

MEMORANDUM

TO: Robert Desmarais
Director of Public Works
City of Amesbury
62 Friend Street
Amesbury, MA 01913

DATE: December 16, 2020

FROM: Elizabeth Oltman, PE
Director of Transportation Planning

PROJECT NO.: T0928

RE: Main Street Traffic Calming Options, Amesbury, MA

INTRODUCTION

The City of Amesbury has retained TEC, Inc. (TEC) to provide traffic engineering services to examine the existing traffic flow patterns, speeds and pedestrian safety considerations along Main Street/Evans Place between the Newburyport municipal boundary and Merrimac Street and to offer options to calm traffic and improve accommodations for multi-modal users. This report primarily focuses on the length of Main Street between the bridge over the Powwow River to the west and Merrill Street to the east.

EXISTING CONDITIONS

Main Street is an urban minor arterial under the jurisdiction of the City of Amesbury. One lane of travel is provided in each direction separated by a double yellow centerline. The travel lanes are generally 11-feet in width, with a striped shoulder on each side of varying width, typically between 3-5. Main Street has a posted speed limit of 30 miles per hour (mph) along its length. There is no regulatory speed limit on file with MassDOT; therefore the roadway is governed by the 30 mph thickly settled / business district statutory speed limit per Massachusetts General Law (MGL) Chapter 90 Section 17.

Sidewalk is provided along the north side of Main Street between Merrimac Street and Evans Place, and then on the south side of Main Street for approximately 800 feet to the west of Merrill Street. Curbing is generally not present between the sidewalk and the vehicular travel way. No specific bicycle accommodations are present. On-street parking is not specifically prohibited by signage along the roadway; however, the pavement width is not sufficient to allow for on-street parking outside of the travel lanes. TEC noted vehicles parked on the sidewalk area.

Seven study locations were identified in 2019 to best capture the daily and peak hour flow of traffic within the local roadway network. Daily and hourly traffic volumes were collected to track the vehicular traffic flow and determine the most common routes. The traffic counts recorded 85th percentile speeds, or the speed at which 85% of the vehicles are traveling at or below, along Main Street in the vicinity of Rocky Hill Road of 33-35 mph for the four days studied. The weekday daily volume along Main Street was recorded as 9400 vehicles per day on a typical weekday.

While the 85th percentile speeds are within the range of the statutory speed limit, residents have expressed concerns regarding the number and speed of vehicles along the roadway. After reviewing the existing traffic volumes and speeds along Main Street, appropriate traffic calming installations can be recommended for implementation to slow vehicular traffic, increase safety for pedestrians and bicycles and ensure adequate access for emergency vehicles.

OPTIONS FOR TRAFFIC CALMING

The following options can be considered to slow traffic speeds, divert traffic volumes, or provide a more comfortable multi-modal environment for all roadway users.

Bicycle Lane Striping

The current pavement markings along Main Street provide for 11-foot lane widths with striped shoulders. The current pavement width is generally sufficient to provide a five-foot bicycle lane in the westbound direction between Point Shore Drive and the Powwow River bridge, with only minor areas of spot widening required. MassDOT allows for striped bicycle lanes without a buffer on roadways with a speed limit less than 40 mph and a daily volume of less than 10,000 vehicles per day. Shared lane markings, or “sharrows,” would be provided in the eastbound direction. This striping option provides accommodations for bicyclists along the roadway length and visually reduces the pavement width for motorists. TEC prepared a concept plan to illustrate the proposed bicycle lane layout. Table 1 at the end of this memorandum outlines a planning level cost estimate for this option.

Sidewalk Reconstruction / Roadway cross-section

The existing sidewalk along Main Street is located along the north side of the roadway between Merrimac Street and Evans Place. The sidewalk is in fair to poor condition, with little curb reveal present in some locations and no curb present in many locations. Reconstruction or construction of new the sidewalk along Main Street to the east of Rocky Hill Road to the existing sidewalk under I-95 to provide a consistent 5-foot ADA-compliant width and cross-slope with the addition of new or reset curbing to provide a consistent 6-inch curb reveal would significantly improve the separation between vehicles and pedestrians. The extension of the existing sidewalk would close a network gap and provide new pedestrian accommodations. TEC prepared a concept plan to illustrate the proposed sidewalk reconstruction layout. The plan shows a consistent roadway width, allowing for grass buffer areas between the sidewalk and the travel way in some locations. Formalized on-street parking is shown where possible. Table 1 at the end of this memorandum outlines a planning level cost estimate for this option.

Raised Crosswalks or Median Islands

The addition of raised crosswalks along Main Street were considered. These traffic calming devices are most effectively used in series. TEC prepared a concept plan to illustrate five raised crosswalks at the existing striped mid-block crossings along Main Street and an additional speed hump to maintain a consistent distance between each raised area. These raised crosswalks may be adequate to reduce vehicle speeds by up to 25 percent (33 MPH to 25 MPH). TEC cautions that Main Street is an urban minor arterial that carries up to 9400 vehicles per day, which is not a

typical roadway for this type of traffic calming device, as it can cause driver frustration and increase travel times. Further, Main Street is an emergency route for the City of Amesbury Emergency Services. TEC notes that emergency response times can increase between 3 to 5 seconds per raised area, or up to 30 seconds for the proposed installation.

