershed:

1) Enhanced Sweeping Program;
2) Catch Basin Cleaning;
   and
3) Organic Waste and Leaf Litter Collection program

The methods include the use of default nutrient reduction factors that EPA has determined are acceptable for calculating nutrient load reduction credits for these practices.

The methods and annual nutrient load export rates presented in this attachment are for the purpose of counting load reductions for various BMPs treating storm water runoff from varying site conditions (i.e., impervious or pervious surfaces) and different land uses (e.g. industrial and commercial) within the impaired watershed. Tables 2-1 and 2-2 below provide annual phosphorus and nitrogen load export rates by land use category for impervious and pervious areas. The estimates of annual phosphorus load and load reductions resulting from BMP implementation are intended for use by the permittee to measure compliance with its Phosphorus Reduction Requirement under the permit. The estimates of annual nitrogen load and load reduction resulting from BMP implementation are intended for use by the permittee to track and account for nitrogen load reductions in accordance with Appendices F and H in the permit.

Examples are provided to illustrate use of the methods. In calculating phosphorus and nitrogen export rates, the permittee shall select the land use category that most closely represents the actual use for the area in question. For watersheds with institutional type uses, such as government properties, hospitals, and schools, the permittee shall use the commercial land use category for the purpose of calculating phosphorus and nitrogen loads. Table 2-3 provides a crosswalk table of land use codes between land use groups in Tables 2-1 and 2-2, and the codes used by Mass GIS. For pervious areas, permittees should use the appropriate value for the hydrologic soil group (HSG) if known, otherwise, assume HSG C conditions.

Alternative Methods and/or Nutrient Reduction Factors: A permittee may propose alternative methods and/or nutrient reduction factors for calculating nutrient load reduction credits for these non-structural practices. EPA will consider alternative methods and/or nutrient reduction factors, provided that the permittee submits adequate supporting documentation to EPA. At a minimum, supporting documentation shall consist of a description of the proposed method, the technical basis of the method, identification of alternative nutrient reduction factors, supporting calculations, and identification of references and sources of information that support the use of the

alternative method and/or factors in the Watershed. If EPA determines that the alternative methods and/or factors are not adequately supported, EPA will notify the permittee and the permittee may receive no nutrient reduction credit other than a reduction credit calculated by the permittee following the methods in this attachment for the identified practices.

Table 2-1: Proposed average annual distinct P Load export rates for use in estimating P Load reduction credits in the MA MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs/acre/year	P Load Export Rate, kg/ha/yr
Commercial (Com) and Industrial (Ind)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (For)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (Open)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (Ag)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV) – HSG B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) – HSG C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	0.29	0.33
*Developed Land Pervious (DevPERV) – HSG D	Pervious	0.37	0.41

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.

- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 2-2: Average annual distinct nitrogen (N) load export rates for use in estimating N load reduction credits in the MA MS4 Permit

Nitrogen Source Category by Land Use	Land Surface Cover	N Load Export Rate, lbs./acre/year	N Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	15.0	16.9
	Pervious	See* DevPERV	See* DevPERV
All Residential	Directly connected impervious	14.1	15.8
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	10.5	11.8
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	11.3	12.7
	Pervious	0.5	0.6
Open Land (OPEN)	Directly connected impervious	11.3	12.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	11.3	12.7
	Pervious	2.6	2.9
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.3	0.3
*Developed Land Pervious (DevPERV) – HSG B	Pervious	1.2	1.3
*Developed Land Pervious (DevPERV) – HSG C	Pervious	2.4	2.7
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	3.1	3.5
*Developed Land Pervious (DevPERV) – HSG D	Pervious	3.6	4.1

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the nitrogen load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for the purpose of calculating nitrogen loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 2-3: Crosswalk of Mass GIS land use categories to land use groups for P load calculations

Mass GIS Land Use LU_CODE	Description	Land Use group for calculating P Load - 2013/14 MA MS4
1	Crop Land	Agriculture
2	Pasture (active)	Agriculture
3	Forest	Forest
4	Wetland	Forest
5	Mining	Industrial
6	Open Land includes inactive pasture	open land
7	Participation Recreation	open land
8	spectator recreation	open land
9	Water Based Recreation	open land
10	Multi-Family Residential	High Density Residential
11	High Density Residential	High Density Residential
12	Medium Density Residential	Medium Density Residential
13	Low Density Residential	Low Density Residential
14	Saltwater Wetland	Water
15	Commercial	Commercial
16	Industrial	Industrial
17	Urban Open	open land
18	Transportation	Highway
19	Waste Disposal	Industrial
20	Water	Water
23	cranberry bog	Agriculture
24	Powerline	open land
25	Saltwater Sandy Beach	open land
26	Golf Course	Agriculture
29	Marina	Commercial
31	Urban Public	Commercial
34	Cemetery	open land
35	Orchard	Forest
36	Nursery	Agriculture
37	Forested Wetland	Forest
38	Very Low Density residential	Low Density Residential
39	Junkyards	Industrial
40	Brush land/Successional	Forest

(1) Enhanced Sweeping Program: The permittee may earn a phosphorus and/or nitrogen reduction credit(s) for conducting an enhanced sweeping program of impervious surfaces. Table 2-4 below outlines the default nutrient removal factors for enhanced sweeping programs. The credit shall be calculated by using the following equations:

$$\text{Phosphorus Credit}_{\text{P sweeping}} = \text{IA}_{\text{swept}} \times \text{PLER}_{\text{IC-land use}} \times \text{PRF}_{\text{sweeping}} \times \text{AF} \quad \textbf{(Equation 2-1)}$$

$$\text{Nitrogen Credit}_{\text{N sweeping}} = \text{IA}_{\text{swept}} \times \text{NLER}_{\text{IC-land use}} \times \text{NRF}_{\text{sweeping}} \times \text{AF} \quad \textbf{(Equation 2-2)}$$

Where:

$\text{Credit}_{\text{sweeping}}$	=	Amount of nutrient load removed by enhanced sweeping program (lb/year)
IA_{swept}	=	Area of impervious surface that is swept under the enhanced sweeping program (acres)
$\text{PLER}_{\text{IC-land use}}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
$\text{NLER}_{\text{IC-land use}}$	=	Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)
$\text{PRF}_{\text{sweeping}}$	=	Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).
$\text{NRF}_{\text{sweeping}}$	=	Nitrogen Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).
AF	=	Annual Frequency of sweeping. For example, if sweeping does not occur in Dec/Jan/Feb, the AF would be 9 mo./12 mo. = 0.75. For year-round sweeping, AF=1.0[1]

As an alternative, the permittee may apply a credible sweeping model of the Watershed and perform continuous simulations reflecting build-up and wash-off of phosphorus or nitrogen using long-term local rainfall data.

Table 2-4: Nutrient reduction efficiency factors for sweeping impervious areas

Frequency[1]	Sweeper Technology	PRF $_{sweeping}$	NFR $_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02	0.02
Monthly	Mechanical Broom	0.03	0.03
Monthly	Vacuum Assisted	0.04	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08	0.08
Weekly	Mechanical Broom	0.05	0.06
Weekly	Vacuum Assisted	0.08	0.07
Weekly	High Efficiency Regenerative Air-Vacuum	0.10	0.10

[1]For full credit for monthly and weekly frequency, sweeping must be conducted year round. Otherwise, the credit should be adjusted proportionally based on the duration of the sweeping season (using AF factor).

[2] In order to earn credit for semi-annual sweeping the sweeping must occur in the spring following snow-melt and road sand applications to impervious surfaces and in the fall after leaf-fall and prior to the onset to the snow season.

Example 2-1: Calculation of enhanced sweeping program credit (Credit $_{P\ sweeping}$): A permittee proposes to implement an enhanced sweeping program and perform weekly sweeping from March 1 – December 1 (9 months) in their Watershed, using a vacuum assisted sweeper on 20.3 acres of parking lots and roadways in a high-density residential area of the Watershed. For this site the needed information to calculate the phosphorus load reduction credit is:

IA_{swept}	= 20.3 acres
$PLER_{IC\text{-}HDR}$	= 2.32 lb/acre/yr (from Table 2-1)
$PRF_{sweeping}$	= 0.08 (from Table 2-4)
AF	= (9 months / 12 months) = 0.75

Substitution into equation 2-1 yields a Credit $_{sweeping}$ of 3.2 pounds of phosphorus removed per year.

Credit $_{sweeping}$	= IA_{swept} x $PLE_{land\ use}$ x $PRF_{sweeping}$ x AF
	= 20.3 acres x 2.32 lbs/acre/yr x 0.08 x 0.75
	= 2.8 lbs/yr

The corresponding **<u>nitrogen</u>** load reduction credit (Credit $_{N\ sweeping}$) for the same sweeping program in the specified LPCP area is calculated as follows:

IA_{swept}	= 20.3 acres
$NLER_{IC\text{-}HDR}$	= 14.1 lb./acre/yr. (from Table 2-2)
$NRF_{sweeping}$	= 0.08 (from Table 2-4)
AF	= (9 months / 12 months) = 0.75

Substitution into equation 2-2 yields a Credit $_{sweeping}$ of 17.2 pounds of nitrogen removed per year.

Credit $_{N\ sweeping}$	= IA_{swept} x $NLER_{land\ use}$ x $NRF_{sweeping}$ x AF
	= 20.3 acres x 14.1 lbs./acre/yr. x 0.08 x 0.75
	= 17.2 lbs./yr.

(2) Catch Basin Cleaning: The permittee may earn phosphorus and/or nitrogen reduction credit(s) by removing accumulated materials from catch basins (i.e., catch basin cleaning) in the Watershed such that a minimum sump storage capacity of 50% is maintained throughout the year. The credits shall be calculated by using the following equations:

$$\text{Credit}_{\text{P CB}} = IA_{CB} \times \text{PLER}_{\text{IC-land use}} \times PRF_{CB} \quad \textbf{(Equation 2-3)}$$

$$\text{Credit}_{\text{N CB}} = IA_{CB} \times \text{NLER}_{\text{IC-land use}} \times NRF_{CB} \quad \textbf{(Equation 2-4)}$$

Where:

Credit_{CB}	=	Amount of nutrient load removed by catch basin cleaning (lb/year)
IA_{CB}	=	Impervious drainage area to catch basins (acres)
$\text{PLER}_{\text{IC-and use}}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
$\text{NLER}_{\text{IC-land use}}$	=	Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)
PRF_{CB}	=	Phosphorus Reduction Factor for catch basin cleaning (see Table 2-5)
NRF_{CB}	=	Nitrogen Reduction Factor for catch basin cleaning (See Table 2-5)

Table 2-5: Nutrient reduction efficiency factors for semi-annual catch basin cleaning

Frequency	Practice	PRF_{CB}	NRF_{CB}
Semi-annual	Catch Basin Cleaning	0.02	0.06

Example 2-2: Calculation for catch basin cleaning credit (Credit_{CB}):

A permittee proposes to clean catch basins in their Watershed (i.e., remove accumulated sediments and contaminants captured in the catch basins) that drain runoff from 15.3 acres of medium-density residential impervious area. For this site the needed information to calculate the phosphorus load reduction credit is:

IA_{CB} = 15.3 acre
$PLER_{IC\text{-}MDR}$ = 1.96 lbs/acre/yr (from Table 2-1)
PRF_{CB} = 0.02 (from Table 2-5)

Substitution into equation 2-3 yields a $Credit_{P\,CB}$ of 0.6 pounds of phosphorus removed per year:

$Credit_{P\,CB}$ = IA_{CB} x $PLE_{IC\text{-}MDR}$ x PRF_{CB}
= 15.3 acre x 1.96 lbs/acre/yr x 0.02
= 0.6 lbs/yr

Note: the same methodology is applicable for calculating the nitrogen load reduction credit (Credit $_{N\,CB}$).

(3) Enhanced Organic Waste and Leaf Litter Collection program: The permittee may earn a phosphorus and/or nitrogen reduction credit(s) by performing regular gathering, removal and disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces from which runoff discharges to the TMDL waterbody or its tributaries. In order to earn this credit (Credit $_{leaf\ litter}$), the permittee must gather and remove all landscaping wastes, organic debris, and leaf litter from impervious roadways and parking lots at least once per week during the period of September 1 to December 1 of each year. Credit can only be earned for those impervious surfaces that are cleared of organic materials in accordance with the description above. The gathering and removal shall occur immediately following any landscaping activities in the Watershed and at additional times when necessary to achieve a weekly cleaning frequency. The permittee must ensure that the disposal of these materials will not contribute pollutants to any surface water discharges. The permittee may use an enhanced sweeping program (e.g., weekly frequency) as part of earning this credit provided that the sweeping is effective at removing leaf litter and organic materials. The Credit $_{leaf\ litter}$ shall be determined by the following equation:

$Credit_{P\,leaf\ litter} = (IA_{leaf\ litter}) \times (PLER_{IC\text{-}land\ use}) \times (0.05)$ **(Equation 2-5)**

$Credit_{N\,leaf\ litter} = (IA_{leaf\ litter}) \times (NLER_{IC\text{-}land\ use}) \times (0.05)$ **(Equation 2-6)**

Where:

$Credit_{leaf\ litter}$ = Amount of nutrient load reduction credit for organicwaste and leaf litter collection program (lb/year)
$IA_{leaf\ litter}$ = Impervious area (acre) in applicable watersheds that are subject to enhanced organic waste and leaf litter collection program
$PLER_{IC\text{-}land\ use}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-1)

$NLER_{IC\text{-}land\ use}$ = Nitrogen Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-2)
0.05 = 5% nutrient reduction factor for organic waste and leaf litter collection program in the Watershed

Example 2-3: Calculation for organic waste and leaf litter collection program credit ($Credit_{leaf\ litter}$): A permittee proposes to implement an organic waste and leaf litter collection program by sweeping the parking lots and access drives at a minimum of once per week using a mechanical broom sweeper for the period of September 1 to December 1 over 12.5 acres of impervious roadways and parking lots in an industrial/commercial area of the Watershed. Also, the permittee will ensure that organic materials are removed from impervious areas immediately following all landscaping activities at the site. For this site the needed information to calculate the $Credit_{leaf\ litter}$ for phosphorus is:

Watershed Area = 12.5 acres; and
$PLER_{IC\text{-}commercial}$ = 1.78 lbs/acre/yr (from Table 2-1)

Substitution into equation 2-5 yields a $Credit_{leaf\ litter}$ of 1.1 pounds of phosphorus removed per year:

$Credit_{leaf\ litter}$ = (12.5 acre) x (1.78 lbs/acre/yr) x (0.05)
= 1.1 lbs/yr

Note: The same methodology is applicable for calculating the nitrogen load reduction credit ($Credit_{N\ leaf\ litter}$) for the specified organic waste leaf litter collection program.

Associated Street/Pavement Cleaning Credit:
The permittee also may earn a nutrientreduction credit for enhanced sweeping of roads and parking lot areas (i.e., $Credit_{sweeping}$) for the three months of use. Using equation 2-1, $Credit_{sweeping}$ is:

$Credit_{sweeping} = IA_{swept} \times PLER_{IC\text{-}land\ use} \times PRF_{sweeping} \times AF$ **(Equation 2-1)**
IA_{swept} = 12.5 acre
$PLE_{IC\text{-}commercial}$ = 1.78 lbs/acre/yr (from Table 2-1)
$PRF_{sweeping}$ = 0.05 (from Table 2-3)
AF = 3 mo./12 mo. = 0.25

Substitution into equation 2-1 yields a $Credit_{P\ sweeping}$ of 0.28 pounds of phosphorus removed per year.

