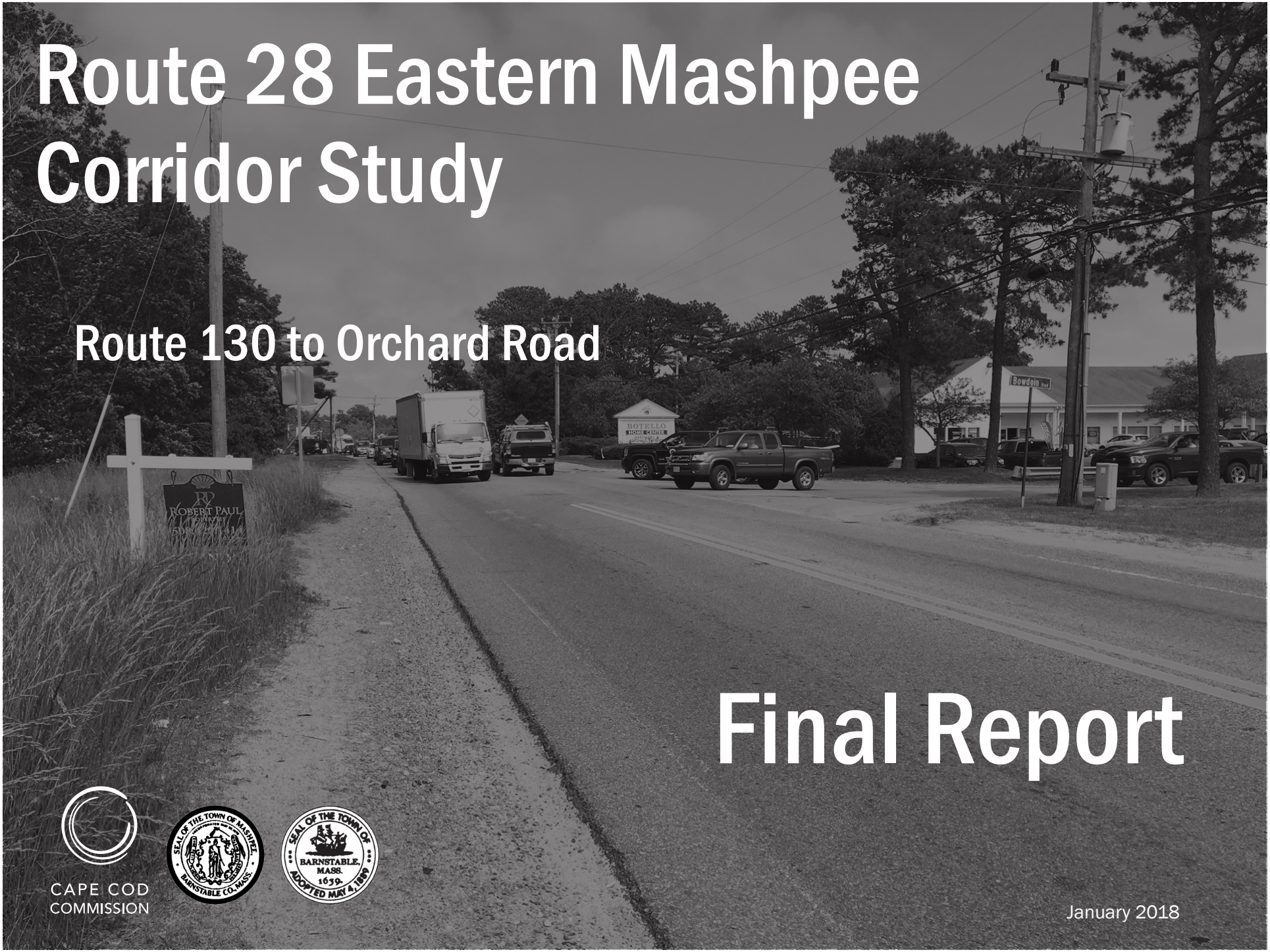
Route 28 Eastern Mashpee Corridor Study

Route 130 to Orchard Road



Final Report

CAPE COD COMMISSION

January 2018

PROJECT TEAM

CAPE COD COMMISSION PROJECT TEAM

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PROJECT FUNDING

This project was funded by the Massachusetts Department of Transportation and the Federal Highway Administration under the Federal Fiscal Year 2017 Unified Planning Work Program.

Contents

EXECUTIVE SUMMARY

Route 28 is a major regional east-west transportation corridor on Cape Cod that is owned and maintained by the Massachusetts Department of Transportation (MassDOT). The portion of Route 28 from Route 130 to Orchard Road connects parts of Mashpee, including the popular Mashpee Commons, with Cotuit and parts of Barnstable. The congestion and safety issues experienced on this section of roadway made it a priority for investigation.

This portion of Route 28 is often congested, with particularly significant back-ups experienced during summer months. This congestion impedes regional travel as well as access to local businesses and residences.

Additionally, safety issues exist at many locations along the corridor, with more than 150 crashes occurring along this stretch of road over a three-year period. Accommodation for all road users, including motorists, pedestrians, bicyclists, and transit users, is also of concern as this is a heavily traveled corridor for non-motorized users accessing jobs and retail destinations from their neighborhoods.

The purpose of this study is to develop alternatives that will provide safe and convenient access within the study area for all users of the roadway system including pedestrians, bicyclists, and motorists. Town of Barnstable, Town of Mashpee, and Cape Cod Commission staff worked with community members at public meetings to conduct a detailed analysis of existing conditions to identify issues along the corridor. The information learned through this process was used to develop a host of potential improvement options for the corridor. Feedback from the public and a technical review by staff identified key recommendations, shown in the table on the next page.

TIME FRAMES FOR RECOMMENDATIONS	ESTIMATED COSTS FOR RECOMMENDATIONS
Short-term: <1 year	$: <$10,000
Mid-term: 1-5 Years	$$: $10,000-$50,000
Long-term: >5 years	$$$: >$50,000

KEY RECOMMENDATIONS	TIME FRAME	COST
CORRIDOR-WIDE		
Conduct a speed study	Short-term	$
PEDESTRIAN ACCOMMODATIONS		
Add rectangular rapid flash beacon (RRFB) at existing crosswalk	Mid-term	$$
Add a crosswalk with an RRFB near Cape Drive	Mid-term	$$
Add a sidewalk along the corridor	Long-term	$$$
BICYCLIST ACCOMMODATIONS		
Provide signed alternate routes for bicyclists	Short-term	$
Install a multi-use path along the corridor	Long-term	$$$
TRANSIT ACCOMMODATIONS		
Review bus stop location	Short-term	$
Upgrade bus stop with a bench or shelter	Mid-term	$$
Create bus pullouts on Route 28	Long-term	$$$
BOWDOIN ROAD		
Install a traffic signal or roundabout at Bowdoin Road	Long-term	$$$ ($3+ million)
NOISY HOLE ROAD		
Install a right-turn lane for drivers exiting Noisy Hole Road	Long-term	$$$
Connect Noisy Hole Road with Route 130 to the north	Long-term	$$$
SAMPSONS MILL ROAD		
Install signage and guardrail improvements at Sampsons Mill Road	Mid-term	$$
Regrade and realign the intersection of Sampsons Mill Road and Route 28	Long-term	$$$
ORCHARD ROAD/ASHERS PATH EAST		
Review signal timing at Orchard Road/Ashers Path East	Short-term	$
Trim vegetation around the intersection at Orchard Road/Ashers Path East	Short-term	$
Install walk signals with countdown timers on traffic signal	Long-term	$$

Introduction

1

Route 28 is a major regional east-west transportation corridor on Cape Cod that is owned and maintained by the Massachusetts Department of Transportation (MassDOT). The portion of Route 28 from Route 130 to Orchard Road connects parts of Mashpee, including the popular Mashpee Commons, with Cotuit and parts of Barnstable. The congestion and safety issues experienced on this section of roadway made it a priority for investigation.

The purpose of this study is to develop alternatives that will provide safe and convenient access within the study area for all users of the roadway system including pedestrians, bicyclists, and motorists.
With the benefit of active participation by members of the community, Town and Commission staff conducted a detailed analysis of existing conditions to identify issues along the corridor. The information learned through this process was used to develop a host of potential improvement options for the corridor.

STUDY AREA

As shown to the right, the study area is approximately 1.3 miles long, stretching west from Route 130 to Orchard Road. The study area is located in two towns: Barnstable contains the eastern portion of Route 28, as well as portions of the study area to the north and south of Route 28. The western portion of the study area and much of the study area south of Route 28 is in the Town of Mashpee.

STUDY GOALS

- Improve safety
- Reduce congestion
- Improve accommodations for all users

This study aims to develop alternatives that will provide safe and convenient access within the study area for all users of the roadway system including pedestrians, bicyclists, and motorists.

PREVIOUS AND ONGOING STUDIES AND PLANS

To better understand the issues and opportunities for the study area, Commission staff reviewed the following studies and plans:

- Route 28 Cotuit Corridor Study – Santuit-Newtown Road to Route 130 (Cape Cod Commission, February 2017)
- Mashpee RESET Report – Non-residential zoned areas (Cape Cod Commission, January 2016)
- Mashpee Wampanoag Tribe of Massachusetts Road Safety Audit – Various Locations (Eastern Tribal Technical Assistance Program at Michigan Technological University, May 2016)
- Mashpee Local Comprehensive Plan (1998)

STUDY PROCESS

This study began with the development of a project scope in the spring of 2016 for consideration of funding under the Cape Cod Unified Planning Work Program for Federal Fiscal Year 2017. In August 2016, MassDOT approved the project scope and funding. Beginning in late spring and early summer of 2017, Commission staff kicked off the project with meetings with staff from the towns of Barnstable and Mashpee. Commission staff then conducted an existing conditions analysis for the study area. A first public meeting, a listening session, gathered public input on issues and opportunities in the corridor. With the information gathered from the Listening Session in mind, Commission and Town staff worked to identify improvements for the corridor and then held a second public meeting to present and gather feedback on these potential improvements. Following this meeting, Commission and Town staff drafted this report of recommendations and the study process.

OUTREACH

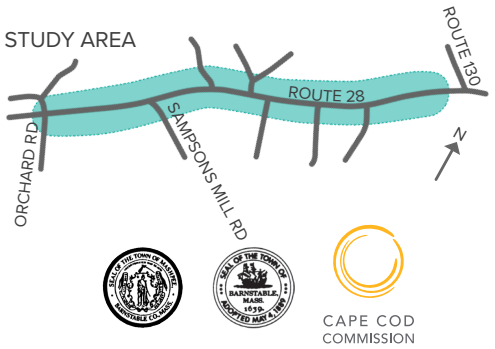
The project included a public participation plan that sought to gather input from community stakeholders and the public to establish a vision for the corridor and to solicit feedback on potential improvement alternatives. This public process included two public meetings. The first being a listening session to identify issues and opportunities in the corridor and the second to gather feedback on potential improvements. Commission staff conducted a targeted outreach campaign to create stakeholder awareness of the study and its meetings, and to gather public ideas and feedback. This included posting flyers about the meetings, sending postcards to residents in the area informing them of the study and the public meetings, and sending email updates about the project. The Commission also established a web page for the project where those interested could read more about the project and review project materials. The web page was also useful for those who could not attend the public meetings. Commission staff also spoke on the phone, in person, and via email with stakeholders that could not attend the meetings but wanted to provide comments and input on the project. To the right is the flyer for the project, part of the targeted outreach campaign.

ROUTE 28 EASTERN MASHPEE
ROUTE 130 TO ORCHARD ROAD
CORRIDOR STUDY PUBLIC MEETINGS

PUBLIC LISTENING SESSION
Wednesday, July 26, 2017 at 6:00 pm
Mashpee Public Library
64 Steeple Street, Mashpee, MA

PRESENTATION OF ALTERNATIVES
Wednesday, September 27, 2017 at 6:00 pm
Mashpee Public Library
64 Steeple Street, Mashpee, MA

What do you think would improve this area? The Town of Mashpee, Town of Barnstable, and the Cape Cod Commission want to hear your thoughts. Join us for two public meetings on this corridor. The first will be July 26 to understand the issues and opportunities **you observe** in this area. Based on the information from this meeting, improvement alternatives for the area will be developed and then presented for **your feedback** September 27.



For more information, please visit www.capecodcommission.org/Route28EasternMashpee or call 508.362.3828

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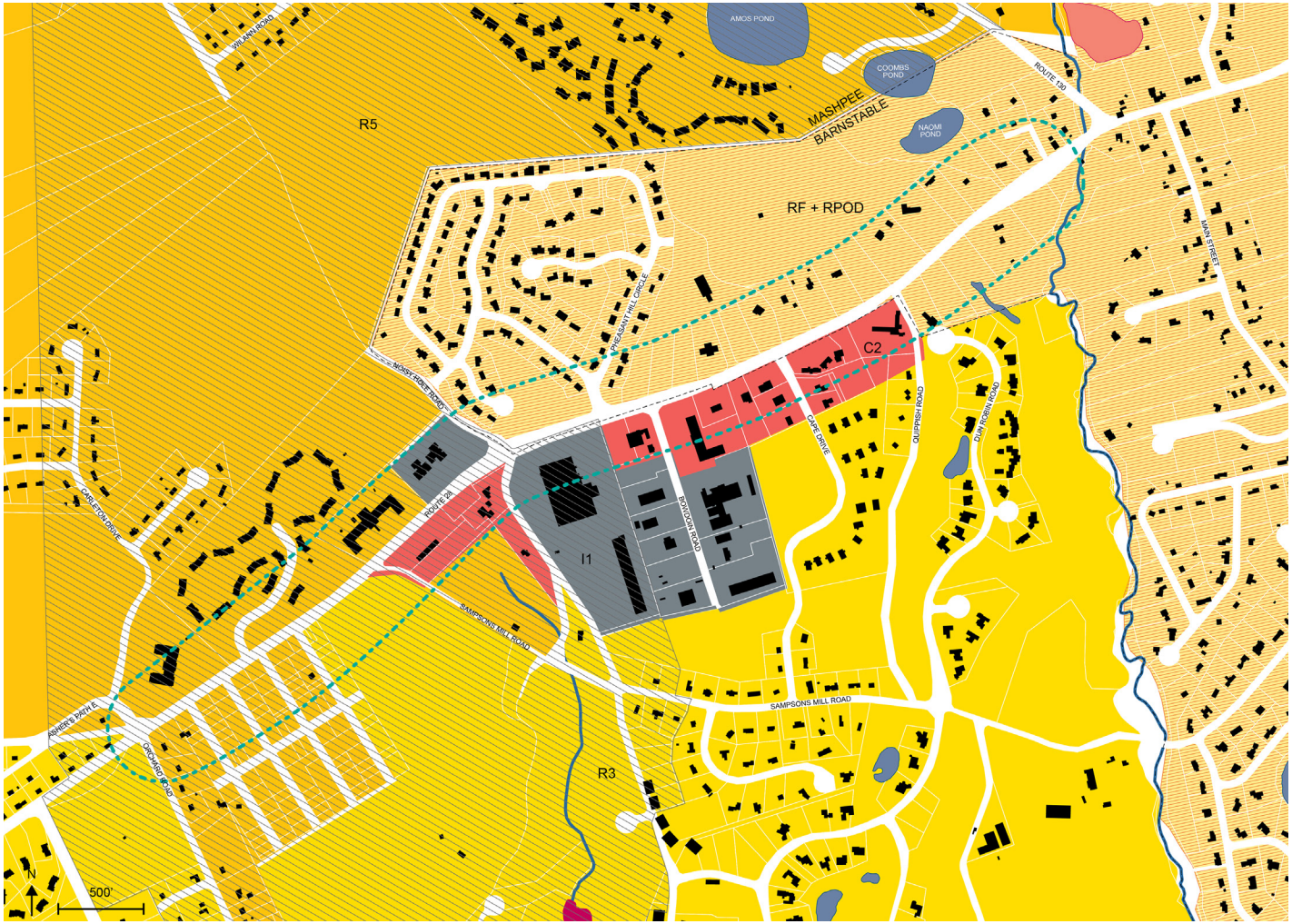
Existing Conditions

2

Commission staff began the study with an existing conditions analysis for the study area. During this analysis, staff reviewed the zoning, land use, bicycle and pedestrian accommodations, transit connections, traffic volumes, speed limits, and crash history for the study area.

ZONING

The study area contains a mix of residential, commercial, and industrial zones, with the surrounding area predominantly zoned residential. Most of the businesses in the area are located on parcels zoned for commercial or industrial uses. There are, however, some non-residential uses located within the RF and R5 residential zones on the northern side of Route 28. The Barnstable portion of the study area also lies within the Resource Protection Overlay District, which provides regulations for development to protect and improve water quality. Much of the area inside and outside of the study area in Mashpee is in the Groundwater Protection Overlay District, which also provides additional regulations to protect water quality and supplies.



ZONING

MASHPEE ZONING
- C-2 COMMERCIAL
- I-1 INDUSTRIAL
- R-3 RESIDENCE
- R-5 RESIDENCE
- GROUNDWATER PROTECTION OVERLAY DISTRICT

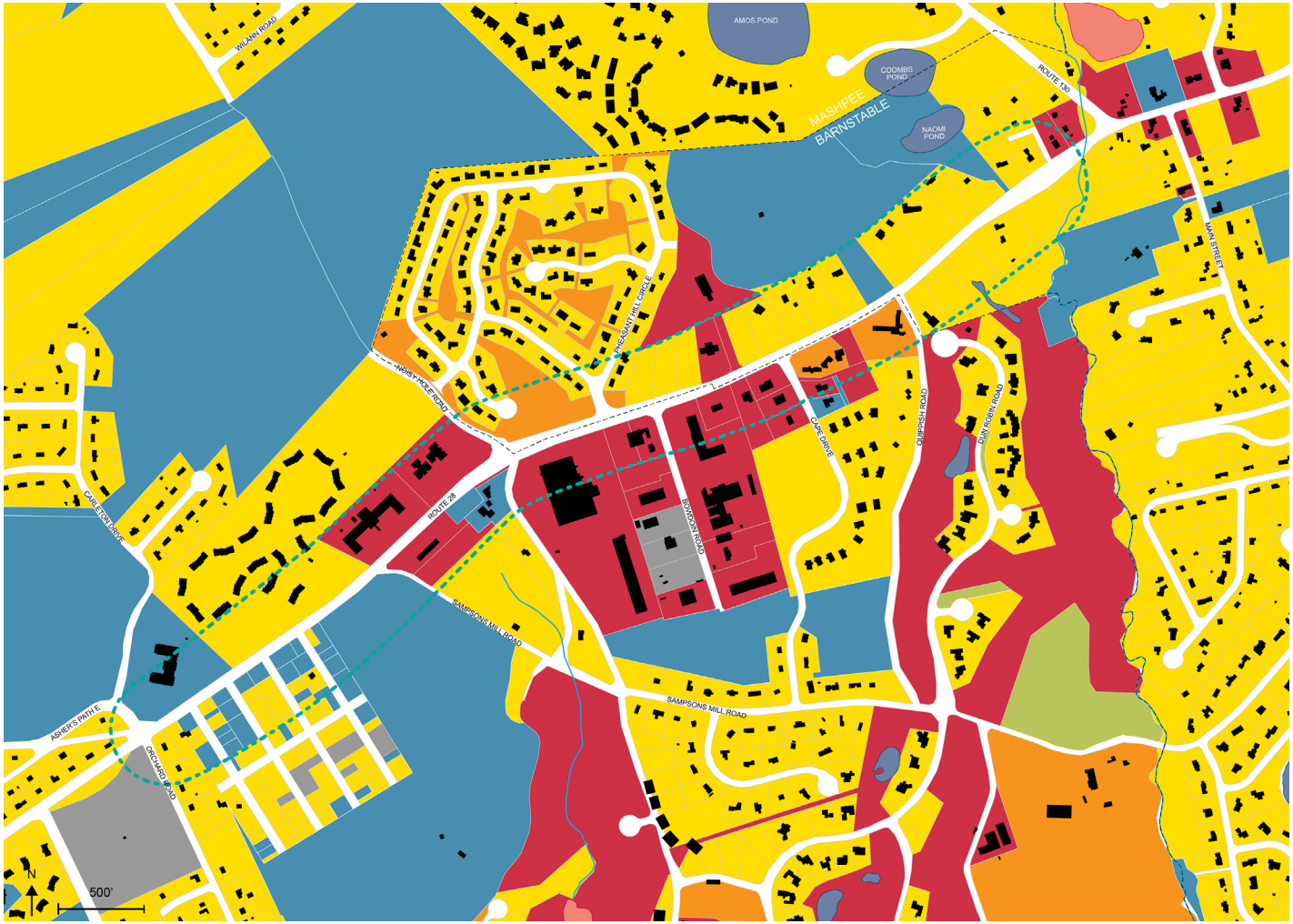
BARNSTABLE ZONING
- RESIDENCE F
- RESOURCE PROTECTION OVERLAY DISTRICT

- CRANBERRY BOG
- RIVER
- POND
- STUDY AREA

Data: Parcel and zoning data from a Cape Cod Commission data set, which uses town assessor data; ponds and rivers also from a Cape Cod Commission data set and Mass DEP; structures data from Mass GIS; road data from MassDOT.

LAND USE

The corridor and surrounding area contain a mix of primarily residential and commercial uses. Residential uses comprise much of the adjacent and nearby area, with some exempt or government-owned properties interspersed. Commercial properties are concentrated between Cape Drive and Sampsons Mill Road within the study area, especially on the South side of the roadway. Larger properties shown as commercial to the South of the study area are in fact part of Willowbend Golf Course and so while they may serve a commercial purpose, they are primarily open spaces. There are also a few industrial uses along Bowdoin Road.



EXISTING LAND USE

- RESIDENTIAL
- COMMERCIAL
- MULTIPLE USES
- OPEN SPACE
- INDUSTRIAL
- EXEMPT
- CRANBERRY BOG
- RIVER
- POND
- STUDY AREA

Data: Parcel data from a regional Cape Cod Commission data set, which uses town assessor data; ponds and rivers also from a Cape Cod Commission data set and Mass DEP; road data from MassDOT; structures data from Mass GIS; land use from Mass GIS.

OPEN SPACE, WETLANDS, AND HISTORIC PROPERTIES

There are wetlands identified in the Sampsons Mill Road area and a couple of areas of protected open space within the study area. Just outside of the study area to the north and south, however, are larger wetland areas and tracts of open space, including the Santuit River to the south, the Quaker Run River west of Noisy Hole Road and near Sampsons Mill Road, and some ponds to the north. Willowbend Golf Course to the south provides large, but unprotected, areas of open space. East of the study area is the Cotuit National Register Historic District, which contains several preserved historic buildings. Within the study area, however, there are only two historic properties identified by the Massachusetts Historical Commission in its Massachusetts Cultural Resource Information System (MACRIS) inventory.

OPEN SPACE, WETLANDS, AND HISTORIC PROPERTIES

OPEN SPACE LEVEL OF PROTECTION
- IN PERPETUITY
- NONE

WETLANDS
- 100' WETLAND BUFFER
- SHALLOW MARSH MEADOW OR FEN
- SHRUB SWAMP
- WOODED SWAMP CONIFEROUS
- WOODED SWAMP DECIDUOUS
- WOODED SWAMP MIXED TREES

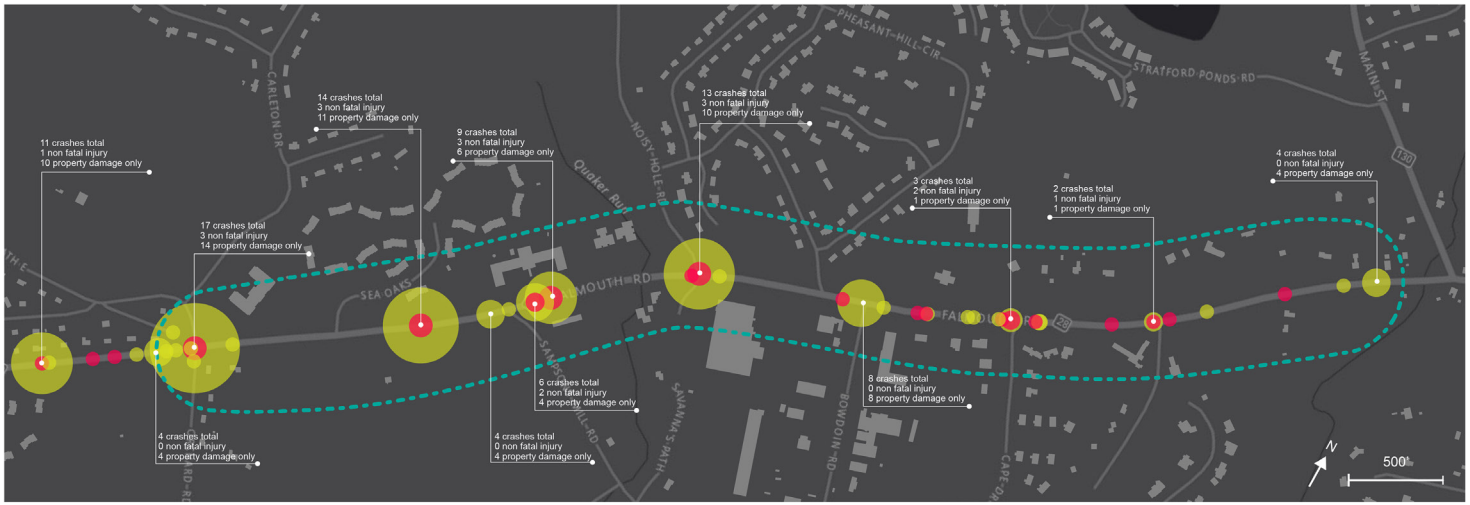
HISTORIC PROPERTIES
- BUILDING OF HISTORICAL SIGNIFICANCE (IN MASSACHUSETTS HISTORICAL COMMISSION MACRIS INVENTORY)

- CRANBERRY BOG
- RIVER
- POND
- STUDY AREA

Data: Parcel data from a regional Cape Cod Commission data set, which uses town assessor data; ponds and rivers also from a Cape Cod Commission data set; road data from MassDOT; structures data from Mass GIS; wetlands and open space data from Mass DEP; historical data from MHC MACRIS; aerial photo from Cape Cod Commission.