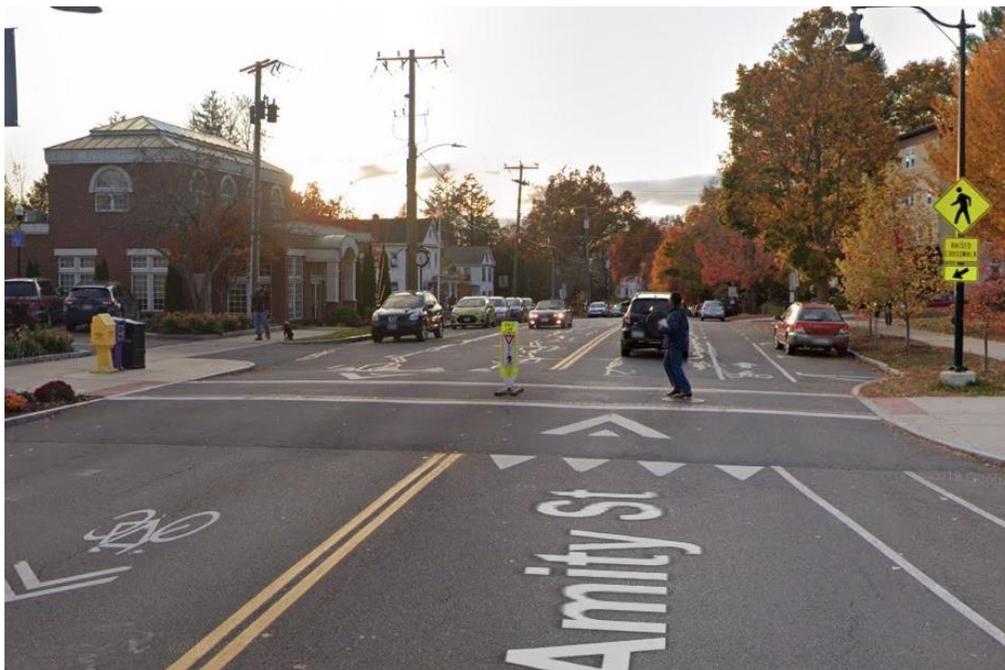


Figure 1 – Example of a raised crosswalk on Amity Street in Amherst, MA

The diversion of vehicles from their travel path, particularly with a physical object, has also been found to noticeably reduce vehicle speeds. As an alternative to the raised crosswalks, median islands could be considered at strategic locations along Main Street to divert vehicles from a through travel path. The median island installations could be 4-5 feet wide and approximately 25-30 feet long. These installations do not impact emergency vehicle access; however, they will require locating for visibility and ease in plowing. Further, installation of a textured pavement treatment within the crosswalks for the five existing mid-block crossings across Main Street may draw more attention to these pedestrian areas and raise motorist awareness of potential pedestrians.



Figure 2 – Example of a median island on Canton Street in Westwood, MA

Table 1 at the end of this memorandum outlines a planning level cost estimate for these options.

Traffic Diversion / All-way Stop Control

At the October 30, 2019 Traffic and Transportation Committee meeting, a resident suggested converting Rocky Hill Road to northbound traffic only, south of the Irving Oil Driveway. Approximately 2000 vehicles travel southbound and 450 vehicles travel northbound along Rocky Hill Road during a regular weekday. The southbound vehicles would be diverted to other area roadways. Ideally, these vehicles would divert to use I-95 southbound to access Newburyport or other locations to the south or east. However, some portion will likely divert to Clark’s Road. Due to the length and geometry of Clark’s Road, this detour is the least likely, except for local residents who have the Main Street / Evans Place area as their destination.

TEC recommends that the potential conversion of Rocky Hill Road to one-way traffic flow northbound be considered in conjunction with conversion of Clark’s Road to one-way traffic flow southbound to form a one-way pair. Approximately 1200 vehicles travel southbound and 1200 vehicles travel northbound along Clark’s Road during a regular weekday. Due to the right turn only restriction on Rocky Hill Road at Macy Street (Route 110), diverted vehicles currently traveling northbound along Clark’s Road destined to the west would likely stay on Main Street to reach their destination. Vehicles destined to the east would likely divert to Rocky Hill Road. Both streets would experience an overall decrease in daily traffic volumes with the implementation of a one-way pair scenario.

For the purposes of this analysis, TEC assumed that all southbound traffic along Rocky Hill Road would divert to Clark’s Road to perform a conservative analysis of the intersection of Clark’s Road

/ Main Street. With the diversion of all southbound traffic to Clark's Road, the intersection of Clark's Road / Main Street will experience increased delays and projected queue lengths of up to eight vehicles during the peak hours. The installation of all-way stop control at the intersection was analyzed. With the installation of stop signs on all approaches, the intersection is projected to operate with good levels of service and minimal delays during the peak hours on all approaches. Some additional queues are projected on the Main Street approaches; however this is to be expected when implementing traffic control rather than the existing free-flow condition.

The implementation of an all-way stop control intersection, similar to other intersection control measures, is based upon warrants identified in Section 2B.07 of the *Manual on Uniform Traffic Control Devices (MUTCD)*¹. Multi-way stop control is a useful safety measure at unsignalized intersections if certain traffic conditions exist. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal, or where there are more than five crashes within a 12-month period. The diverted traffic volumes entering the intersection of Main Street / Clark's Road were reviewed for applicability to the MUTCD guidance for installation of stop signs along Main Street.

The traffic volume warranting conditions outlined in the *MUTCD* for an all-way stop-controlled location are met under the guidance defined under Section 2B.07(04) for the combined Rocky Hill Road / Clark's Road southbound traffic volumes on the side street and a combined crash history. The worksheet is attached.

Further, the *MUTCD* does provide the option to consider supplemental criteria for the installation of stop signs on all four approaches based on the following:

"Option C: Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop." Section 2B.07(05)(C).

For intersections with all-way stop control, the sight distance guidance provided by American Association of State Highway and Transportation Officials (AASHTO)² states:

"At intersections with all-way stop control, the first stopped vehicle on one approach should be visible to the drivers of the first stopped vehicles on each of the other approaches. There are no other sight distance criteria applicable to intersections with all-way stop control and, indeed all-way stop control may be the best option at a limited number of intersections where sight distance for other control types cannot be attained."

The *MUTCD* supplemental criteria complements the installation of all-way stop control at the intersection, thereby meeting AASHTO requirements for sight distance.

TEC staff performed field reviews in November 2019 and November 2020, during which TEC performed measurements of the existing sight lines for the Clark's Road approach to Main Street.

¹ *Manual on Uniform Traffic Control Devices*; USDOT / Federal Highway Administration and others; Section 2B.07; 2010

² *A Policy on Geometric Design of Highways and Street*, American Association of State Highway Transportation Officials (AASHTO); 7th Edition; 2018; page 9-56

Based on the thickly settled speed limit of 30 MPH, and the recorded 85th percentile speeds along Main Street, the actual sight lines fall below the industry-accepted standards for intersection sight distance.

Implementation of an all-way stop controlled intersection can be considered for the intersection of Main Street / Clark’s Road with the conversion of Rocky Hill Road and Clark’s Road to a one-way pair for vehicular traffic. Implementation of this option is minimal, as it is primarily the addition of regulatory signage.

Statutory Speed Alternative

The City of Amesbury has the option of adopting MGL Chapter 90, Section 17C on either a city-wide basis or street-by-street basis. MassDOT recommends the former as the messaging is consistent and less likely to create confusion.

“Thickly Settled or Business Districts, as defined in MGL c. 90 Section 1 have a default statutory speed limit of 30 MPH unless the municipality has adopted MGL chapter 90 section 17C, wherein the statutory speed limit in these areas is reduced to 25 MPH. However if a Special Seed Regulation has been enacted on this section of roadway, the regulatory speed will govern.”