$Credit_{P\ sweeping} = IA_{swept} \times PLE_{IC\text{-}commercial} \times PRF_{sweeping} \times AF$
= 12.5 acre x 1.78 lbs/acre/yr x 0.05 x 0.25
= 0.3 lbs/yr

NOAA Atlas 14, Volume 10, Version 3
Location name: Reading, Massachusetts, USA*
Latitude: 42.5206°, Longitude: -71.1029°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.309 (0.238-0.390)	0.373 (0.287-0.471)	0.478 (0.367-0.605)	0.565 (0.431-0.720)	0.685 (0.508-0.915)	0.774 (0.564-1.06)	0.869 (0.618-1.24)	0.980 (0.658-1.42)	1.15 (0.741-1.72)	1.28 (0.813-1.97)
10-min	0.438 (0.338-0.552)	0.529 (0.407-0.667)	0.677 (0.520-0.857)	0.800 (0.611-1.02)	0.970 (0.720-1.30)	1.10 (0.799-1.50)	1.23 (0.875-1.75)	1.39 (0.932-2.01)	1.62 (1.05-2.44)	1.82 (1.15-2.79)
15-min	0.516 (0.397-0.650)	0.622 (0.479-0.785)	0.797 (0.612-1.01)	0.942 (0.719-1.20)	1.14 (0.847-1.53)	1.29 (0.940-1.77)	1.45 (1.03-2.06)	1.63 (1.10-2.37)	1.91 (1.24-2.87)	2.14 (1.35-3.28)
30-min	0.709 (0.546-0.893)	0.856 (0.659-1.08)	1.10 (0.842-1.39)	1.30 (0.990-1.65)	1.57 (1.17-2.10)	1.78 (1.30-2.43)	2.00 (1.42-2.84)	2.25 (1.51-3.27)	2.64 (1.71-3.96)	2.96 (1.87-4.54)
60-min	0.902 (0.695-1.14)	1.09 (0.839-1.38)	1.40 (1.07-1.77)	1.65 (1.26-2.10)	2.00 (1.49-2.68)	2.26 (1.65-3.10)	2.54 (1.81-3.63)	2.87 (1.93-4.17)	3.36 (2.18-5.06)	3.78 (2.39-5.79)
2-hr	1.17 (0.906-1.46)	1.42 (1.10-1.78)	1.84 (1.42-2.31)	2.18 (1.67-2.75)	2.65 (1.98-3.53)	3.00 (2.20-4.09)	3.38 (2.43-4.82)	3.85 (2.59-5.54)	4.57 (2.96-6.82)	5.20 (3.30-7.91)
3-hr	1.36 (1.06-1.69)	1.66 (1.29-2.07)	2.14 (1.66-2.68)	2.55 (1.97-3.21)	3.11 (2.33-4.12)	3.51 (2.60-4.78)	3.96 (2.86-5.64)	4.53 (3.05-6.49)	5.40 (3.51-8.03)	6.17 (3.92-9.34)
6-hr	1.75 (1.38-2.17)	2.14 (1.68-2.66)	2.78 (2.17-3.45)	3.30 (2.56-4.13)	4.03 (3.04-5.31)	4.56 (3.39-6.16)	5.14 (3.74-7.27)	5.87 (3.98-8.36)	7.02 (4.58-10.3)	8.02 (5.11-12.0)
12-hr	2.23 (1.76-2.74)	2.73 (2.15-3.36)	3.54 (2.78-4.37)	4.21 (3.29-5.23)	5.13 (3.90-6.72)	5.82 (4.34-7.80)	6.56 (4.78-9.19)	7.48 (5.09-10.6)	8.90 (5.83-13.0)	10.1 (6.49-15.1)
24-hr	2.67 (2.13-3.27)	3.31 (2.63-4.05)	4.35 (3.44-5.34)	5.21 (4.10-6.44)	6.40 (4.90-8.33)	7.28 (5.46-9.70)	8.23 (6.04-11.5)	9.44 (6.44-13.2)	11.3 (7.43-16.4)	13.0 (8.31-19.1)
2-day	3.03 (2.43-3.68)	3.83 (3.06-4.65)	5.14 (4.09-6.26)	6.22 (4.93-7.63)	7.71 (5.94-9.99)	8.80 (6.67-11.7)	10.0 (7.43-14.0)	11.6 (7.93-16.1)	14.1 (9.29-20.3)	16.4 (10.5-24.0)
3-day	3.32 (2.67-4.01)	4.18 (3.35-5.06)	5.58 (4.47-6.78)	6.75 (5.37-8.24)	8.36 (6.47-10.8)	9.52 (7.25-12.6)	10.8 (8.07-15.1)	12.5 (8.61-17.4)	15.3 (10.1-21.9)	17.8 (11.5-25.9)
4-day	3.59 (2.90-4.33)	4.48 (3.61-5.41)	5.93 (4.76-7.18)	7.13 (5.69-8.68)	8.79 (6.82-11.3)	9.99 (7.62-13.2)	11.3 (8.47-15.7)	13.1 (9.01-18.1)	16.0 (10.6-22.8)	18.5 (12.0-26.9)
7-day	4.36 (3.54-5.23)	5.28 (4.28-6.34)	6.79 (5.48-8.18)	8.04 (6.45-9.73)	9.76 (7.60-12.5)	11.0 (8.43-14.4)	12.4 (9.28-17.0)	14.2 (9.82-19.5)	17.1 (11.4-24.3)	19.7 (12.8-28.5)
10-day	5.06 (4.12-6.05)	6.01 (4.89-7.19)	7.56 (6.12-9.07)	8.85 (7.12-10.7)	10.6 (8.29-13.5)	11.9 (9.12-15.5)	13.3 (9.96-18.1)	15.2 (10.5-20.7)	18.0 (12.0-25.5)	20.6 (13.3-29.6)
20-day	7.04 (5.77-8.35)	8.09 (6.62-9.60)	9.79 (7.98-11.7)	11.2 (9.08-13.4)	13.2 (10.3-16.4)	14.6 (11.2-18.6)	16.2 (12.0-21.4)	17.9 (12.5-24.2)	20.5 (13.7-28.7)	22.7 (14.8-32.4)
30-day	8.69 (7.15-10.3)	9.81 (8.06-11.6)	11.6 (9.53-13.8)	13.1 (10.7-15.7)	15.2 (11.9-18.9)	16.8 (12.9-21.2)	18.4 (13.6-24.1)	20.2 (14.1-27.1)	22.6 (15.1-31.4)	24.5 (15.9-34.7)
45-day	10.8 (8.91-12.7)	12.0 (9.89-14.1)	13.9 (11.5-16.5)	15.5 (12.7-18.5)	17.8 (14.0-21.8)	19.5 (14.9-24.4)	21.2 (15.6-27.3)	22.9 (16.1-30.6)	25.1 (16.9-34.7)	26.7 (17.4-37.7)
60-day	12.6 (10.4-14.8)	13.8 (11.4-16.2)	15.9 (13.1-18.7)	17.6 (14.4-20.8)	19.9 (15.7-24.3)	21.7 (16.6-27.0)	23.5 (17.2-30.0)	25.1 (17.7-33.4)	27.2 (18.3-37.4)	28.6 (18.7-40.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

McDonald's
413 Main Street
Reading, MA
Bohler Job Number: W222000
July 28, 2023

Rational Pipe Sizing Calculations

Design Period Storm:		25	Year	Design Period Intensity*			6.4	in/hr									
LOCATION		IMPERVIOUS			OTHER			SUM CA	Tc (min)	I (in/hr)	Q (cfs)	D (in)	S (ft/ft)	Material	n	Q Full (cfs)	V Full (fps)
FROM	TO	A	C	CA	A	C	CA										
CB-1	SWQU-1	0.100	0.95	0.10	0.027	0.30	0.01	0.10	6	6.4	0.66	12	0.011	HDPE	0.012	4.05	5.15
SWQU-1	Culvert	0.100	0.95	0.10	0.027	0.30	0.01	0.10	6	6.4	0.66	12	0.012	HDPE	0.012	4.23	5.38
CB-2	Exist. CB	0.070	0.95	0.07	0.007	0.30	0.00	0.07	6	6.4	0.44	12	0.006	HDPE	0.012	2.99	3.81
CB-3	SWQU-2	0.094	0.95	0.09	0.011	0.30	0.00	0.09	6	6.4	0.59	12	0.006	HDPE	0.012	2.99	3.81
ROOF	Culvert	0.091	0.95	0.09	0.000	0.30	0.00	0.09	6	6.4	0.55	8	0.037	HDPE	0.012	2.52	7.21
SWQU-2	Culvert	0.185	0.95	0.18	0.011	0.30	0.00	0.18	6	6.4	1.15	12	0.005	HDPE	0.012	2.73	3.47

*Rainfall intensity provided by NOAA Atlas 14, Volume 10, Version 3 on 3/28/2023

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

APPENDIX G: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*
- *INSPECTION REPORT*
- *INSPECTION AND MAINTENANCE LOG FORM*
- *LONG-TERM POLLUTION PREVENTION PLAN*
- *ILLICIT DISCHARGE STATEMENT*
- *SPILL PREVENTION*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

McDonald's
413 Main Street
Reading, MA 01867

RESPONSIBLE PARTY DURING CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

RESPONSIBLE PARTY POST CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP) if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots: Mechanical Broom Sweeping at least two (2) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.

2. Catch basins, yard drains, trench drains, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with MADEP and other applicable requirements.

3. Regular removal and disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces at least once per week during the period of September 1 through December 1 and immediately following landscape activities.

4. Water Quality Unit (Proprietary Separator): Follow manufacturer's recommendations (attached).

All components of the stormwater system will be accessible by the owner or their assignee.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

RESPONSIBLE PARTY:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Stormwater Quality Units:	
Other:	

Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):
Catch Basins:
Stormwater Quality Units:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM			
McDonald's ***413 Main Street - Reading, MA 01867***			
Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

McDonald's
413 Main Street
Reading, MA 01867

RESPONSIBLE PARTY DURING CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

RESPONSIBLE PARTY POST CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc. and as noted in the "O&M Plan".
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a Mechanical Broom Sweeping Unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

Discuss the Spill Prevention and Response Procedures

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

_____

Name & Title Date

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

McDonald's
413 Main Street
Reading, Massachusetts 01867

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Reading Fire Department (at **9-1-1**)

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Reading Public Health Department at (781) 942-9061 and the Reading Conservation Commission at (781) 942-6616.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Reading Public Health Department and Reading Conservation Commission

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill: _____

_____

Measures Taken to Clean up Spill: _____

_____

Type of equipment: _____ Make: _____ Size: _____

License or S/N: _____

Location and Method of Disposal _____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

_____

_____

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCY PHONE: (888) 372-7341

CONTECH®
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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

McMAHON
a Bowman company

MEMORANDUM

To: Daniel Allen

From: Jason T. Adams, P.E., PTOE

Date: November 28, 2023

RE: Supplemental Traffic Assessment
McDonald's Redevelopment
413 Main Street, Reading, MA

McMahon, a Bowman company, has completed a supplemental traffic assessment for the proposed McDonald's redevelopment located at 413 Main Street (Route 28) in Reading, Massachusetts. The proposed redevelopment would demolish the existing McDonald's building and construct a new McDonald's with additional drive-thru queuing space. As part of the redevelopment, 11 parking spaces would be removed to accommodate the additional drive-thru area.

This assessment includes a review of traffic count data, delay and queue study data, and data provided by McDonald's. The findings are summarized below.

Project Description
The project site is located at 413 Main Street in Reading, Massachusetts. Access is provided via three driveways: one enter-only driveway on Main Street, one exit-only driveway on Main Street, and one full-access driveway on Bolton Street. The existing drive-thru is a single lane circulating counterclockwise around the McDonald's building from the south of the building to the north. A total of 43 parking spaces are provided on the site.

The existing building is approximately 3,398 square feet (sf) with a single drive-thru lane. The proposed redevelopment would replace the existing building with an approximately 3,922 sf McDonald's with two order boards and additional drive-thru queueing space. The redeveloped site would provide 32 parking spaces including two accessible spaces, two mobile order pick-up spaces, and two drive-thru pull-up parking spaces. Access to the site is not proposed to be changed significantly with the redevelopment.

Traffic Count Data
At the request of the Town to catalog existing site activity, turning movement counts (TMCs) were conducted for the entering and exiting movements at the three site driveways to McDonald's during the weekday midday, weekday afternoon, and Saturday midday peak periods. The TMCs were conducted on Thursday, November 9, 2023 from 11:30 AM to 1:30 PM and from 4:30 PM to 6:30 PM and on Saturday, November 11, 2023 from 11:00 AM to 2:00 PM. The results of the TMCs are tabulated by 15-minute periods and are provided in the attachments. Based on a review of the peak period traffic data, the weekday midday peak hour of the site was identified as 12:00 PM to 1:00 PM, the weekday afternoon peak hour was identified as 4:45 PM to 5:45 PM, and the Saturday midday peak hour was identified as 11:45 AM to 12:45 PM.

Table 1 below shows the entering and exiting vehicles at each site driveway during the peak hours.

120 Water Street, 4th Floor, Boston, MA 02109
P: 617.556.0020
mcmahonassociates.com | bowman.com

Table 1: Entering and Exiting Vehicles

	Main Street (Route 28)		Bolton Street		Combined	
	Entering Vehicles	Exiting Vehicles	Entering Vehicles	Exiting Vehicles	Entering Vehicles	Exiting Vehicles
Weekday Midday Peak	62	63	25	22	*87*	*85*
Weekday PM Peak	49	57	18	11	*67*	*68*
Saturday Midday Peak	65	58	23	25	*88*	*83*

Of the vehicles observed to exit the site onto Main Street (Route 28), the majority of vehicles turned right to head north toward Washington Street in all three peak hours. During the weekday midday peak hour 49 vehicles turned right onto Main Street (Route 28) while 14 turned left. Of those turning left onto Main Street (Route 28), 2 then turned left onto Bolton Street. During the weekday afternoon peak hour 44 vehicles turned right and 13 vehicles turned left, with 5 of the left-turning vehicles then turning left onto Bolton Street. During the Saturday midday peak hour 41 vehicles turned right and 17 vehicles turned left, with 3 of the left-turning vehicles then turning left onto Bolton Street. With the proposed project in place, the vehicles exiting the site onto Main Street (Route 28) via a left turn and then traveling onto Bolton Street would be able to stay on the site and exit directly onto Bolton Street.

The entering and exiting vehicle trips shown in Table 1 above, are very similar to the number of vehicle trips forecasted for the existing McDonald's using the Institute of Transportation Engineers (ITE) publication *Trip Generation Manual, 11th* Edition in the original McMahon Traffic Assessment dated April 26, 2023. A comparison of the existing TMC counts at the site to the ITE data provided previously for the existing and proposed McDonalds is shown below in Table 2.

Table 2: Count Data Vs. ITE Trip Generation Data

		Weekday Midday			Weekday PM			Saturday Midday		
Description	**Size**	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
November 2023 TMC Counts[1]	3,398 s.f.	87	85	172	67	68	135	88	83	171
ITE - Existing McDonald's Trips[2]	3,398 s.f.	88	85	173	58	54	112	96	92	188
ITE - Proposed McDonald's Trips[3]	3,922 s.f.	102	98	200	67	62	129	111	106	217

1 Based on November 2023 turning movement count data.
2 ITE Land Use Code 934 (Fast-Food Restaurant with Drive-Through Window) based on 3,398 square feet.
3 ITE Land Use Code 934 (Fast-Food Restaurant with Drive-Through Window) based on 3,922 square feet.

As shown above in Table 2, the data collected at the site is nearly identical to the ITE projection of the existing site during the weekday midday peak hour, is slightly higher during the weekday afternoon peak hour, and is slightly lower during the Saturday midday peak hour. Overall, the data collected as part of this effort is considered to validate the data presented using ITE in the April 26, 2023 Traffic Assessment.

In order to understand the number of vehicles using the drive-through facilities on the existing site, entering vehicles were noted as either entering the drive-through or going direct to the parking lot. Table 3 below shows the vehicles entering the McDonald's that entered the drive-through or parked on site.