CRASHES AND SPEED LIMITS

Crashes reported over the most recently available three-year period are shown below. Crashes occur throughout the corridor though the intersections of Route 28 and Bowdoin Road, Noisy Hole Road, and Orchard Road stand out as particularly problematic. Identified crash clusters also exist on Route 28 east of the Sea Oaks development and at a number of commercial driveways east of Sampsons Mill Road. The majority of crashes were either rear-end crashes related to traffic congestion or angle crashes involving left turns. Almost the entire section of Route 28 in the study area has a 50-mph speed limit, the exception being a portion at the eastern end of the study area, near Route 130, which has a 35-mph speed limit.



CRASHES (2012-2014)

- PROPERTY DAMAGE ONLY CRASH
- NON FATAL INJURY CRASH
- STUDY AREA
- 1 CRASH
- 5 CRASHES
- 10 CRASHES
- 15 CRASHES

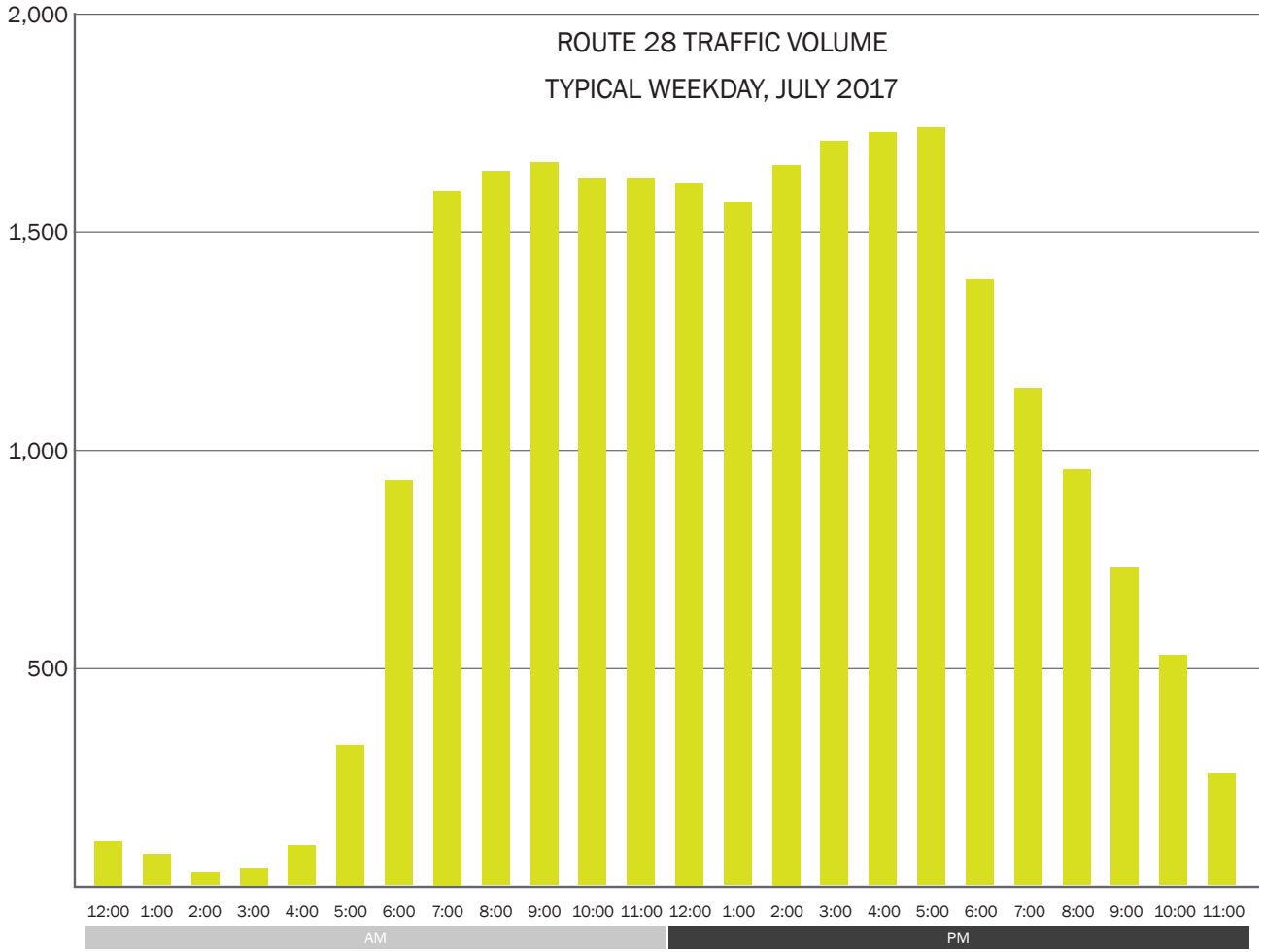
SPEED LIMITS

- 25 MPH
- 35 MPH
- 40 MPH
- 50 MPH
- STUDY AREA

Data: Structures data from Mass GIS; crash data from MassDOT; speed limit data from MassDOT. Base map: ESRI, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

TRAFFIC VOLUMES

Commission staff measured traffic volumes on major roads and at major intersections within the study area. Route 28 averages 26,000 – 28,000 vehicle trips per day on the roadway over the months of July and August. Traffic volumes recorded on Route 28 on a typical weekday in July of 2017 are shown to the right. Detailed traffic volume data is included in Appendix A.



PEDESTRIAN, BICYCLIST, AND TRANSIT ACCOMMODATIONS

The study area is void of any bicyclist and pedestrian accommodations within its bounds. Despite the lack of facilities, people do walk and bike along the corridor. Commission staff observed this during site visits to the study area. The shoulders of the road are not wide enough to accommodate bicyclists and cars often travel in the shoulder area to pass cars stopped to make left turns, creating an unsafe environment for bicyclists who do ride on the road. West of Route 130, there are some sidewalks, and there is a multi-use path further north on Route 130. There is one bus stop in the area at Cape Drive. The Cape Cod Regional Transit Authority Sealine runs from Hyannis to Falmouth along this portion of Route 28.

SITE VISITS

In addition to researching existing data, maps, and plans for the area, Commission staff conducted site visits of the study area to better understand how the traffic functions, what it is like to be a pedestrian in the area, and to gain more insight into the issues and opportunities of the study area. Staff noticed that although issues certainly exist due to congestion, traffic, and lack of pedestrian and bicyclist accommodations, the businesses and nearby residences provide good activity for the area, which could be enhanced.

MAKING LEFT TURNS IS DIFFICULT THROUGHOUT THE CORRIDOR

THIS IS A HEAVILY TRAVELED CORRIDOR CONNECTING MASHPEE AND BARNSTABLE


CARS FREQUENTLY GO OFF THE ROAD AND AROUND VEHICLES WAITING TO MAKE LEFT TURNS, ERODING THE SHOULDER


A CROSSWALK EXISTS BUT IT IS NOT VERY VISIBLE AND IS NOT CONNECTED TO ANY SIDEWALKS

Alternatives Development

3

The analysis of existing conditions supported a community-driven alternatives development process that began with a listening session, which was followed by a public review of the developed alternatives.

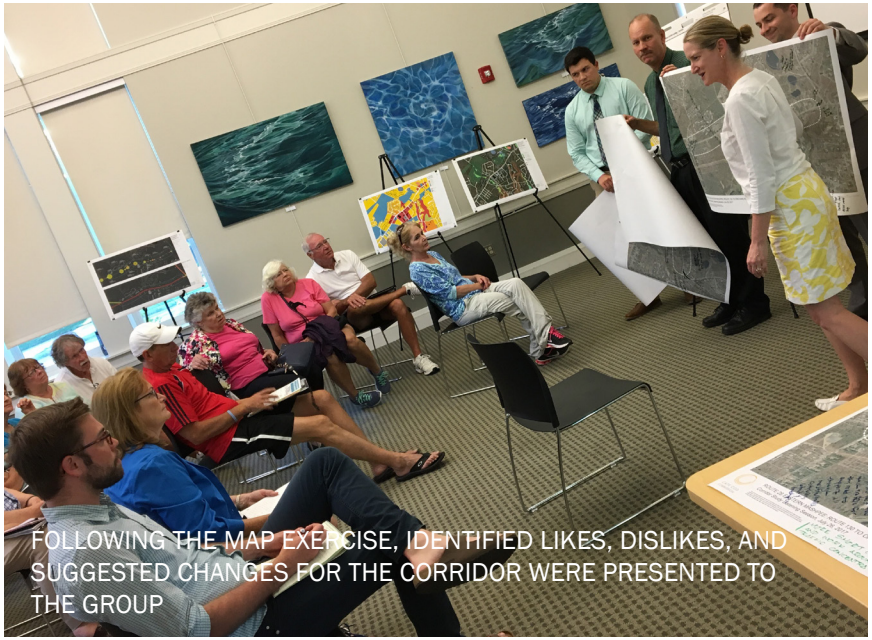
LISTENING SESSION

The listening session was held on July 26, 2017 at the Mashpee Public Library. Following a presentation to the audience about the study area, goals, and existing conditions, attendees identified what they liked, disliked, and wanted to see changed in the study area through an interactive map exercise.

The likes, dislikes, and suggested changes are listed on the next page followed by mapped likes, dislikes, and suggested changes from the map exercise. A full set of meeting notes, including a copy of the presentation, are included as Appendix B.

STAKEHOLDERS IDENTIFIED WHAT THEY LIKED, DISLIKED, AND WANTED TO SEE CHANGED IN THE AREA

STEVEN TUPPER PRESENTED AN OVERVIEW OF THE PROJECT AND EXISTING CONDITIONS OF THE AREA



FOLLOWING THE MAP EXERCISE, IDENTIFIED LIKES, DISLIKES, AND SUGGESTED CHANGES FOR THE CORRIDOR WERE PRESENTED TO THE GROUP

LIKES

- Businesses, shops, and gym are great
- Good gym
- Good businesses
- Very popular businesses
- Pheasant Hill Circle to Noisy Hole Road workaround
- Curb cut into the gym is good
- Good access to many retailers
- New light at Orchard Road is great
- Access to dump from Orchard Road
- Access to village from Orchard Road
- Access to village along Sampsons Mill Road, avoiding Route 28 traffic
- Access from Sampsons Mill Road to business plaza on Route 28
- Use of access road to Stratford Ponds

DISLIKES

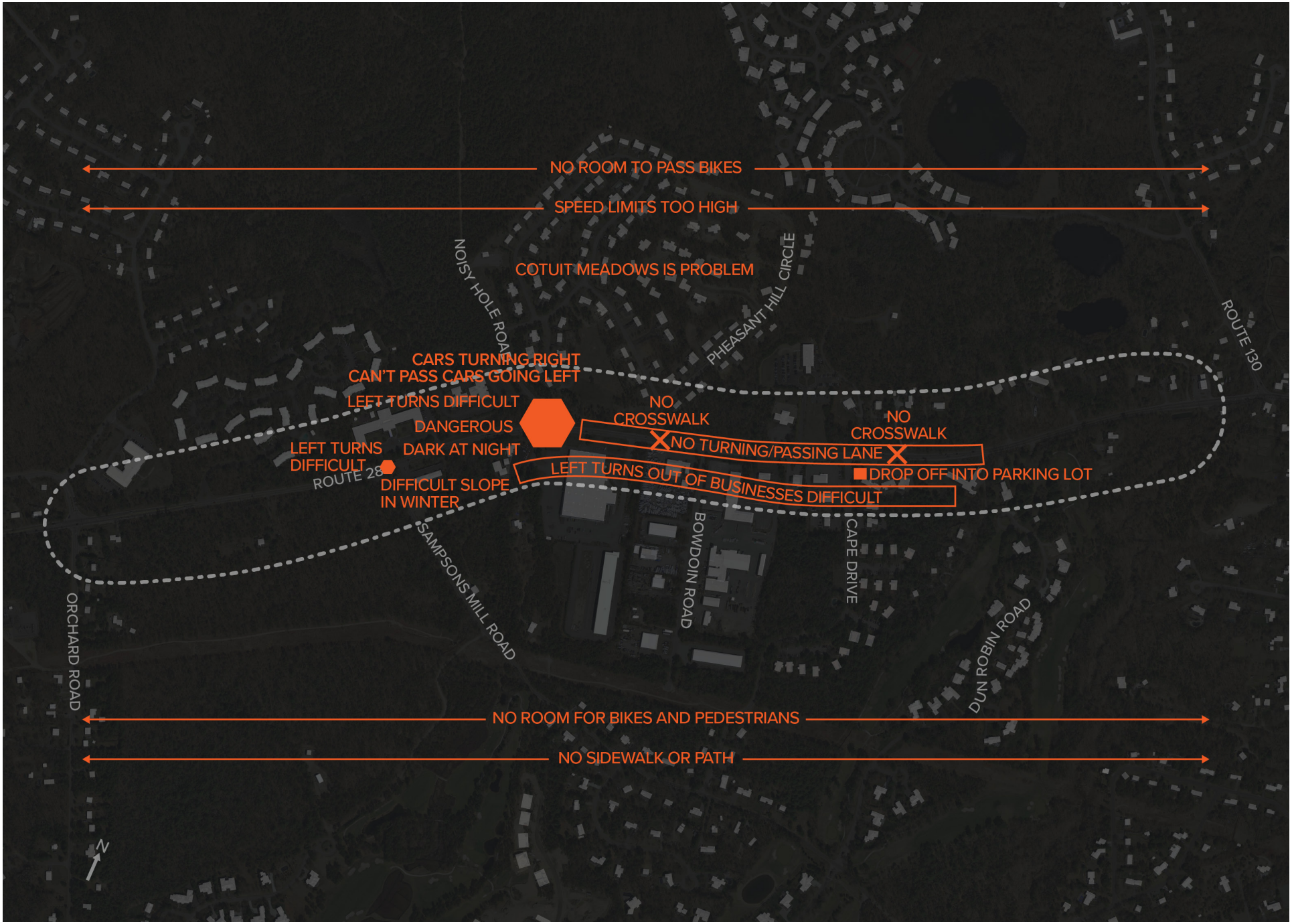
- No room for bikes and pedestrians
- Cannot cross Route 28 to get to shops and businesses
- Not safe for bikes
- Lack of sidewalks/paths
- Too hard to take a left at Noisy Hole Road and Route 28
- Noisy Hole Road and Route 28 is dangerous intersection
- Cars going right can't pass cars turning left at the Noisy Hole Road and Route 28 intersection
- Dark at night at Noisy Hole Road and Route 28
- No crosswalks
- Bowdoin Road and Route 28 intersection is a problem
- Steep drop into the parking lot east of Cape Drive
- Cars cannot pass at Quippish Road and Route 28 intersection
- No turning lane near commercial area
- Cars turning left into Pheasant Hill Circle
- Speed limits are too high
- Hard to turn left out of Sampsons Mill Road
- Hard to turn left out of businesses

SUGGESTED CHANGES

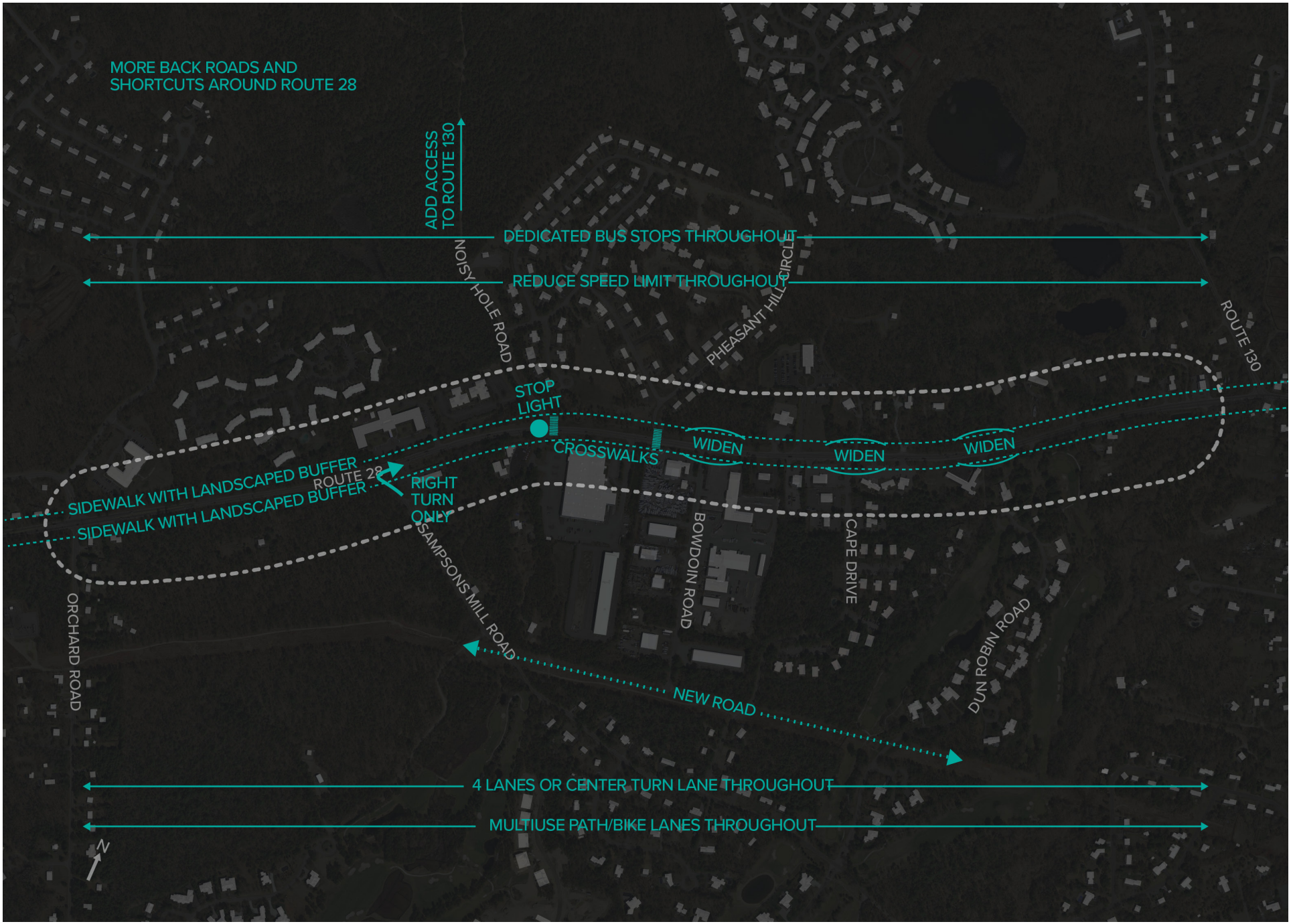
- Right turn only out of Sampsons Mill Road
- Center turn lane near businesses
- More back roads and other options to reduce traffic on this road
- Stoplight at Noisy Hole Road and Route 28 (motion activated)
- Double the fines for speeding
- Improve and widen shoulders near businesses
- Add access to Route 130 from Noisy Hole Road
- Sidewalk with landscaped buffer to slow traffic
- Add multi-use path or bike lanes and sidewalks on both sides along Route 28
- Reduce the speed limit
- Add crosswalk at Pheasant Hill Circle
- Add crosswalk to businesses
- Dedicated bus stops along corridor
- Sync the traffic lights

WHAT PEOPLE LIKE ABOUT THE CORRIDOR

WHAT PEOPLE DISLIKE ABOUT THE CORRIDOR



SUGGESTED CHANGES FOR THE CORRIDOR



ALTERNATIVES DEVELOPMENT

Based on the comments received at the listening session and a technical review of the issues in the corridor, Commission and Town staff developed an initial list of potential improvements for the corridor. Commission and Town staff then refined the initial list of potential alternatives and removed any that further investigation showed were technically infeasible or presented significant impacts that outweighed the potential benefits.

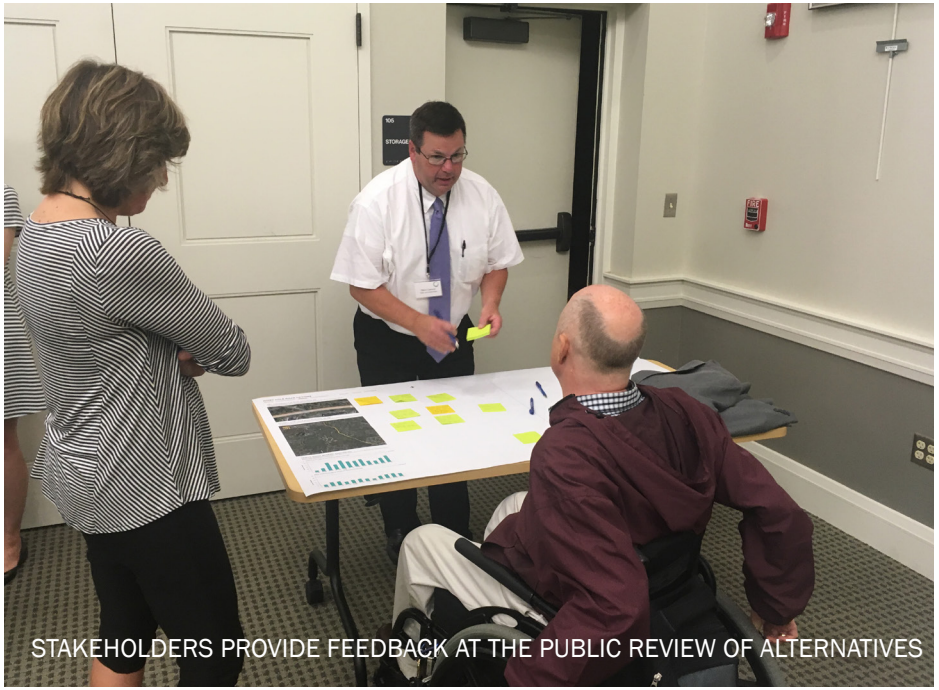
PUBLIC REVIEW OF ALTERNATIVES

The second public meeting for the project was September 27, 2017, again at the Mashpee Public Library. Commission staff presented the alternatives considered and carried forward after a brief project overview. Attendees then provided comments and feedback on each alternative by visiting five tables in the room. Each table had a different intersection or issue area for the corridor broken out as follows: Sampsons Mill Road and Orchard Road intersections, Noisy Hole Road intersection, Bowdoin Road and Cape Drive intersections, Pedestrian Accommodations, and Bicyclist and Transit Accommodations.

At each table, attendees wrote down feedback and comments for each alternative and put their feedback in a + or - column to show whether they generally supported the idea or not.

ALTERNATIVES NOT CARRIED FORWARD FOR FURTHER INVESTIGATION	REASON
Restrict left turns out of Sampsons Mill Road onto Route 28	Without a good alternate route for travelers looking to make left turns, this is not recommended. Though the Orchard Road traffic signal is an alternative for many travelers, a turn restriction would present an unacceptably long detour for residents on Sampsons Mill Road.
Install a traffic signal or roundabout at Noisy Hole Road	A traffic signal or roundabout is not warranted at this intersection based on current traffic volumes (see graph on page 29).
Install a left turn pocket on Route 28 at Noisy Hole Road	This treatment would not improve the ability of drivers to get out of Noisy Hole Road and would likely increase vehicle speeds on Route 28.
Install a traffic signal or roundabout at Cape Drive	A traffic signal or roundabout is not warranted at this intersection based on current traffic volumes (see traffic volumes in Appendix A).
Install two-way center left turn lanes throughout the corridor	This treatment is not recommended on high speed roadways (45 mph or greater) or on roadways that carry over 17,500 or more vehicles per day; this section of Route 28 exceeds both thresholds.
Widening of the entire corridor to accommodate four vehicular travel lanes (two in each direction)	Due to the potential to increase vehicle speeds and impacts on adjacent properties, this is not recommended at this time.

A summary of the public review of alternatives, including the comments received on proposed alternatives, is included in Appendix C. The greatest support was voiced for corridor-wide pedestrian improvements, a traffic signal at Bowdoin Road, and improvement for left turns out of Noisy Hole Road.



STAKEHOLDERS PROVIDE FEEDBACK AT THE PUBLIC REVIEW OF ALTERNATIVES

COMMISSION STAFF PROVIDE AN OVERVIEW OF COMMENTS RECEIVED

Recommended Improvements

4

Commission and Town staff used the feedback from the second public meeting to come up with a finalized list of recommended improvement options for the corridor. The following section provides a brief overview of each potential improvement, as well as the relative time frame and cost.