MGL Chapter 90, Section 1 defines a Thickly Settled or Business District as “the territory contiguous to any way which is built up with structures devoted to business, or the territory contiguous to any way where dwelling houses are situated at such distances as will average less than two hundred feet between them for a distance of a quarter of a mile or over.” The City of Amesbury has many such areas, indicating that adoption of MGL Chapter 90, Section 17C may be a viable option for adoption by the City for those roadways within the City that do not have established speed regulations on file with MassDOT.

Main Street, Rocky Hill Road, Clark’s Road and Merrimac Street do not have established speed regulations on file with MassDOT, making them eligible for the statutory speed alternative.

Table 1 - Cost Estimates for the Concepts Provided

Alternative	Estimated Cost
Bicycle Lane Striping	\$325,000
Sidewalk Replacement	\$525,000
Raised Crosswalks (5 crosswalks and 1 speed hump)	\$190,000
Median Islands	\$150,000

Appendix A

Multi-way Stop Warrant
Capacity Analyses

Multi-Way Stop Applications

Project: [T0928]
 Date: November 20, 2020
 Analyst: TEC Inc. / KEA

Criteria B - Five or More Preventable Crashes

Angle Crashes In Last 12-Month Period = average per year 2017-2019 at both Rocky Hill Road and Clarks Road at Main Street

Result:

Criteria C - Minimum Vehicular Volumes

Average Delay to Minor-Street Vehicular Traffic = seconds per vehicle

Condition 1/2: Major Street 85th-Percentile Speed < 40 MPH

Street	Average Volume	ATR Data												
		6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	300	430	745	721	513	527	492	503	512	600	838	893	913	674
Minor	200	151	297	295	175	173	153	175	133	210	208	244	264	229
Met?		NO	YES	YES	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES

Result:

OR

Condition 3: Major Street 85th-Percentile Speed > 40 MPH
 70%

Street	Average Volume	ATR Data												
		6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	210	430	745	721	513	527	492	503	512	600	838	893	913	674
Minor	140	151	297	295	175	173	153	175	133	210	208	244	264	229
Met?		YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES

Result:

Criteria D - Minimum Values all Satisfied to 80% (Volumes, Crashes, & Delay)

80%

Street	Average Volume	ATR Data												
		6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	240	430	745	721	513	527	492	503	512	600	838	893	913	674
Minor	160	151	297	295	175	173	153	175	133	210	208	244	264	229
Met?		YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES

Result:

Lanes, Volumes, Timings
3: Main Street & Clarks Road

2019 One-way Pair AM Peak
AM Peak

						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	376	230	0	306	46
Future Volume (vph)	0	376	230	0	306	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.982	
Flt Protected					0.958	
Satd. Flow (prot)	0	1801	1801	0	1694	0
Flt Permitted					0.958	
Satd. Flow (perm)	0	1801	1801	0	1694	0
Link Speed (mph)		30	30		30	
Link Distance (ft)		535	610		418	
Travel Time (s)		12.2	13.9		9.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Sign Control		Free	Free		Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

HCM 2010 TWSC
3: Main Street & Clarks Road

2019 One-way Pair AM Peak
AM Peak

Intersection						
Int Delay, s/veh	15.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	
Traffic Vol, veh/h	0	376	230	0	306	46
Future Vol, veh/h	0	376	230	0	306	46
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	409	250	0	333	50

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	659
Stage 1	-	-	-	-	250
Stage 2	-	-	-	-	409
Critical Hdwy	-	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	-	-	3.518
Pot Cap-1 Maneuver	0	-	-	0	429
Stage 1	0	-	-	0	792
Stage 2	0	-	-	0	671
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	429
Mov Cap-2 Maneuver	-	-	-	-	429
Stage 1	-	-	-	-	792
Stage 2	-	-	-	-	671

Approach	EB	WB	SB
HCM Control Delay, s	0	0	42.2
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	456
HCM Lane V/C Ratio	-	-	0.839
HCM Control Delay (s)	-	-	42.2
HCM Lane LOS	-	-	E
HCM 95th %tile Q(veh)	-	-	8.2

Lanes, Volumes, Timings
3: Main Street & Clarks Road

2019 One-way Pair PM Peak
PM Peak

						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations					 	
Traffic Volume (vph)	0	200	486	0	225	61
Future Volume (vph)	0	200	486	0	225	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.971	
Flt Protected					0.962	
Satd. Flow (prot)	0	1801	1801	0	1682	0
Flt Permitted					0.962	
Satd. Flow (perm)	0	1801	1801	0	1682	0
Link Speed (mph)		30	30		30	
Link Distance (ft)		535	610		418	
Travel Time (s)		12.2	13.9		9.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Sign Control		Free	Free		Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

HCM 2010 TWSC
3: Main Street & Clarks Road

2019 One-way Pair PM Peak
PM Peak

Intersection						
Int Delay, s/veh	10.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	0	200	486	0	225	61
Future Vol, veh/h	0	200	486	0	225	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	217	528	0	245	66

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	745
Stage 1	-	-	-	-	528
Stage 2	-	-	-	-	217
Critical Hdwy	-	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	-	-	3.518
Pot Cap-1 Maneuver	0	-	-	0	382
Stage 1	0	-	-	0	592
Stage 2	0	-	-	0	819
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	382
Mov Cap-2 Maneuver	-	-	-	-	382
Stage 1	-	-	-	-	592
Stage 2	-	-	-	-	819

Approach	EB	WB	SB
HCM Control Delay, s	0	0	36.8
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	409
HCM Lane V/C Ratio	-	-	0.76
HCM Control Delay (s)	-	-	36.8
HCM Lane LOS	-	-	E
HCM 95th %tile Q(veh)	-	-	6.3

Lanes, Volumes, Timings
3: Main Street & Clarks Road

2019 One-way Pair AM Peak - All way stop
AM Peak

						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	376	230	0	306	46
Future Volume (vph)	0	376	230	0	306	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.982	
Flt Protected					0.958	
Satd. Flow (prot)	0	1801	1801	0	1694	0
Flt Permitted					0.958	
Satd. Flow (perm)	0	1801	1801	0	1694	0
Link Speed (mph)		30	30		30	
Link Distance (ft)		535	610		418	
Travel Time (s)		12.2	13.9		9.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Sign Control		Stop	Stop		Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

HCM 2010 AWSC
3: Main Street & Clarks Road

2019 One-way Pair AM Peak - All way stop
AM Peak

Intersection
Intersection Delay, s/veh 16.5
Intersection LOS C

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↑↑	
Traffic Vol, veh/h	0	376	230	0	306	46
Future Vol, veh/h	0	376	230	0	306	46
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	409	250	0	333	50
Number of Lanes	0	1	1	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay	17.6	12.7	17.9
HCM LOS	C	B	C