Table 3: Parking Lot Vs. Drive-Through Trips

	Main Street (Route 28)		Bolton Street		Combined		
	Drive-Through	Parking Lot	Drive-Through	Parking Lot	Drive-Through	Parking Lot	*Total*
Weekday Midday Peak	43	19	11	14	*54*	*33*	*87*
Weekday PM Peak	38	11	9	9	*47*	*20*	*67*
Saturday Midday Peak	44	21	16	7	*60*	*28*	*88*

As shown in Table 3, the majority of vehicles to the site are using the drive-through. The maximum number of vehicles observed to use the drive-through during the data collection periods was 60 vehicles during the Saturday midday peak hour.

Based on information received from McDonald's, the installation of a new side-by-side drive-through like the one proposed at this site typically increases the sales volume by 3 to 5%. Increasing the number of entering vehicles observed at the site during the peak periods by 5% would result in an additional 4 entering vehicles during the weekday midday and Saturday midday peak hours and an additional 3 vehicles during the weekday afternoon peak hour. The vehicle increases associated with the projected sales increases are less than the vehicle increases projected by ITE, which are displayed in Table 2 and were previously presented in the April 26, 2023 Traffic Assessment.

Delay and Queue Observations

McMahon performed vehicle delay and vehicle queue studies at the Main Street (Route 28) exit-only driveway in conjunction with the TMCs in order to document the amount of delay vehicles exiting the site are currently experiencing. The observation data from the weekday midday, weekday afternoon and Saturday midday peak periods is provided as an attachment and the data is summarized in Table 4 below.

Table 4: Delay and Queue Study

	Delay[1]	95th %tile Queue[2]	Max Queue[3]
Weekday Midday	25.3	2	3
Weekday Afternoon	29.1	2	3
Saturday Midday	28.9	2	3

1 Average delay in seconds.

2 95th percentile queue in number of vehicles.

3 Maximum queue in number of vehicles.

As shown in Table 4, the average vehicle delay experienced exiting the site onto Main Street (Route 28) was less than 30 seconds during each of the three peak periods studied. This average delay equates to a level-of-service (LOS) D operation, which is typical for a stop-controlled approach to a roadway such as Main Street (Route 28). During the delay and queue studies, a number of vehicles were observed to accept courtesy gaps in traffic to facilitate exiting movements.

The maximum vehicle queue observed at the Main Street (Route 28) exit-only driveway was three vehicles during each of the weekday midday, weekday afternoon, and Saturday midday peak periods.

Given the relatively minor increase in the number of vehicles projected using ITE trip generation data and McDonald's sales data to be added as a result of the project, the movement exiting the project site is not expected to be significantly impacted. The proposed project is primarily intended to better organize the site operations and user experience at the McDonald's.

Attachments
Count Data
Delay and Queue Observation Data

120 Water Street, 4th Floor, Boston, MA 02109
P: 617.556.0020
mcmahonassociates.com | bowman.com

Count Data

Transportation Data Corporation

Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N,S/SE: Main Street/Ash & Bolton Streets
E: McDonald's Northerly Exit Driveway
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786A
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

Groups Printed- Cars & Peds

	Main Street (Route 28) From North				McD Northerly Exit Driveway From East				Ash Street/Bolton Street From Southeast					Main Street (Route 28) From South				
Start Time	Thru	Bear Left	Left	Peds	Right	Left	Hard Left	Peds	Hard Right	Bear Right	Hard Left	Peds	Peds	Hard Right	Right	Thru	Peds	Int. Total
11:30 AM	0	0	0	0	8	3	0	0	0	0	0	0	0	0	0	0	0	11
11:45 AM	0	0	0	0	5	3	2	0	0	0	0	0	0	0	0	0	0	10
Total	0	0	0	0	13	6	2	0	0	0	0	0	0	0	0	0	0	21
12:00 PM	0	0	0	0	12	2	0	0	0	0	0	0	0	0	0	0	0	14
12:15 PM	0	0	0	0	13	4	1	0	0	0	0	0	0	0	0	0	0	18
12:30 PM	0	0	0	0	15	4	0	0	0	0	0	0	0	0	0	0	0	19
12:45 PM	0	0	0	0	9	2	1	0	0	0	0	0	0	0	0	0	0	12
Total	0	0	0	0	49	12	2	0	0	0	0	0	0	0	0	0	0	63
01:00 PM	0	0	0	0	14	3	0	0	0	0	0	0	0	0	0	0	0	17
01:15 PM	0	0	0	0	16	2	0	0	0	0	0	0	0	0	0	0	0	18
Grand Total	0	0	0	0	92	23	4	0	0	0	0	0	0	0	0	0	0	119
Apprch %	0	0	0	0	77.3	19.3	3.4	0	0	0	0	0	0	0	0	0	0	
Total %	0	0	0	0	77.3	19.3	3.4	0	0	0	0	0	0	0	0	0	0	

	Main Street (Route 28) From North					McD Northerly Exit Driveway From East					Ash Street/Bolton Street From Southeast						Main Street (Route 28) From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:15 PM																						
12:15 PM	0	0	0	0	0	13	**4**	**1**	0	18	0	0	0	0	0	0	0	0	0	0	0	18
12:30 PM	0	0	0	0	0	**15**	4	0	0	**19**	0	0	0	0	0	0	0	0	0	0	0	**19**
12:45 PM	0	0	0	0	0	9	2	1	0	12	0	0	0	0	0	0	0	0	0	0	0	12
01:00 PM	0	0	0	0	0	14	3	0	0	17	0	0	0	0	0	0	0	0	0	0	0	17
Total Volume	0	0	0	0	0	51	13	2	0	66	0	0	0	0	0	0	0	0	0	0	0	66
% App. Total	0	0	0	0		77.3	19.7	3	0		0	0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.850	.813	.500	.000	.868	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.868

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N,S/SE: Main Street/Ash & Bolton Streets
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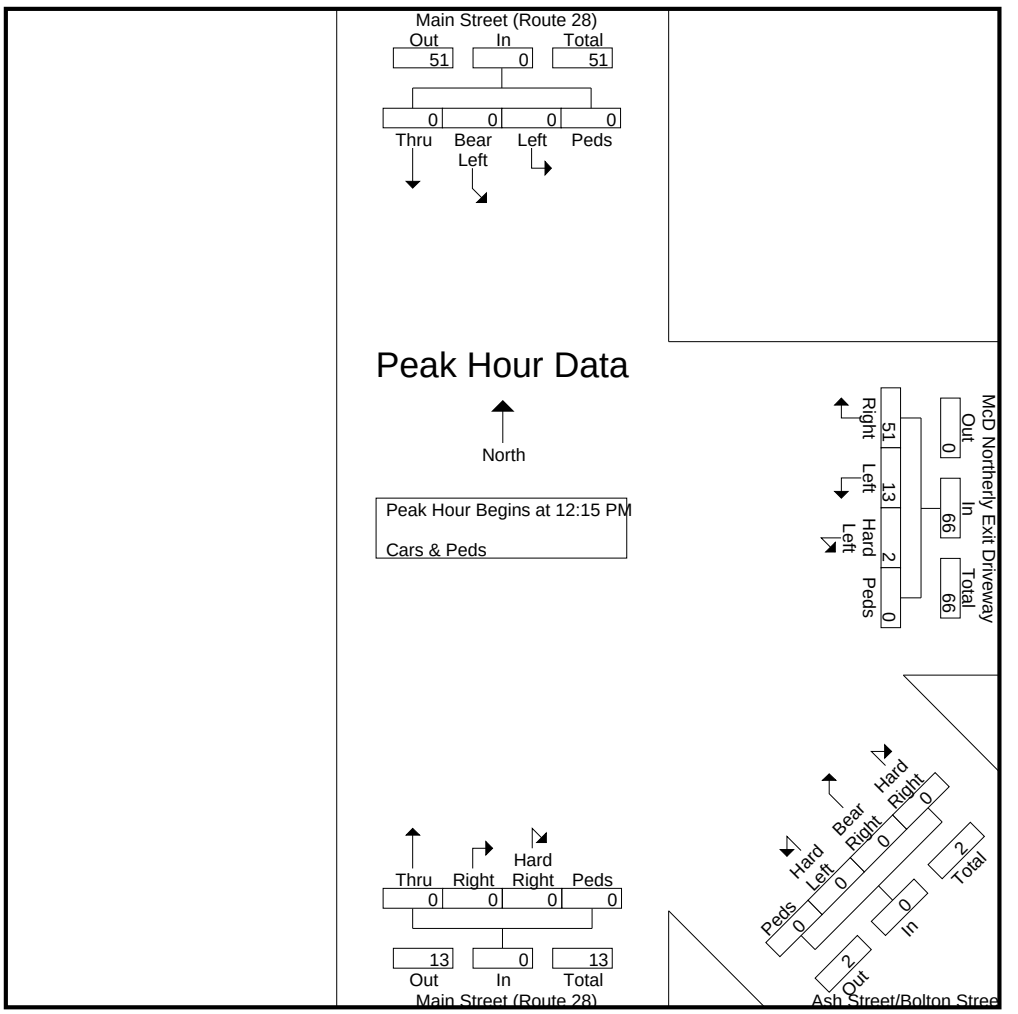
	Main Street (Route 28) From North					McD Northerly Exit Driveway From East					Ash Street/Bolton Street From Southeast						Main Street (Route 28) From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:15 PM																						
12:15 PM	0	0	0	0	0	13	**4**	**1**	0	18	0	0	0	0	0	0	0	0	0	0	0	18
12:30 PM	0	0	0	0	0	**15**	4	0	0	**19**	0	0	0	0	0	0	0	0	0	0	0	**19**
12:45 PM	0	0	0	0	0	9	2	1	0	12	0	0	0	0	0	0	0	0	0	0	0	12
01:00 PM	0	0	0	0	0	14	3	0	0	17	0	0	0	0	0	0	0	0	0	0	0	17
Total Volume	0	0	0	0	0	51	13	2	0	66	0	0	0	0	0	0	0	0	0	0	0	66
% App. Total	0	0	0	0		77.3	19.7	3	0		0	0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.850	.813	.500	.000	.868	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.868



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Start Time	Thru	Bear Left	Left	Peds	Right	Left	Hard Left	Peds	Hard Right	Bear Right	Hard Left	Peds	Peds	Hard Right	Right	Thru	Peds	Int. Total
04:30 PM	0	0	0	0	7	1	0	0	0	0	0	0	0	0	0	0	0	8
04:45 PM	0	0	0	0	11	0	1	0	0	0	0	0	0	0	0	0	0	12
Total	0	0	0	0	18	1	1	0	0	0	0	0	0	0	0	0	0	20
05:00 PM	0	0	0	0	7	3	1	0	0	0	0	0	0	0	0	0	0	11
05:15 PM	0	0	0	0	16	1	1	0	0	0	0	0	0	0	0	0	0	18
05:30 PM	0	0	0	0	10	4	2	0	0	0	0	0	0	0	0	0	0	16
05:45 PM	0	0	0	0	5	1	1	0	0	0	0	0	0	0	0	0	0	7
Total	0	0	0	0	38	9	5	0	0	0	0	0	0	0	0	0	0	52
06:00 PM	0	0	0	0	14	2	0	0	0	0	0	0	0	0	0	0	0	16
06:15 PM	0	0	0	0	8	2	0	0	0	0	0	0	0	0	0	0	0	10
Grand Total	0	0	0	0	78	14	6	0	0	0	0	0	0	0	0	0	0	98
Apprch %	0	0	0	0	79.6	14.3	6.1	0	0	0	0	0	0	0	0	0	0	
Total %	0	0	0	0	79.6	14.3	6.1	0	0	0	0	0	0	0	0	0	0	

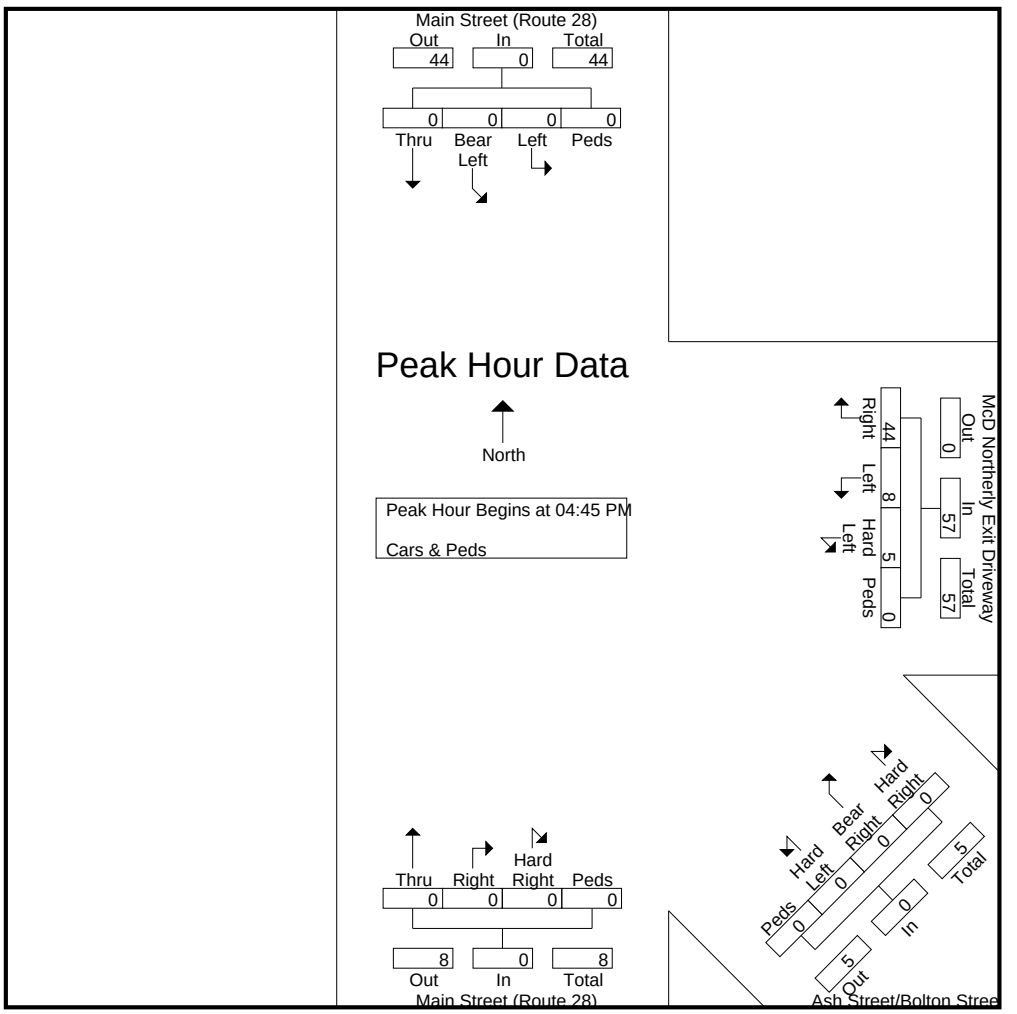
	Main Street (Route 28) From North					McD Northerly Exit Driveway From East					Ash Street/Bolton Street From Southeast						Main Street (Route 28) From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:45 PM																						
04:45 PM	0	0	0	0	0	11	0	1	0	12	0	0	0	0	0	0	0	0	0	0	0	12
05:00 PM	0	0	0	0	0	7	3	1	0	11	0	0	0	0	0	0	0	0	0	0	0	11
05:15 PM	0	0	0	0	0	**16**	1	1	0	**18**	0	0	0	0	0	0	0	0	0	0	0	**18**
05:30 PM	0	0	0	0	0	10	**4**	**2**	0	16	0	0	0	0	0	0	0	0	0	0	0	16
Total Volume	0	0	0	0	0	44	8	5	0	57	0	0	0	0	0	0	0	0	0	0	0	57
% App. Total	0	0	0	0		77.2	14	8.8	0		0	0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.688	.500	.625	.000	.792	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.792

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N,S/SE: Main Street/Ash & Bolton Streets
E: McDonald's Northerly Exit Driveway
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786AA
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