PEDESTRIAN ACCOMMODATIONS

No sidewalks or other pedestrian accommodations exist along this portion of Route 28. Worn trails on the grass next to the roadway indicate pedestrian traffic in the area, which Commission staff also observed during their site visits. The one existing crosswalk, located west of Noisy Hole Road, does not have landing pads and does not connect to any sidewalks.

UPGRADE CROSSWALK WITH A RECTANGULAR RAPID FLASH BEACON

A Rectangular Rapid Flash Beacon (RRFB) would encourage drivers to stop on Route 28 to allow pedestrians to safely cross. This would be a mid-term, medium cost improvement.

ADD A NEW CROSSWALK NEAR CAPE DRIVE

A crosswalk near Cape Drive, with a Rectangular Rapid Flash Beacon (RRFB), would provide a safer location for pedestrians to cross Route 28 for better access to the local businesses and the bus stop in the area. This would be a mid-term, medium cost improvement.

ADD A SIDEWALK ALONG THE CORRIDOR

Due to environmental constraints, the recommended alternative is a sidewalk along the south side of the road until the crosswalk

PROPOSED SIDEWALK CROSSWALK

west of Noisy Hole Road, and then along the north side of the road from the crosswalk west to Orchard Road. A sidewalk on the north side of Route 28 between the two crosswalks is also recommended, provided there are sidewalks on both sides of the roadway between the crosswalks.

Providing sidewalks along Route 28 will allow greater pedestrian access to the corridor and the area businesses. Focusing sidewalks in the commercial area would limit the cost and impacts of this improvement. This would change the character of the area and likely reduce vehicle speeds. This would be a long-term, high cost improvement.

The final location of any sidewalks and crosswalks will require an engineering-level review of the roadway and adjacent site constraints, as well as a review of destinations and likely pedestrian routes.

BICYCLIST ACCOMMODATIONS

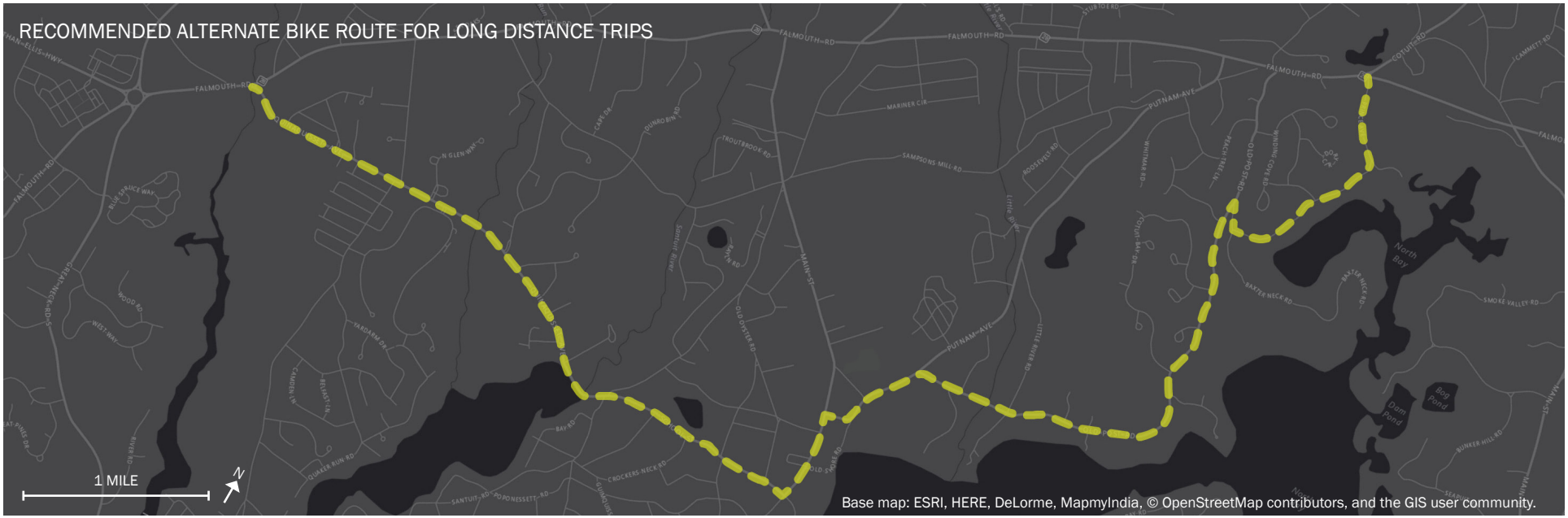
No dedicated bicyclist accommodations exist in the areas; bikers must ride on the roads. There is potential, however, for bicyclist connections in the area, especially with a multi-use path on Route 130.

PROVIDE SIGNAGE FOR ALTERNATE ROUTES

Providing new/improved signage will direct bicyclists to quieter and safer streets for bicyclists not traveling directly to a destination on this stretch of Route 28. The suggested alternate route would take riders along Quinaquissett Ave to School Street in Cotuit to Main Street to Putnam Ave briefly to Old Post Road and then onto Cedar Tree Neck Way to Prince Road to Route 28. This would be a short-term, low cost improvement.

INSTALL A MULTI-USE PATH

With larger-scale, regional improvements to Route 28, installing a multi-use path along the corridor could eventually connect to the multi-use path along Route 130. This would provide safer, dedicated bike accommodations and greater bicyclist accommodations connectivity throughout the region. This would be a long-term, high cost improvement.



TRANSIT

BUS STOP REVIEW

The current bus stop is located on Cape Drive. Reviewing the current bus stop location to determine if it should be located elsewhere to better serve riders could improve safety and ridership. This would be a short-term, low cost improvement.

EXISTING BUS STOP CONDITIONS

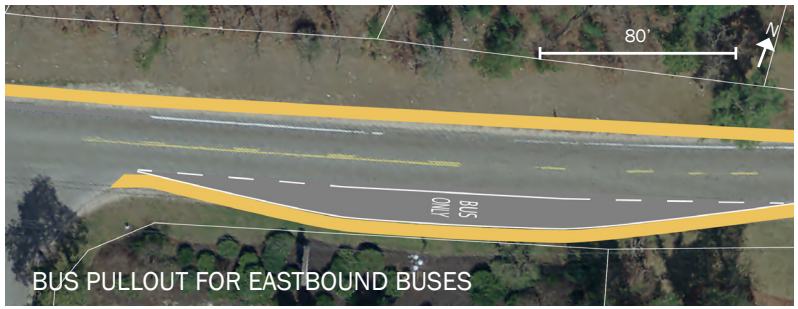
UPGRADED BUS STOP

Providing improved accommodations at the bus stop will benefit transit users waiting for the bus and may encourage more people to use public transportation. This would be a mid-term, medium cost improvement.


EXAMPLE OF BUS STOP UPGRADES

BUS PULLOUTS

Putting in bus pullouts--dedicated areas for the bus to pull off of the road--along Route 28 would allow traffic to pass stopped buses safely. In addition to reducing congestion on Route 28, this would also provide better loading and unloading areas for riders. This would be a long-term, high cost improvement.



BUS PULLOUT FOR EASTBOUND BUSES

BUS PULLOUT FOR WESTBOUND BUSES

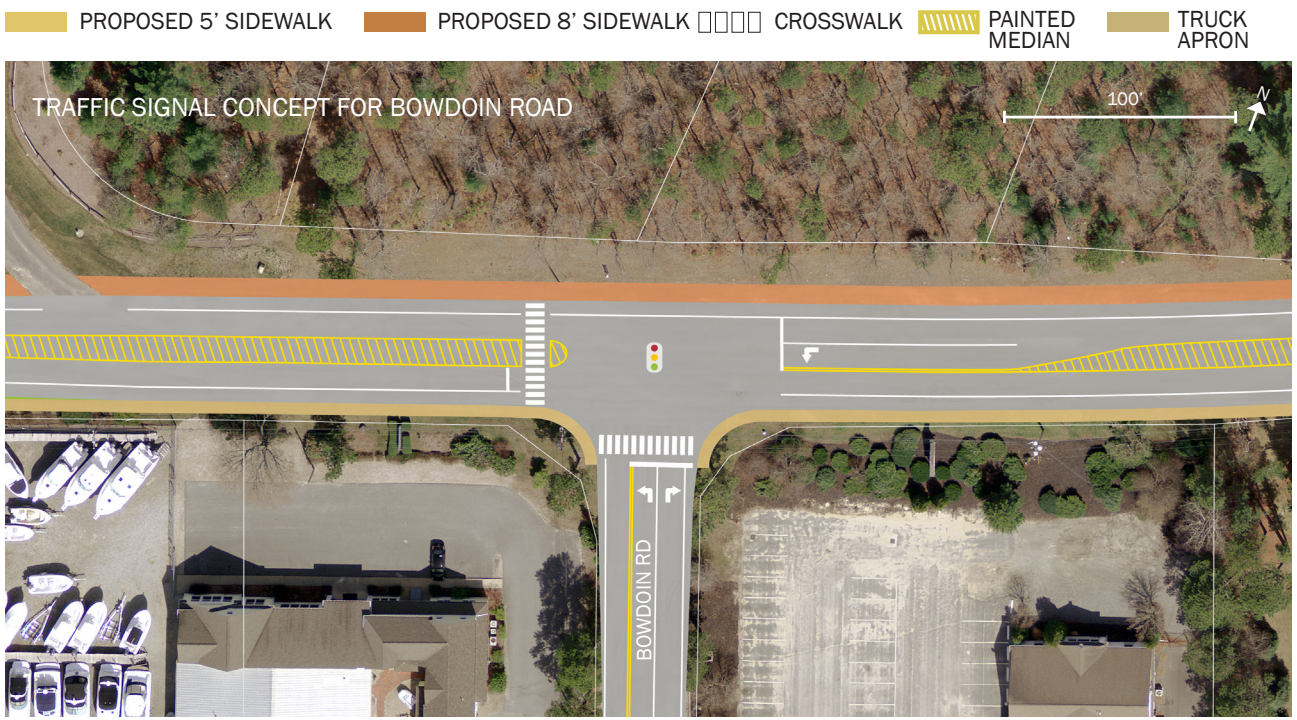
POTENTIAL BUS PULLOUT LOCATIONS

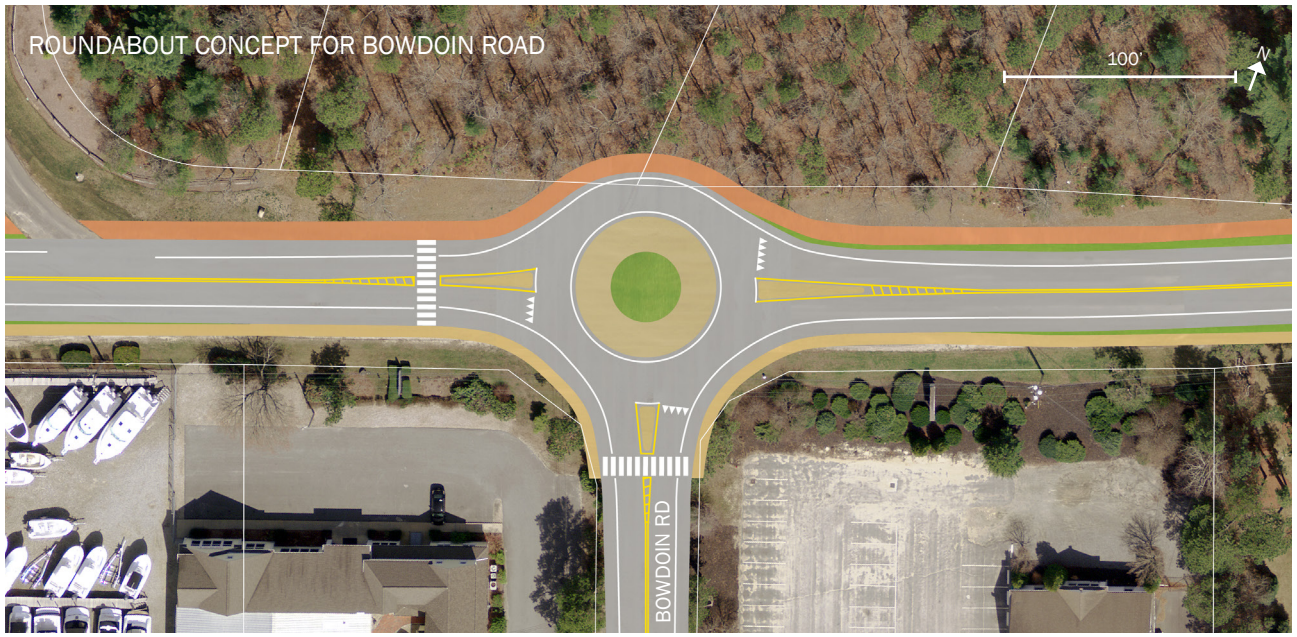
BOWDOIN ROAD INTERSECTION

Bowdoin Road provides access to several of the businesses in the area. Traffic is frequently backed up due to cars waiting to turn left onto Bowdoin Road. Similarly, it is difficult for motorists to turn left out of Bowdoin Road onto Route 28 due to the high speeds and traffic on Route 28.

TRAFFIC SIGNAL OR ROUNDABOUT

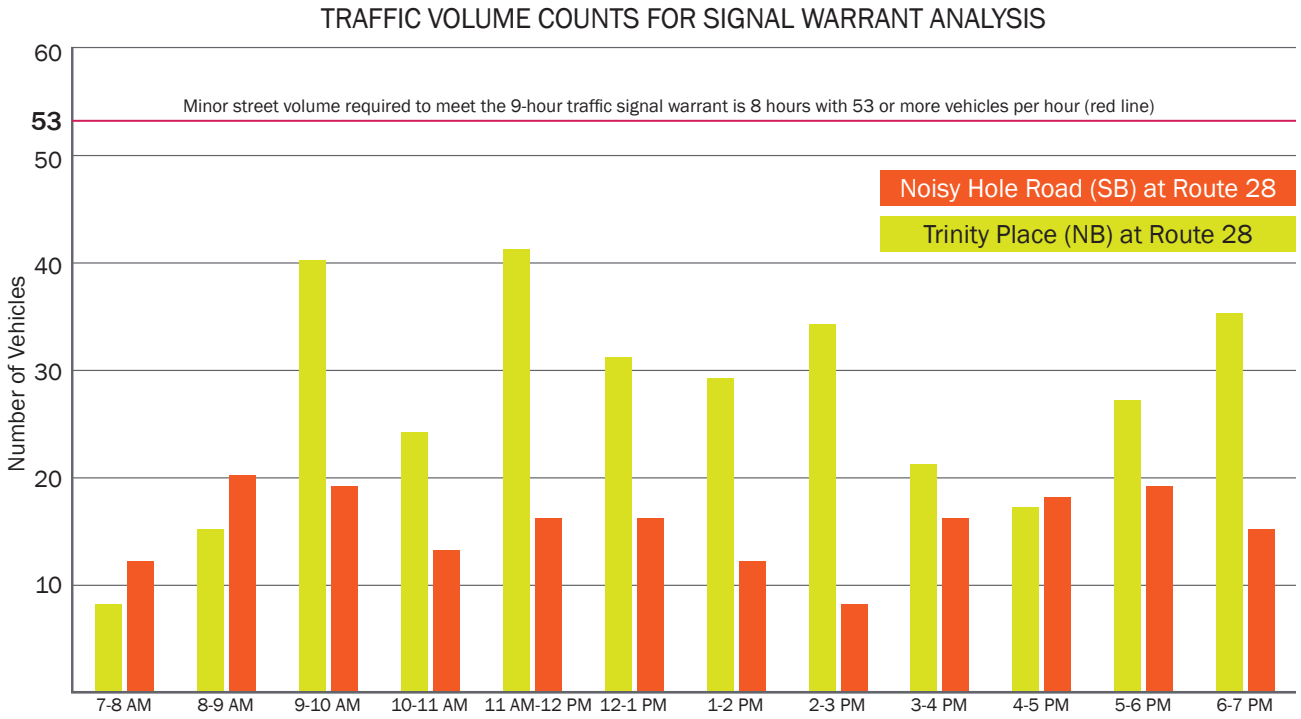
Installing a traffic signal or roundabout at Bowdoin Road would provide safe access in and out of Bowdoin Road and Route 28. Although public feedback generally supported a traffic signal over a roundabout, consideration for a roundabout is required anytime a traffic signal is proposed on a state-owned roadway or using state funds. Additionally, a roundabout could provide an opportunity for vehicles to easily reverse direction and make right turns into the Cotuit Meadows housing development just to the northwest of Bowdoin Road, rather than trying to make difficult left turns off of Route 28. Either a traffic signal or roundabout would be a long-term improvement with a cost of over $3 million and could potentially involve some land takings. The land takings would most likely be greater for a roundabout.





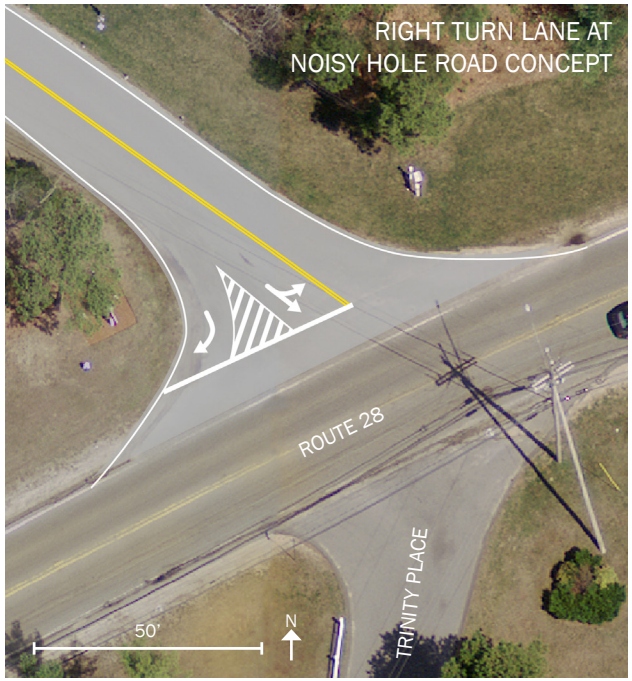
NOISY HOLE ROAD INTERSECTION

Noisy Hole Road is a main entrance and exit for dozens of houses in the Cotuit Meadows housing development. Residents struggle to turn left out of Noisy Hole Road onto Route 28. Stakeholders identified a traffic signal or roundabout as a potential improvement for this intersection, however, Commission staff determined a traffic signal or roundabout was not warranted based on current traffic counts for this intersection. The minor street volume required to meet the 8-hour traffic signal warrant is 8 hours with 53 or more vehicles per hour. Neither Trinity Place nor Noisy Hole Road meet this minimum requirement, as shown in the graph on the right. Thus, other improvements are recommended.



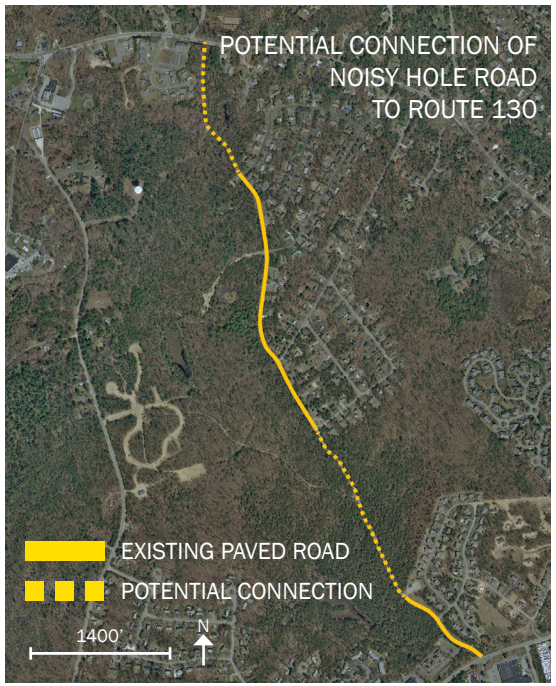
RIGHT TURN LANE

Installing a right turn lane for drivers exiting Noisy Hole Road would allow those drivers to safely bypass drivers waiting to turn left out of Noisy Hole Road. This would be a long-term, medium cost improvement.



CONNECT NOISY HOLE ROAD TO ROUTE 130

Noisy Hole Road could be connected with Route 130 to the north using an existing Town of Mashpee layout to reduce the number of vehicles traveling through the intersection of Noisy Hole Road and Route 28. This would be a long-



term, high cost improvement, and impacts from additional traffic on area neighborhoods, adjacent open space, and the existing roads would need to be considered.

SAMPSONS MILL ROAD INTERSECTION

SIGNAGE AND GUARDRAIL IMPROVEMENTS

A 2016 Road Safety Audit for the area identifies signage and guardrail improvements for the intersection of Sampsons Mill Road and Route 28. These changes would improve safety for drivers along Sampsons Mill Road and would be mid-term, medium cost improvements. The recommendations from the Road Safety Audit for this location are included in Appendix D.

EXISTING SIGNAGE AND GUARDRAIL CONDITIONS AT SAMPSONS MILL ROAD

REGRADE AND REALIGN SAMPSONS MILL ROAD

As Sampsons Mill Road approaches Route 28, the road climbs uphill. This change in elevation paired with an odd angle of intersection at Route 28 and Sampsons Mill Road make it difficult for drivers turning out of Sampsons Mill Road to see oncoming traffic. Regrading the road to improve the elevation difference, and realigning the intersection of the two streets so that it is closer to perpendicular would improve sightlines for drivers. This would be a long-term, high cost improvement. The development or redevelopment of abutting parcels would provide both a need and an opportunity to revisit this potential improvement.

ORCHARD ROAD INTERSECTION

VEGETATION TRIMMING

Maintaining and trimming the vegetation at the intersection can improve visibility for motorists and help them to turn safely at the intersection. This would be a short-term, low cost improvement.

SIGNAL TIMING

To ensure the signal is performing in the most efficient manner, MassDOT can conduct a review of the signal timing at the intersection. If the signal timing is not optimal right now, the timing can be altered. This would be a short-term, low cost improvement.

PEDESTRIAN AND BICYCLIST UPGRADES

Currently at the Orchard Road intersection, there are no walk signals for pedestrians or bicyclists trying to cross the intersection. Installing walk signals with countdown timers can help pedestrians and bicyclists cross the intersection safely. This would be a long-term, medium cost improvement.

OTHER RECOMMENDATIONS

SPEED STUDY

A request for a speed study can be submitted to MassDOT. A request for a speed study can be submitted to MassDOT. A request for a speed study can be submitted to MassDOT. The speed study will measure current travel speeds on the roadway to determine appropriate speed limits for the corridor. While stakeholders felt the existing speed limit of 50 mph should be lowered, the speed study could result in a recommendation to decrease, maintain, or increase the speed limit. This would be a short-term, low cost improvement.

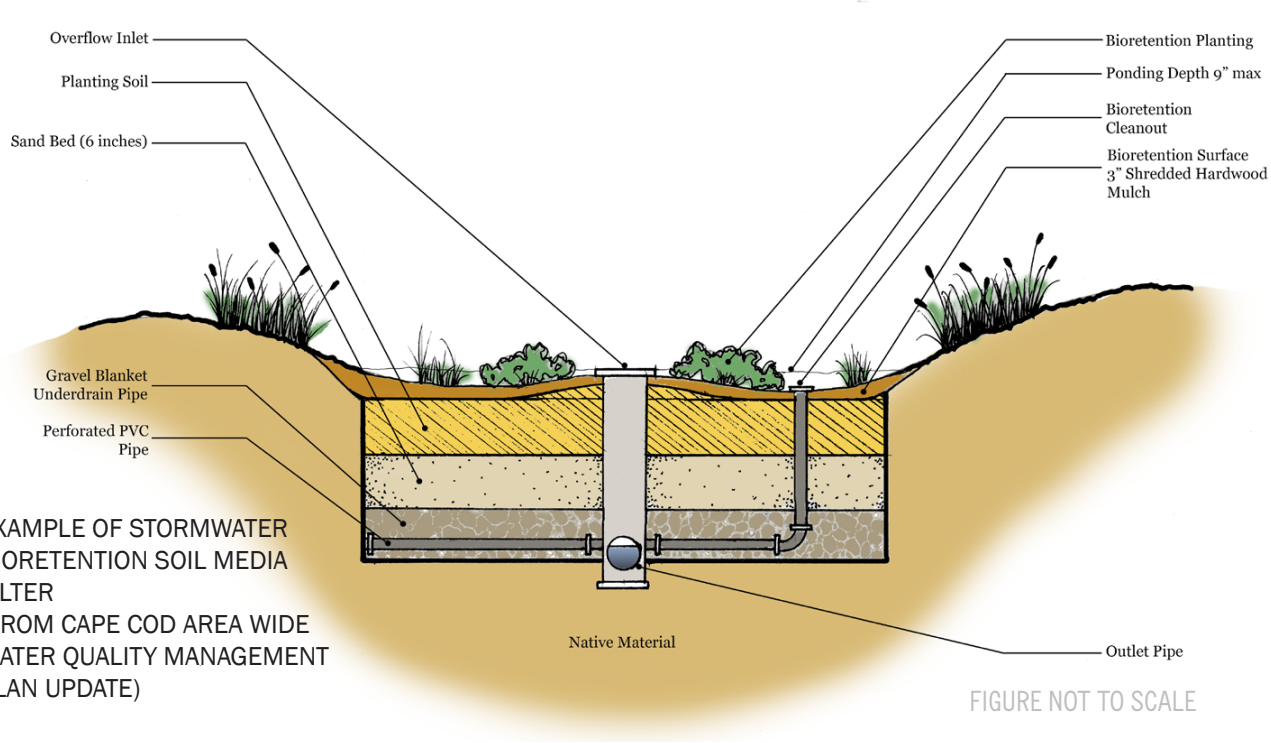
IMPROVED STORMWATER MANAGEMENT AND TREATMENT

Effective stormwater management has both road safety and environmental benefits. Removing water from the roadway surface is critical in reducing hazards such as hydroplaning, while the elimination of untreated stormwater discharge into groundwater and surface water sources is critical to the health of the area's natural environment. As part of this study, contaminants of concern and a set of Best Management Practices (BMPs) well-suited to capture and treat these contaminants were identified. The contaminants of concern identified include nitrogen, phosphorus, and pathogens. Nitrogen is of particular concern for this section of roadway as it is located within the nitrogen-overloaded Popponesset Bay Watershed. See Appendix E for details on this watershed.