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	87%
Vol Thru, %	100%	100%	0%
Vol Right, %	0%	0%	13%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	376	230	352
LT Vol	0	0	306
Through Vol	376	230	0
RT Vol	0	0	46
Lane Flow Rate	409	250	383
Geometry Grp	1	1	1
Degree of Util (X)	0.629	0.402	0.618
Departure Headway (Hd)	5.54	5.782	5.819
Convergence, Y/N	Yes	Yes	Yes
Cap	650	620	620
Service Time	3.594	3.843	3.872
HCM Lane V/C Ratio	0.629	0.403	0.618
HCM Control Delay	17.6	12.7	17.9
HCM Lane LOS	C	B	C
HCM 95th-tile Q	4.4	1.9	4.2

Lanes, Volumes, Timings
3: Main Street & Clarks Road

2019 One-way Pair PM Peak All Way Stop
PM Peak

						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	200	486	0	225	61
Future Volume (vph)	0	200	486	0	225	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.971	
Flt Protected					0.962	
Satd. Flow (prot)	0	1801	1801	0	1682	0
Flt Permitted					0.962	
Satd. Flow (perm)	0	1801	1801	0	1682	0
Link Speed (mph)		30	30		30	
Link Distance (ft)		535	610		418	
Travel Time (s)		12.2	13.9		9.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Sign Control		Stop	Stop		Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

HCM 2010 AWSC
3: Main Street & Clarks Road

2019 One-way Pair PM Peak All Way Stop
PM Peak

Intersection
Intersection Delay, s/veh 18.8
Intersection LOS C

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↑↑	
Traffic Vol, veh/h	0	200	486	0	225	61
Future Vol, veh/h	0	200	486	0	225	61
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	217	528	0	245	66
Number of Lanes	0	1	1	0	1	0

Approach		EB	WB		SB	
Opposing Approach		WB	EB			
Opposing Lanes		1	1		0	
Conflicting Approach Left		SB			WB	
Conflicting Lanes Left		1	0		1	
Conflicting Approach Right			SB		EB	
Conflicting Lanes Right		0	1		1	
HCM Control Delay		11.7	23.9		15	
HCM LOS		B	C		B	

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	79%
Vol Thru, %	100%	100%	0%
Vol Right, %	0%	0%	21%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	200	486	286
LT Vol	0	0	225
Through Vol	200	486	0
RT Vol	0	0	61
Lane Flow Rate	217	528	311
Geometry Grp	1	1	1
Degree of Util (X)	0.344	0.772	0.511
Departure Headway (Hd)	5.698	5.26	5.912
Convergence, Y/N	Yes	Yes	Yes
Cap	628	687	609
Service Time	3.753	3.304	3.963
HCM Lane V/C Ratio	0.346	0.769	0.511
HCM Control Delay	11.7	23.9	15
HCM Lane LOS	B	C	B
HCM 95th-tile Q	1.5	7.4	2.9

Appendix B

Estimates



**Preliminary Cost Estimate
Main Street Bike Lane**

146 Dascomb Road, Andover, MA 01810
 311 Main Street, 2nd Floor, Worcester MA 01608
 169 Ocean Blvd., Hampton, NH 03842
 978-794-1792 "TheEngineeringCorp.com"

Project: Main Street Traffic Calming
Location: Amesbury, Massachusetts
Title: Preliminary Cost Estimate
Estimated By: GMR

Project No.: T0928
Date: 12/4/2020
Sheet: 1 of 1
Checked By:

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 5,000	\$ 5,000
Full Depth Pavement	600	SY	\$ 135	\$ 81,000
HMA Driveway Reconstruction	400	SY	\$ 75	\$ 30,000
New Granite Curb	600	LF	\$ 60	\$ 36,000
Landscaping	900	SY	\$ 15	\$ 13,500
High Friction Surface Treatment	629	SY	\$ 20	\$ 12,580
Traffic Signing & Markings	1	LS	\$ 33,000	\$ 33,000
Subtotal				\$ 211,080
Traffic Management				\$ 10,000
Subtotal - Construction Items				\$ 221,080
Contingencies				
15% Construction				\$ 33,162
Police Detail				\$ 32,000
10% Construction Engineering				\$ 22,108
Contingencies Subtotal				\$ 87,270
Total				\$ 308,350
Say				\$ 325,000



**Preliminary Cost Estimate
Main Street & Evans Place Sidewalk
Reconstruction ALT #1**

146 Dascomb Road, Andover, MA 01810
 311 Main Street, 2nd Floor, Worcester MA 01608
 169 Ocean Blvd., Hampton, NH 03842
 978-794-1792 "TheEngineeringCorp.com"

Project: Main Street Traffic Calming
Location: Amesbury, Massachusetts
Title: Preliminary Cost Estimate
Estimated By: GMR

Project No.: T0928
Date: 12/15/2020
Sheet: 1 of 1
Checked By:

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 15,000	\$ 15,000
Landscaping	700	SY	\$ 15	\$ 10,500
HMA Driveway Reconstruction	400	SY	\$ 75	\$ 30,000
New Granite Curb	2200	FT	\$ 60	\$ 132,000
New Cem Conc Sidewalk	1100	SY	\$ 105	\$ 115,500
New ADA Ramps	8	EA	\$ 1,750	\$ 14,000
Drainage Modifications	1	LS	\$ 40,000	\$ 40,000
Traffic Signing & Markings	1	LS	\$ 13,000	\$ 13,000
Subtotal				\$ 370,000
Traffic Management				\$ 10,000
Subtotal - Construction Items				\$ 380,000
Contingencies				
15% Construction				\$ 57,000
Police Detail				\$ 48,000
10% Construction Engineering				\$ 38,000
Contingencies Subtotal				\$ 143,000
Total				\$ 523,000
Say				\$ 525,000



Preliminary Cost Estimate
Main Street Speed Hump

146 Dascomb Road, Andover, MA 01810
 311 Main Street, 2nd Floor, Worcester MA 01608
 169 Ocean Blvd., Hampton, NH 03842
 978-794-1792 "TheEngineeringCorp.com"

Project: Main Street Traffic Calming
Location: Amesbury, Massachusetts
Title: Preliminary Cost Estimate
Estimated By: GMR

Project No.: T0928
Date: 12/4/2020
Sheet: 1 of 1
Checked By: SWG

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 5,000	\$ 5,000
Pavement	450	SY	\$ 40	\$ 18,000
New Granite Curb	400	FT	\$ 60	\$ 24,000
New Cem Conc Sidewalk	250	SY	\$ 105	\$ 26,250
New ADA Ramps	6	EA	\$ 1,750	\$ 10,500
Landscaping	400	SY	\$ 15	\$ 6,000
Drainage Modifications	1	LS	\$ 45,000	\$ 45,000
Traffic Signing & Markings	1	LS	\$ 10,000	\$ 10,000
Subtotal				\$ 144,750
Traffic Management				\$ 5,000
Subtotal - Construction Items				\$ 149,750
Contingencies				
5% Construction				\$ 7,488
Police Detail				\$ 8,000
10% Construction Engineering				\$ 14,975
Contingencies Subtotal				\$ 30,463
Total				\$ 180,213
Say				\$ 190,000