	Main Street (Route 28) From North					McD Northerly Exit Driveway From East					Ash Street/Bolton Street From Southeast						Main Street (Route 28) From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:45 PM																						
04:45 PM	0	0	0	0	0	11	0	1	0	12	0	0	0	0	0	0	0	0	0	0	0	12
05:00 PM	0	0	0	0	0	7	3	1	0	11	0	0	0	0	0	0	0	0	0	0	0	11
05:15 PM	0	0	0	0	0	**16**	1	1	0	**18**	0	0	0	0	0	0	0	0	0	0	0	**18**
05:30 PM	0	0	0	0	0	10	**4**	**2**	0	16	0	0	0	0	0	0	0	0	0	0	0	16
Total Volume	0	0	0	0	0	44	8	5	0	57	0	0	0	0	0	0	0	0	0	0	0	57
% App. Total	0	0	0	0		77.2	14	8.8	0		0	0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.688	.500	.625	.000	.792	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.792



Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N,S/SE: Main Street/Ash & Bolton Streets
E: McDonald's Northerly Exit Driveway
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786AAA
Site Code : 31343101
Start Date : 11/11/2023
Page No : 1

Groups Printed- Cars & Peds

	Main Street (Route 28) From North				McD Northerly Exit Driveway From East				Ash Street/Bolton Street From Southeast					Main Street (Route 28) From South				
Start Time	Thru	Bear Left	Left	Peds	Right	Left	Hard Left	Peds	Hard Right	Bear Right	Hard Left	Peds	Peds	Hard Right	Right	Thru	Peds	Int. Total
11:00 AM	0	0	0	0	8	1	1	0	0	0	0	0	0	0	0	0	0	10
11:15 AM	0	0	0	0	7	2	0	0	0	0	0	0	0	0	0	0	0	9
11:30 AM	0	0	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0	7
11:45 AM	0	0	0	0	9	4	0	0	0	0	0	0	0	0	0	0	0	13
Total	0	0	0	0	30	7	2	0	0	0	0	0	0	0	0	0	0	39
12:00 PM	0	0	0	0	12	5	1	0	0	0	0	0	0	0	0	0	0	18
12:15 PM	0	0	0	0	11	2	1	0	0	0	0	0	0	0	0	0	0	14
12:30 PM	0	0	0	0	9	3	1	0	0	0	0	0	0	0	0	0	0	13
12:45 PM	0	0	0	0	12	3	0	0	0	0	0	0	0	0	0	0	0	15
Total	0	0	0	0	44	13	3	0	0	0	0	0	0	0	0	0	0	60
01:00 PM	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	8
01:15 PM	0	0	0	0	11	3	0	0	0	0	0	0	0	0	0	0	0	14
01:30 PM	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6
01:45 PM	0	0	0	0	7	5	1	0	0	0	0	0	0	0	0	0	0	13
Total	0	0	0	0	27	13	1	0	0	0	0	0	0	0	0	0	0	41
Grand Total	0	0	0	0	101	33	6	0	0	0	0	0	0	0	0	0	0	140
Apprch %	0	0	0	0	72.1	23.6	4.3	0	0	0	0	0	0	0	0	0	0	
Total %	0	0	0	0	72.1	23.6	4.3	0	0	0	0	0	0	0	0	0	0	

	Main Street (Route 28) From North					McD Northerly Exit Driveway From East					Ash Street/Bolton Street From Southeast						Main Street (Route 28) From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 01:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:00 PM																						
12:00 PM	0	0	0	0	0	**12**	**5**	**1**	0	**18**	0	0	0	0	0	0	0	0	0	0	0	**18**
12:15 PM	0	0	0	0	0	11	2	1	0	14	0	0	0	0	0	0	0	0	0	0	0	14
12:30 PM	0	0	0	0	0	9	3	1	0	13	0	0	0	0	0	0	0	0	0	0	0	13
12:45 PM	0	0	0	0	0	12	3	0	0	15	0	0	0	0	0	0	0	0	0	0	0	15
Total Volume	0	0	0	0	0	44	13	3	0	60	0	0	0	0	0	0	0	0	0	0	0	60
% App. Total	0	0	0	0		73.3	21.7	5	0		0	0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.917	.650	.750	.000	.833	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.833

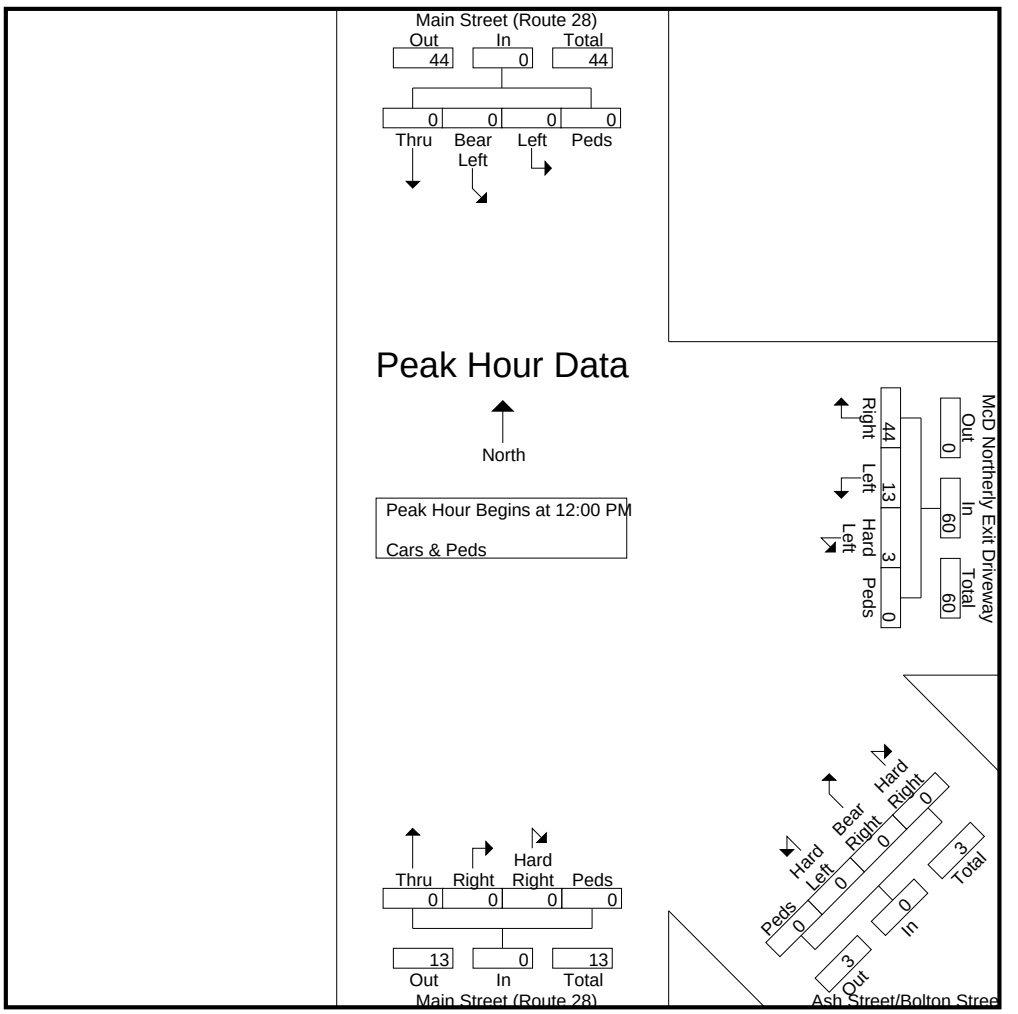
Transportation Data Corporation

Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N,S/SE: Main Street/Ash & Bolton Streets
E: McDonald's Northerly Exit Driveway
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786AAA
Site Code : 31343101
Start Date : 11/11/2023
Page No : 1

	Main Street (Route 28) From North					McD Northerly Exit Driveway From East					Ash Street/Bolton Street From Southeast						Main Street (Route 28) From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 01:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:00 PM																						
12:00 PM	0	0	0	0	0	**12**	**5**	**1**	0	**18**	0	0	0	0	0	0	0	0	0	0	0	**18**
12:15 PM	0	0	0	0	0	11	2	1	0	14	0	0	0	0	0	0	0	0	0	0	0	14
12:30 PM	0	0	0	0	0	9	3	1	0	13	0	0	0	0	0	0	0	0	0	0	0	13
12:45 PM	0	0	0	0	0	12	3	0	0	15	0	0	0	0	0	0	0	0	0	0	0	15
Total Volume	0	0	0	0	0	44	13	3	0	60	0	0	0	0	0	0	0	0	0	0	0	60
% App. Total	0	0	0	0		73.3	21.7	5	0		0	0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.917	.650	.750	.000	.833	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.833



Transportation Data Corporation

Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Main Street (Route 28)
E/NE: McD Enter Only Lot/McD Drive-Thru
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786B
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

Groups Printed- Cars & Peds

	Main Street (Route 28) From North				McDonald's Drive-Thru From Northeast					McDonald's Southerly Enter Driveway From East				Main Street (Route 28) From South				
Start Time	Thru	Left	Hard Left	Peds	Hard Right	Bear Left	Hard Left	Peds	Peds	Hard Right	Right	Left	Peds	Right	Bear Right	Thru	Peds	Int. Total
11:30 AM	0	1	2	0	0	0	0	0	0	0	0	0	0	0	6	0	0	9
11:45 AM	0	6	9	0	0	0	0	0	0	0	0	0	0	0	3	0	0	18
Total	0	7	11	0	0	0	0	0	0	0	0	0	0	0	9	0	0	27
12:00 PM	0	5	7	0	0	0	0	0	0	0	0	0	0	0	5	0	0	17
12:15 PM	0	2	7	0	0	0	0	0	0	0	0	0	0	0	3	0	0	12
12:30 PM	0	4	7	0	0	0	0	0	0	0	0	0	0	2	3	0	0	16
12:45 PM	0	5	9	0	0	0	0	0	0	0	0	0	0	1	2	0	0	17
Total	0	16	30	0	0	0	0	0	0	0	0	0	0	3	13	0	0	62
01:00 PM	0	1	6	0	0	0	0	0	0	0	0	0	0	2	5	0	0	14
01:15 PM	0	2	5	0	0	0	0	0	0	0	0	0	0	0	2	0	0	9
Grand Total	0	26	52	0	0	0	0	0	0	0	0	0	0	5	29	0	0	112
Apprch %	0	33.3	66.7	0	0	0	0	0	0	0	0	0	0	14.7	85.3	0	0	
Total %	0	23.2	46.4	0	0	0	0	0	0	0	0	0	0	4.5	25.9	0	0	

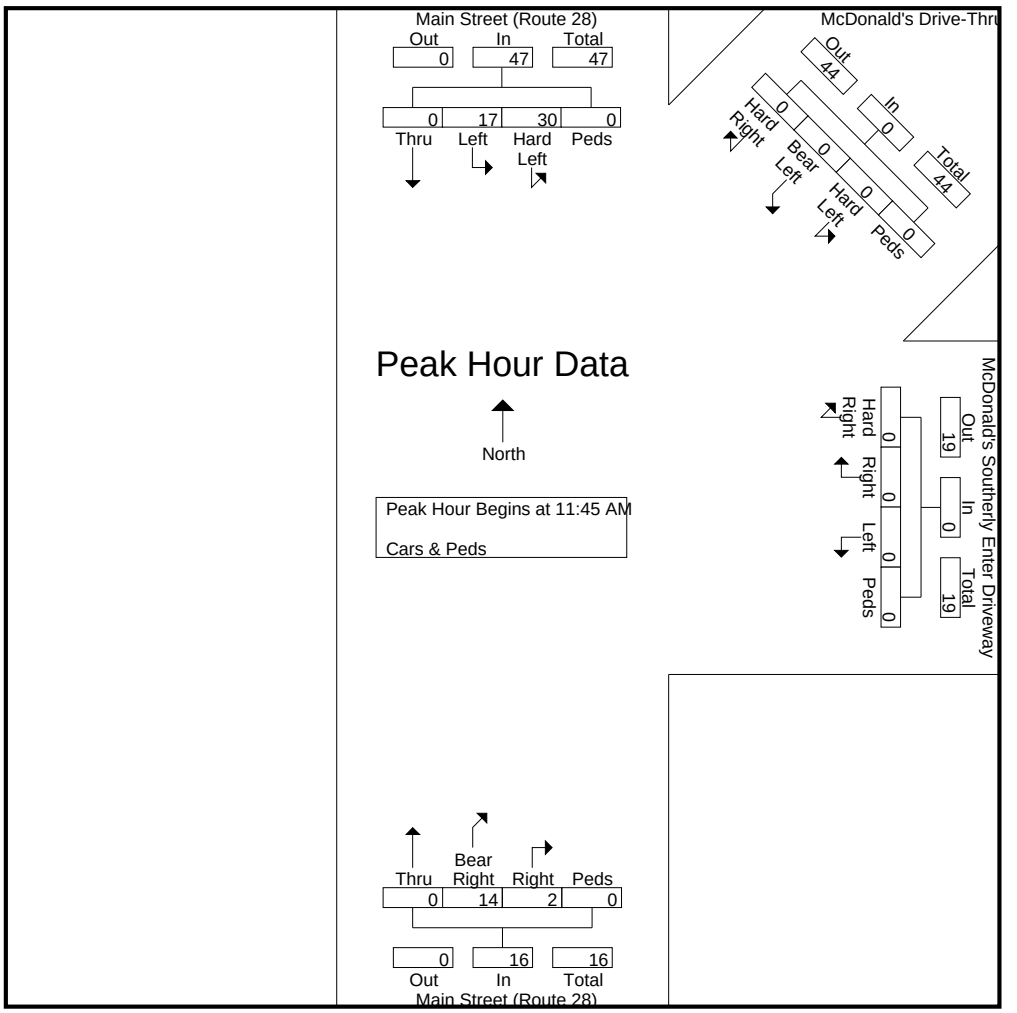
	Main Street (Route 28) From North					McDonald's Drive-Thru From Northeast						McDonald's Southerly Enter Driveway From East					Main Street (Route 28) From South					
Start Time	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Left	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Left	Peds	App. Total	Right	Bear Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 11:45 AM																						
11:45 AM	0	**6**	**9**	0	**15**	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	**18**
12:00 PM	0	5	7	0	12	0	0	0	0	0	0	0	0	0	0	0	0	**5**	0	0	**5**	17
12:15 PM	0	2	7	0	9	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	12
12:30 PM	0	4	7	0	11	0	0	0	0	0	0	0	0	0	0	0	**2**	3	0	0	5	16
Total Volume	0	17	30	0	47	0	0	0	0	0	0	0	0	0	0	0	2	14	0	0	16	63
% App. Total	0	36.2	63.8	0		0	0	0	0	0		0	0	0	0		12.5	87.5	0	0		
PHF	.000	.708	.833	.000	.783	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.700	.000	.000	.800	.875

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Main Street (Route 28)
E/NE: McD Enter Only Lot/McD Drive-Thru
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786B
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

	Main Street (Route 28) From North					McDonald's Drive-Thru From Northeast						McDonald's Southerly Enter Driveway From East					Main Street (Route 28) From South					
Start Time	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Left	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Left	Peds	App. Total	Right	Bear Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 11:45 AM																						
11:45 AM	0	**6**	**9**	0	**15**	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	**18**
12:00 PM	0	5	7	0	12	0	0	0	0	0	0	0	0	0	0	0	0	**5**	0	0	**5**	17
12:15 PM	0	2	7	0	9	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	12
12:30 PM	0	4	7	0	11	0	0	0	0	0	0	0	0	0	0	0	**2**	3	0	0	5	16
Total Volume	0	17	30	0	47	0	0	0	0	0	0	0	0	0	0	0	2	14	0	0	16	63
% App. Total	0	36.2	63.8	0		0	0	0	0	0		0	0	0	0		12.5	87.5	0	0		
PHF	.000	.708	.833	.000	.783	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.700	.000	.000	.800	.875