Currently, stormwater along the roadway is collected in catch basins with subsurface infiltration chambers, which do not treat nitrogen, a contaminant of concern for the area's watershed. Stormwater BMPs, as detailed in Appendix F, should be implemented as standalone projects or whenever major upgrades to the roadway are planned. Given the location within a nitrogen-sensitive watershed, stormwater improvements should utilize BMPs with the ability to remove nitrogen.

CORRIDOR-WIDE VEGETATION MANAGEMENT

While only relatively minor issues were noted in the field, it is important that vegetation near the roadway and signs continue to be well maintained to avoid obstructing the sightlines of motorists. Tree limbs that extend towards the roadways, and hedges and shrubs near intersections, need to be periodically trimmed.



EXAMPLE OF STORMWATER BIORETENTION SOIL MEDIA FILTER
(FROM CAPE COD AREA WIDE WATER QUALITY MANAGEMENT PLAN UPDATE)

This is particularly important in locations where obstructions may compromise drivers' ability to see pedestrians and bicyclists. Issues with vegetation limiting sightlines were noted approaching the traffic signal at Orchard Road prompting the previously mentioned recommendation at that intersection.

NEXT STEPS

Given that Route 28 is owned and maintained by MassDOT, the Towns of Mashpee and Barnstable will have to work with MassDOT on the improvements detailed in this report. Staff of the Cape Cod Commission are available to assist the Towns in this effort. It is recommended that a meeting between MassDOT, Town of Barnstable, Town of Mashpee, and Commission staff be set up to discuss the implementation of the short-term recommendations and potential funding options for the long-term recommendations.

Appendices

Cape Cod Traffic Counting Report — Printed: 12/7/2017

Automated Traffic Recorder Data

Year	Begin Date	End Date	Weather	% Trucks	Dir.	ADT	Speed MPH	PEAK HOUR DATA [Date&Day	Hour	Vol]	Four~ Five	AADT
Mashpee Barnstable												
Rt 130 @ Mash/Barn TL											Site Code 7220	
2016	8/2/16	8/4/16	Overcast	8.0%	Total	7,967		8/3/16 Wed	16	623	609	6,055
					NB	3,940	41			322	298	2,994
					SB	4,027	42			301	312	3,061
Mashpee Barnstable												
Rt 28 @ Mash/Barn TL											Site Code 20270	
2017	7/26/17	7/28/17	Clear	10.0%	Total	24,595		7/27/17 Thu	15	1,741	1,719	18,692
					EB	12,539	38			880	926	9,530
					WB	12,056	39			861	794	9,163
2016	8/2/16	8/4/16	Overcast		Total	26,113		8/3/16 Wed	15	2,129	1,868	19,846
2015	6/17/15	6/19/15	Clear	2.3%	Total	20,800		6/18/15 Thu	17	1,571	1,415	18,512
					EB	10,527	32			782	764	9,369
					WB	10,270	27			789	650	9,140
Mashpee												
Rt 28 W of Orchard Rd & Ashers Path											Site Code 21405	
2016	6/21/16	6/24/16	Clear	14.0%	Total	24,592		6/23/16 Thu	17	1,800	1,701	21,887
					EB	11,403	41			883	819	10,149
					WB	13,189	42			917	882	11,738
Mashpee												
Ashers Pa (E) N of Rt 28											Site Code 20241	
2016	6/8/16	6/10/16	Clear	8.1%	Total	1,084		6/9/16 Thu	16	80	90	965
					NB	545	33			44	48	485
					SB	535	33			36	42	476
Mashpee												
Orchard Rd S of Rt 28											Site Code 20258	
2016	6/8/16	6/10/16	Clear	10.1%	Total	4,270		6/9/16 Thu	16	325	338	3,800
					NB	3,284	39			247	252	2,923
					SB	987	41			78	86	878
Mashpee												
Sampsons Mill Rd E of Rt 28											Site Code 20257	
2016	6/7/16	6/10/16	Clear	6.5%	Total	517		6/8/16 Wed	10	41	34	460
					EB	276	38			23	20	246
					WB	246	37			18	14	219

Cape Cod Commission
3225 Main St.
Barnstable, MA 02630
www.capecodcommission.org

Site# 2936
Rt 130 @ Cotuit Rd/Emma Oakley Mills Way
Town: Mashpee
Counter# 3

File Name : 2936_11082016
Site Code : 00002936
Start Date : 11/8/2016
Page No : 1

Groups Printed- Cars - Trucks

	Rt 130 From North					Cotuit Rd From East					Rt 130 From South					Emma Oakley Mills Way From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	19	36	1	0	56	25	1	18	0	44	0	44	26	0	70	0	0	0	1	1	171
04:15 PM	15	42	1	0	58	37	1	14	0	52	1	41	36	0	78	0	1	0	3	4	192
04:30 PM	15	43	1	0	59	27	0	8	0	35	0	37	41	0	78	0	0	0	0	0	172
04:45 PM	16	52	0	0	68	34	3	16	0	53	0	43	34	0	77	0	0	0	2	2	200
Total	65	173	3	0	241	123	5	56	0	184	1	165	137	0	303	0	1	0	6	7	735
05:00 PM	21	37	1	0	59	21	0	16	0	37	0	50	33	0	83	1	1	1	2	5	184
05:15 PM	19	47	0	0	66	25	0	22	0	47	0	28	31	0	59	0	0	1	0	1	173
Grand Total	105	257	4	0	366	169	5	94	0	268	1	243	201	0	445	1	2	2	8	13	1092
Apprch %	28.7	70.2	1.1	0		63.1	1.9	35.1	0		0.2	54.6	45.2	0		7.7	15.4	15.4	61.5		
Total %	9.6	23.5	0.4	0	33.5	15.5	0.5	8.6	0	24.5	0.1	22.3	18.4	0	40.8	0.1	0.2	0.2	0.7	1.2	
Cars	103	249	4	0	356	165	4	93	0	262	1	234	199	0	434	1	2	2	8	13	1065
% Cars	98.1	96.9	100	0	97.3	97.6	80	98.9	0	97.8	100	96.3	99	0	97.5	100	100	100	100	100	97.5
Trucks	2	8	0	0	10	4	1	1	0	6	0	9	2	0	11	0	0	0	0	0	27
% Trucks	1.9	3.1	0	0	2.7	2.4	20	1.1	0	2.2	0	3.7	1	0	2.5	0	0	0	0	0	2.5

	Rt 130 From North					Cotuit Rd From East					Rt 130 From South					Emma Oakley Mills Way From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	15	42	**1**	0	58	**37**	1	14	0	52	**1**	41	36	0	78	0	**1**	0	**3**	4	192
04:30 PM	15	43	1	0	59	27	0	8	0	35	0	37	**41**	0	78	0	0	0	0	0	172
04:45 PM	16	**52**	0	0	**68**	34	**3**	**16**	0	**53**	0	43	34	0	77	0	0	0	2	2	**200**
05:00 PM	**21**	37	1	0	59	21	0	16	0	37	0	**50**	33	0	**83**	**1**	1	**1**	2	**5**	184
Total Volume	67	174	3	0	244	119	4	54	0	177	1	171	144	0	316	1	2	1	7	11	748
% App. Total	27.5	71.3	1.2	0		67.2	2.3	30.5	0		0.3	54.1	45.6	0		9.1	18.2	9.1	63.6		
PHF	.798	.837	.750	.000	.897	.804	.333	.844	.000	.835	.250	.855	.878	.000	.952	.250	.500	.250	.583	.550	.935

Cape Cod Commission

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Site# 2936
Rt 130 @ Cotuit Rd/Emma Oakley Mills Way
Town: Mashpee
Counter# 3

File Name : 2936_11082016
Site Code : 00002936
Start Date : 11/8/2016
Page No : 1

Groups Printed- Cars

	Rt 130 From North					Cotuit Rd From East					Rt 130 From South					Emma Oakley Mills Way From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	18	33	1	0	52	24	1	18	0	43	0	41	26	0	67	0	0	0	1	1	163
04:15 PM	15	41	1	0	57	36	0	13	0	49	1	40	36	0	77	0	1	0	3	4	187
04:30 PM	15	43	1	0	59	27	0	8	0	35	0	35	41	0	76	0	0	0	0	0	170
04:45 PM	16	50	0	0	66	33	3	16	0	52	0	42	32	0	74	0	0	0	2	2	194
Total	64	167	3	0	234	120	4	55	0	179	1	158	135	0	294	0	1	0	6	7	714
05:00 PM	21	36	1	0	58	21	0	16	0	37	0	49	33	0	82	1	1	1	2	5	182
05:15 PM	18	46	0	0	64	24	0	22	0	46	0	27	31	0	58	0	0	1	0	1	169
Grand Total	103	249	4	0	356	165	4	93	0	262	1	234	199	0	434	1	2	2	8	13	1065
Apprch %	28.9	69.9	1.1	0		63	1.5	35.5	0		0.2	53.9	45.9	0		7.7	15.4	15.4	61.5		
Total %	9.7	23.4	0.4	0	33.4	15.5	0.4	8.7	0	24.6	0.1	22	18.7	0	40.8	0.1	0.2	0.2	0.8	1.2	

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File Name : 2936_11082016
Site Code : 00002936
Start Date : 11/8/2016
Page No : 1

Groups Printed- Trucks

	Rt 130 From North					Cotuit Rd From East					Rt 130 From South					Emma Oakley Mills Way From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	1	3	0	0	4	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	8
04:15 PM	0	1	0	0	1	1	1	1	0	3	0	1	0	0	1	0	0	0	0	0	5
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
04:45 PM	0	2	0	0	2	1	0	0	0	1	0	1	2	0	3	0	0	0	0	0	6
Total	1	6	0	0	7	3	1	1	0	5	0	7	2	0	9	0	0	0	0	0	21
05:00 PM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
05:15 PM	1	1	0	0	2	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	4
Grand Total	2	8	0	0	10	4	1	1	0	6	0	9	2	0	11	0	0	0	0	0	27
Apprch %	20	80	0	0		66.7	16.7	16.7	0		0	81.8	18.2	0		0	0	0	0		
Total %	7.4	29.6	0	0	37	14.8	3.7	3.7	0	22.2	0	33.3	7.4	0	40.7	0	0	0	0	0	

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Town: Mashpee
Counter# 3

File Name : 2936_11082016
Site Code : 00002936
Start Date : 11/8/2016
Page No : 1

Groups Printed- Bikes

	Rt 130 From North					Cotuit Rd From East					Rt 130 From South					Emma Oakley Mills Way From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
*** BREAK ***																					
05:15 PM	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Apprch %	100	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %	100	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

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Site: 2982
Location: Rt 28 and Ashers Path/Orchard
Town: Mashpee
Counter: 3/4

File Name : 2982_08232016
Site Code : 00002982
Start Date : 8/23/2016
Page No : 1

Groups Printed- Cars - Trucks

	Ashers Path/Orchard from North					Rt 28 from East					Ashers Path/Orchard from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	3	4	1	0	8	15	210	4	0	229	44	4	10	0	58	3	220	1	0	224	519
04:15 PM	3	7	3	0	13	11	191	6	0	208	46	6	12	0	64	4	216	1	0	221	506
04:30 PM	3	12	0	0	15	14	209	7	0	230	48	7	8	0	63	1	184	3	0	188	496
04:45 PM	6	6	6	0	18	7	190	7	0	204	32	8	9	0	49	5	208	2	0	215	486
→ Total	15	29	10	0	54	47	800	24	0	871	170	25	39	0	234	13	828	7	0	848	2007
05:00 PM	2	9	5	0	16	6	220	4	0	230	33	6	16	0	55	4	219	0	0	223	524
05:15 PM	1	6	0	0	7	7	218	3	0	228	42	9	16	0	67	2	231	0	0	233	535
Grand Total	18	44	15	0	77	60	1238	31	0	1329	245	40	71	0	356	19	1278	7	0	1304	3066
Apprch %	23.4	57.1	19.5	0		4.5	93.2	2.3	0		68.8	11.2	19.9	0		1.5	98	0.5	0		
Total %	0.6	1.4	0.5	0	2.5	2	40.4	1	0	43.3	8	1.3	2.3	0	11.6	0.6	41.7	0.2	0	42.5	
Cars	17	42	15	0	74	60	1214	30	0	1304	240	35	71	0	346	19	1240	7	0	1266	2990
% Cars	94.4	95.5	100	0	96.1	100	98.1	96.8	0	98.1	98	87.5	100	0	97.2	100	97	100	0	97.1	97.5
Trucks	1	2	0	0	3	0	24	1	0	25	5	5	0	0	10	0	38	0	0	38	76
% Trucks	5.6	4.5	0	0	3.9	0	1.9	3.2	0	1.9	2	12.5	0	0	2.8	0	3	0	0	2.9	2.5

	Ashers Path/Orchard from North					Rt 28 from East					Ashers Path/Orchard from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM ←																					
04:30 PM	3	**12**	0	0	15	**14**	209	**7**	0	**230**	**48**	7	8	0	63	1	184	**3**	0	188	496
04:45 PM	**6**	6	**6**	0	**18**	7	190	7	0	204	32	8	9	0	49	**5**	208	2	0	215	486
05:00 PM	2	9	5	0	16	6	**220**	4	0	230	33	6	**16**	0	55	4	219	0	0	223	524
05:15 PM	1	6	0	0	7	7	218	3	0	228	42	**9**	16	0	**67**	2	**231**	0	0	**233**	**535**
Total Volume	12	33	11	0	56	34	837	21	0	892	155	30	49	0	234	12	842	5	0	859	2041
% App. Total	21.4	58.9	19.6	0		3.8	93.8	2.4	0		66.2	12.8	20.9	0		1.4	98	0.6	0		
PHF	.500	.688	.458	.000	.778	.607	.951	.750	.000	.970	.807	.833	.766	.000	.873	.600	.911	.417	.000	.922	.954

Cape Cod Commission

3225 Main St.
Barnstable, MA 02630
www.capecodcommission.org

Site: 2982
Location: Rt 28 and Ashers Path/Orchard
Town: Mashpee
Counter: 3/4

File Name : 2982_08232016
Site Code : 00002982
Start Date : 8/23/2016
Page No : 1

Groups Printed- Cars

	Ashers Path/Orchard from North					Rt 28 from East					Ashers Path/Orchard from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	3	4	1	0	8	15	202	4	0	221	43	2	10	0	55	3	216	1	0	220	504
04:15 PM	3	6	3	0	12	11	187	6	0	204	45	5	12	0	62	4	207	1	0	212	490
04:30 PM	3	12	0	0	15	14	206	7	0	227	47	6	8	0	61	1	178	3	0	182	485
04:45 PM	6	6	6	0	18	7	186	6	0	199	31	7	9	0	47	5	202	2	0	209	473
Total	15	28	10	0	53	47	781	23	0	851	166	20	39	0	225	13	803	7	0	823	1952
05:00 PM	1	8	5	0	14	6	218	4	0	228	33	6	16	0	55	4	215	0	0	219	516
05:15 PM	1	6	0	0	7	7	215	3	0	225	41	9	16	0	66	2	222	0	0	224	522
Grand Total	17	42	15	0	74	60	1214	30	0	1304	240	35	71	0	346	19	1240	7	0	1266	2990
Apprch %	23	56.8	20.3	0		4.6	93.1	2.3	0		69.4	10.1	20.5	0		1.5	97.9	0.6	0		
Total %	0.6	1.4	0.5	0	2.5	2	40.6	1	0	43.6	8	1.2	2.4	0	11.6	0.6	41.5	0.2	0	42.3	

Cape Cod Commission

3225 Main St.
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Site: 2982
Location: Rt 28 and Ashers Path/Orchard
Town: Mashpee
Counter: 3/4

File Name : 2982_08232016
Site Code : 00002982
Start Date : 8/23/2016
Page No : 1

Groups Printed- Trucks

	Ashers Path/Orchard from North					Rt 28 from East					Ashers Path/Orchard from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	8	0	0	8	1	2	0	0	3	0	4	0	0	4	15
04:15 PM	0	1	0	0	1	0	4	0	0	4	1	1	0	0	2	0	9	0	0	9	16
04:30 PM	0	0	0	0	0	0	3	0	0	3	1	1	0	0	2	0	6	0	0	6	11
04:45 PM	0	0	0	0	0	0	4	1	0	5	1	1	0	0	2	0	6	0	0	6	13
Total	0	1	0	0	1	0	19	1	0	20	4	5	0	0	9	0	25	0	0	25	55
05:00 PM	1	1	0	0	2	0	2	0	0	2	0	0	0	0	0	0	4	0	0	4	8
05:15 PM	0	0	0	0	0	0	3	0	0	3	1	0	0	0	1	0	9	0	0	9	13
Grand Total	1	2	0	0	3	0	24	1	0	25	5	5	0	0	10	0	38	0	0	38	76
Apprch %	33.3	66.7	0	0		0	96	4	0		50	50	0	0		0	100	0	0		
Total %	1.3	2.6	0	0	3.9	0	31.6	1.3	0	32.9	6.6	6.6	0	0	13.2	0	50	0	0	50	

Cape Cod Commission

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Site: 2982
Location: Rt 28 and Ashers Path/Orchard
Town: Mashpee
Counter: 3/4

File Name : 2982_08232016
Site Code : 00002982
Start Date : 8/23/2016
Page No : 1

Groups Printed- Bikes

	Ashers Path/Orchard from North					Rt 28 from East					Ashers Path/Orchard from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
*** BREAK ***																					
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
*** BREAK ***																					
Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
*** BREAK ***																					
Grand Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Apprch %	0	0	0	0		0	0	0	0		0	100	0	0		0	0	0	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	100	0	0	100	0	0	0	0	0	

Cape Cod Commission

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Site: 3098
Location: Rt 28 and Sampson Mill Rd
Town: Mashpee
Counter: 6

File Name : 3098_08172016
Site Code : 00003098
Start Date : 8/17/2016
Page No : 1

Groups Printed- Cars - Trucks

						Rt 28 From East					Sampson Mill Rd from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	216	0	0	216	3	0	1	0	4	0	214	4	0	218	438
04:15 PM	0	0	0	0	0	0	220	0	0	220	3	0	2	0	5	0	212	5	0	217	442
04:30 PM	0	0	0	0	0	1	193	0	0	194	0	0	3	0	3	0	220	3	0	223	420
04:45 PM	0	0	0	0	0	1	219	0	0	220	3	0	0	0	3	0	195	1	0	196	419
Total	0	0	0	0	0	2	848	0	0	850	9	0	6	0	15	0	841	13	0	854	1719
05:00 PM	0	0	0	0	0	0	189	0	0	189	1	0	1	1	3	0	227	4	0	231	423
05:15 PM	0	0	0	0	0	0	184	0	0	184	2	0	1	1	4	0	200	8	0	208	396
Grand Total	0	0	0	0	0	2	1221	0	0	1223	12	0	8	2	22	0	1268	25	0	1293	2538
Apprch %	0	0	0	0		0.2	99.8	0	0		54.5	0	36.4	9.1		0	98.1	1.9	0		
Total %	0	0	0	0	0	0.1	48.1	0	0	48.2	0.5	0	0.3	0.1	0.9	0	50	1	0	50.9	
Cars	0	0	0	0	0	2	1206	0	0	1208	12	0	8	2	22	0	1249	25	0	1274	2504
% Cars	0	0	0	0	0	100	98.8	0	0	98.8	100	0	100	100	100	0	98.5	100	0	98.5	98.7
Trucks	0	0	0	0	0	0	15	0	0	15	0	0	0	0	0	0	19	0	0	19	34
% Trucks	0	0	0	0	0	0	1.2	0	0	1.2	0	0	0	0	0	0	1.5	0	0	1.5	1.3

						Rt 28 From East					Sampson Mill Rd from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	0	0	0	0	0	216	0	0	216	**3**	0	1	0	4	0	214	**4**	0	218	438
04:15 PM	0	0	0	0	0	0	**220**	0	0	**220**	3	0	2	0	**5**	0	212	**5**	0	217	**442**
04:30 PM	0	0	0	0	0	**1**	193	0	0	194	0	0	**3**	0	3	0	**220**	3	0	**223**	420
04:45 PM	0	0	0	0	0	1	219	0	0	220	3	0	0	0	3	0	195	1	0	196	419
Total Volume	0	0	0	0		2	848	0	0	850	9	0	6	0	15	0	841	13	0	854	1719
% App. Total	0	0	0	0		0.2	99.8	0	0		60	0	40	0		0	98.5	1.5	0		
PHF	.000	.000	.000	.000	.000	.500	.964	.000	.000	.966	.750	.000	.500	.000	.750	.000	.956	.650	.000	.957	.972

Cape Cod Commission

3225 Main St.
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Site: 3098
Location: Rt 28 and Sampson Mill Rd
Town: Mashpee
Counter: 6

File Name : 3098_08172016
Site Code : 00003098
Start Date : 8/17/2016
Page No : 1

Groups Printed- Cars

	Rt 28 From East					Sampson Mill Rd from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	211	0	0	211	3	0	1	0	4	0	214	4	0	218	433
04:15 PM	0	0	0	0	0	0	216	0	0	216	3	0	2	0	5	0	206	5	0	211	432
04:30 PM	0	0	0	0	0	1	192	0	0	193	0	0	3	0	3	0	218	3	0	221	417
04:45 PM	0	0	0	0	0	1	216	0	0	217	3	0	0	0	3	0	192	1	0	193	413
Total	0	0	0	0	0	2	835	0	0	837	9	0	6	0	15	0	830	13	0	843	1695
05:00 PM	0	0	0	0	0	0	189	0	0	189	1	0	1	1	3	0	222	4	0	226	418
05:15 PM	0	0	0	0	0	0	182	0	0	182	2	0	1	1	4	0	197	8	0	205	391
Grand Total	0	0	0	0	0	2	1206	0	0	1208	12	0	8	2	22	0	1249	25	0	1274	2504
Apprch %	0	0	0	0		0.2	99.8	0	0		54.5	0	36.4	9.1		0	98	2	0		
Total %	0	0	0	0	0	0.1	48.2	0	0	48.2	0.5	0	0.3	0.1	0.9	0	49.9	1	0	50.9	

Cape Cod Commission

3225 Main St.
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Site: 3098
Location: Rt 28 and Sampson Mill Rd
Town: Mashpee
Counter: 6

File Name : 3098_08172016
Site Code : 00003098
Start Date : 8/17/2016
Page No : 1

Groups Printed- Trucks

	Rt 28 From East					Sampson Mill Rd from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	0	0	0	0	5
04:15 PM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	6	0	0	6	10
04:30 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3
04:45 PM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6
Total	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	0	11	0	0	11	24
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5	5
05:15 PM	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	5
Grand Total	0	0	0	0	0	0	15	0	0	15	0	0	0	0	0	0	19	0	0	19	34
Apprch %	0	0	0	0		0	100	0	0		0	0	0	0		0	100	0	0		
Total %	0	0	0	0	0	0	44.1	0	0	44.1	0	0	0	0	0	0	55.9	0	0	55.9	

Cape Cod Commission

3225 Main St.
Barnstable, MA 02630
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Site: 3098
Location: Rt 28 and Sampson Mill Rd
Town: Mashpee
Counter: 6

File Name : 3098_08172016
Site Code : 00003098
Start Date : 8/17/2016
Page No : 1

Groups Printed- Bikes

	Rt 28 From East					Sampson Mill Rd from South					Rt 28 from West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		
Total %																

Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter; 4
Counted By; DN
Town; Mashpee
Location; Rt 28 @ Noisy Hole & Trinity