Appendix C

Concept Plans

AMESBURY
 MAIN STREET / EVANS PLACE
 TRAFFIC CALMING PLAN
 SHEET 1 OF 10



NOTES:

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CONTINUED ON
 SHEET NO. 2

AMESBURY
MAIN STREET / EVANS PLACE
TRAFFIC CALMING PLAN
SHEET 2 OF 10



W11-1
W16-1P

PROPOSED THERMOPLASTIC BICYCLE
LANE PAVEMENT MARKING (TYP)

PROPOSED BOX WIDENING (VARIES
WIDTH) TO ACCOMMODATE 5' BIKE LANE

PROPOSED HIGH FRICTION PAINT - GREEN (TYP)

R3-17

PROPOSED SHARED USE LANE THERMOPLASTIC
PAVEMENT MARKING OVER HIGH FRICTION PAINT (TYP)

CONTINUED ON
SHEET NO. 1

CONTINUED ON
SHEET NO. 3



EASTMAN'S LN

PROPOSED BOX WIDENING (VARIES WIDTH)
TO ACCOMMODATE 5' BIKE LANE

PROPOSED HIGH FRICTION PAINT - GREEN (TYP)

PROPOSED BOX WIDENING (VARIES WIDTH)
TO ACCOMMODATE 5' BIKE LANE

PROPOSED THERMOPLASTIC BICYCLE
LANE PAVEMENT MARKING (TYP)

EXTEND THE PAVEMENT WIDTH 1'-1.5' TO
ACCOMMODATE MINIMUM 5' BIKE LANE

PROPOSED BOX WIDENING (VARIES
WIDTH) TO ACCOMMODATE 5' BIKE LANE

R3-17

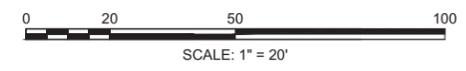
ADD W11-1—
ADD W16-1p

PROPOSED SHARED USE LANE THERMOPLASTIC
PAVEMENT MARKING OVER HIGH FRICTION PAINT (TYP)

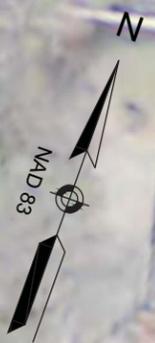
ADD W11-1—
ADD W16-1p

CONTINUED ON
SHEET NO. 2

CONTINUED ON
SHEET NO. 4



AMESBURY
MAIN STREET / EVANS PLACE
TRAFFIC CALMING PLAN
SHEET 4 OF 10



PROPOSED BICYCLE LANE THERMOPLASTIC PAVEMENT MARKING (TYP)

PROPOSED HIGH FRICTION PAINT (TYP)

PROPOSED BOX WIDENING (VARIES WIDTH) TO ACCOMMODATE 5' BIKE LANE

PROPOSED THERMOPLASTIC BICYCLE LANE PAVEMENT MARKING (TYP)

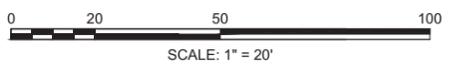
PROPOSED HIGH FRICTION PAINT - GREEN (TYP)

R3-17

PROPOSED SHARED USE LANE THERMOPLASTIC PAVEMENT MARKING OVER HIGH FRICTION PAINT (TYP)

CONTINUED ON SHEET NO. 3

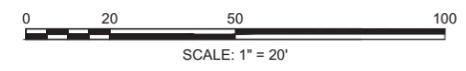
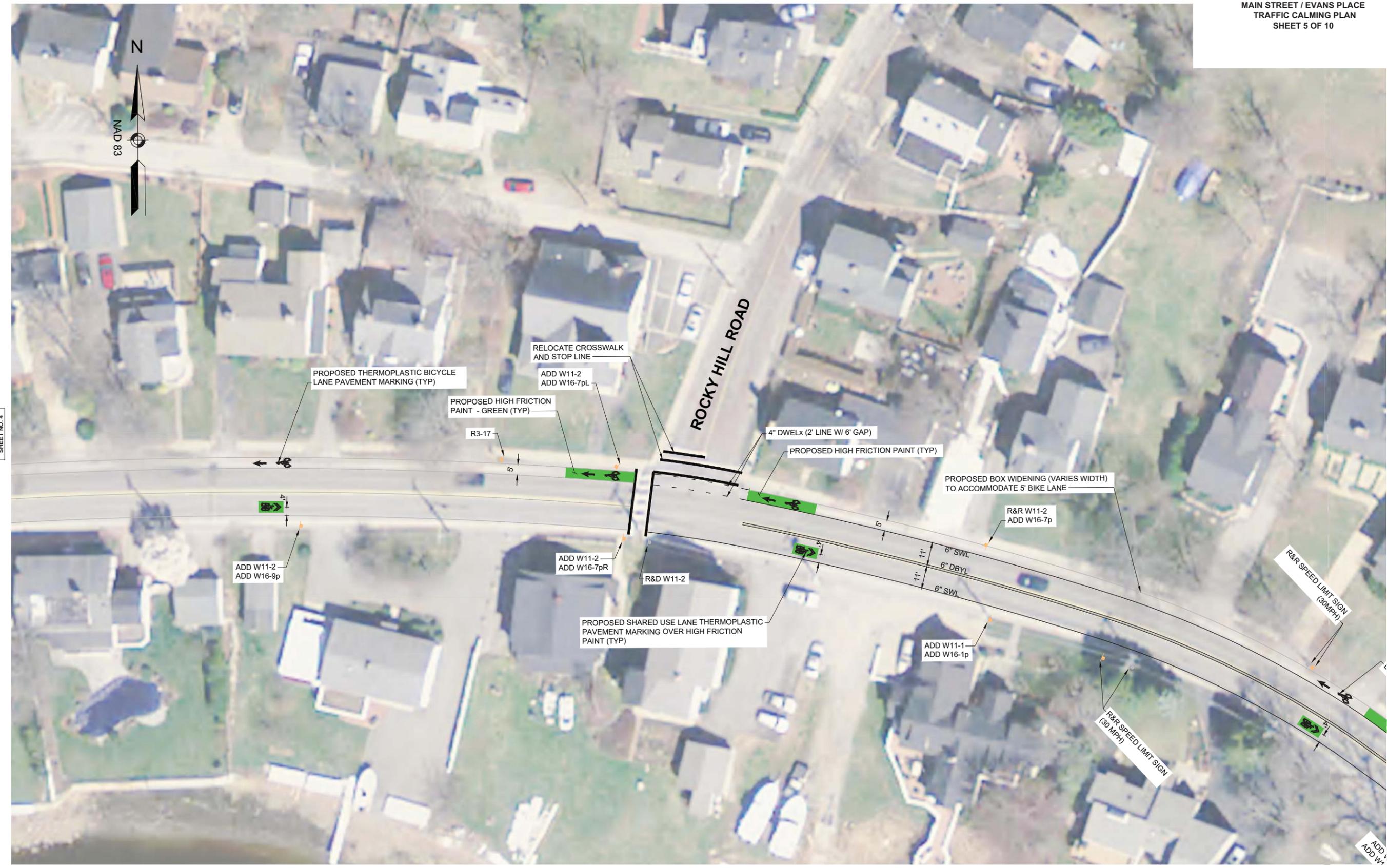
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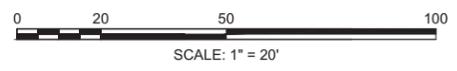
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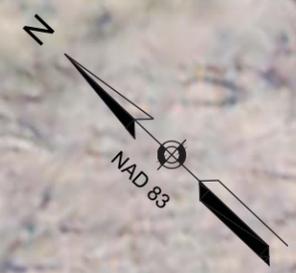