Transportation Data Corporation

Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Main Street (Route 28)
E/NE: McD Enter Only Lot/McD Drive-Thru
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786BB
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

Groups Printed- Cars & Peds

	Main Street (Route 28) From North				McDonald's Drive-Thru From Northeast					McDonald's Southerly Enter Driveway From East				Main Street (Route 28) From South				
Start Time	Thru	Left	Hard Left	Peds	Hard Right	Bear Left	Hard Left	Peds	Peds	Hard Right	Right	Left	Peds	Right	Bear Right	Thru	Peds	Int. Total
04:30 PM	0	0	2	0	0	0	0	0	0	0	0	0	0	2	4	0	0	8
04:45 PM	0	4	4	0	0	0	0	0	0	0	0	0	0	1	4	0	0	13
Total	0	4	6	0	0	0	0	0	0	0	0	0	0	3	8	0	0	21
05:00 PM	0	1	7	0	0	0	0	0	0	0	0	0	0	1	4	0	0	13
05:15 PM	0	2	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	10
05:30 PM	0	2	6	0	0	0	0	0	0	0	0	0	0	0	5	0	0	13
05:45 PM	0	3	6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	10
Total	0	8	23	0	0	0	0	0	0	0	0	0	0	1	14	0	0	46
06:00 PM	0	6	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	10
06:15 PM	0	0	5	0	0	0	0	0	0	0	0	0	0	3	4	0	0	12
Grand Total	0	18	36	0	0	0	0	0	0	0	0	0	0	7	28	0	0	89
Apprch %	0	33.3	66.7	0	0	0	0	0	0	0	0	0	0	20	80	0	0	
Total %	0	20.2	40.4	0	0	0	0	0	0	0	0	0	0	7.9	31.5	0	0	

	Main Street (Route 28) From North					McDonald's Drive-Thru From Northeast						McDonald's Southerly Enter Driveway From East					Main Street (Route 28) From South					
Start Time	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Left	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Left	Peds	App. Total	Right	Bear Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:45 PM																						
04:45 PM	0	**4**	4	0	**8**	0	0	0	0	0	0	0	0	0	0	0	**1**	4	0	0	**5**	**13**
05:00 PM	0	1	**7**	0	8	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	5	13
05:15 PM	0	2	4	0	6	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	10
05:30 PM	0	2	6	0	8	0	0	0	0	0	0	0	0	0	0	0	0	**5**	0	0	5	13
Total Volume	0	9	21	0	30	0	0	0	0	0	0	0	0	0	0	0	2	17	0	0	19	49
% App. Total	0	30	70	0		0	0	0	0	0		0	0	0	0		10.5	89.5	0	0		
PHF	.000	.563	.750	.000	.938	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.850	.000	.000	.950	.942

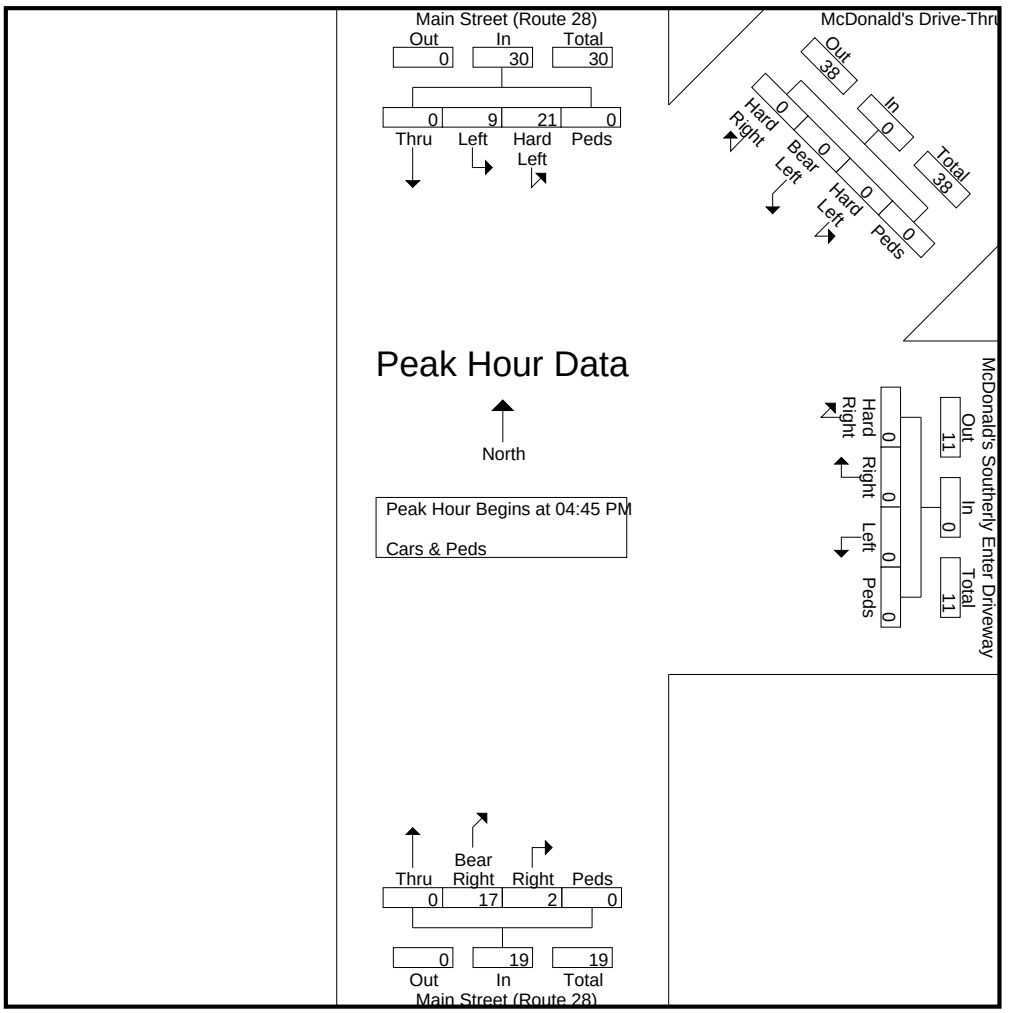
Transportation Data Corporation

Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Main Street (Route 28)
E/NE: McD Enter Only Lot/McD Drive-Thru
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786BB
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

	Main Street (Route 28) From North					McDonald's Drive-Thru From Northeast						McDonald's Southerly Enter Driveway From East					Main Street (Route 28) From South					
Start Time	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Left	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Left	Peds	App. Total	Right	Bear Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:45 PM																						
04:45 PM	0	**4**	4	0	**8**	0	0	0	0	0	0	0	0	0	0	0	**1**	4	0	0	**5**	**13**
05:00 PM	0	1	**7**	0	8	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	5	13
05:15 PM	0	2	4	0	6	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	10
05:30 PM	0	2	6	0	8	0	0	0	0	0	0	0	0	0	0	0	0	**5**	0	0	5	13
Total Volume	0	9	21	0	30	0	0	0	0	0	0	0	0	0	0	0	2	17	0	0	19	49
% App. Total	0	30	70	0		0	0	0	0	0		0	0	0	0		10.5	89.5	0	0		
PHF	.000	.563	.750	.000	.938	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.850	.000	.000	.950	.942



Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Main Street (Route 28)
E/NE: McD Enter Only Lot/McD Drive-Thru
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786BBB
Site Code : 31343101
Start Date : 11/11/2023
Page No : 1

Groups Printed- Cars & Peds

	Main Street (Route 28) From North				McDonald's Drive-Thru From Northeast					McDonald's Southerly Enter Driveway From East				Main Street (Route 28) From South				
Start Time	Thru	Left	Hard Left	Peds	Hard Right	Bear Left	Hard Left	Peds	Peds	Hard Right	Right	Left	Peds	Right	Bear Right	Thru	Peds	Int. Total
11:00 AM	0	3	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	10
11:15 AM	0	1	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0	7
11:30 AM	0	5	5	0	0	0	0	0	0	0	0	0	0	0	3	0	0	13
11:45 AM	0	1	8	0	0	0	0	0	0	0	0	0	0	2	4	0	0	15
Total	0	10	20	0	0	0	0	0	0	0	0	0	0	2	13	0	0	45
12:00 PM	0	7	5	0	0	0	0	0	0	0	0	0	0	5	5	0	0	22
12:15 PM	0	3	6	0	0	0	0	0	0	0	0	0	0	2	2	0	0	13
12:30 PM	0	0	10	0	0	0	0	0	0	0	0	0	0	1	4	0	0	15
12:45 PM	0	0	3	0	0	0	0	0	0	0	0	0	0	2	2	0	0	7
Total	0	10	24	0	0	0	0	0	0	0	0	0	0	10	13	0	0	57
01:00 PM	0	0	7	0	0	0	0	0	0	0	0	0	0	1	7	0	0	15
01:15 PM	0	2	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6
01:30 PM	0	1	8	0	0	0	0	0	0	0	0	0	0	1	5	0	0	15
01:45 PM	0	5	3	0	0	0	0	0	0	0	0	0	0	2	3	0	0	13
Total	0	8	21	0	0	0	0	0	0	0	0	0	0	4	16	0	0	49
Grand Total	0	28	65	0	0	0	0	0	0	0	0	0	0	16	42	0	0	151
Apprch %	0	30.1	69.9	0	0	0	0	0	0	0	0	0	0	27.6	72.4	0	0	
Total %	0	18.5	43	0	0	0	0	0	0	0	0	0	0	10.6	27.8	0	0	

	Main Street (Route 28) From North					McDonald's Drive-Thru From Northeast						McDonald's Southerly Enter Driveway From East					Main Street (Route 28) From South					
Start Time	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Left	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Left	Peds	App. Total	Right	Bear Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 01:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 11:45 AM																						
11:45 AM	0	1	8	0	9	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	6	15
12:00 PM	0	**7**	5	0	**12**	0	0	0	0	0	0	0	0	0	0	0	**5**	**5**	0	0	**10**	**22**
12:15 PM	0	3	6	0	9	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	4	13
12:30 PM	0	0	**10**	0	10	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	5	15
Total Volume	0	11	29	0	40	0	0	0	0	0	0	0	0	0	0	0	10	15	0	0	25	65
% App. Total	0	27.5	72.5	0		0	0	0	0	0		0	0	0	0		40	60	0	0		
PHF	.000	.393	.725	.000	.833	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.750	.000	.000	.625	.739

Transportation Data Corporation

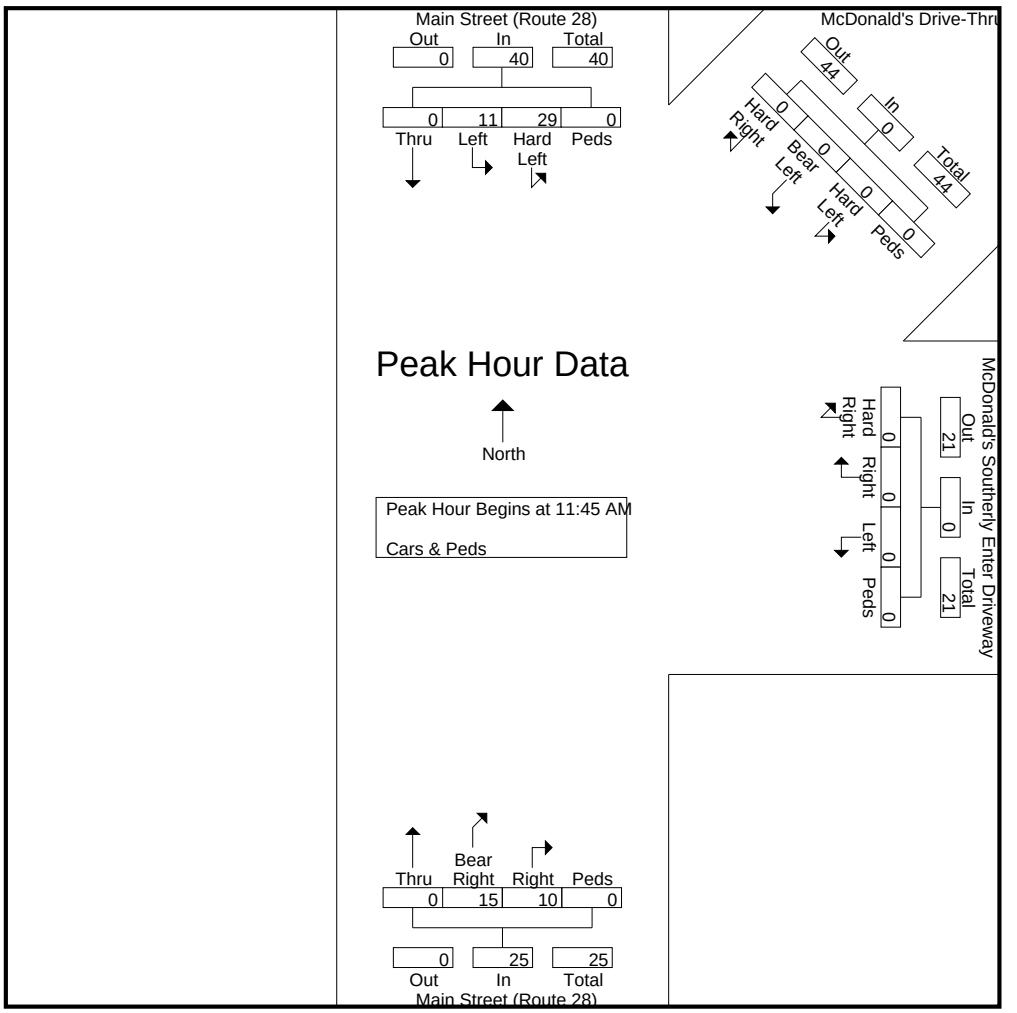
Mario Perone, mperone1@verizon.net

tel (781) 587-0086 cell (781) 439-4999

N/S: Main Street (Route 28)
E/NE: McD Enter Only Lot/McD Drive-Thru
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786BBB
Site Code : 31343101
Start Date : 11/11/2023
Page No : 1

	Main Street (Route 28) From North					McDonald's Drive-Thru From Northeast						McDonald's Southerly Enter Driveway From East					Main Street (Route 28) From South					
Start Time	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Left	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Left	Peds	App. Total	Right	Bear Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 01:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 11:45 AM																						
11:45 AM	0	1	8	0	9	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	6	15
12:00 PM	0	**7**	5	0	**12**	0	0	0	0	0	0	0	0	0	0	0	**5**	**5**	0	0	**10**	**22**
12:15 PM	0	3	6	0	9	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	4	13
12:30 PM	0	0	**10**	0	10	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	5	15
Total Volume	0	11	29	0	40	0	0	0	0	0	0	0	0	0	0	0	10	15	0	0	25	65
% App. Total	0	27.5	72.5	0		0	0	0	0	0		0	0	0	0		40	60	0	0		
PHF	.000	.393	.725	.000	.833	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.750	.000	.000	.625	.739



Transportation Data Corporation

Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/NE: McD Lot/McD Drive-Thru
E/W: Bolton Street & [Ash Street]
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786C
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

Groups Printed- Cars & Peds

	McDonald's Parking Lot From North				McDonald's Drive-Thru From Northeast					Bolton Street From East				Bolton Street From West				
Start Time	Right	Left	Hard Left	Peds	Hard Right	Bear Right	Hard Left	Peds	Peds	Hard Right	Right	Thru	Peds	Thru	Bear Left	Left	Peds	Int. Total
11:30 AM	3	0	0	0	0	0	0	0	0	1	1	0	0	0	1	2	0	8
11:45 AM	2	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	6
Total	5	0	0	0	0	0	0	0	0	1	4	0	0	0	2	2	0	14
12:00 PM	4	1	0	0	0	0	0	0	0	1	4	0	0	0	0	1	0	11
12:15 PM	5	1	0	0	0	0	0	0	0	1	0	0	0	0	2	4	0	13
12:30 PM	3	1	0	0	0	0	0	0	0	3	1	0	0	0	1	1	0	10
12:45 PM	7	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	13
Total	19	3	0	0	0	0	0	0	0	5	5	0	0	0	6	9	0	47
01:00 PM	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6
01:15 PM	0	0	0	0	0	0	0	0	0	4	1	0	0	0	5	2	0	12
Grand Total	29	3	0	0	0	0	0	0	0	10	10	0	0	0	13	14	0	79
Apprch %	90.6	9.4	0	0	0	0	0	0	0	50	50	0	0	0	48.1	51.9	0	
Total %	36.7	3.8	0	0	0	0	0	0	0	12.7	12.7	0	0	0	16.5	17.7	0	