File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
Page No : 1

Groups Printed- Cars - Trucks

	Noisy Hole Rd From North				Route 28 From East				Trinity Place From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	6	0	2	0	1	158	4	0	0	0	1	0	2	176	1	0	351
07:15 AM	2	0	7	0	0	155	0	0	0	0	1	0	4	225	3	0	397
07:30 AM	1	0	4	0	1	203	0	0	2	0	3	0	3	231	0	0	448
07:45 AM	2	0	6	0	2	203	0	0	0	0	1	0	5	222	3	0	444
Total	11	0	19	0	4	719	4	0	2	0	6	0	14	854	7	0	1640
08:00 AM	2	1	5	0	0	216	3	0	1	0	3	0	10	210	0	0	451
08:15 AM	3	1	6	0	1	197	0	0	2	0	1	0	24	229	0	0	464
08:30 AM	7	0	7	0	4	230	3	0	3	0	2	0	9	234	1	0	500
08:45 AM	5	0	7	0	5	179	3	0	2	0	1	0	8	203	3	0	416
Total	17	2	25	0	10	822	9	0	8	0	7	0	51	876	4	0	1831
09:00 AM	2	0	5	0	1	172	3	0	2	1	4	0	10	194	3	0	397
09:15 AM	3	0	8	0	5	177	3	0	1	0	4	0	2	193	1	0	397
09:30 AM	8	0	5	1	2	209	3	1	4	0	14	0	8	208	3	0	466
09:45 AM	5	0	10	0	5	201	2	0	3	0	7	0	6	198	4	0	441
Total	18	0	28	1	13	759	11	1	10	1	29	0	26	793	11	0	1701
10:00 AM	3	0	7	0	0	198	2	0	2	0	2	0	6	188	4	0	412
10:15 AM	4	0	6	0	2	215	1	0	3	0	5	0	7	169	0	0	412
10:30 AM	3	0	5	0	2	178	4	0	2	1	3	0	9	212	1	1	421
10:45 AM	3	0	8	0	1	190	2	0	1	0	5	0	4	212	9	0	435
Total	13	0	26	0	5	781	9	0	8	1	15	0	26	781	14	1	1680
11:00 AM	4	0	7	0	2	193	7	0	2	0	7	0	7	188	3	0	420
11:15 AM	1	0	4	0	1	159	2	0	5	0	11	0	10	194	3	0	390
11:30 AM	7	0	7	0	1	195	1	0	3	0	6	0	6	227	1	0	454
11:45 AM	3	0	10	0	4	162	5	0	5	0	2	0	4	207	2	0	404
Total	15	0	28	0	8	709	15	0	15	0	26	0	27	816	9	0	1668
12:00 PM	7	0	6	0	0	197	2	0	5	0	5	0	3	201	3	0	429
12:15 PM	2	1	6	0	2	187	1	0	4	0	6	0	1	214	1	0	425
12:30 PM	3	0	6	0	0	179	0	0	3	0	2	0	6	213	3	0	415
12:45 PM	2	0	5	0	4	186	2	0	3	0	3	0	9	192	3	0	409
Total	14	1	23	0	6	749	5	0	15	0	16	0	19	820	10	0	1678
01:00 PM	3	0	3	0	1	147	3	0	3	0	4	0	6	174	2	0	346
01:15 PM	3	0	7	0	2	161	4	0	2	1	7	0	4	188	3	0	382
01:30 PM	2	0	2	0	1	172	3	0	1	0	4	0	8	199	1	0	393
01:45 PM	3	1	4	0	1	199	1	0	5	0	2	0	5	212	8	0	441
Total	11	1	16	0	5	679	11	0	11	1	17	0	23	773	14	0	1562
02:00 PM	3	0	1	0	2	198	2	0	5	0	2	0	1	186	5	0	405
02:15 PM	2	0	8	0	1	178	3	0	1	0	8	0	4	186	3	0	394
02:30 PM	3	0	4	0	1	179	3	0	7	0	3	0	6	195	4	0	405
02:45 PM	0	0	2	0	5	202	2	0	3	0	5	0	2	182	1	0	404
Total	8	0	15	0	9	757	10	0	16	0	18	0	13	749	13	0	1608
03:00 PM	2	0	4	0	0	181	5	0	4	0	3	1	7	195	2	1	405
03:15 PM	1	0	5	0	2	204	6	0	2	0	3	0	2	208	2	0	435
03:30 PM	6	0	6	0	4	190	4	0	1	0	4	0	4	219	1	0	439
03:45 PM	7	0	7	0	3	187	4	0	2	0	2	1	6	202	7	0	428
Total	16	0	22	0	9	762	19	0	9	0	12	2	19	824	12	1	1707
04:00 PM	5	0	3	0	3	208	3	0	0	0	2	0	6	213	5	0	448
04:15 PM	5	0	6	0	2	182	0	0	2	0	2	0	6	217	8	0	430
04:30 PM	3	0	10	0	4	191	0	0	3	0	4	0	5	222	3	0	445
04:45 PM	5	0	7	0	0	208	2	0	3	0	1	0	4	219	3	0	452
Total	18	0	26	0	9	789	5	0	8	0	9	0	21	871	19	0	1775

Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
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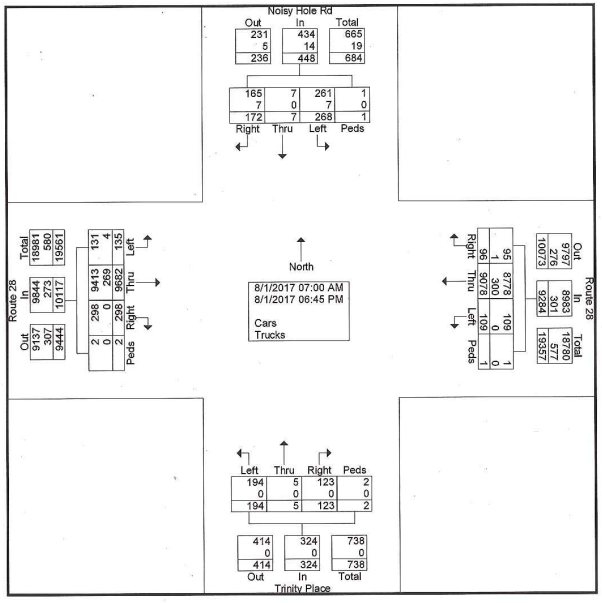
Counter; 4
Counted By; DN
Town; Mashpee
Location; Rt 28 @ Noisy Hole & Trinity

File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
Page No : 2

Groups Printed- Cars - Trucks

	Noisy Hole Rd From North				Route 28 From East				Trinity Place From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
05:00 PM	8	0	7	0	2	221	2	0	3	0	3	0	19	212	2	0	479
05:15 PM	4	1	7	0	2	210	2	0	2	0	3	0	12	194	8	0	445
05:30 PM	5	0	5	0	3	198	2	0	2	0	4	0	3	214	3	0	439
05:45 PM	1	0	8	0	1	224	2	0	4	0	6	0	3	193	1	0	443
Total	18	1	27	0	8	853	8	0	11	0	16	0	37	813	14	0	1806
06:00 PM	1	1	5	0	1	200	0	0	4	0	3	0	7	164	2	0	388
06:15 PM	3	0	3	0	3	169	1	0	0	0	8	0	6	179	3	0	375
06:30 PM	5	0	2	0	3	172	2	0	6	2	5	0	7	204	3	0	411
06:45 PM	4	1	3	0	3	158	0	0	0	0	7	0	2	165	0	0	343
Total	13	2	13	0	10	699	3	0	10	2	23	0	22	712	8	0	1517
Grand Total	172	7	268	1	96	9078	109	1	123	5	194	2	298	9682	135	2	20173
Apprch %	38.4	1.6	59.8	0.2	1	97.8	1.2	0	38	1.5	59.9	0.6	2.9	95.7	1.3	0	
Total %	0.9	0	1.3	0	0.5	45	0.5	0	0.6	0	1	0	1.5	48	0.7	0	
Cars	165	7	261	1	95	8778	109	1	123	5	194	2	298	9413	131	2	19585
% Cars	95.9	100	97.4	100	99	96.7	100	100	100	100	100	100	100	97.2	97	100	97.1
Trucks	7	0	7	0	1	300	0	0	0	0	0	0	0	269	4	0	588
% Trucks	4.1	0	2.6	0	1	3.3	0	0	0	0	0	0	0	2.8	3	0	2.9



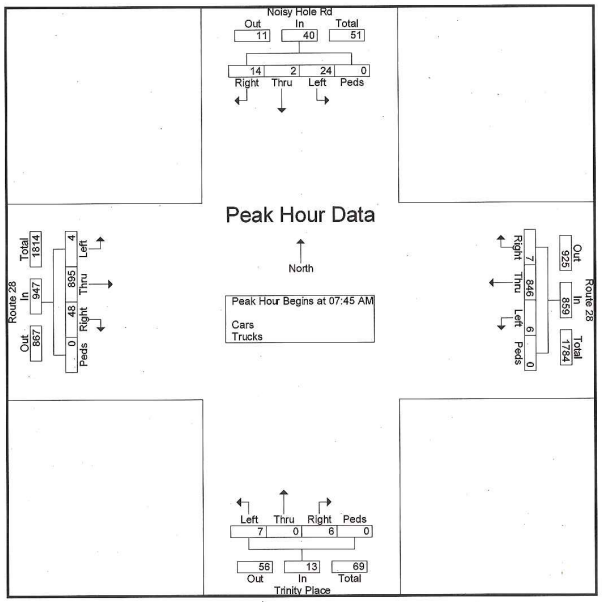
Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter; 4
Counted By; DN
Town; Mashpee
Location; Rt 28 @ Noisy Hole & Trinity

File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
Page No : 3

	Noisy Hole Rd From North					Route 28 From East					Trinity Place From South					Route 28 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	2	0	6	0	8	2	203	0	0	205	0	0	1	0	1	5	222	**3**	0	230	444
08:00 AM	2	**1**	5	0	8	0	216	**3**	0	219	1	0	**3**	0	4	10	210	0	0	220	451
08:15 AM	3	1	6	0	10	1	197	0	0	198	2	0	1	0	3	**24**	229	0	0	**253**	464
08:30 AM	**7**	0	**7**	0	**14**	**4**	**230**	3	0	**237**	**3**	0	2	0	**5**	9	**234**	1	0	244	**500**
Total Volume	14	2	24	0	40	7	846	6	0	859	6	0	7	0	13	48	895	4	0	947	1859
% App. Total	35	5	60	0		0.8	98.5	0.7	0		46.2	0	53.8	0		5.1	94.5	0.4	0		
PHF	.500	.500	.857	.000	.714	.438	.920	.500	.000	.906	.500	.000	.583	.000	.650	.500	.956	.333	.000	.936	.930



Cape Cod Commission

3225 Main Street
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Counter; 4
Counted By; DN
Town; Mashpee
Location; Rt 28 @ Noisy Hole & Trinity

File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
Page No : 1

Groups Printed- Cars

	Noisy Hole Rd From North				Route 28 From East				Trinity Place From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	6	0	2	0	1	149	4	0	0	0	1	0	2	171	1	0	337
07:15 AM	2	0	6	0	0	141	0	0	0	0	1	0	4	213	3	0	370
07:30 AM	1	0	4	0	1	189	0	0	2	0	3	0	3	220	0	0	423
07:45 AM	2	0	6	0	2	189	0	0	0	0	1	0	5	218	3	0	426
Total	11	0	18	0	4	668	4	0	2	0	6	0	14	822	7	0	1556
08:00 AM	2	1	5	0	0	201	3	0	1	0	3	0	10	202	0	0	428
08:15 AM	3	1	6	0	1	182	0	0	2	0	1	0	24	215	0	0	435
08:30 AM	7	0	7	0	4	210	3	0	3	0	2	0	9	224	1	0	470
08:45 AM	5	0	6	0	5	168	3	0	2	0	1	0	8	191	3	0	392
Total	17	2	24	0	10	761	9	0	8	0	7	0	51	832	4	0	1725
09:00 AM	2	0	5	0	1	164	3	0	2	1	4	0	10	191	3	0	386
09:15 AM	3	0	8	0	5	169	3	0	1	0	4	0	2	187	1	0	383
09:30 AM	8	0	5	1	2	204	3	1	4	0	14	0	8	201	3	0	454
09:45 AM	5	0	9	0	5	198	2	0	3	0	7	0	6	193	4	0	432
Total	18	0	27	1	13	735	11	1	10	1	29	0	26	772	11	0	1655
10:00 AM	3	0	7	0	0	193	2	0	2	0	2	0	6	180	4	0	399
10:15 AM	4	0	6	0	2	205	1	0	3	0	5	0	7	167	0	0	400
10:30 AM	3	0	5	0	2	173	4	0	2	1	3	0	9	207	1	1	411
10:45 AM	2	0	8	0	1	183	2	0	1	0	5	0	4	206	9	0	421
Total	12	0	26	0	5	754	9	0	8	1	15	0	26	760	14	1	1631
11:00 AM	4	0	7	0	2	182	7	0	2	0	7	0	7	178	3	0	399
11:15 AM	0	0	4	0	0	152	2	0	5	0	11	0	10	184	3	0	371
11:30 AM	7	0	7	0	1	187	1	0	3	0	6	0	6	217	1	0	436
11:45 AM	3	0	10	0	4	156	5	0	5	0	2	0	4	202	2	0	393
Total	14	0	28	0	7	677	15	0	15	0	26	0	27	781	9	0	1599
12:00 PM	7	0	6	0	0	189	2	0	5	0	5	0	3	195	3	0	415
12:15 PM	2	1	6	0	2	185	1	0	4	0	6	0	1	204	1	0	413
12:30 PM	2	0	6	0	0	173	0	0	3	0	2	0	6	209	3	0	404
12:45 PM	1	0	5	0	4	178	2	0	3	0	3	0	9	187	3	0	395
Total	12	1	23	0	6	725	5	0	15	0	16	0	19	795	10	0	1627
01:00 PM	3	0	3	0	1	145	3	0	3	0	4	0	6	170	1	0	339
01:15 PM	3	0	7	0	2	158	4	0	2	1	7	0	4	186	3	0	377
01:30 PM	2	0	1	0	1	166	3	0	1	0	4	0	8	191	1	0	378
01:45 PM	3	1	4	0	1	196	1	0	5	0	2	0	5	210	8	0	436
Total	11	1	15	0	5	665	11	0	11	1	17	0	23	757	13	0	1530
02:00 PM	2	0	1	0	2	189	2	0	5	0	2	0	1	181	5	0	390
02:15 PM	2	0	8	0	1	162	3	0	1	0	8	0	4	178	3	0	370
02:30 PM	3	0	4	0	1	176	3	0	7	0	3	0	6	192	4	0	399
02:45 PM	0	0	2	0	5	199	2	0	3	0	5	0	2	178	1	0	397
Total	7	0	15	0	9	726	10	0	16	0	18	0	13	729	13	0	1556
03:00 PM	2	0	3	0	0	177	5	0	4	0	3	1	7	192	1	1	396
03:15 PM	1	0	5	0	2	201	6	0	2	0	3	0	2	205	2	0	429
03:30 PM	6	0	6	0	4	188	4	0	1	0	4	0	4	215	1	0	433
03:45 PM	6	0	7	0	3	186	4	0	2	0	2	1	6	199	7	0	423
Total	15	0	21	0	9	752	19	0	9	0	12	2	19	811	11	1	1681
04:00 PM	5	0	3	0	3	203	3	0	0	0	2	0	6	209	5	0	439
04:15 PM	5	0	6	0	2	176	0	0	2	0	2	0	6	206	8	0	413
04:30 PM	3	0	10	0	4	188	0	0	3	0	4	0	5	217	3	0	437
04:45 PM	5	0	7	0	0	206	2	0	3	0	1	0	4	215	3	0	446
Total	18	0	26	0	9	773	5	0	8	0	9	0	21	847	19	0	1735

Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter; 4
Counted By; DN
Town; Mashpee
Location; Rt 28 @ Noisy Hole & Trinity

File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
Page No : 2

Groups Printed- Cars

	Noisy Hole Rd From North				Route 28 From East				Trinity Place From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
05:00 PM	8	0	6	0	2	216	2	0	3	0	3	0	19	212	2	0	473
05:15 PM	4	1	6	0	2	209	2	0	2	0	3	0	12	191	7	0	439
05:30 PM	5	0	5	0	3	198	2	0	2	0	4	0	3	213	2	0	437
05:45 PM	0	0	8	0	1	223	2	0	4	0	6	0	3	190	1	0	438
Total	17	1	25	0	8	846	8	0	11	0	16	0	37	806	12	0	1787
06:00 PM	1	1	5	0	1	200	0	0	4	0	3	0	7	162	2	0	386
06:15 PM	3	0	3	0	3	169	1	0	0	0	8	0	6	175	3	0	371
06:30 PM	5	0	2	0	3	172	2	0	6	2	5	0	7	199	3	0	406
06:45 PM	4	1	3	0	3	155	0	0	0	0	7	0	2	165	0	0	340
Total	13	2	13	0	10	696	3	0	10	2	23	0	22	701	8	0	1503
Grand Total	165	7	261	1	95	8778	109	1	123	5	194	2	298	9413	131	2	19585
Apprch %	38	1.6	60.1	0.2	1.1	97.7	1.2	0	38	1.5	59.9	0.6	3	95.6	1.3	0	
Total %	0.8	0	1.3	0	0.5	44.8	0.6	0	0.6	0	1	0	1.5	48.1	0.7	0	

Cape Cod Commission
3225 Main Street
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Counter; 4
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Town; Mashpee
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File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
Page No : 1

Groups Printed- Trucks

	Noisy Hole Rd From North				Route 28 From East				Trinity Place From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	9	0	0	0	0	0	0	0	5	0	0	14
07:15 AM	0	0	1	0	0	14	0	0	0	0	0	0	0	12	0	0	27
07:30 AM	0	0	0	0	0	14	0	0	0	0	0	0	0	11	0	0	25
07:45 AM	0	0	0	0	0	14	0	0	0	0	0	0	0	4	0	0	18
Total	0	0	1	0	0	51	0	0	0	0	0	0	0	32	0	0	84
08:00 AM	0	0	0	0	0	15	0	0	0	0	0	0	0	8	0	0	23
08:15 AM	0	0	0	0	0	15	0	0	0	0	0	0	0	14	0	0	29
08:30 AM	0	0	0	0	0	20	0	0	0	0	0	0	0	10	0	0	30
08:45 AM	0	0	1	0	0	11	0	0	0	0	0	0	0	12	0	0	24
Total	0	0	1	0	0	61	0	0	0	0	0	0	0	44	0	0	106
09:00 AM	0	0	0	0	0	8	0	0	0	0	0	0	0	3	0	0	11
09:15 AM	0	0	0	0	0	8	0	0	0	0	0	0	0	6	0	0	14
09:30 AM	0	0	0	0	0	5	0	0	0	0	0	0	0	7	0	0	12
09:45 AM	0	0	1	0	0	3	0	0	0	0	0	0	0	5	0	0	9
Total	0	0	1	0	0	24	0	0	0	0	0	0	0	21	0	0	46
10:00 AM	0	0	0	0	0	5	0	0	0	0	0	0	0	8	0	0	13
10:15 AM	0	0	0	0	0	10	0	0	0	0	0	0	0	2	0	0	12
10:30 AM	0	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	10
10:45 AM	1	0	0	0	0	7	0	0	0	0	0	0	0	6	0	0	14
Total	1	0	0	0	0	27	0	0	0	0	0	0	0	21	0	0	49
11:00 AM	0	0	0	0	0	11	0	0	0	0	0	0	0	10	0	0	21
11:15 AM	1	0	0	0	1	7	0	0	0	0	0	0	0	10	0	0	19
11:30 AM	0	0	0	0	0	8	0	0	0	0	0	0	0	10	0	0	18
11:45 AM	0	0	0	0	0	6	0	0	0	0	0	0	0	5	0	0	11
Total	1	0	0	0	1	32	0	0	0	0	0	0	0	35	0	0	69
12:00 PM	0	0	0	0	0	8	0	0	0	0	0	0	0	6	0	0	14
12:15 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	10	0	0	12
12:30 PM	1	0	0	0	0	6	0	0	0	0	0	0	0	4	0	0	11
12:45 PM	1	0	0	0	0	8	0	0	0	0	0	0	0	5	0	0	14
Total	2	0	0	0	0	24	0	0	0	0	0	0	0	25	0	0	51
01:00 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	4	1	0	7
01:15 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	5
01:30 PM	0	0	1	0	0	6	0	0	0	0	0	0	0	8	0	0	15
01:45 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	5
Total	0	0	1	0	0	14	0	0	0	0	0	0	0	16	1	0	32
02:00 PM	1	0	0	0	0	9	0	0	0	0	0	0	0	5	0	0	15
02:15 PM	0	0	0	0	0	16	0	0	0	0	0	0	0	8	0	0	24
02:30 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	3	0	0	6
02:45 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	4	0	0	7
Total	1	0	0	0	0	31	0	0	0	0	0	0	0	20	0	0	52
03:00 PM	0	0	1	0	0	4	0	0	0	0	0	0	0	3	1	0	9
03:15 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	3	0	0	6
03:30 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	0	6
03:45 PM	1	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	5
Total	1	0	1	0	0	10	0	0	0	0	0	0	0	13	1	0	26
04:00 PM	0	0	0	0	0	5	0	0	0	0	0	0	0	4	0	0	9
04:15 PM	0	0	0	0	0	6	0	0	0	0	0	0	0	11	0	0	17
04:30 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	5	0	0	8
04:45 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	0	6
Total	0	0	0	0	0	16	0	0	0	0	0	0	0	24	0	0	40

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File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
Page No : 2

Groups Printed- Trucks

	Noisy Hole Rd From North				Route 28 From East				Trinity Place From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
05:00 PM	0	0	1	0	0	5	0	0	0	0	0	0	0	0	0	0	6
05:15 PM	0	0	1	0	0	1	0	0	0	0	0	0	0	3	1	0	6
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
05:45 PM	1	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	5
Total	1	0	2	0	0	7	0	0	0	0	0	0	0	7	2	0	19
06:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
06:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
06:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5
06:45 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
Total	0	0	0	0	0	3	0	0	0	0	0	0	0	11	0	0	14
Grand Total	7	0	7	0	1	300	0	0	0	0	0	0	0	269	4	0	588
Apprch %	50	0	50	0	0.3	99.7	0	0	0	0	0	0	0	98.5	1.5	0	
Total %	1.2	0	1.2	0	0.2	51	0	0	0	0	0	0	0	45.7	0.7	0	

Cape Cod Commission

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File Name : 3103_08012017
Site Code : 00003103
Start Date : 8/1/2017
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Groups Printed- Bikes

	Noisy Hole Rd From North				Route 28 From East				Trinity Place From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
*** BREAK ***																	
07:30 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
Total	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
*** BREAK ***																	
08:45 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
10:15 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
Total	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
11:15 AM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
Total	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2
12:00 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
*** BREAK ***																	
Total	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2
01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
*** BREAK ***																	
01:45 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Total	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	3
*** BREAK ***																	
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
*** BREAK ***																	
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
05:30 PM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
Total	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2
*** BREAK ***																	
Grand Total	2	0	2	0	1	3	0	0	0	0	0	0	1	6	1	0	16
Apprch %	50	0	50	0	25	75	0	0	0	0	0	0	12.5	75	12.5	0	
Total %	12.5	0	12.5	0	6.2	18.8	0	0	0	0	0	0	6.2	37.5	6.2	0	

Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter; 3
Counted By; ST
Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 1