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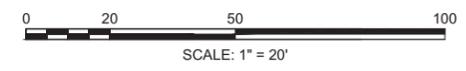


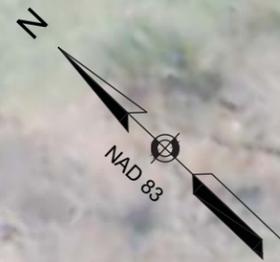
AMESBURY
 MAIN STREET / EVANS PLACE
 TRAFFIC CALMING PLAN
 SHEET 7 OF 10



CONTINUED ON
 SHEET NO. 6

CONTINUED ON
 SHEET NO. 8





CRUM HILL ROAD

PROPOSED HIGH FRICTION PAINT - GREEN (TYP)

PROPOSED BOX WIDENING (VARIES WIDTH) TO ACCOMMODATE 5' BIKE LANE

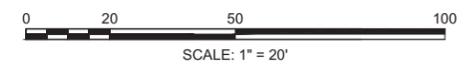
PROPOSED THERMOPLASTIC BICYCLE LANE PAVEMENT MARKING (TYP)

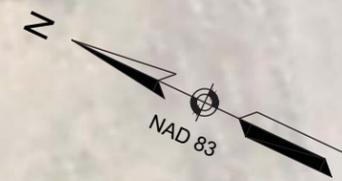
PROPOSED SHARED USE LANE THERMOPLASTIC PAVEMENT MARKING OVER HIGH FRICTION PAINT (TYP)

R&R SPEED LIMIT SIGN (30MPH)

CONTINUED ON SHEET NO. 7

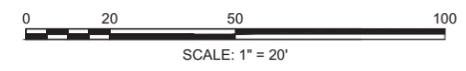
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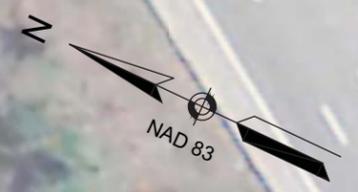




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CONTINUED ON
 SHEET NO. 10





CONTINUED ON
SHEET NO. 9



PROPOSED THERMOPLASTIC BICYCLE
LANE PAVEMENT MARKING (TYP)

PROPOSED HIGH FRICTION PAINT - GREEN (TYP)

R&D W11-2

ADD W11-2
ADD W16-7pL

R3-17

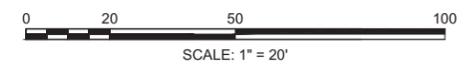
5'