	McDonald's Parking Lot From North					McDonald's Drive-Thru From Northeast						Bolton Street From East					Bolton Street From West					
Start Time	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Thru	Bear Left	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:00 PM																						
12:00 PM	4	**1**	0	0	5	0	0	0	0	0	0	1	**4**	0	0	**5**	0	0	1	0	1	11
12:15 PM	5	1	0	0	6	0	0	0	0	0	0	1	0	0	0	1	0	2	**4**	0	**6**	**13**
12:30 PM	3	1	0	0	4	0	0	0	0	0	0	**3**	1	0	0	4	0	1	1	0	2	10
12:45 PM	**7**	0	0	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	**3**	3	0	6	13
Total Volume	19	3	0	0	22	0	0	0	0	0	0	5	5	0	0	10	0	6	9	0	15	47
% App. Total	86.4	13.6	0	0		0	0	0	0	0		50	50	0	0		0	40	60	0		
PHF	.679	.750	.000	.000	.786	.000	.000	.000	.000	.000	.000	.417	.313	.000	.000	.500	.000	.500	.563	.000	.625	.904

Transportation Data Corporation

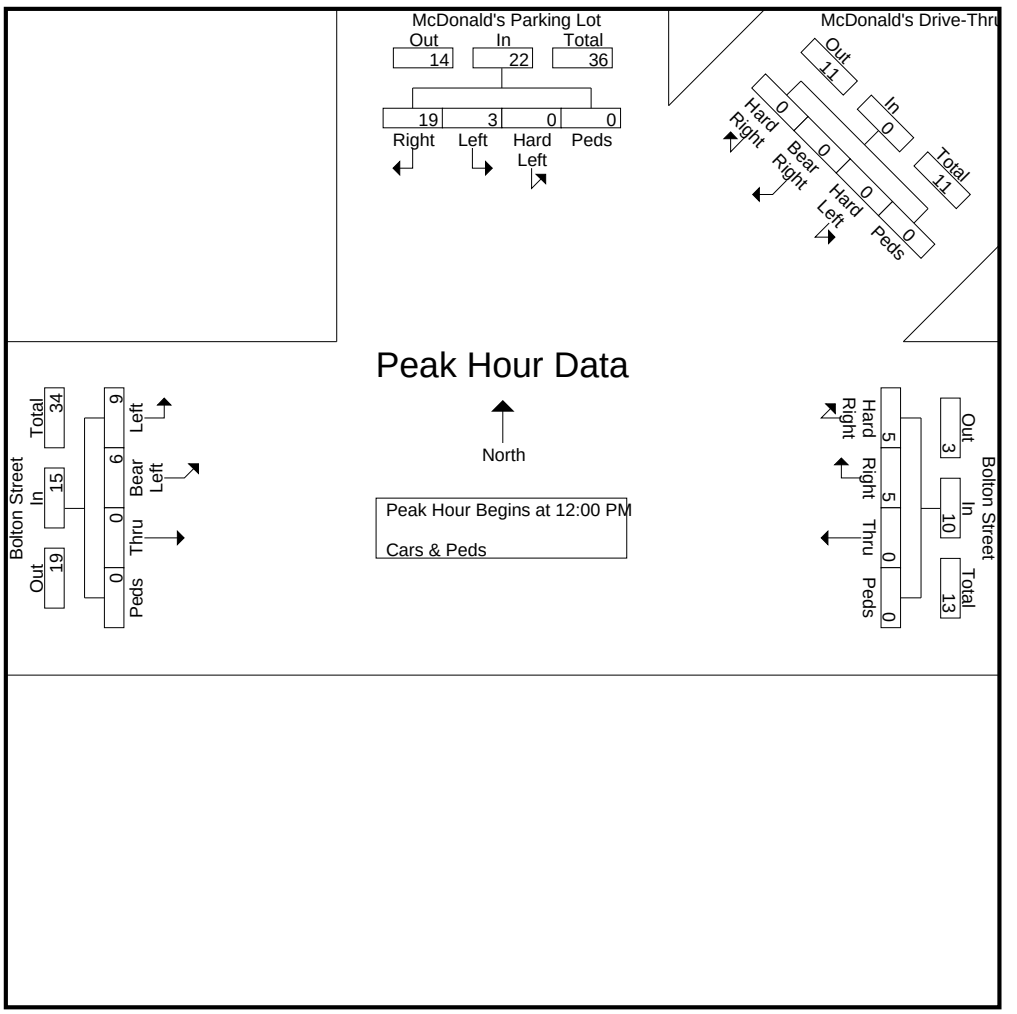
Mario Perone, mperone1@verizon.net

tel (781) 587-0086 cell (781) 439-4999

N/NE: McD Lot/McD Drive-Thru
E/W: Bolton Street & [Ash Street]
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786C
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

	McDonald's Parking Lot From North					McDonald's Drive-Thru From Northeast						Bolton Street From East					Bolton Street From West					
Start Time	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Thru	Bear Left	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:00 PM																						
12:00 PM	4	**1**	0	0	5	0	0	0	0	0	0	1	**4**	0	0	**5**	0	0	1	0	1	11
12:15 PM	5	1	0	0	6	0	0	0	0	0	0	1	0	0	0	1	0	2	**4**	0	**6**	**13**
12:30 PM	3	1	0	0	4	0	0	0	0	0	0	**3**	1	0	0	4	0	1	1	0	2	10
12:45 PM	**7**	0	0	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	**3**	3	0	6	13
Total Volume	19	3	0	0	22	0	0	0	0	0	0	5	5	0	0	10	0	6	9	0	15	47
% App. Total	86.4	13.6	0	0		0	0	0	0	0		50	50	0	0		0	40	60	0		
PHF	.679	.750	.000	.000	.786	.000	.000	.000	.000	.000	.000	.417	.313	.000	.000	.500	.000	.500	.563	.000	.625	.904



Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/NE: McD Lot/McD Drive-Thru
E/W: Bolton Street & [Ash Street]
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786CC
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

Groups Printed- Cars & Peds

	McDonald's Parking Lot From North				McDonald's Drive-Thru From Northeast					Bolton Street From East				Bolton Street From West				
Start Time	Right	Left	Hard Left	Peds	Hard Right	Bear Right	Hard Left	Peds	Peds	Hard Right	Right	Thru	Peds	Thru	Bear Left	Left	Peds	Int. Total
04:30 PM	0	1	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	5
04:45 PM	3	1	0	0	0	0	0	0	0	1	1	0	0	0	3	3	0	12
Total	3	2	0	0	0	0	0	0	0	1	2	0	0	0	6	3	0	17
05:00 PM	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	5
05:15 PM	4	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	7
05:30 PM	2	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	5
05:45 PM	1	0	0	0	0	0	0	0	0	2	0	0	0	0	1	3	0	7
Total	8	0	0	0	0	0	0	0	0	5	1	0	0	0	3	7	0	24
06:00 PM	3	1	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	9
06:15 PM	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	5
Grand Total	16	3	0	0	0	0	0	0	0	9	4	0	0	0	11	12	0	55
Apprch %	84.2	15.8	0	0	0	0	0	0	0	69.2	30.8	0	0	0	47.8	52.2	0	
Total %	29.1	5.5	0	0	0	0	0	0	0	16.4	7.3	0	0	0	20	21.8	0	

	McDonald's Parking Lot From North					McDonald's Drive-Thru From Northeast						Bolton Street From East					Bolton Street From West					
Start Time	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Thru	Bear Left	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:30 PM																						
04:30 PM	0	**1**	0	0	1	0	0	0	0	0	0	0	**1**	0	0	1	0	**3**	0	0	3	5
04:45 PM	3	1	0	0	**4**	0	0	0	0	0	0	**1**	1	0	0	**2**	0	3	**3**	0	**6**	**12**
05:00 PM	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	2	0	3	5
05:15 PM	**4**	0	0	0	4	0	0	0	0	0	0	1	1	0	0	2	0	0	1	0	1	7
Total Volume	8	2	0	0	10	0	0	0	0	0	0	3	3	0	0	6	0	7	6	0	13	29
% App. Total	80	20	0	0		0	0	0	0	0		50	50	0	0		0	53.8	46.2	0		
PHF	.500	.500	.000	.000	.625	.000	.000	.000	.000	.000	.000	.750	.750	.000	.000	.750	.000	.583	.500	.000	.542	.604

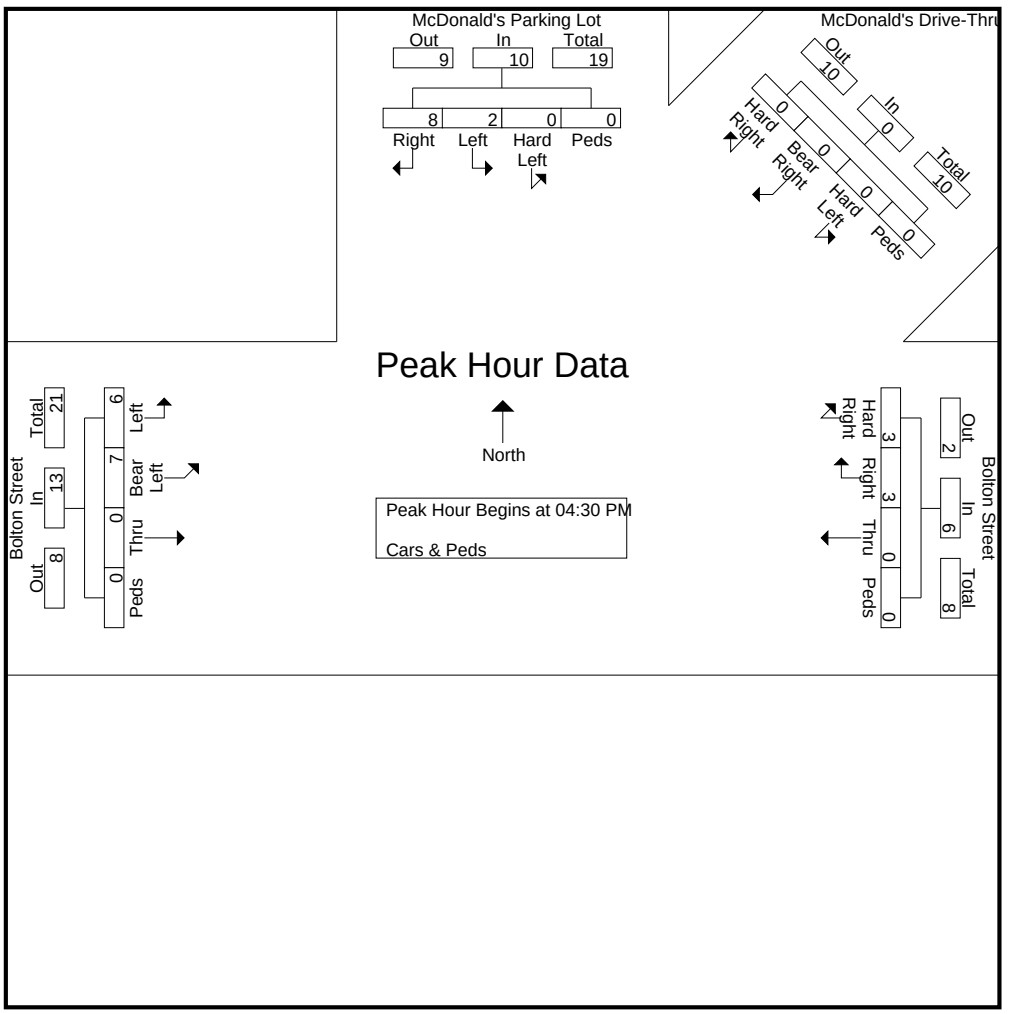
Transportation Data Corporation

Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/NE: McD Lot/McD Drive-Thru
E/W: Bolton Street & [Ash Street]
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786CC
Site Code : 31343101
Start Date : 11/9/2023
Page No : 1

	McDonald's Parking Lot From North					McDonald's Drive-Thru From Northeast						Bolton Street From East					Bolton Street From West					
Start Time	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Thru	Bear Left	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:30 PM																						
04:30 PM	0	**1**	0	0	1	0	0	0	0	0	0	0	**1**	0	0	1	0	**3**	0	0	3	5
04:45 PM	3	1	0	0	**4**	0	0	0	0	0	0	**1**	1	0	0	**2**	0	3	**3**	0	**6**	**12**
05:00 PM	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	2	0	3	5
05:15 PM	**4**	0	0	0	4	0	0	0	0	0	0	1	1	0	0	2	0	0	1	0	1	7
Total Volume	8	2	0	0	10	0	0	0	0	0	0	3	3	0	0	6	0	7	6	0	13	29
% App. Total	80	20	0	0		0	0	0	0	0		50	50	0	0		0	53.8	46.2	0		
PHF	.500	.500	.000	.000	.625	.000	.000	.000	.000	.000	.000	.750	.750	.000	.000	.750	.000	.583	.500	.000	.542	.604



Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/NE: McD Lot/McD Drive-Thru
E/W: Bolton Street & [Ash Street]
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786CCC
Site Code : 31343101
Start Date : 11/11/2023
Page No : 1

Groups Printed- Cars & Peds

	McDonald's Parking Lot From North				McDonald's Drive-Thru From Northeast					Bolton Street From East				Bolton Street From West				
Start Time	Right	Left	Hard Left	Peds	Hard Right	Bear Right	Hard Left	Peds	Peds	Hard Right	Right	Thru	Peds	Thru	Bear Left	Left	Peds	Int. Total
11:00 AM	3	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	6
11:15 AM	0	0	0	0	0	0	0	0	0	3	1	0	0	0	2	0	0	6
11:30 AM	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	5
11:45 AM	5	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	8
Total	10	1	0	0	0	0	0	0	0	6	1	0	0	0	4	3	0	25
12:00 PM	5	1	0	0	0	0	0	0	0	3	1	0	0	0	2	1	0	13
12:15 PM	7	1	0	0	0	0	0	0	0	3	1	0	0	0	0	1	0	13
12:30 PM	5	1	0	0	0	0	0	0	0	2	1	0	0	0	4	1	0	14
12:45 PM	3	1	0	0	0	0	0	0	0	1	2	0	0	0	1	3	0	11
Total	20	4	0	0	0	0	0	0	0	9	5	0	0	0	7	6	0	51
01:00 PM	3	0	0	0	0	0	0	0	0	2	4	0	0	0	1	1	0	11
01:15 PM	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	6
01:30 PM	3	4	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	11
01:45 PM	1	1	0	0	0	0	0	0	0	2	0	0	0	0	1	3	0	8
Total	8	6	0	0	0	0	0	0	0	4	4	0	0	0	6	8	0	36
Grand Total	38	11	0	0	0	0	0	0	0	19	10	0	0	0	17	17	0	112
Apprch %	77.6	22.4	0	0	0	0	0	0	0	65.5	34.5	0	0	0	50	50	0	
Total %	33.9	9.8	0	0	0	0	0	0	0	17	8.9	0	0	0	15.2	15.2	0	