Groups Printed- Cars - Trucks

	From North				Route 28 From East				Bowdoin Rd. From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	163	15	0	16	0	10	0	10	173	0	0	387
07:15 AM	0	0	0	1	0	172	19	0	13	0	5	0	11	226	0	0	447
07:30 AM	0	0	0	0	0	196	24	0	19	0	12	0	15	228	0	0	494
07:45 AM	0	0	0	0	0	194	25	0	21	0	12	0	12	218	0	0	482
Total	0	0	0	1	0	725	83	0	69	0	39	0	48	845	0	0	1810
08:00 AM	0	0	0	0	0	213	11	0	12	0	12	0	22	192	0	0	462
08:15 AM	0	0	0	0	0	201	17	0	20	0	18	0	13	220	0	0	489
08:30 AM	0	0	0	0	0	210	23	0	18	0	10	0	12	255	0	0	528
08:45 AM	0	0	0	0	0	154	18	0	15	0	7	0	11	163	0	0	368
Total	0	0	0	0	0	778	69	0	65	0	47	0	58	830	0	0	1847
09:00 AM	0	0	0	0	0	167	13	0	20	0	7	0	10	185	0	0	402
09:15 AM	0	0	0	0	0	190	15	0	11	0	7	0	12	199	0	0	434
09:30 AM	0	0	0	0	0	205	11	0	15	0	4	0	11	213	0	0	459
09:45 AM	0	0	0	0	0	195	18	0	19	0	12	0	18	203	0	0	465
Total	0	0	0	0	0	757	57	0	65	0	30	0	51	800	0	0	1760
10:00 AM	0	0	0	0	0	201	23	0	27	0	11	0	16	170	0	0	448
10:15 AM	0	0	0	0	0	196	7	0	9	0	15	0	13	178	0	0	418
10:30 AM	0	0	0	0	0	177	13	0	21	0	7	0	8	229	0	0	455
10:45 AM	0	0	0	0	0	82	7	0	6	0	2	0	8	80	0	0	185
Total	0	0	0	0	0	656	50	0	63	0	35	0	45	657	0	0	1506
11:00 AM	0	0	0	0	0	175	15	0	15	0	13	0	10	183	0	0	411
11:15 AM	0	0	0	0	0	160	13	0	16	0	13	0	12	196	0	0	410
11:30 AM	0	0	0	0	0	183	12	0	19	0	10	0	16	229	0	0	469
11:45 AM	0	0	0	0	1	168	12	0	16	0	7	0	12	206	0	0	422
Total	0	0	0	0	1	686	52	0	66	0	43	0	50	814	0	0	1712
12:00 PM	0	0	0	0	0	196	9	0	14	0	8	0	12	208	0	0	447
12:15 PM	0	0	0	0	0	188	14	0	12	0	8	1	7	203	0	0	433
12:30 PM	0	0	0	0	0	175	22	0	19	0	14	0	15	208	0	0	453
12:45 PM	0	0	0	0	0	179	13	0	23	0	13	0	17	193	0	1	439
Total	0	0	0	0	0	738	58	0	68	0	43	1	51	812	0	1	1772
01:00 PM	0	0	0	0	0	151	15	0	11	0	10	1	12	181	0	0	381
01:15 PM	0	0	0	0	7	151	9	0	11	0	12	0	11	185	0	0	386
01:30 PM	0	0	0	0	0	184	5	0	9	0	10	0	16	190	0	0	414
01:45 PM	0	0	0	0	0	199	13	0	14	0	9	0	12	199	0	0	446
Total	0	0	0	0	7	685	42	0	45	0	41	1	51	755	0	0	1627
02:00 PM	0	0	0	0	0	182	10	0	14	0	8	0	12	172	0	0	398
02:15 PM	0	0	0	0	0	162	11	0	13	0	14	0	9	200	1	0	410
02:30 PM	0	0	0	0	4	190	10	0	8	0	6	0	9	198	0	0	425
02:45 PM	0	0	0	0	0	200	7	0	10	0	10	0	12	177	0	0	416
Total	0	0	0	0	4	734	38	0	45	0	38	0	42	747	1	0	1649
03:00 PM	0	0	0	0	0	203	14	0	15	0	4	1	12	181	0	0	430
03:15 PM	0	0	0	0	0	192	11	0	20	0	17	1	14	221	0	0	476
03:30 PM	0	0	0	0	0	191	7	0	20	0	7	0	10	200	0	0	435
03:45 PM	0	0	0	0	0	188	11	0	15	0	7	0	13	204	4	0	442
Total	0	0	0	0	0	774	43	0	70	0	35	2	49	806	4	0	1783
04:00 PM	0	0	0	0	0	204	11	0	15	0	7	0	9	201	0	0	447
04:15 PM	0	0	0	0	1	176	10	1	15	0	5	0	3	207	0	0	418
04:30 PM	0	0	0	0	0	189	4	0	18	0	4	0	3	226	0	0	444
04:45 PM	0	0	0	0	0	195	4	0	11	0	7	0	6	223	0	0	446
Total	0	0	0	0	1	764	29	1	59	0	23	0	21	857	0	0	1755

1754 1754

Cape Cod Commission

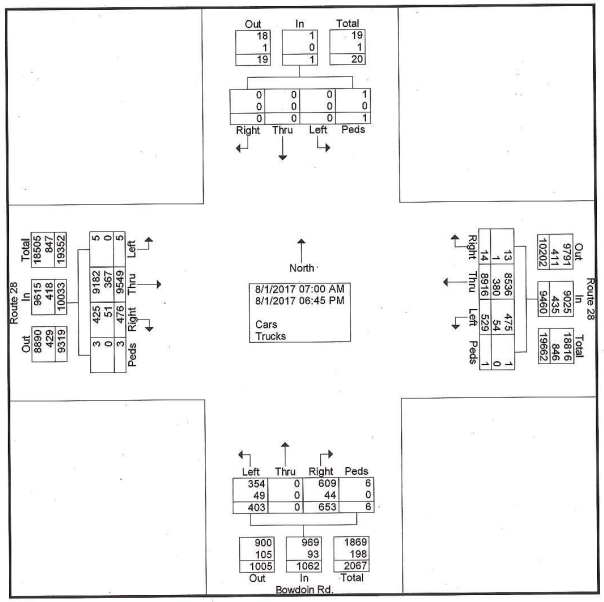
3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter; 3
Counted By; ST
Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 2

Groups Printed- Cars - Trucks

	From North				Route 28 From East				Bowdoin Rd. From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
05:00 PM	0	0	0	0	0	233	3	0	23	0	18	0	4	236	0	0	517
05:15 PM	0	0	0	0	1	220	1	0	6	0	9	2	2	204	0	2	447
05:30 PM	0	0	0	0	0	220	0	0	3	0	0	0	1	230	0	0	454
05:45 PM	0	0	0	0	0	218	1	0	1	0	1	0	1	198	0	0	420
Total	0	0	0	0	1	891	5	0	33	0	28	2	8	868	0	2	1838
06:00 PM	0	0	0	0	0	205	0	0	2	0	0	0	0	181	0	0	388
06:15 PM	0	0	0	0	0	180	0	0	0	0	0	0	0	198	0	0	378
06:30 PM	0	0	0	0	0	175	3	0	2	0	1	0	2	210	0	0	393
06:45 PM	0	0	0	0	0	168	0	0	1	0	0	0	0	169	0	0	338
Total	0	0	0	0	0	728	3	0	5	0	1	0	2	758	0	0	1497
Grand Total	0	0	0	1	14	8916	529	1	653	0	403	6	476	9549	5	3	20556
Apprch %	0	0	0	100	0.1	94.2	5.6	0	61.5	0	37.9	0.6	4.7	95.2	0	0	
Total %	0	0	0	0	0.1	43.4	2.6	0	3.2	0	2	0	2.3	46.5	0	0	
Cars	0	0	0	1	13	8536	475	1	609	0	354	6	425	9182	5	3	19610
% Cars	0	0	0	100	92.9	95.7	89.8	100	93.3	0	87.8	100	89.3	96.2	100	100	95.4
Trucks	0	0	0	0	1	380	54	0	44	0	49	0	51	367	0	0	946
% Trucks	0	0	0	0	7.1	4.3	10.2	0	6.7	0	12.2	0	10.7	3.8	0	0	4.6



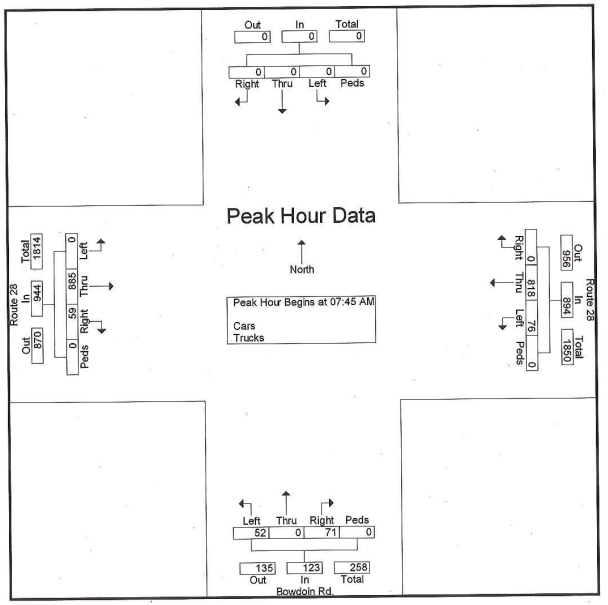
Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter; 3
Counted By; ST
Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 3

	From North					Route 28 From East					Bowdoin Rd. From South					Route 28 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM ←																					
07:45 AM	0	0	0	0	0	0	194	**25**	0	219	**21**	0	12	0	33	12	218	0	0	230	482
08:00 AM	0	0	0	0	0	0	**213**	11	0	224	12	0	12	0	24	**22**	192	0	0	214	462
08:15 AM	0	0	0	0	0	0	201	17	0	218	20	0	**18**	0	**38**	13	220	0	0	233	489
08:30 AM	0	0	0	0	0	0	210	23	0	**233**	18	0	10	0	28	12	**255**	0	0	**267**	**528**
Total Volume	0	0	0	0	0	0	818	76	0	894	71	0	52	0	123	59	885	0	0	944	1961
% App. Total	0	0	0	0		0	91.5	8.5	0		57.7	0	42.3	0		6.2	93.8	0	0		
PHF	.000	.000	.000	.000	.000	.000	.960	.760	.000	.959	.845	.000	.722	.000	.809	.670	.868	.000	.000	.884	.929



Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
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Counter; 3
Counted By; ST
Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 1

Groups Printed- Cars

	From North				Route 28 From East				Bowdoin Rd. From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	155	14	0	13	0	7	0	9	167	0	0	365
07:15 AM	0	0	0	1	0	163	17	0	10	0	4	0	9	214	0	0	418
07:30 AM	0	0	0	0	0	185	24	0	18	0	12	0	13	223	0	0	475
07:45 AM	0	0	0	0	0	180	23	0	20	0	11	0	9	212	0	0	455
Total	0	0	0	1	0	683	78	0	61	0	34	0	40	816	0	0	1713
08:00 AM	0	0	0	0	0	199	10	0	10	0	9	0	19	186	0	0	433
08:15 AM	0	0	0	0	0	187	14	0	20	0	16	0	12	211	0	0	460
08:30 AM	0	0	0	0	0	195	22	0	14	0	10	0	12	246	0	0	499
08:45 AM	0	0	0	0	0	145	17	0	15	0	5	0	10	154	0	0	346
Total	0	0	0	0	0	726	63	0	59	0	40	0	53	797	0	0	1738
09:00 AM	0	0	0	0	0	160	13	0	17	0	5	0	9	176	0	0	380
09:15 AM	0	0	0	0	0	176	12	0	10	0	6	0	12	191	0	0	407
09:30 AM	0	0	0	0	0	193	7	0	13	0	3	0	10	204	0	0	430
09:45 AM	0	0	0	0	0	187	16	0	17	0	10	0	17	195	0	0	442
Total	0	0	0	0	0	716	48	0	57	0	24	0	48	766	0	0	1659
10:00 AM	0	0	0	0	0	185	22	0	25	0	8	0	11	159	0	0	410
10:15 AM	0	0	0	0	0	176	7	0	9	0	12	0	12	168	0	0	384
10:30 AM	0	0	0	0	0	172	11	0	20	0	5	0	8	217	0	0	433
10:45 AM	0	0	0	0	0	77	5	0	6	0	1	0	7	72	0	0	168
Total	0	0	0	0	0	610	45	0	60	0	26	0	38	616	0	0	1395
11:00 AM	0	0	0	0	0	170	15	0	15	0	12	0	8	176	0	0	396
11:15 AM	0	0	0	0	0	153	13	0	15	0	11	0	9	188	0	0	389
11:30 AM	0	0	0	0	0	176	11	0	19	0	10	0	15	220	0	0	451
11:45 AM	0	0	0	0	1	157	11	0	14	0	7	0	11	198	0	0	399
Total	0	0	0	0	1	656	50	0	63	0	40	0	43	782	0	0	1635
12:00 PM	0	0	0	0	0	189	8	0	12	0	7	0	12	197	0	0	425
12:15 PM	0	0	0	0	0	177	12	0	10	0	8	1	6	190	0	0	404
12:30 PM	0	0	0	0	0	170	20	0	19	0	11	0	14	198	0	0	432
12:45 PM	0	0	0	0	0	170	13	0	21	0	13	0	16	181	0	1	415
Total	0	0	0	0	0	706	53	0	62	0	39	1	48	766	0	1	1676
01:00 PM	0	0	0	0	0	134	13	0	11	0	10	1	11	173	0	0	353
01:15 PM	0	0	0	0	7	146	8	0	11	0	10	0	11	173	0	0	366
01:30 PM	0	0	0	0	0	175	4	0	8	0	10	0	15	180	0	0	392
01:45 PM	0	0	0	0	0	191	11	0	13	0	7	0	11	193	0	0	426
Total	0	0	0	0	7	646	36	0	43	0	37	1	48	719	0	0	1537
02:00 PM	0	0	0	0	0	174	9	0	14	0	5	0	12	165	0	0	379
02:15 PM	0	0	0	0	0	150	9	0	13	0	12	0	9	194	1	0	388
02:30 PM	0	0	0	0	3	188	9	0	8	0	6	0	8	189	0	0	411
02:45 PM	0	0	0	0	0	195	6	0	10	0	9	0	11	170	0	0	401
Total	0	0	0	0	3	707	33	0	45	0	32	0	40	718	1	0	1579
03:00 PM	0	0	0	0	0	194	9	0	13	0	1	1	12	175	0	0	405
03:15 PM	0	0	0	0	0	182	11	0	18	0	17	1	12	210	0	0	451
03:30 PM	0	0	0	0	0	187	7	0	20	0	7	0	7	194	0	0	422
03:45 PM	0	0	0	0	0	186	8	0	15	0	7	0	10	203	4	0	433
Total	0	0	0	0	0	749	35	0	66	0	32	2	41	782	4	0	1711
04:00 PM	0	0	0	0	0	194	10	0	15	0	5	0	7	192	0	0	423
04:15 PM	0	0	0	0	1	173	9	1	13	0	5	0	2	196	0	0	400
04:30 PM	0	0	0	0	0	185	4	0	18	0	4	0	2	221	0	0	434
04:45 PM	0	0	0	0	0	191	3	0	10	0	7	0	6	219	0	0	436
Total	0	0	0	0	1	743	26	1	56	0	21	0	17	828	0	0	1693

Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
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Counter; 3
Counted By; ST
Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 2

Groups Printed- Cars

	From North				Route 28 From East				Bowdoin Rd. From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
05:00 PM	0	0	0	0	0	226	3	0	23	0	18	0	4	230	0	0	504
05:15 PM	0	0	0	0	1	217	1	0	6	0	9	2	2	198	0	2	438
05:30 PM	0	0	0	0	0	216	0	0	2	0	0	0	1	228	0	0	447
05:45 PM	0	0	0	0	0	214	1	0	1	0	1	0	1	193	0	0	411
Total	0	0	0	0	1	873	5	0	32	0	28	2	8	849	0	2	1800
06:00 PM	0	0	0	0	0	203	0	0	2	0	0	0	0	178	0	0	383
06:15 PM	0	0	0	0	0	178	0	0	0	0	0	0	0	194	0	0	372
06:30 PM	0	0	0	0	0	174	3	0	2	0	1	0	1	204	0	0	385
06:45 PM	0	0	0	0	0	166	0	0	1	0	0	0	0	167	0	0	334
Total	0	0	0	0	0	721	3	0	5	0	1	0	1	743	0	0	1474
Grand Total	0	0	0	1	13	8536	475	1	609	0	354	6	425	9182	5	3	19610
Apprch %	0	0	0	100	0.1	94.6	5.3	0	62.8	0	36.5	0.6	4.4	95.5	0.1	0	
Total %	0	0	0	0	0.1	43.5	2.4	0	3.1	0	1.8	0	2.2	46.8	0	0	

Cape Cod Commission

3225 Main Street
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Counter; 3
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Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 1

Groups Printed- Trucks

	From North				Route 28 From East				Bowdoin Rd. From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	8	1	0	3	0	3	0	1	6	0	0	22
07:15 AM	0	0	0	0	0	9	2	0	3	0	1	0	2	12	0	0	29
07:30 AM	0	0	0	0	0	11	0	0	1	0	0	0	2	5	0	0	19
07:45 AM	0	0	0	0	0	14	2	0	1	0	1	0	3	6	0	0	27
Total	0	0	0	0	0	42	5	0	8	0	5	0	8	29	0	0	97
08:00 AM	0	0	0	0	0	14	1	0	2	0	3	0	3	6	0	0	29
08:15 AM	0	0	0	0	0	14	3	0	0	0	2	0	1	9	0	0	29
08:30 AM	0	0	0	0	0	15	1	0	4	0	0	0	0	9	0	0	29
08:45 AM	0	0	0	0	0	9	1	0	0	0	2	0	1	9	0	0	22
Total	0	0	0	0	0	52	6	0	6	0	7	0	5	33	0	0	109
09:00 AM	0	0	0	0	0	7	0	0	3	0	2	0	1	9	0	0	22
09:15 AM	0	0	0	0	0	14	3	0	1	0	1	0	0	8	0	0	27
09:30 AM	0	0	0	0	0	12	4	0	2	0	1	0	1	9	0	0	29
09:45 AM	0	0	0	0	0	8	2	0	2	0	2	0	1	8	0	0	23
Total	0	0	0	0	0	41	9	0	8	0	6	0	3	34	0	0	101
10:00 AM	0	0	0	0	0	16	1	0	2	0	3	0	5	11	0	0	38
10:15 AM	0	0	0	0	0	20	0	0	0	0	3	0	1	10	0	0	34
10:30 AM	0	0	0	0	0	5	2	0	1	0	2	0	0	12	0	0	22
10:45 AM	0	0	0	0	0	5	2	0	0	0	1	0	1	8	0	0	17
Total	0	0	0	0	0	46	5	0	3	0	9	0	7	41	0	0	111
11:00 AM	0	0	0	0	0	5	0	0	0	0	1	0	2	7	0	0	15
11:15 AM	0	0	0	0	0	7	0	0	1	0	2	0	3	8	0	0	21
11:30 AM	0	0	0	0	0	7	1	0	0	0	0	0	1	9	0	0	18
11:45 AM	0	0	0	0	0	11	1	0	2	0	0	0	1	8	0	0	23
Total	0	0	0	0	0	30	2	0	3	0	3	0	7	32	0	0	77
12:00 PM	0	0	0	0	0	7	1	0	2	0	1	0	0	11	0	0	22
12:15 PM	0	0	0	0	0	11	2	0	2	0	0	0	1	13	0	0	29
12:30 PM	0	0	0	0	0	5	2	0	0	0	3	0	1	10	0	0	21
12:45 PM	0	0	0	0	0	9	0	0	2	0	0	0	1	12	0	0	24
Total	0	0	0	0	0	32	5	0	6	0	4	0	3	46	0	0	96
01:00 PM	0	0	0	0	0	17	2	0	0	0	0	0	1	8	0	0	28
01:15 PM	0	0	0	0	0	5	1	0	0	0	2	0	0	12	0	0	20
01:30 PM	0	0	0	0	0	9	1	0	1	0	0	0	1	10	0	0	22
01:45 PM	0	0	0	0	0	8	2	0	1	0	2	0	1	6	0	0	20
Total	0	0	0	0	0	39	6	0	2	0	4	0	3	36	0	0	90
02:00 PM	0	0	0	0	0	8	1	0	0	0	3	0	0	7	0	0	19
02:15 PM	0	0	0	0	0	12	2	0	0	0	2	0	0	6	0	0	22
02:30 PM	0	0	0	0	1	2	1	0	0	0	0	0	1	9	0	0	14
02:45 PM	0	0	0	0	0	5	1	0	0	0	1	0	1	7	0	0	15
Total	0	0	0	0	1	27	5	0	0	0	6	0	2	29	0	0	70
03:00 PM	0	0	0	0	0	9	5	0	2	0	3	0	0	6	0	0	25
03:15 PM	0	0	0	0	0	10	0	0	2	0	0	0	2	11	0	0	25
03:30 PM	0	0	0	0	0	4	0	0	0	0	0	0	3	6	0	0	13
03:45 PM	0	0	0	0	0	2	3	0	0	0	0	0	3	1	0	0	9
Total	0	0	0	0	0	25	8	0	4	0	3	0	8	24	0	0	72
04:00 PM	0	0	0	0	0	10	1	0	0	0	2	0	2	9	0	0	24
04:15 PM	0	0	0	0	0	3	1	0	2	0	0	0	1	11	0	0	18
04:30 PM	0	0	0	0	0	4	0	0	0	0	0	0	1	5	0	0	10
04:45 PM	0	0	0	0	0	4	1	0	1	0	0	0	0	4	0	0	10
Total	0	0	0	0	0	21	3	0	3	0	2	0	4	29	0	0	62

Cape Cod Commission

3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter; 3
Counted By; ST
Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 2

Groups Printed- Trucks

	From North				Route 28 From East				Bowdoin Rd. From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
05:00 PM	0	0	0	0	0	7	0	0	0	0	0	0	0	6	0	0	13
05:15 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	6	0	0	9
05:30 PM	0	0	0	0	0	4	0	0	1	0	0	0	0	2	0	0	7
05:45 PM	0	0	0	0	0	4	0	0	0	0	0	0	0	5	0	0	9
Total	0	0	0	0	0	18	0	0	1	0	0	0	0	19	0	0	38
06:00 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	5
06:15 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	0	6
06:30 PM	0	0	0	0	0	1	0	0	0	0	0	0	1	6	0	0	8
06:45 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	4
Total	0	0	0	0	0	7	0	0	0	0	0	0	1	15	0	0	23
Grand Total	0	0	0	0	1	380	54	0	44	0	49	0	51	367	0	0	946
Apprch %	0	0	0	0	0.2	87.4	12.4	0	47.3	0	52.7	0	12.2	87.8	0	0	
Total %	0	0	0	0	0.1	40.2	5.7	0	4.7	0	5.2	0	5.4	38.8	0	0	

Cape Cod Commission

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Counter; 3
Counted By; ST
Town; Mashpee
Location; Route 28 @ Bowdoin Rd.

File Name : 3104_08012017
Site Code : 00003104
Start Date : 8/1/2017
Page No : 1

Groups Printed- Bikes

	From North				Route 28 From East				Bowdoin Rd. From South				Route 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
*** BREAK ***																	
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*** BREAK ***																	
10:15 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
Total	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
*** BREAK ***																	
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
*** BREAK ***																	
01:45 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
Total	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	3
*** BREAK ***																	
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*** BREAK ***																	
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
*** BREAK ***																	
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
05:30 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																	
Total	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
*** BREAK ***																	
Grand Total	0	0	0	0	0	1	0	3	0	0	0	0	0	3	0	4	11
Apprch %	0	0	0	0	0	25	0	75	0	0	0	0	0	42.9	0	57.1	
Total %	0	0	0	0	0	9.1	0	27.3	0	0	0	0	0	27.3	0	36.4	

Cape Cod Commission

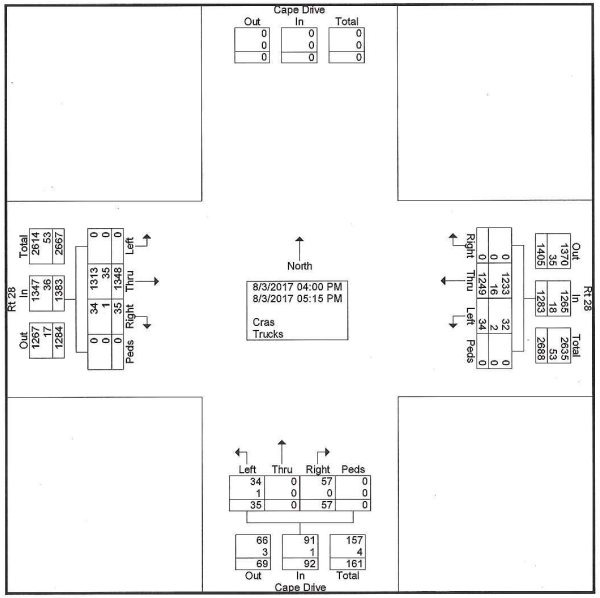
3225 Main Street
Barnstable, MA 02630
www.capecodcommission.org

Counter: 3
Counted By: AR
Town: Mashpee
Location: Rt 28 @ Cape Drive

File Name : 3105_08032017
Site Code : 00003105
Start Date : 8/3/2017
Page No : 1

Groups Printed- Cras - Trucks

	Rt 28 From East				Cape Drive From South				Rt 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	0	208	6	0	12	0	5	0	8	201	0	0	440
04:15 PM	0	195	3	0	11	0	7	0	8	205	0	0	429
04:30 PM	0	203	3	0	4	0	8	0	4	236	0	0	458
04:45 PM	0	213	7	0	3	0	5	0	5	227	0	0	460
Total	0	819	19	0	30	0	25	0	25	869	0	0	1787
05:00 PM	0	209	7	0	18	0	5	0	4	263	0	0	506
05:15 PM	0	221	8	0	9	0	5	0	6	216	0	0	465
Grand Total	0	1249	34	0	57	0	35	0	35	1348	0	0	2758
Apprch %	0	97.3	2.7	0	62	0	38	0	2.5	97.5	0	0	
Total %	0	45.3	1.2	0	2.1	0	1.3	0	1.3	48.9	0	0	
Cras	0	1233	32	0	57	0	34	0	34	1313	0	0	2703
% Cras	0	98.7	94.1	0	100	0	97.1	0	97.1	97.4	0	0	98
Trucks	0	16	2	0	0	0	1	0	1	35	0	0	55
% Trucks	0	1.3	5.9	0	0	0	2.9	0	2.9	2.6	0	0	2



Cape Cod Commission

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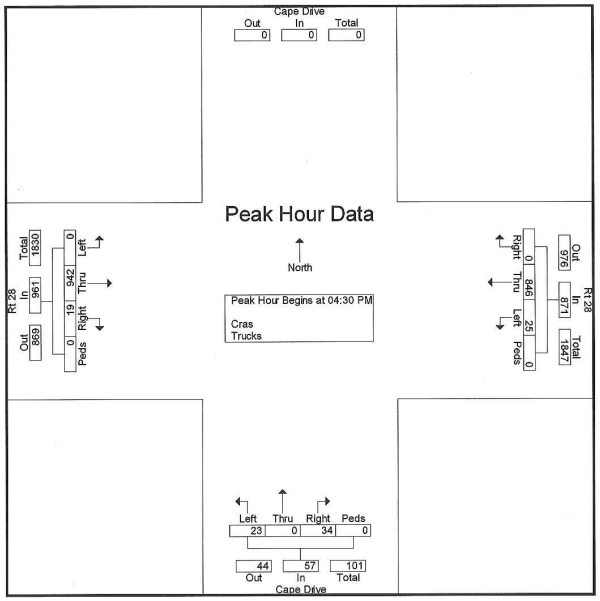
Counter: 3
Counted By: AR
Town: Mashpee
Location: Rt 28 @ Cape Drive