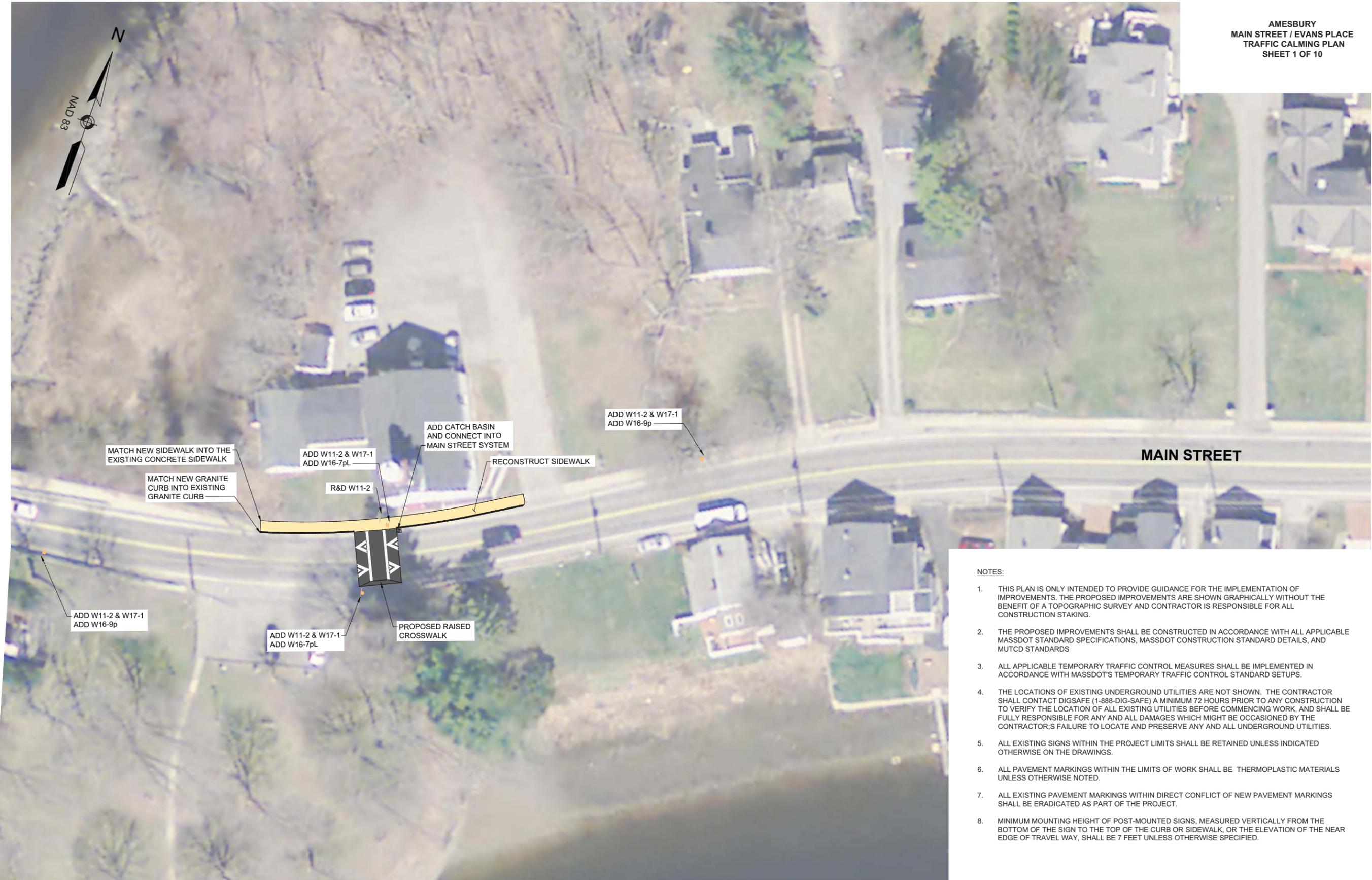
ADD W11-2
ADD W16-p

R3-17
R3-17bP

ADD W11-2
ADD W16-7pL

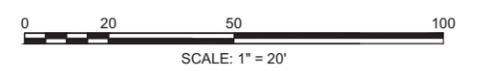
R&D W11-2





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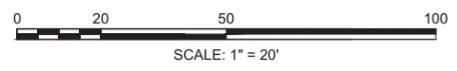


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SHEET NO. 1

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SHEET NO. 3





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SHEET NO. 2

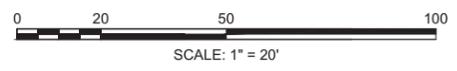
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0 20 50 100
SCALE: 1" = 20'



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SHEET NO. 3

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SHEET NO. 5





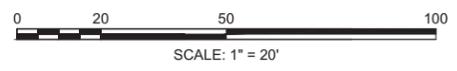
ANDREWS LN

ROCKY HILL ROAD

MAIN STREET

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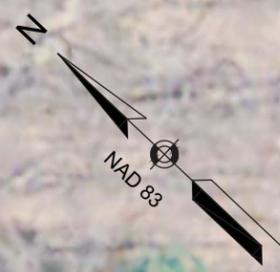
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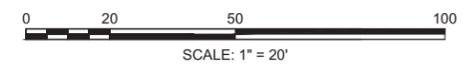


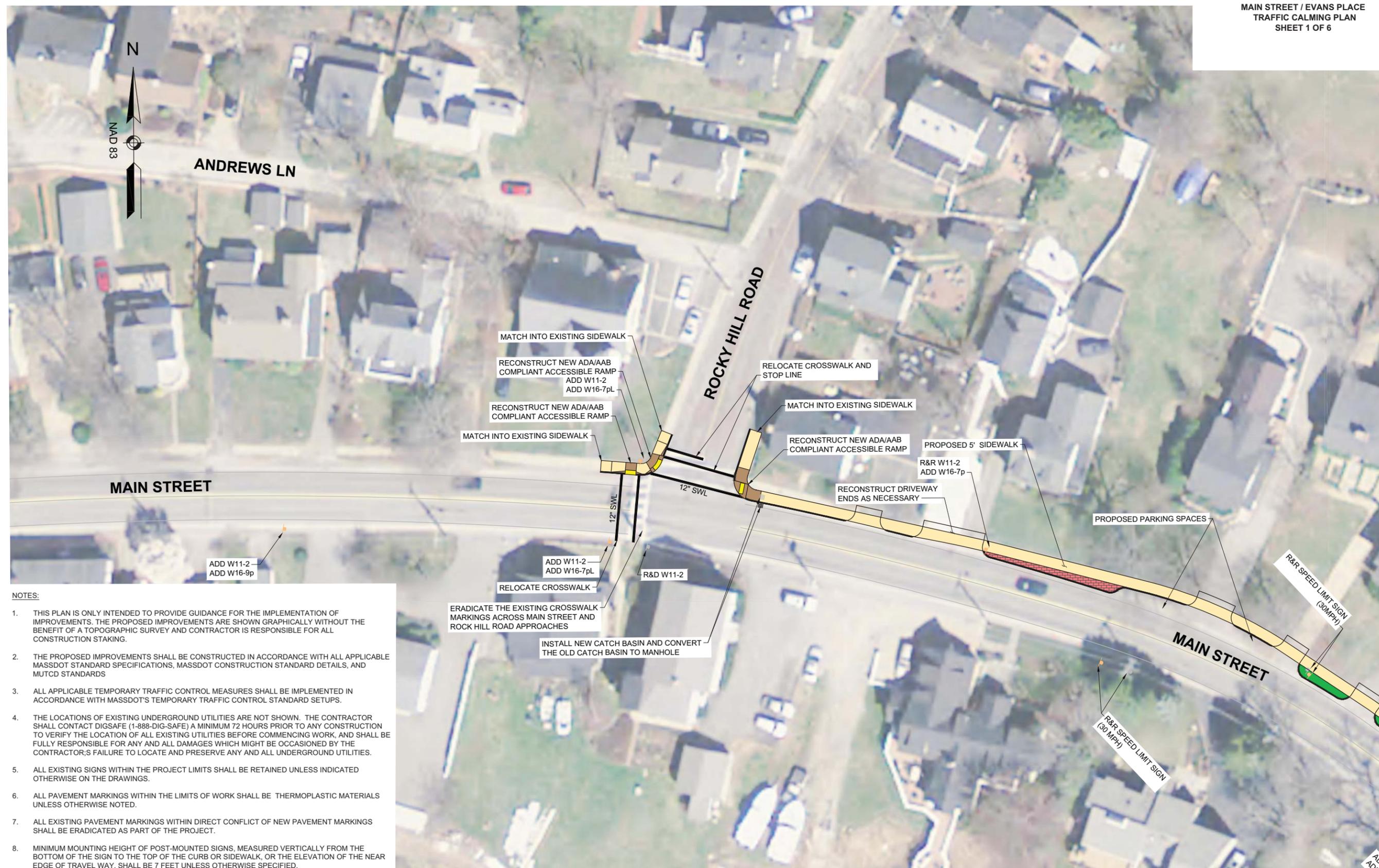
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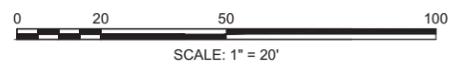