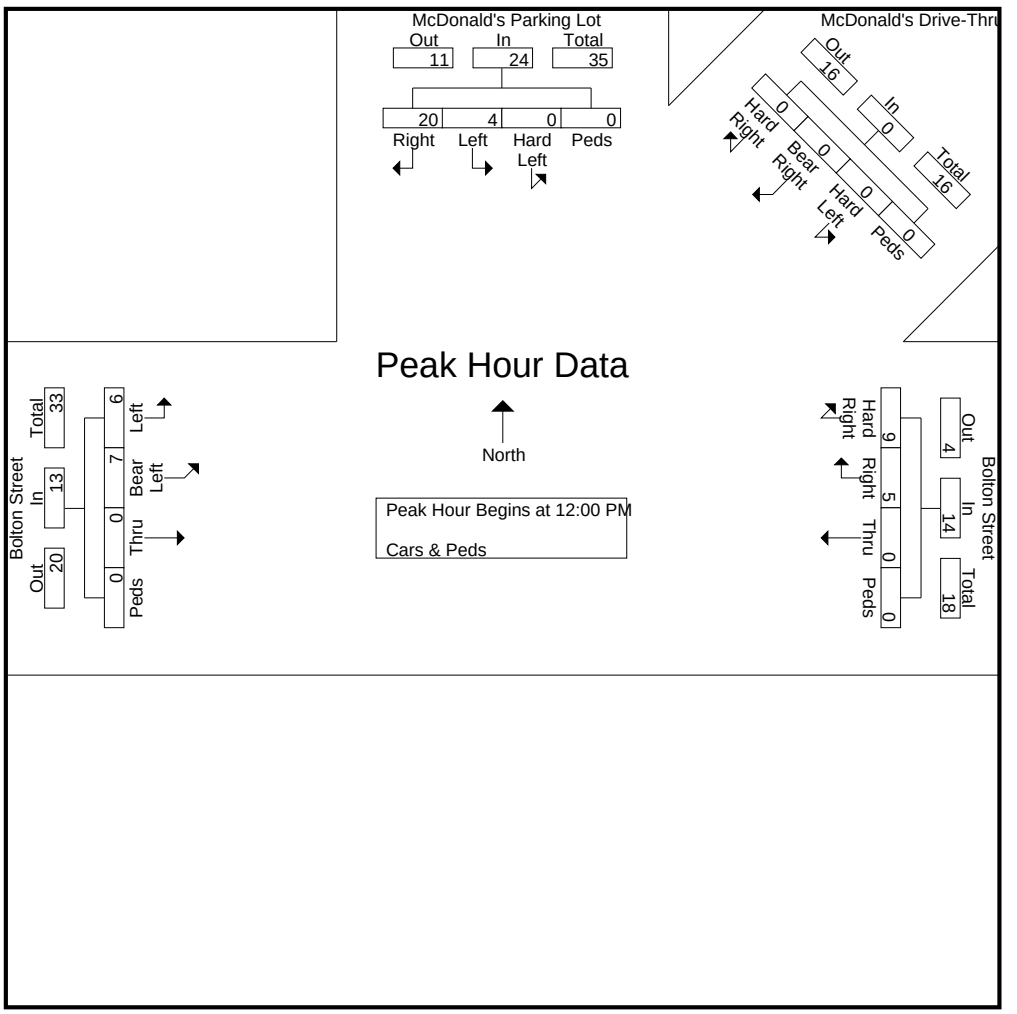
	McDonald's Parking Lot From North					McDonald's Drive-Thru From Northeast						Bolton Street From East					Bolton Street From West					
Start Time	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Thru	Bear Left	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 01:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:00 PM																						
12:00 PM	5	**1**	0	0	6	0	0	0	0	0	0	**3**	1	0	0	**4**	0	2	1	0	3	13
12:15 PM	**7**	1	0	0	**8**	0	0	0	0	0	0	3	1	0	0	4	0	0	1	0	1	13
12:30 PM	5	1	0	0	6	0	0	0	0	0	0	2	1	0	0	3	0	**4**	1	0	**5**	**14**
12:45 PM	3	1	0	0	4	0	0	0	0	0	0	1	**2**	0	0	3	0	1	**3**	0	4	11
Total Volume	20	4	0	0	24	0	0	0	0	0	0	9	5	0	0	14	0	7	6	0	13	51
% App. Total	83.3	16.7	0	0		0	0	0	0	0		64.3	35.7	0	0		0	53.8	46.2	0		
PHF	.714	1.00	.000	.000	.750	.000	.000	.000	.000	.000	.000	.750	.625	.000	.000	.875	.000	.438	.500	.000	.650	.911

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/NE: McD Lot/McD Drive-Thru
E/W: Bolton Street & [Ash Street]
City, State: Reading, MA
Client: McM/Zoe Dickerson

File Name : 05786CCC
Site Code : 31343101
Start Date : 11/11/2023
Page No : 1

	McDonald's Parking Lot From North					McDonald's Drive-Thru From Northeast						Bolton Street From East					Bolton Street From West					
Start Time	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Thru	Bear Left	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 01:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 12:00 PM																						
12:00 PM	5	**1**	0	0	6	0	0	0	0	0	0	**3**	1	0	0	**4**	0	2	1	0	3	13
12:15 PM	**7**	1	0	0	**8**	0	0	0	0	0	0	3	1	0	0	4	0	0	1	0	1	13
12:30 PM	5	1	0	0	6	0	0	0	0	0	0	2	1	0	0	3	0	**4**	1	0	**5**	**14**
12:45 PM	3	1	0	0	4	0	0	0	0	0	0	1	**2**	0	0	3	0	1	**3**	0	4	11
Total Volume	20	4	0	0	24	0	0	0	0	0	0	9	5	0	0	14	0	7	6	0	13	51
% App. Total	83.3	16.7	0	0		0	0	0	0	0		64.3	35.7	0	0		0	53.8	46.2	0		
PHF	.714	1.00	.000	.000	.750	.000	.000	.000	.000	.000	.000	.750	.625	.000	.000	.875	.000	.438	.500	.000	.650	.911



Delay and Queue Observation Data

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Rain Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
11:30 AM	0	0	0	0		0	0
11:31 AM	0	0	0	0		1	0
11:32 AM	1	0	0	0		1	0
11:33 AM	1	0	0	0		0	0
11:34 AM	0	0	0	0		1	0
11:35 AM	1	0	0	0		0	0
11:36 AM	0	0	0	1		0	1
11:37 AM	0	1	0	0		0	1
11:38 AM	0	0	0	0		0	0
11:39 AM	0	0	0	1		0	1
11:40 AM	0	1	0	0		2	0
11:41 AM	1	1	2	0		1	0
11:42 AM	0	0	0	1		1	0
11:43 AM	0	0	0	0		0	0
11:44 AM	0	0	0	0		0	0
11:45 AM	0	0	0	1		1	1
11:46 AM	0	0	0	0		0	0
11:47 AM	0	0	0	0		0	1
11:48 AM	1	0	0	0		0	0
11:49 AM	0	0	0	0		0	0
11:50 AM	0	0	0	0		0	0
11:51 AM	0	0	1	0		0	1
11:52 AM	0	0	0	1		1	0
11:53 AM	0	1	1	1		1	0
11:54 AM	0	0	0	0		1	0
11:55 AM	1	0	0	0		0	0
11:56 AM	0	0	1	0		1	0
11:57 AM	0	0	0	0		1	0
11:58 AM	0	1	0	0		0	2
11:59 AM	1	0	0	0		0	0
12:00 PM	0	0	0	0		0	0
12:01 PM	0	0	0	0		0	0
12:02 PM	0	0	0	1		1	0

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Rain Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
12:03 PM	2	3	3	1		2	0
12:04 PM	0	0	0	0		0	0
12:05 PM	0	0	0	0		0	0
12:06 PM	0	0	0	0		0	0
12:07 PM	0	0	0	1		1	0
12:08 PM	1	0	0	0		2	1
12:09 PM	2	1	1	1		1	0
12:10 PM	0	1	0	0		1	0
12:11 PM	0	0	0	0		1	0
12:12 PM	0	0	0	0		2	0
12:13 PM	1	0	0	0		0	0
12:14 PM	0	1	0	0		1	1
12:15 PM	0	0	0	1		1	0
12:16 PM	0	0	0	0		1	0
12:17 PM	0	1	0	1		1	1
12:18 PM	1	2	1	0		2	0
12:19 PM	1	0	0	0		1	0
12:20 PM	1	1	2	1		0	1
12:21 PM	1	1	0	0		0	0
12:22 PM	0	1	3	3		3	0
12:23 PM	2	1	2	1		2	0
12:24 PM	1	0	0	0		0	0
12:25 PM	0	0	0	1		0	1
12:26 PM	0	0	1	1		1	0
12:27 PM	1	2	2	1		0	1
12:28 PM	0	0	0	0		0	0
12:29 PM	0	0	0	0		1	1
12:30 PM	0	0	0	1		2	0
12:31 PM	0	1	0	0		1	0
12:32 PM	0	0	0	0		0	0
12:33 PM	0	0	0	0		0	1
12:34 PM	0	0	0	0		2	0
12:35 PM	1	0	0	0		2	0

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Rain Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
12:36 PM	0	0	0	0		1	0
12:37 PM	0	0	1	0		1	0
12:38 PM	0	0	0	0		1	0
12:39 PM	1	0	1	1		0	1
12:40 PM	1	1	0	0		1	0
12:41 PM	0	0	0	1		1	0
12:42 PM	1	2	1	1		1	1
12:43 PM	0	0	0	0		2	0
12:44 PM	1	1	2	1		0	1
12:45 PM	0	0	0	0		0	0
12:46 PM	0	0	0	0		1	0
12:47 PM	1	1	0	0		2	0
12:48 PM	2	0	0	0		0	0
12:49 PM	0	0	0	0		0	0
12:50 PM	0	0	0	0		1	0
12:51 PM	1	1	1	1		0	0
12:52 PM	0	0	0	0		0	1
12:53 PM	0	0	0	1		1	0
12:54 PM	1	1	1	2		1	0
12:55 PM	1	1	1	1		1	0
12:56 PM	1	0	0	0		0	0
12:57 PM	0	0	1	1		1	1
12:58 PM	2	3	2	2		0	1
12:59 PM	1	0	0	0		0	0
1:00 PM	0	1	1	0		2	0
1:01 PM	1	0	0	0		1	0
1:02 PM	0	0	0	0		1	0
1:03 PM	1	1	0	0		1	0
1:04 PM	1	0	1	1		1	1
1:05 PM	0	2	0	1		2	1
1:06 PM	0	0	0	0		0	1
1:07 PM	0	1	0	1		2	0
1:08 PM	0	0	0	1		1	0

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St
Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Rain Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
1:09 PM	0	0	0	1		1	0
1:10 PM	1	0	0	0		0	0
1:11 PM	0	0	0	0		0	0
1:12 PM	0	0	1	0		1	0
1:13 PM	0	0	0	0		0	0
1:14 PM	0	1	1	1		1	0
1:15 PM	1	0	0	0		0	0
1:16 PM	0	0	0	1		1	0
1:17 PM	1	1	1	1		1	0
1:18 PM	1	0	1	0		1	0
1:19 PM	0	1	1	1		1	1
1:20 PM	2	2	2	0		1	0
1:21 PM	0	1	1	1		2	0
1:22 PM	1	1	1	0		1	0
1:23 PM	1	3	0	0		3	0
1:24 PM	1	1	1	1		0	0
1:25 PM	0	1	1	0		2	0
1:26 PM	1	1	1	2		1	0
1:27 PM	2	2	2	2		2	0
1:28 PM	1	0	0	0		0	0
1:29 PM	0	0	1	1		2	0
Subtotal	52	52	48	49		93	26
Total	201					119	

Total Delay = Total Number Stopped x Sampling Interval

= 201 x 15 = 3015 veh-sec

$$\text{Average Delay per Approach Vehicle} = \frac{\text{Total Delay}}{\text{Approach Volume}}$$

= 3015/119 = 25.3 sec.

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Cloudy Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
4:30 PM	0	0	1	2		2	1
4:31 PM	0	1	1	0		1	0
4:32 PM	0	0	0	0		0	0
4:33 PM	0	0	0	0		0	0
4:34 PM	0	0	0	0		0	0
4:35 PM	0	0	0	0		0	0
4:36 PM	0	0	0	0		1	0
4:37 PM	1	0	0	0		0	0
4:38 PM	0	0	0	0		0	1
4:39 PM	1	0	0	0		0	0
4:40 PM	0	0	0	0		1	0
4:41 PM	1	1	1	1		2	0
4:42 PM	0	0	0	0		0	0
4:43 PM	0	1	1	1		1	0
4:44 PM	0	1	1	1		0	1
4:45 PM	1	0	0	1		1	0
4:46 PM	1	1	0	1		1	0
4:47 PM	1	0	0	0		0	0
4:48 PM	0	0	0	0		0	0
4:49 PM	0	1	1	0		1	0
4:50 PM	0	1	0	0		0	1
4:51 PM	0	0	0	1		1	0
4:52 PM	0	0	1	2		2	0
4:53 PM	2	1	1	0		0	0
4:54 PM	0	0	0	0		0	0
4:55 PM	0	1	0	0		1	0
4:56 PM	0	0	0	0		0	0
4:57 PM	0	0	1	0		2	0
4:58 PM	1	0	0	0		0	0
4:59 PM	0	1	1	1		1	0
5:00 PM	1	0	0	0		1	1
5:01 PM	0	0	1	0		0	1
5:02 PM	0	0	2	3		3	0

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Cloudy Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
5:03 PM	3	2	0	0		0	1
5:04 PM	1	0	0	0		0	0
5:05 PM	0	0	0	1		1	0
5:06 PM	1	1	0	0		1	0
5:07 PM	0	0	0	0		0	0
5:08 PM	0	0	0	0		0	0
5:09 PM	0	1	1	1		0	1
5:10 PM	1	1	1	1		0	0
5:11 PM	0	0	0	0		1	0
5:12 PM	0	0	0	0		0	0
5:13 PM	0	0	0	0		0	0
5:14 PM	0	0	0	0		0	0
5:15 PM	0	1	0	0		2	0
5:16 PM	1	2	1	1		1	0
5:17 PM	1	1	1	1		1	0
5:18 PM	1	1	1	1		1	1
5:19 PM	1	0	0	0		1	0
5:20 PM	1	1	1	0		1	0
5:21 PM	1	1	0	0		0	0
5:22 PM	0	0	1	1		2	0
5:23 PM	2	1	2	2		2	0
5:24 PM	3	2	3	3		2	0
5:25 PM	3	3	3	3		1	0
5:26 PM	3	1	1	0		1	0
5:27 PM	0	0	0	0		0	0
5:28 PM	0	0	1	0		0	1
5:29 PM	0	0	0	0		0	0
5:30 PM	0	0	1	1		1	0
5:31 PM	0	0	0	0		0	0
5:32 PM	0	0	0	0		0	0
5:33 PM	0	1	1	0		1	1
5:34 PM	1	0	0	0		1	0
5:35 PM	1	1	0	1		1	0

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Cloudy Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
5:36 PM	1	1	0	0		0	2
5:37 PM	1	0	0	0		1	0
5:38 PM	0	0	0	1		0	1
5:39 PM	0	0	0	0		0	0
5:40 PM	0	0	0	0		0	0
5:41 PM	0	0	1	0		0	1
5:42 PM	0	1	3	2		3	0
5:43 PM	0	1	0	0		2	1
5:44 PM	0	0	1	1		1	0
5:45 PM	1	0	0	0		0	0
5:46 PM	0	0	0	0		0	0
5:47 PM	0	0	0	0		0	0
5:48 PM	0	0	0	0		0	0
5:49 PM	0	0	0	0		1	0
5:50 PM	1	1	0	0		0	0
5:51 PM	0	0	0	0		0	0
5:52 PM	0	0	0	0		0	0
5:53 PM	0	0	0	0		1	1
5:54 PM	0	0	0	0		1	0
5:55 PM	1	0	0	1		0	1
5:56 PM	1	0	0	0		0	0
5:57 PM	0	0	0	0		0	0
5:58 PM	0	0	0	0		1	0
5:59 PM	0	1	1	1		1	0
6:00 PM	1	0	0	0		0	0
6:01 PM	0	0	0	0		0	0
6:02 PM	0	1	1	1		1	0
6:03 PM	0	0	0	0		1	0
6:04 PM	0	0	1	0		1	0
6:05 PM	0	0	2	1		4	0
6:06 PM	1	1	1	1		1	0
6:07 PM	1	2	2	2		1	0
6:08 PM	1	0	1	1		0	1

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/9/23 Weather Cloudy Study No. _____ Observer LCY

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
6:09 PM	1	0	0	1		0	1
6:10 PM	0	0	0	0		1	0
6:11 PM	0	0	0	0		0	0
6:12 PM	0	0	0	0		0	0
6:13 PM	0	0	0	1		1	0
6:14 PM	1	1	0	0		0	0
6:15 PM	0	0	0	1		1	0
6:16 PM	0	1	1	1		1	0
6:17 PM	1	1	0	0		1	1
6:18 PM	0	0	0	0		1	0
6:19 PM	0	0	0	0		0	0
6:20 PM	0	0	0	0		0	0
6:21 PM	0	0	0	0		0	0
6:22 PM	0	0	0	0		2	0
6:23 PM	1	1	0	1		1	0
6:24 PM	0	0	0	0		1	0
6:25 PM	0	0	0	0		0	0
6:26 PM	0	0	0	0		0	0
6:27 PM	0	0	0	0		0	0
6:28 PM	0	0	0	0		0	1
6:29 PM	1	0	0	1		1	0
Subtotal	50	44	47	49		76	22
Total	190					98	

Total Delay = Total Number Stopped x Sampling Interval

= 190 x 15 = 2850 veh-sec

$$\text{Average Delay per Approach Vehicle} = \frac{\text{Total Delay}}{\text{Approach Volume}}$$

= 2850/98 = 29.1 sec.