File Name : 3105_08032017
Site Code : 00003105
Start Date : 8/3/2017
Page No : 2

	Rt 28 From East					Cape Drive From South					Rt 28 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:15 PM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 04:30 PM																
04:30 PM	0	203	3	0	206	4	0	**8**	0	12	4	236	0	0	240	458
04:45 PM	0	213	7	0	220	3	0	5	0	8	5	227	0	0	232	460
05:00 PM	0	209	7	0	216	**18**	0	5	0	**23**	4	**263**	0	0	**267**	**506**
05:15 PM	0	**221**	**8**	0	**229**	9	0	5	0	14	**6**	216	0	0	222	465
Total Volume	0	846	25	0	871	34	0	23	0	57	19	942	0	0	961	1889
% App. Total	0	97.1	2.9	0		59.6	0	40.4	0		2	98	0	0		
PHF	.000	.957	.781	.000	.951	.472	.000	.719	.000	.620	.792	.895	.000	.000	.900	.933



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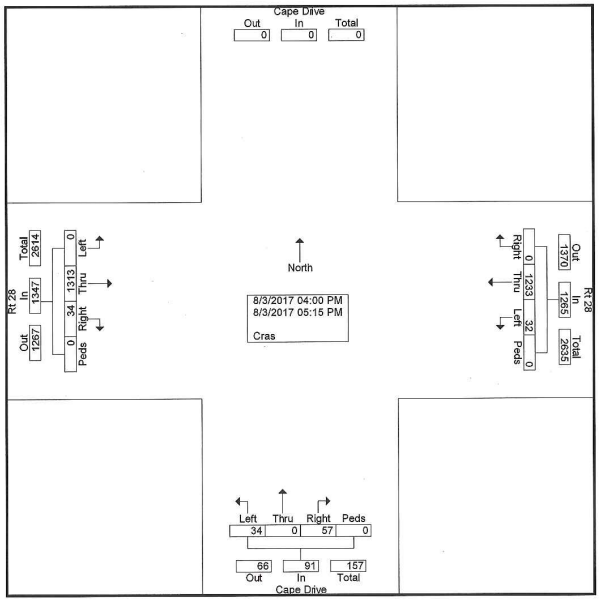
File Name : 3105_08032017
Site Code : 00003105
Start Date : 8/3/2017
Page No : 1

Groups Printed- Cras

	Rt 28 From East				Cape Drive From South				Rt 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	0	203	4	0	12	0	5	0	7	191	0	0	422
04:15 PM	0	192	3	0	11	0	7	0	8	194	0	0	415
04:30 PM	0	198	3	0	4	0	8	0	4	234	0	0	451
04:45 PM	0	211	7	0	3	0	4	0	5	225	0	0	455
Total	0	804	17	0	30	0	24	0	24	844	0	0	1743
05:00 PM	0	208	7	0	18	0	5	0	4	258	0	0	500
05:15 PM	0	221	8	0	9	0	5	0	6	211	0	0	460
Grand Total	0	1233	32	0	57	0	34	0	34	1313	0	0	2703
Apprch %	0	97.5	2.5	0	62.6	0	37.4	0	2.5	97.5	0	0	
Total %	0	45.6	1.2	0	2.1	0	1.3	0	1.3	48.6	0	0	



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Counter: 3
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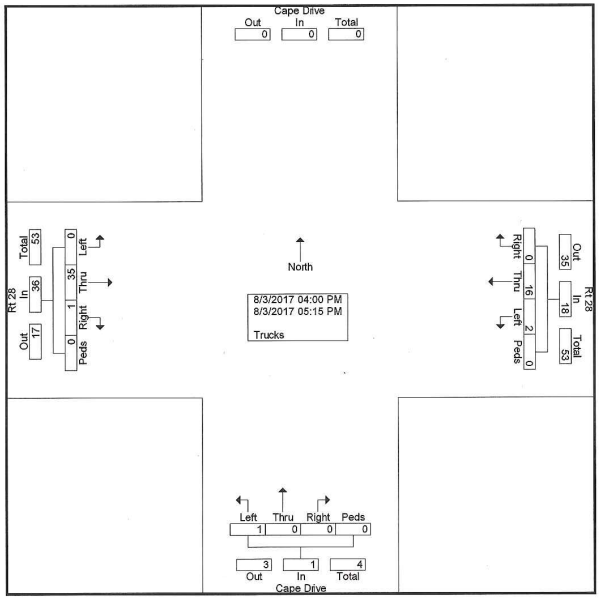
File Name : 3105_08032017
Site Code : 00003105
Start Date : 8/3/2017
Page No : 1

Groups Printed- Trucks

	Rt 28 From East				Cape Drive From South				Rt 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	0	5	2	0	0	0	0	0	1	10	0	0	18
04:15 PM	0	3	0	0	0	0	0	0	0	11	0	0	14
04:30 PM	0	5	0	0	0	0	0	0	0	2	0	0	7
04:45 PM	0	2	0	0	0	0	1	0	0	2	0	0	5
Total	0	15	2	0	0	0	1	0	1	25	0	0	44
05:00 PM	0	1	0	0	0	0	0	0	0	5	0	0	6
05:15 PM	0	0	0	0	0	0	0	0	0	5	0	0	5
Grand Total	0	16	2	0	0	0	1	0	1	35	0	0	55
Apprch %	0	88.9	11.1	0	0	0	100	0	2.8	97.2	0	0	
Total %	0	29.1	3.6	0	0	0	1.8	0	1.8	63.6	0	0	



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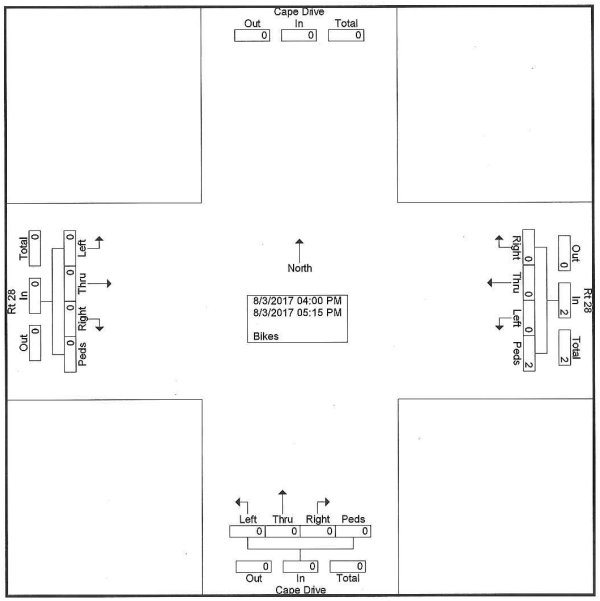
Counter: 3
Counted By: AR
Town: Mashpee
Location: Rt 28 @ Cape Drive

File Name : 3105_08032017
Site Code : 00003105
Start Date : 8/3/2017
Page No : 1

Groups Printed- Bikes

	Rt 28 From East				Cape Drive From South				Rt 28 From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
*** BREAK ***													
05:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	1
05:15 PM	0	0	0	1	0	0	0	0	0	0	0	0	1
Grand Total	0	0	0	2	0	0	0	0	0	0	0	0	2
Apprch %	0	0	0	100	0	0	0	0	0	0	0	0	
Total %	0	0	0	100	0	0	0	0	0	0	0	0	



ROUTE 28 EASTERN MASHPEE
ROUTE 130 TO ORCHARD ROAD CORRIDOR STUDY
PUBLIC LISTENING SESSION MEETING SUMMARY

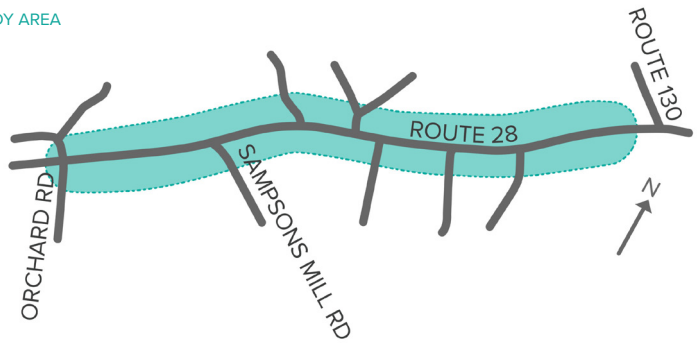
WEDNESDAY, JULY 26, 2017, 6:00 PM
MASHPEE PUBLIC LIBRARY
64 STEEPLE STREET, MASHPEE

CAPE COD COMMISSION

ATTENDEES

- Steven Tupper, Cape Cod Commission
- Chloe Schaefer, Cape Cod Commission
- Glenn Cannon, Cape Cod Commission
- Lev Malakhoff, Cape Cod Commission
- David Nolan, Cape Cod Commission
- Catherine Laurent, Town of Mashpee
- Jason Steiding, Mashpee Wampanoag Tribe
- Ann Marie Askew, Mashpee Wampanoag Tribe
- Timothy Kochan, MassDOT District 5
- Deb Rizzo
- Paula Fullerton
- Al Fullerton
- Thomas Feronti
- Colin Baird
- Bud Carey
- Winona Pocknett
- Ron Beauchoin
- Carol Beauchoin
- Kathy Jacobsen
- J. Marie Stevenson
- Trish Keliinui
- Linda A. Butzke
- David Baker
- Linda Baker
- Paula Butler
- Jim Saret
- Marshall McStay
- Linda Cahoon
- Dennis Cahoon
- Tony Felicetti
- Carolyn Felicetti
- Jessica Rapp Grassetti
- Debbie Gasior
- Chuck Gasior
- Fred Parker
- Dorothy Harker
- John Harker
- Jon Schwarz
- Deborah Ripperger
- Cheryl Smith
- Maurine Wacks
- Bill Wacks
- Susan Thomas
- Mark Thomas
- Peg Fraser
- Dick Fraser
- Kathryn Risotti
- Chris Lindahl
- Bridget Delaney
- Phyllis Sprout
- John Connell
- Peter Menounos
- Marjoree M Harvey

STUDY AREA



INTRODUCTION

Steven Tupper introduced the project team and reviewed the meeting's agenda (see page 8).

PROJECT OVERVIEW, PREVIOUS STUDY, AND EXISTING CONDITIONS PRESENTATION

Steven Tupper gave a presentation on the goals of the project, the outcomes of the previous study to the west of the current study area (Route 28 Cotuit Corridor Study) , and provided an overview of the existing conditions of the corridor (see pages 9-21).

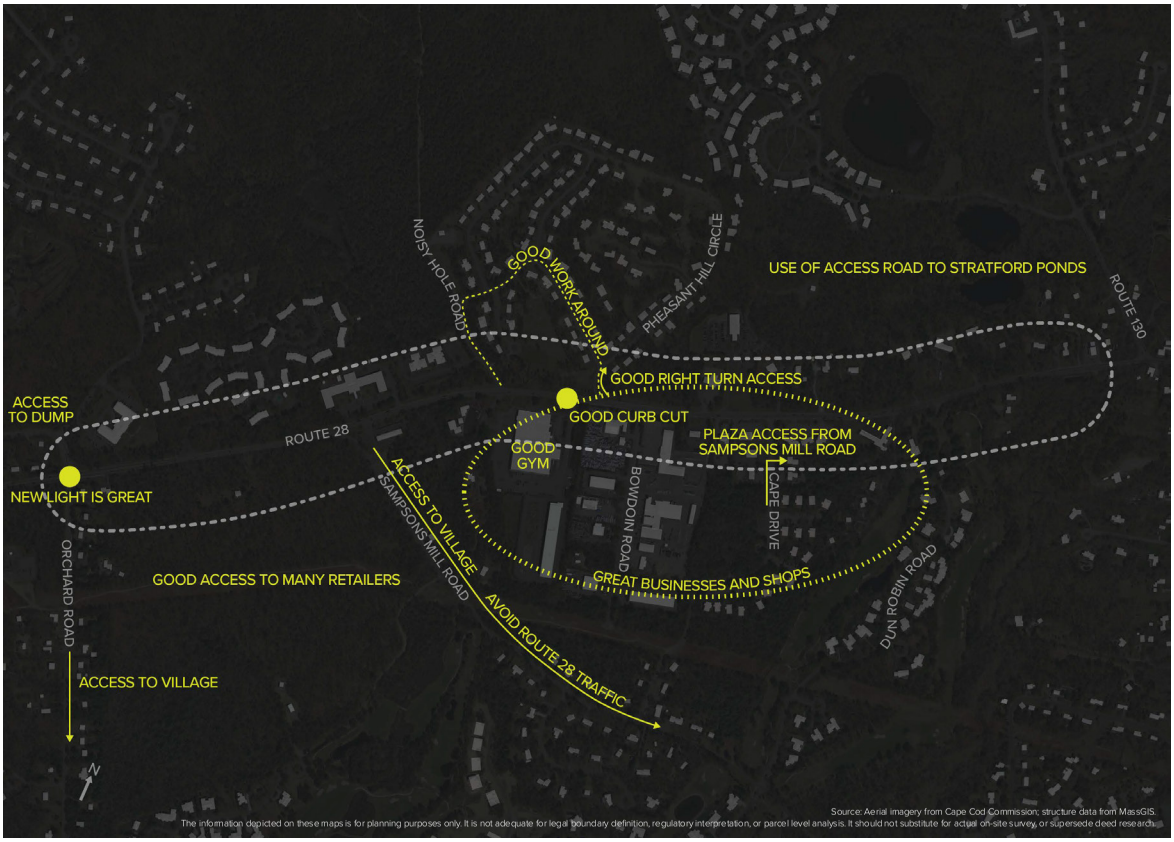
MAP EXERCISE

Following the project overview, attendees participated in a map exercise, during which attendees split into groups to record on maps things they liked about the study area, things they didn't like, and things they wanted to see changed. Each map was then presented to the group as a whole. These comments are summarized below, as well as in the maps on pages 3, 4, and 5.

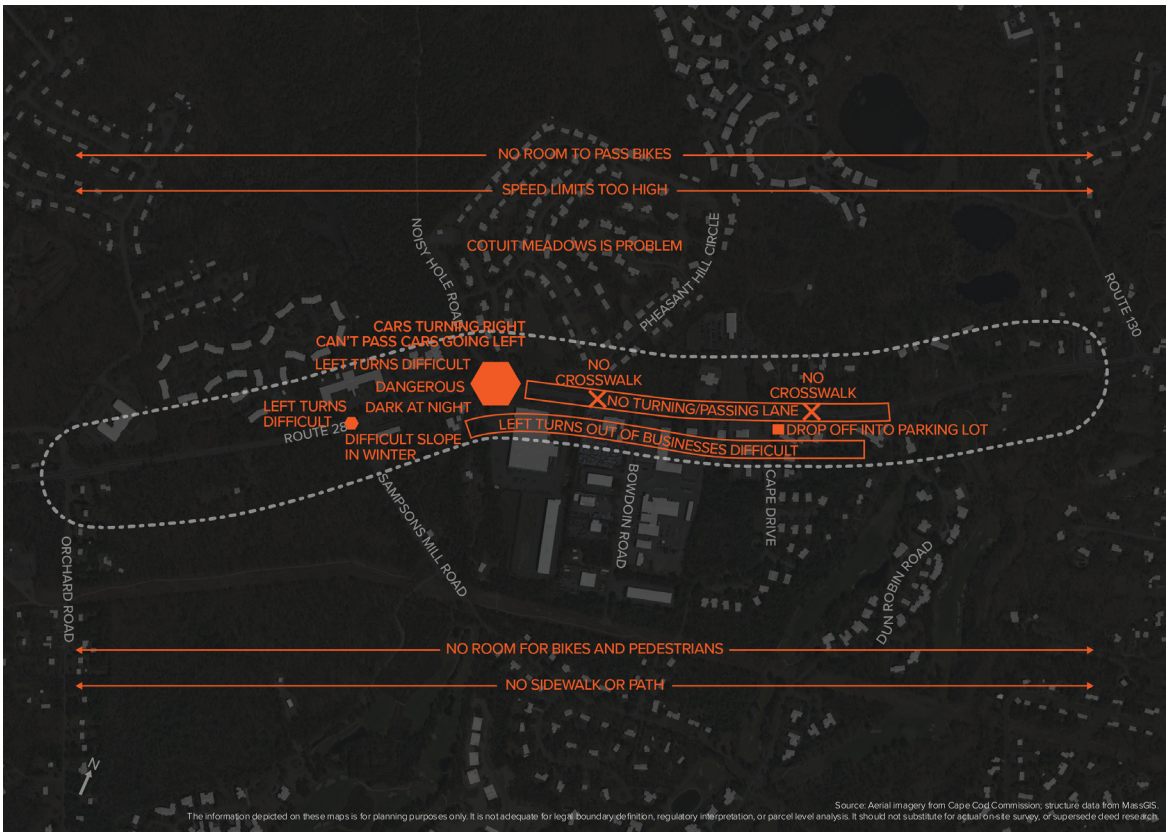
LIKES

- Businesses, shops, and gym are great
- Good gym
- Good businesses
- Very popular businesses
- Pheasant Hill Circle to Noisy Hole Road workaround
- Curb cut into the gym is good
- Good access to many retailers
- New light at Orchard Road is great
- Access to dump from Orchard Road
- Access to village from Orchard Road
- Access to village along Sampsons Mill Road, avoiding Route 28 traffic
- Access from Sampsons Mill Road to business plaza on Route 28
- Use of access road to Stratford Ponds

LIKES



DISLIKES



DISLIKES

- No room for bikes and pedestrians
- Cannot cross Route 28 to get to shops and businesses
- Not safe for bikes
- Lack of sidewalks/paths
- Too hard to take a left at Noisy Hole Road and Route 28
- Noisy Hole Road and Route 28 is dangerous intersection
- Cars going right can't pass cars turning left at the Noisy Hole and Route 28 intersection
- Dark at night at Noisy Hole and Route 28
- No crosswalks
- Bowdoin Road and Route 28 intersection is a problem
- Drop into the parking lot east of Cape Drive
- Cars cannot pass at Quippish Road and Route 28 intersection
- No turning lane near commercial area
- Cars turning left into Pheasant Hill Circle
- Speed limits are too high
- Hard to turn left out of Sampsons Mill Road
- Hard to turn left out of businesses

SUGGESTED CHANGES

- Right turn only out of Sampsons Mill Road
- Center turn lane near businesses
- More back roads and other options to reduce traffic on this road
- Stoplight at Noisy Hole Road and Route 28 (motion activated)
- Double the fines for speeding
- Improve and widen shoulders near businesses
- Add access to Route 130 from Noisy Hole Road
- Sidewalk with landscaped buffer to slow traffic
- Add multi-use path or bike lanes and sidewalks on both sides along Route 28
- Reduce the speed limit
- Add crosswalk at Pheasant Hill Circle
- Add crosswalk to businesses
- Dedicated bus stops along corridor
- Sync the traffic lights

REGROUP

Following the map exercise, attendees had the opportunity to share additional ideas or comments with the whole group. Comments from this part of the meeting that had not been previously captured on the maps included:

- Squaring up and leveling the Sampsons Mill Road intersection
- Perform a traffic and turn count at Noisy Hole Road
- Support for roundabouts with good signage and markings
- Concern about traffic backing up from the Mashpee rotary
- Concern about trucks going through roundabouts/rotaries
- Importance of understanding the impacts a project will have on abutters
- Concern that the road is simply not big enough to handle the traffic
- Concern regarding construction vehicles traveling through the area
- Support for shared access and fewer curb cuts along the road
- Need for lighting for pedestrians

WRAP UP

Steven Tupper informed attendees about the next steps of the project. Following the development of some alternative concepts, the next public meeting will be held September 27, 2017 at 6:00 pm at the Mashpee Public Library. Attendees who provided their email addresses on the sign in sheet will be notified of project updates via email.

FOR THOSE WHO COULD NOT ATTEND

Project materials, including existing conditions maps and the project overview, are available on the Cape Cod Commission project website at: www.capecodcommission.org/Route28EasternMashpee

All of the comments heard during this meeting and received throughout the project will be taken into consideration during the concept development and concept refinement.

MEETING AGENDA

ROUTE 28 EASTERN MASHPEE
ROUTE 130 TO ORCHARD ROAD
CORRIDOR STUDY PUBLIC MEETING

AGENDA

WEDNESDAY, JULY 26, 2017, 6:00 PM
MASHPEE PUBLIC LIBRARY, 64 STEEPLE STREET, MASHPEE

CAPE COD COMMISSION

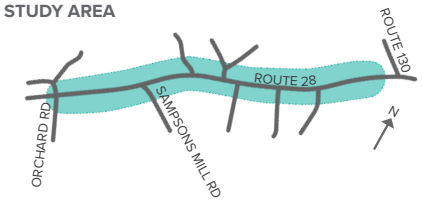
1. Project + existing conditions overview

2. Breakout listening session

3. Wrap up and next steps

To be added to the project email list, email Steven Tupper at stupper@capecodcommission.org

STUDY AREA



For more information, please visit www.capecodcommission.orgRoute28EasternMashpee or call 508.362.3828

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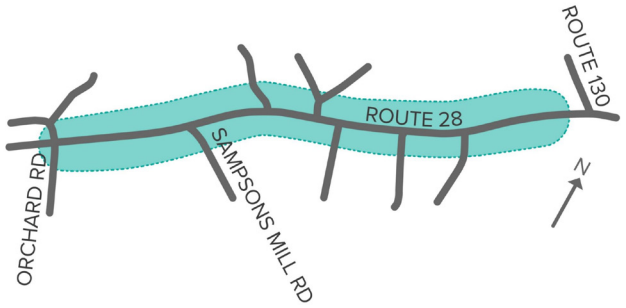
ROUTE 28 EASTERN MASHPEE

ROUTE 130 TO ORCHARD ROAD CORRIDOR STUDY

PUBLIC LISTENING SESSION | JULY 26, 2017

STUDY AREA



PROJECT OVERVIEW

Develop alternatives that will provide safe and convenient access within the study area for all users of the roadway system including pedestrians, bicyclists, transit users, and motorists.