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SHEET NO. 6





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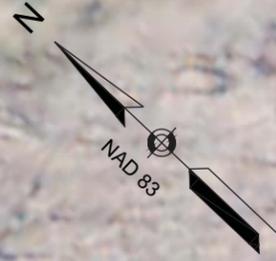
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ADD



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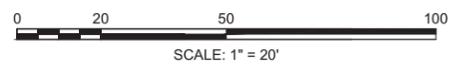
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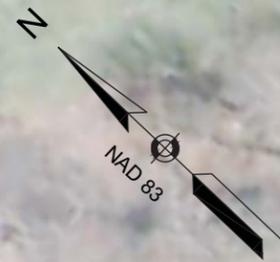
AMESBURY
 MAIN STREET / EVANS PLACE
 TRAFFIC CALMING PLAN
 SHEET 3 OF 6



CONTINUED ON
 SHEET NO. 2

CONTINUED ON
 SHEET NO. 4





CRUM HILL ROAD

CONTINUED ON
SHEET NO. 3

CONTINUED ON
SHEET NO. 5

ADD W11-2
ADD W16-9p

PROPOSED BOX WIDENING IF
NECESSARY (VARIES WIDTH) TO
ACCOMMODATE THE 5' SIDEWALK

RECONSTRUCT DRIVEWAY
ENDS AS NECESSARY

PROPOSED 5' SIDEWALK

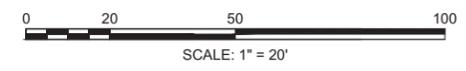
PROPOSED GRANITE CURB

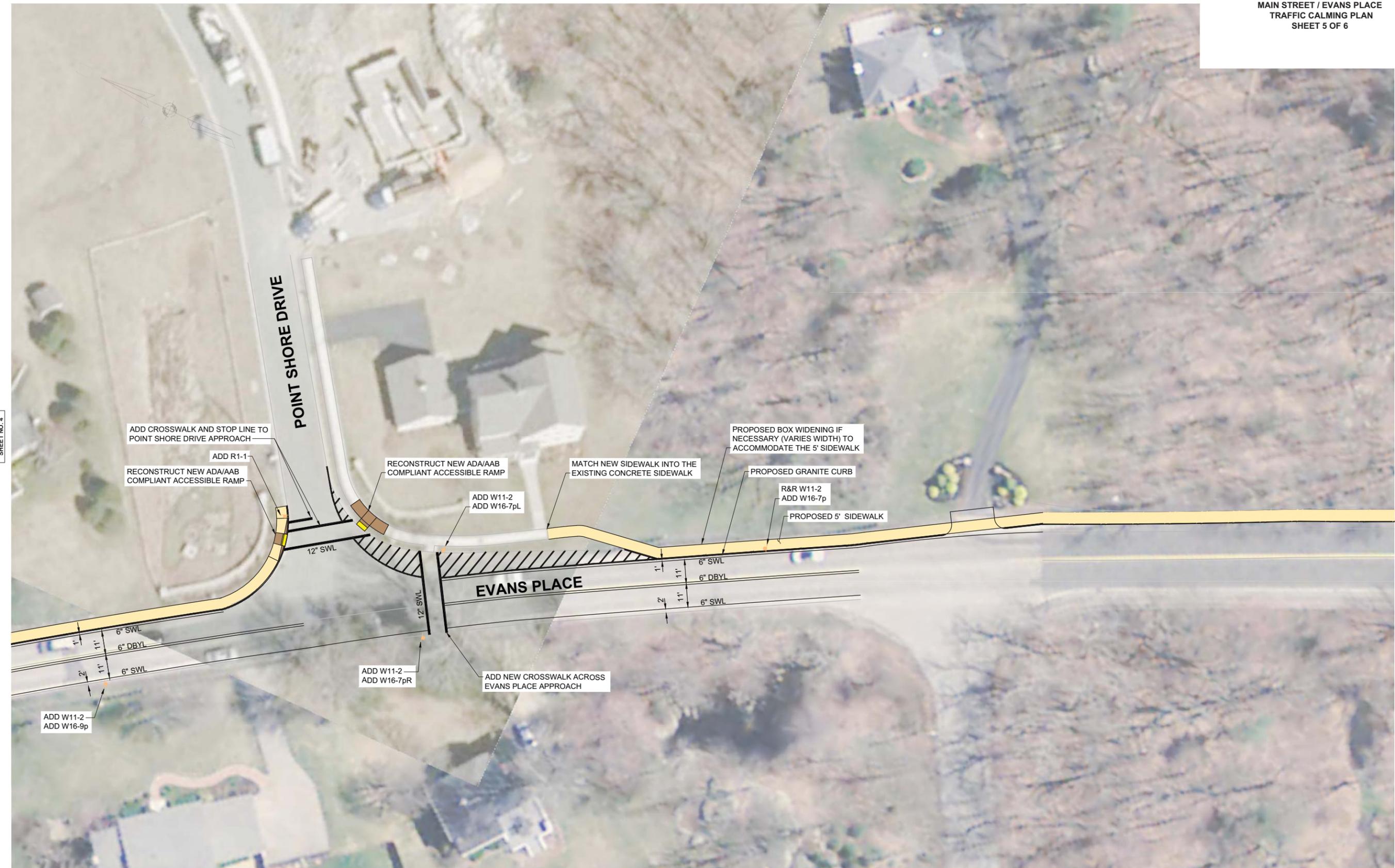
INSTALL NEW CATCH BASIN
AND CONVERT THE OLD
CATCH BASIN TO MANHOLE

ADD W11-2
ADD W16-9p

1'
11"
6" SWL
6" DBYL
1'
11"
6" SWL

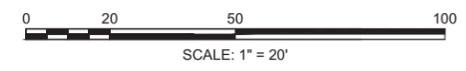
1'
11"
6" SWL
6" DBYL
2'
11"
6" SWL



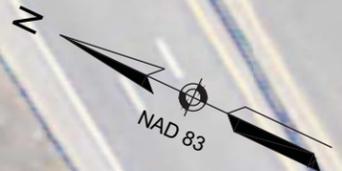


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 SHEET NO. 4

CONTINUED ON
 SHEET NO. 6



AMESBURY
MAIN STREET / EVANS PLACE
TRAFFIC CALMING PLAN
SHEET 6 OF 6



CONTINUED ON
SHEET NO. 5

PROPOSED 5' SIDEWALK
PROPOSED GRANITE CURB
MATCH NEW SIDEWALK INTO THE
EXISTING CONCRETE SIDEWALK

R&D W11-2
ADD W11-2
ADD W16-7pL

ADD W11-2
ADD W16-p

ADD W11-2
ADD W16-7pL
R&D W11-2