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/11/23 Weather Clear Study No. _____ Observer EG

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
11:00 AM	1	0	0	0		1	0
11:01 AM	0	0	0	0		0	0
11:02 AM	1	1	0	0		2	0
11:03 AM	0	0	0	0		0	0
11:04 AM	0	0	0	0		0	0
11:05 AM	0	0	0	1		1	0
11:06 AM	0	0	1	1		2	0
11:07 AM	0	0	0	0		0	0
11:08 AM	1	1	2	2		2	0
11:09 AM	2	2	2	2		2	0
11:10 AM	2	1	0	0		2	0
11:11 AM	0	0	0	0		0	0
11:12 AM	0	1	0	1		2	0
11:13 AM	1	0	0	1		0	1
11:14 AM	1	1	1	1		0	1
11:15 AM	1	1	1	0		0	0
11:16 AM	0	0	0	0		1	0
11:17 AM	0	0	0	0		0	0
11:18 AM	0	0	0	0		0	0
11:19 AM	0	0	0	1		1	0
11:20 AM	0	0	0	2		1	1
11:21 AM	1	1	0	0		2	0
11:22 AM	0	0	0	1		1	0
11:23 AM	0	0	0	0		0	0
11:24 AM	0	0	0	0		0	0
11:25 AM	0	0	0	0		0	0
11:26 AM	0	1	1	1		2	0
11:27 AM	1	1	0	1		1	0
11:28 AM	0	0	0	0		0	0
11:29 AM	0	0	0	0		0	0
11:30 AM	0	0	0	0		0	1
11:31 AM	0	0	1	1		1	0
11:32 AM	1	0	0	0		1	0

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St

Location Reading, MA **Approach** WB **Movement** LR

Date 11/11/23 Weather Clear Study No. _____ Observer EG

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
11:33 AM	0	0	0	0		0	0
11:34 AM	0	0	1	0		0	1
11:35 AM	0	0	0	1		1	0
11:36 AM	1	0	0	0		1	0
11:37 AM	0	0	0	1		1	0
11:38 AM	0	0	1	1		0	0
11:39 AM	1	1	1	1		2	0
11:40 AM	1	0	0	0		1	0
11:41 AM	0	0	0	0		0	0
11:42 AM	1	1	1	0		2	0
11:43 AM	0	0	0	0		0	0
11:44 AM	0	0	0	0		0	0
11:45 AM	0	0	0	0		0	0
11:46 AM	0	0	0	0		0	0
11:47 AM	0	0	0	0		0	0
11:48 AM	0	0	0	0		0	0
11:49 AM	0	0	0	0		0	0
11:50 AM	0	0	0	0		0	0
11:51 AM	0	1	2	3		1	0
11:52 AM	2	3	2	0		2	0
11:53 AM	0	0	0	0		0	0
11:54 AM	1	1	1	1		2	0
11:55 AM	0	0	1	0		1	0
11:56 AM	0	0	0	0		0	0
11:57 AM	0	1	0	1		1	0
11:58 AM	2	2	2	2		0	0
11:59 AM	2	2	0	0		0	2
12:00 PM	1	0	0	0		1	0
12:01 PM	0	1	1	1		1	0
12:02 PM	0	0	0	1		0	0
12:03 PM	1	1	0	1		0	1
12:04 PM	1	1	0	0		1	0
12:05 PM	0	0	0	1		0	0

INTERSECTION DELAY STUDY

FIELD SHEET

Intersection McDonald's Exit at Main St
Location Reading, MA **Approach** WB **Movement** LR

Date 11/11/23 Weather Clear Study No. _____ Observer EG

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
12:06 PM	1	1	1	1		1	0
12:07 PM	1	1	0	0		0	2
12:08 PM	0	1	2	2		0	0
12:09 PM	1	0	1	0		2	0
12:10 PM	0	0	0	0		0	0
12:11 PM	0	0	0	0		0	0
12:12 PM	0	0	0	1		0	0
12:13 PM	0	1	2	2		0	0
12:14 PM	1	2	0	0		1	1
12:15 PM	0	0	1	1		0	0
12:16 PM	1	1	1	2		1	1
12:17 PM	0	0	0	0		0	0
12:18 PM	0	1	1	0		1	0
12:19 PM	1	0	0	0		1	0
12:20 PM	0	0	0	0		0	0
12:21 PM	1	1	1	1		1	1
12:22 PM	0	0	0	0		0	0
12:23 PM	1	1	0	0		1	0
12:24 PM	0	0	0	0		0	0
12:25 PM	1	1	1	1		1	0
12:26 PM	1	1	0	1		2	0
12:27 PM	0	0	1	1		0	0
12:28 PM	1	0	0	0		1	0
12:29 PM	0	0	0	0		0	0
12:30 PM	0	0	0	0		0	0
12:31 PM	1	0	0	0		1	0
12:32 PM	0	0	0	0		0	0
12:33 PM	0	0	0	0		0	0
12:34 PM	0	1	1	0		1	0
12:35 PM	0	1	1	1		1	0
12:36 PM	0	0	0	0		0	0
12:37 PM	0	0	0	1		0	0
12:38 PM	1	1	1	0		3	0

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Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
12:39 PM	0	1	0	0		1	0
12:40 PM	0	0	0	0		0	0
12:41 PM	0	1	1	0		0	2
12:42 PM	0	0	0	0		0	0
12:43 PM	0	0	0	1		2	0
12:44 PM	0	0	1	0		1	0
12:45 PM	1	0	0	0		1	0
12:46 PM	0	0	0	0		0	0
12:47 PM	1	0	0	0		1	0
12:48 PM	0	0	1	1		0	0
12:49 PM	2	1	0	0		2	0
12:50 PM	0	1	1	1		1	0
12:51 PM	2	2	2	0		1	1
12:52 PM	0	0	0	1		0	0
12:53 PM	1	2	1	0		2	1
12:54 PM	1	0	0	0		0	1
12:55 PM	0	1	1	2		0	0
12:56 PM	2	1	0	0		3	0
12:57 PM	0	0	1	1		0	0
12:58 PM	1	0	0	0		1	0
12:59 PM	0	0	0	0		0	0
1:00 PM	0	0	0	0		0	0
1:01 PM	0	0	0	0		0	0
1:02 PM	0	0	0	1		1	0
1:03 PM	0	0	0	1		1	0
1:04 PM	0	0	0	0		0	0
1:05 PM	1	1	1	0		1	0
1:06 PM	0	1	0	1		1	1
1:07 PM	0	0	0	0		0	0
1:08 PM	0	0	0	1		1	0
1:09 PM	0	0	0	0		0	0
1:10 PM	0	0	1	1		0	0
1:11 PM	1	0	1	0		0	2

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Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
1:12 PM	1	1	0	0		1	1
1:13 PM	1	1	0	0		1	0
1:14 PM	0	0	0	0		0	0
1:15 PM	0	0	0	0		0	0
1:16 PM	1	1	0	0		1	0
1:17 PM	0	0	1	0		0	1
1:18 PM	0	1	1	0		2	0
1:19 PM	0	0	0	0		0	0
1:20 PM	0	0	0	1		0	0
1:21 PM	1	1	0	0		1	1
1:22 PM	0	1	1	2		2	0
1:23 PM	0	0	0	0		0	0
1:24 PM	0	0	0	1		0	0
1:25 PM	1	1	1	0		1	0
1:26 PM	0	0	0	0		0	0
1:27 PM	0	1	1	1		1	0
1:28 PM	1	2	0	0		2	0
1:29 PM	0	1	0	1		2	0
1:30 PM	0	0	0	0		0	0
1:31 PM	0	0	0	0		0	0
1:32 PM	0	0	0	0		0	0
1:33 PM	0	1	1	0		0	1
1:34 PM	0	0	1	0		1	0
1:35 PM	0	1	1	1		0	0
1:36 PM	1	1	1	1		1	1
1:37 PM	0	0	0	0		0	0
1:38 PM	0	1	1	1		1	0
1:39 PM	0	0	1	0		1	0
1:40 PM	0	1	1	0		1	0
1:41 PM	1	1	1	0		2	0
1:42 PM	1	0	0	0		1	0
1:43 PM	0	0	0	0		0	0
1:44 PM	0	0	0	0		0	0

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Date 11/11/23 Weather Clear Study No. _____ Observer EG

Time (minute starting at)	Total Number of Vehicles Stopped in the Approach at Time:				Approach Volume		
	+0 sec	+15 sec	+30 sec	+45 sec	R	Number Stopped	L
1:45 PM	0	0	0	0		0	0
1:46 PM	1	0	0	0		1	0
1:47 PM	0	0	0	0		1	0
1:48 PM	0	0	1	2		0	0
1:49 PM	2	2	0	0		1	2
1:50 PM	0	0	0	0		0	0
1:51 PM	0	1	0	0		1	0
1:52 PM	0	0	0	0		0	1
1:53 PM	0	0	1	1		2	0
1:54 PM	2	1	1	0		0	1
1:55 PM	0	0	0	0		0	0
1:56 PM	1	0	1	0		1	1
1:57 PM	0	1	0	0		0	1
1:58 PM	0	0	0	0		0	0
1:59 PM	0	0	0	0		1	0
Subtotal	68	75	66	70		113	32
Total	279					145	

Total Delay = Total Number Stopped x Sampling Interval

= 279 x 15 = 4185 veh-sec

$$\text{Average Delay per Approach Vehicle} = \frac{\text{Total Delay}}{\text{Approach Volume}}$$

= 4185 = 28.9 sec.

Benedetto, Mary

From: Martel Sandra <Sandra.Martel@us.mcd.com>
Sent: Wednesday, November 8, 2023 2:31 PM
To: David Talbot
Cc: MacNichol, Andrew; Mayo Daniel; Daniel Allen; CPDC; Kaprielian Rachel; Cullen Matt; Smith Antwan; Diozzi Joe; Czerwionka Rebekah
Subject: RE: Updated version of resident report reviewing the McDonald's traffic study

Good afternoon Mr. Talbot,

I hope this email finds you well.

I wanted to follow up regarding the recent discussions about potential changes in our redevelopment of the McDonald's site.

Our respective teams have reviewed all the information provided and discussed internally and after careful consideration, we have concluded that we are unable to accommodate the requested changes. We understand that your proposed modification from a single use to a mixed-use development are being made with good intentions, but our project plans are well underway, and any significant alternations would result in a significant delay and would not align with the vision plan for the McDonald's asset.

We have been a staple in town since we opened in 1963 as a freestanding traditional restaurant serving the community and our vision is to improve operations on the existing site to better serve the community.

We are obtaining additional traffic information in accordance with the requests made by the Board which will answer some of the questions you posed. We did also agree to dedicate the area of the public sidewalk that in on McDonald's property to the town per their request.

I have spoken with Mr. MacNichol relative to this decision and have advised that when the town is ready to move forward with their vision plan of the area that McDonald's will work with them, to the extend possible, to accomplish the improvements. We did agree to dedicate the area of the public sidewalk that in on McDonald's property to the town.

We appreciate your valuable input and please know that this decision was not made lightly.

Please call me if you would like to discuss in greater detail.

Thank you,

Best regards,
Sandra W. Martel
Mcdonalds USA LLC
Real Estate Portfolio Manager – Stamford Field Office
P.O. Box 588, Weare NH 03281
P (603) 325-3319 | E Sandra.Martel@us.mcd.com

READING POLICE DEPARTMENT

15 Union Street ▪ Reading, Massachusetts 01867

Emergency Only: 911 ▪ All Other Calls: (781) 944-1212 ▪ Fax: (781) 944-2893

Web: www.readingma.gov/police-department

To: Reading Community Planning and Development Commission
From: TSO Michael Scouten
Date: November 8, 2023

Re: 413 Main St McDonalds Development Traffic concerns

The Reading Police Department has reviewed the proposed traffic management plans for 413 Main Street (McDonalds property), specifically with traffic crashes at this location.

A 6-year crash study yielded a minimal outcome of crashes involving the existing McDonalds property and traffic pattern. This study was done from 2017 to 2023 showing that there were only five crashes, three on the property and two at the exit to the property. (1) minor hit/run within the parking lot, (1) involving a vehicle jumping the curb and hitting a tree on the property, (1) involving a box truck backing into a light pole on the property, and (2) minor crashes involving vehicles exiting the property onto the public way (Main St).

The adjacent roadways have had multiple motor vehicle crashes in the area not involving the McDonalds traffic. Main Street and Washington Street and Main Street at Ash St are two of the busiest intersections within the Town of Reading causing heavy congestion in the area. Furthermore, there is also major congestion in this area due to its close proximity to Main Street at Ash St and the Rail Road crossings. The Main Street and Ash Street railroad crossings intersection causes back-ups contributing to the day to day heavy traffic flow in this area causing the intersection to become very hazardous.

The police department feels that there are no safety concerns with the new traffic patterns associated with this project.

Respectfully submitted,

Michael Scouten
Traffic and Safety Officer
Reading Police Department
Reading, Ma. 01867
(781) 942-6775

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Web: www.readingma.gov/police-department

To: Reading Community Planning and Development Commission
From: Lieutenant Christopher Jones
Date: November 29, 2023

Re: 413 Main St McDonalds Development Traffic concerns

The Reading Police Department has reviewed the latest revised plans from McDonalds – 413 Main Street, including the Supplemental Traffic Assessment and Traffic Count Data.

The police department still believes there are no traffic or safety concerns with the new traffic patterns associated with the proposed site plan. The proposed driveway at the front of the building which allows patrons to exit the drive-thru and circle the building to exit onto Bolton Street rather than Main street can reduce the vehicles turning left onto Main Street (southbound). This in turn can reduce further congestion on Main Street for those vehicles which turn left onto Main street and then immediately left onto Ash/Bolton Street.

Furthermore, the Delay and Queue Observations showed the average vehicle delay exiting was less than 30 seconds and operators were able to exit using courtesy gaps in traffic. This would be associated with the stop light at the intersection of Main and Washington streets which demonstrates that operators are able to safely pull onto Main street even when traffic is stopped in the area.

Respectfully submitted,

Lieutenant Christopher Jones
Reading Police Department
Reading, MA 01867
(781) 942-6701