PROJECT GOALS

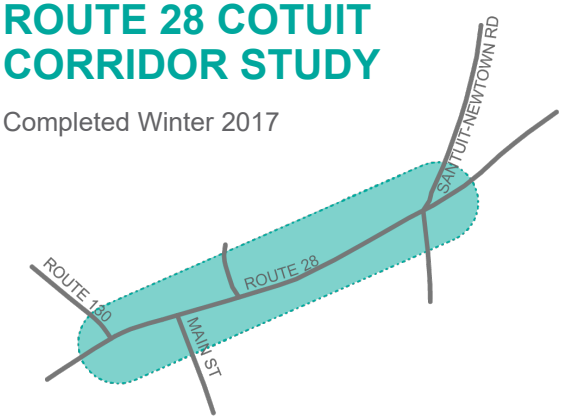
IMPROVE SAFETY

REDUCE CONGESTION

ACCOMMODATE ALL USERS

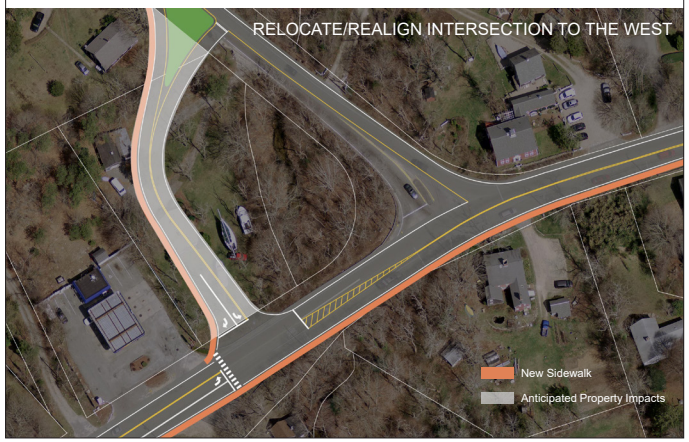
ROUTE 28 COTUIT CORRIDOR STUDY

Completed Winter 2017



SANTUIT-NEWTOWN ROAD INTERSECTION POTENTIAL LONG-TERM SOLUTIONS

ROUTE 130 INTERSECTION POTENTIAL LONG-TERM SOLUTION




EXISTING CONDITIONS

SPEED LIMITS

25 mph 35 mph 40 mph 50 mph

REPORTED CRASHES

2012-2014

Property damage only crash Non fatal injury crash

1 crash 5 crashes 10 crashes

ZONING

C2 COMMERCIAL
I1 INDUSTRIAL
R3 RESIDENTIAL
GROUNDWATER PROTECTION OVERLAY DISTRICT
R5 RESIDENTIAL
RF RESIDENTIAL + RESOURCE PROTECTION OVERLAY DISTRICT

LAND USE

RESIDENTIAL
OPEN SPACE
COMMERCIAL
INDUSTRIAL
MULTIPLE USES
EXEMPT

OPEN SPACE, WETLANDS, AND HISTORIC PROPERTIES

VISIONING EXERCISE

- What are the things you **LIKE** in this area?
- What are the **ISSUES** you see?
- What would you like to see **CHANGED**?
- Focus on the **ROADWAY, SIDEWALKS, AND PATHS**
- All thoughts are welcomed

Please sign up on the sign in sheet to be involved with follow-up meetings and be included in the project email list.

www.capecodcommission.org/Route28EasternMashpee

NEXT STEPS

- Review and Summarize Input from Today's Meeting
  - Available on website August 2017
- Concept Development and Analysis
  - August/September 2017
- **PUBLIC MEETING: REVIEW OF DRAFT CONCEPTS**
  - **September 27, 2017 at 6:00 pm**
    Mashpee Public Library
- Report
  - Fall 2017


THANK YOU!
For more information:
www.capecodcommission.org/Route28EasternMashpee
Steven Tupper
Transportation Planner
stupper@capecodcommission.org
508.362.3828
Chloe Schaefer
Community Design Planner
chloe.schaefer@capecodcommission.org
508.362.3828

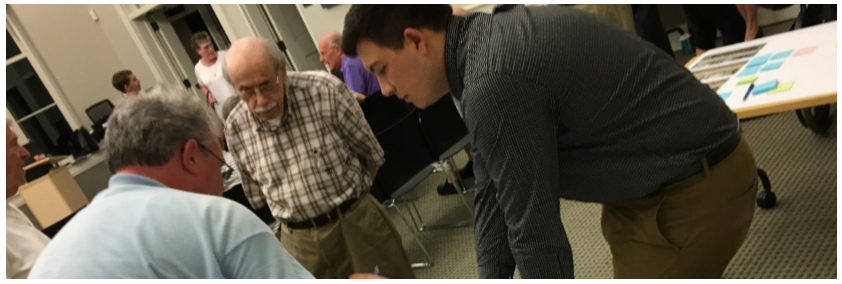
ROUTE 28 EASTERN MASHPEE
ROUTE 130 TO ORCHARD ROAD CORRIDOR STUDY
PUBLIC REVIEW OF ALTERNATIVES MEETING SUMMARY

WEDNESDAY, SEPTEMBER 27, 2017, 6:00 PM
MASHPEE PUBLIC LIBRARY
64 STEEPLE STREET, MASHPEE

CAPE COD COMMISSION

ATTENDEES

- Steven Tupper, Cape Cod Commission
- Chloe Schaefer, Cape Cod Commission
- Glenn Cannon, Cape Cod Commission
- Lev Malakhoff, Cape Cod Commission
- David Nolan, Cape Cod Commission
- Catherine Laurent, Town of Mashpee
- Tom Fudala, Town of Mashpee
- Paul Graves, Town of Barnstable
- Timothy Kochan, MassDOT District 5
- Tim Leedham
- Jim Saret
- Paula Butler
- Paul Logan
- Janet Logan
- Tony Felicetti
- Carolyn Felicetti
- Ken Foster
- Fred Parker
- Pamela Fullerton
- Al Fullerton
- Chuck Gasior
- Debbie Gasior
- Mark Lawrence
- Kathryn Risotti
- Mark Thomas
- Peter Menounos
- Marshall McStay
- Linda Cahoon
- Dennis Cahoon
- Maurine Wacks
- Bill Wacks



PRESENTATION

Steven Tupper reviewed the meeting's agenda and provided a brief overview of the project. He presented a summary of the issues and suggestions provided at the July public meeting (see pages 13-15 of this summary) and then walked through the potential improvements for the area (see pages 15-36 of this summary), including brief overviews of any improvements that were researched but not suitable for carrying forward for public review. Below is a list of the potential alternatives put forth for review by the public.

CORRIDOR-WIDE CONCEPTS FOR VEHICLES

Request a follow-up speed study
Install left-turn pockets

CORRIDOR-WIDE CONCEPTS FOR PEDESTRIAN ACCOMMODATIONS

- Upgrade existing crosswalk with Rectangular Rapid Flash Beacon (RRFB)
- Add sidewalks focusing on the commercial core with an additional crosswalk with an RRFB
- Add sidewalks on both sides of the roadway throughout the corridor

CORRIDOR-WIDE CONCEPTS FOR BICYCLIST ACCOMMODATIONS

- Add signage for alternate routes
- Bicycle accommodating shoulders

CORRIDOR-WIDE CONCEPTS FOR TRANSIT

- Review bus stop location
- Improve bus stop with bench, shelter, etc.
- Add bus pullouts along Route 28

OTHER CORRIDOR-WIDE CONCEPTS

- Add interconnects (vehicular and/or pedestrian) between parcels where feasible
- Reduce the size and number of curb cuts where feasible

CAPE DRIVE INTERSECTION CONCEPTS

- Install left-turn pocket

BOWDOIN ROAD INTERSECTION CONCEPTS

- Install left-turn pocket
- Install traffic signal
- Install roundabout

NOISY HOLE ROAD/TRINITY PLACE INTERSECTION CONCEPTS

- Install left-turn pocket
- Consider connection to Route 130 to the North using existing Town layout

SAMPSONS MILL ROAD INTERSECTION CONCEPTS

- Signage and guardrail upgrades
- Realignment and regrading

ORCHARD ROAD/ASHERS PATH INTERSECTION CONCEPTS

- Request review of signal timing
- Pedestrian/bicyclist upgrades

BREAKOUT GROUPS

Following the overview of the alternative concepts, attendees provided comments and feedback on each concept by visiting five tables throughout the room. Each table had a different intersection or issue area for the corridor broken out as follows: Pedestrian Accommodations, Transit and Bicyclist Accommodations, Bowdoin Road/Cape

Drive, Noisy Hole Road, Sampsons Mill Road and Orchard Road. At each table, attendees wrote down feedback and comments for each concept and put their feedback in a + or - or other (o) column to show whether they generally supported the idea or not. Attendees circulated to each table they were interested in. Following is a summary of the comments for each concept from the tables.

PEDESTRIAN ACCOMMODATIONS

Additional Crosswalk Near Cape Drive

+ Yes, but any crosswalk needs a beacon
+ Sidewalk only 1 side
+ Enhanced crosswalks a must. There is a need for two crosswalks

Upgraded crosswalks with Rectangular Rapid Flash Beacons (RRFBs)

+ Great idea
+ Yes to crosswalks on both ends of sidewalk and south side
+ A beacon is needed at existing crosswalk and proposed new crosswalk
+ Add crosswalk with beacon at Noisy Hole

Sidewalks on both sides in the commercial core

+ Like sidewalk for North side for entire corridor with sidewalks on both sides extending to Noisy Hole
+ Sidewalks are necessary
+ Sidewalks on both sides in congested area is best
- No, 1 side only
- No, one side, not enough use

Sidewalks on both sides of Route 28

+ Two would be ideal, but one is ok
- No
- A dream

BICYCLIST AND TRANSIT ACCOMMODATIONS

Bus stop upgrades

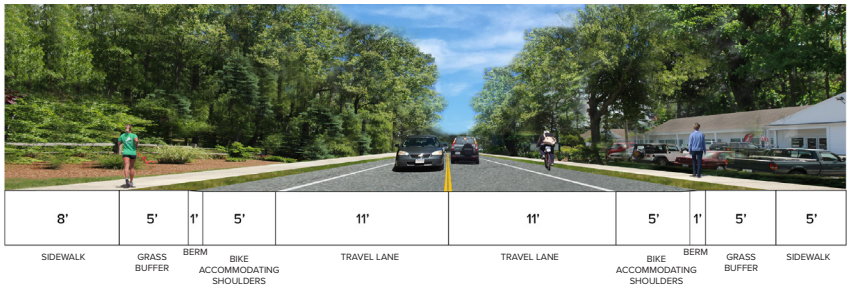
+ Ok
+ Yes, needed. Schedule is not that frequent and people stand in heat, rain, etc
+ This is a bus stop – for condos on Cape Drive

Bus pullouts

+ Great idea bus pullout
+ Bus turn out great addition
+ Great idea-ease flow of bus blocking route 28

Bike accommodating shoulders

+ Widened area for bikes and walkers a must
+ J1 students are for first time in our area- Stop & Shop and they stay at Plaza del Sol on 130 work late hours and ride their bikes
+ 1 sidewalk not 2
+ Space for bikes needed- many people commute to work via bike



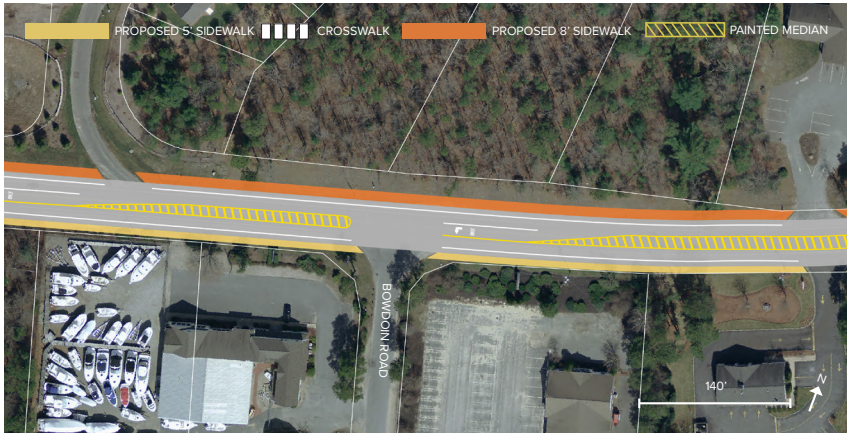
Alternate bike route (for long distance trips)

+ Good idea for bikers
o Good but not realistic
o Good but not realistic
o Good but does not help

BOWDOIN ROAD AND CAPE DRIVE INTERSECTIONS

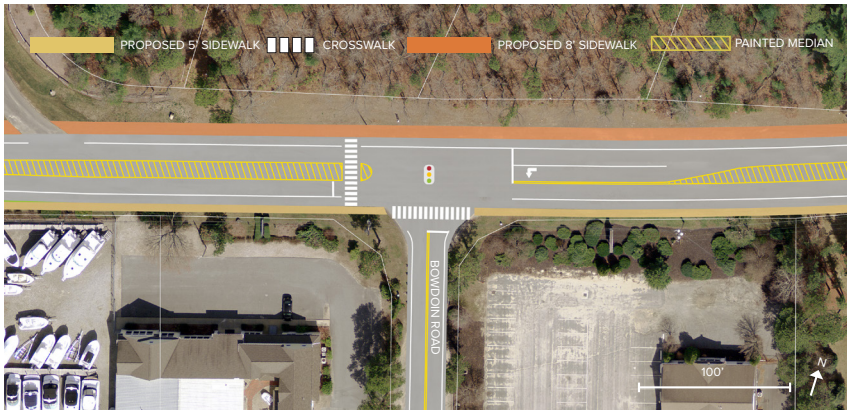
Left turn pocket at Bowdoin Road

- No to Bowdoin Road Northbound left turn pocket. Too dangerous for cars turning left out of Bowdoin
- For a left out of Bowdoin this would create a death trap with the left turn lane off 28



Traffic signal at Bowdoin Road

+ Yes to traffic light
+ Light at Bowdoin yes
+ Yes to traffic light- it will help other nearby roads as well and slow down excessive truck speeds
+ Light at Bowdoin Rd. yes
+ Traffic signal best idea, on a sensor
+ Yes to traffic light- will slow down flow
+ Yes to light or roundabout
+ Install traffic signal with pedestrian controlled light
+ Add left/right turn lanes from Bowdoin



Roundabout at Bowdoin Road

+ Yes to light or roundabout
- No way dangerous
- Too many trucks no way to rotary
- No to rotary here too much truck traffic; Falmouth to Hyannis
- Roundabout potentially creates too much of a traffic backup

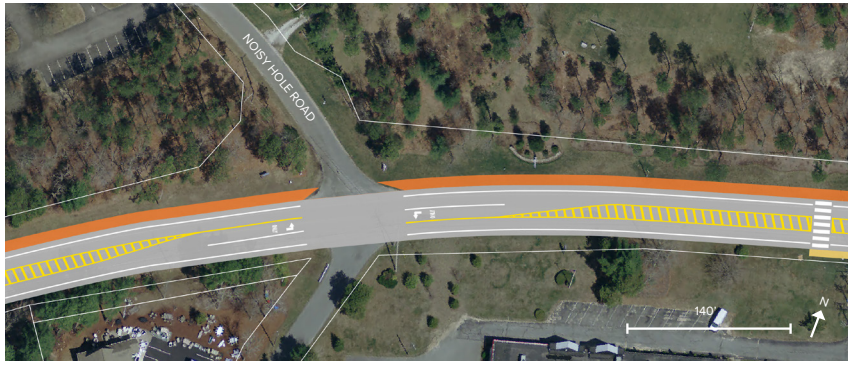
Left Turn Pocket at Cape Drive

+ Merry Meadow Plaza make easy exit right turn only, but break the painted median there
- Left turn pocket creates issue for people in opposite direction now dealing with 2 lanes- oncoming traffic
-"Agree with this comment" (with regard to the comment that "Left turn pocket creates issue for people in opposite direction now dealing with 2 lanes- oncoming traffic")

NOISY HOLE ROAD

Left turn pockets at Noisy Hole Road

+ Left turn pockets are helpful
+ Easier in and out of Cotuit Meadows improve flow
+ Left turn pockets are important especially if light not approved
+ Add a left hand turn lane out of Noisy Hole
+ Include beacon at crosswalk
+ Right turn lane on Noisy Hole Road
- Concern over making a left turn out of Noisy Hole with 1 lane stopped and 1 lane moving because of left turn lane
o Location of crosswalk should be moved



Connect Noisy Hole Road to Route 130

+ I like this option to connect Noisy Hole to Rt 130
+ Open and pair access road from Noisy Hole Rd. to 130, it moves traffic off 28
+ Recommend- 45 MPH
+ Dream-but good idea
- Negative traffic impacts in neighborhoods
- Too costly: minimal benefit
o Street lighting is needed
o Need traffic signal

SAMPSONS MILL ROAD AND ORCHARD ROAD INTERSECTIONS

Realign and regrade intersection at Sampsons Mill Road

+ Right turn one car go into on-coming traffic
+ Allow left turn into Sampsosn Mill Rd. from Route 28
+ Left turn out of Sampsons Mill to Mashpee should be restricted

Guardrail and signage improvements at Sampsons Mill Road

No comments

EXISTING GUARDRAIL CONDITIONS AT SAMPSONS MILL ROAD

Review signal timing at Orchard Road

No comments

Pedestrian and bicyclist upgrades at Orchard Road

+ Add bus stop at Ashers Path with crosswalk across Route 28

EXAMPLES OF UPGRADES FOR ORCHARD ROAD

OTHER COMMENTS

- Need vegetation trimming around Orchard Road intersection and signs throughout corridor
- Town land connects Bowdoin Road and Cape Drive
- Getting speeds down to 45 mph would be great

WRAP UP

Following the breakout session, staff members provided the audience with a brief summary of the comments and discussion at each table. Steven Tupper summarized the next steps on the project and answered questions from the audience. He thanked the audience for their input in the process and noted that thoughts on the project could be submitted until October 11, 2017.

MEETING AGENDA

ROUTE 28 EASTERN MASHPEE ROUTE 130 TO ORCHARD ROAD CORRIDOR STUDY PUBLIC MEETING

AGENDA

WEDNESDAY, JULY 26, 2017, 6:00 PM

MASHPEE PUBLIC LIBRARY, 64 STEEPLE STREET, MASHPEE

CAPE COD COMMISSION

1. Project + existing conditions overview

2. Breakout listening session

3. Wrap up and next steps

To be added to the project email list, email Steven Tupper at stupper@capecodcommission.org

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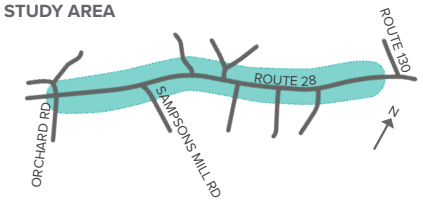

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ROUTE 28 EASTERN MASHPEE

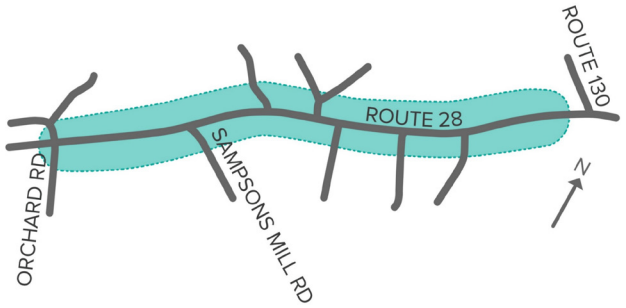
ROUTE 130 TO ORCHARD ROAD CORRIDOR STUDY

PUBLIC REVIEW OF ALTERNATIVES
SEPTEMBER 27, 2017

AGENDA

- Welcome + Introductions
- Project Overview
- Listening Session Summary
- Alternatives Review and Discussion
- Next Steps

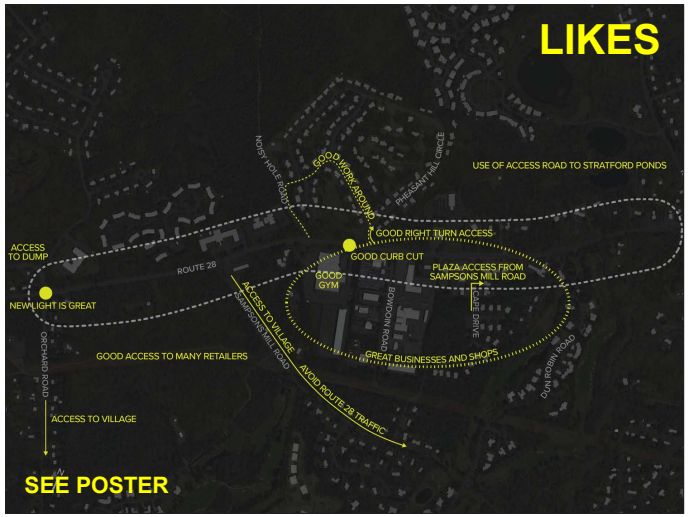
STUDY AREA

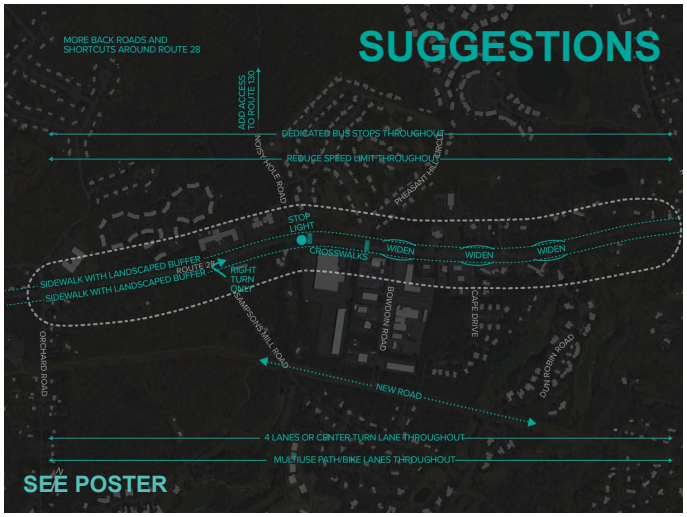


PROJECT OVERVIEW

Develop alternatives that will provide safe and convenient access within the study area for all users of the roadway system including pedestrians, bicyclists, transit users, and motorists.

PROJECT GOALS




SUGGESTIONS
MORE BACK ROADS AND SHORTCUTS AROUND ROUTE 28
ADD ACCESS TO ROUTE 130
DEDICATED BUS STOPS THROUGHOUT
REDUCE SPEED LIMIT THROUGHOUT
NOISY HOLE ROAD
PHEASANT HILL ROAD
STOP LIGHT
CROSSWALKS
WIDEN
WIDEN
WIDEN
SIDEWALK WITH LANDSCAPED BUFFER
ROUTE 28
SIDEWALK WITH LANDSCAPED BUFFER
RIGHT TURN OVER
SAMPSONS MILL ROAD
BOWDOIN ROAD
CAPE DRIVE
DUN ROBIN ROAD
ORCHARD ROAD
NEW ROAD
4 LANES OR CENTER TURN LANE THROUGHOUT
MULTI USE PATH/BIKE LANES THROUGHOUT
SEE POSTER


ALTERNATIVE REVIEW
• Corridor Concepts
• Intersection Concepts
• Cape Drive
• Bowdoin Drive
• Noisy Hole Road/Trinity Place
• Sampsons Mill Road
• Orchard Road/Ashers Path


CORRIDOR CONCEPTS
VEHICLE
• ~~Install two-way left turn lanes~~
• Not recommended with speeds of 40 mph or greater


CORRIDOR CONCEPTS
VEHICLE
• ~~Install two-way left turn lanes~~
• Not recommended with speeds of 40 mph or greater
• ~~Widen to a four-lane cross section~~
• Not recommended based on significant right-of-way impacts

CORRIDOR CONCEPTS
VEHICLE

- ~~Install two-way left turn lanes~~
  - Not recommended with speeds of 40 mph or greater
- ~~Widen to a four-lane cross-section~~
  - Not recommended based on significant right-of-way impacts
- Request follow-up speed study
- Install turn pockets

INSTALL TURN POCKETS

CORRIDOR CONCEPTS
PEDESTRIAN

- Upgrade existing crosswalk with Rectangular Rapid Flash Beacon (RRFB)

UPGRADE EXISTING CROSSWALK
WITH RECTANGULAR RAPID FLASHING BEACON

CORRIDOR CONCEPTS
PEDESTRIAN

- Upgrade existing crosswalk with Rectangular Rapid Flash Beacon (RRFB)
- Add sidewalks focusing on the commercial core with an additional crosswalk with RRFB

PEDESTRIAN CONCEPT

UPGRADED CROSSWALKS WITH COMMERCIAL AREA SIDEWALKS

PEDESTRIAN CONCEPT

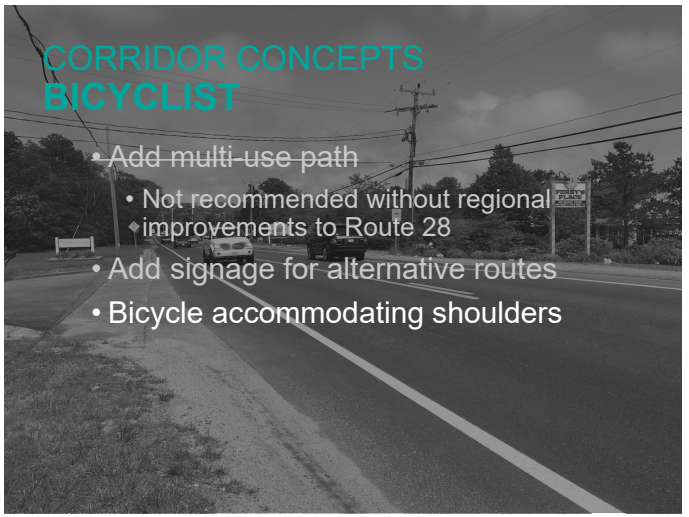
POTENTIAL CROSS-SECTIONS WITH SIDEWALK ALTERNATIVES

CORRIDOR CONCEPTS
PEDESTRIAN

- Upgrade existing crosswalk with Rectangular Rapid Flash Beacon (RRFB)
- Add sidewalks focusing on the commercial core with an additional crosswalk with RRFB
- Add sidewalks on both sides throughout the corridor

BICYCLIST CONCEPT

ALTERNATE BIKE ROUTE (FOR LONG DISTANCE TRIPS)



BICYCLIST CONCEPT

CROSS-SECTION WITH BICYCLE ACCOMMODATING SHOULDER

TRANSIT CONCEPT

REVIEW BUS STOP PLACEMENT

TRANSIT CONCEPT

BUS BENCH/SHELTER

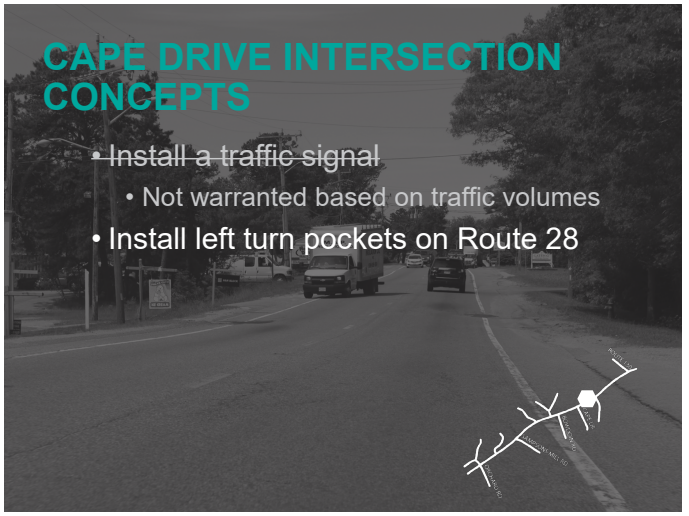
TRANSIT CONCEPT

BUS PULLOUT

CAPE DRIVE INTERSECTION ANALYSIS

TRAFFIC SIGNAL WARRANT ANALYSIS

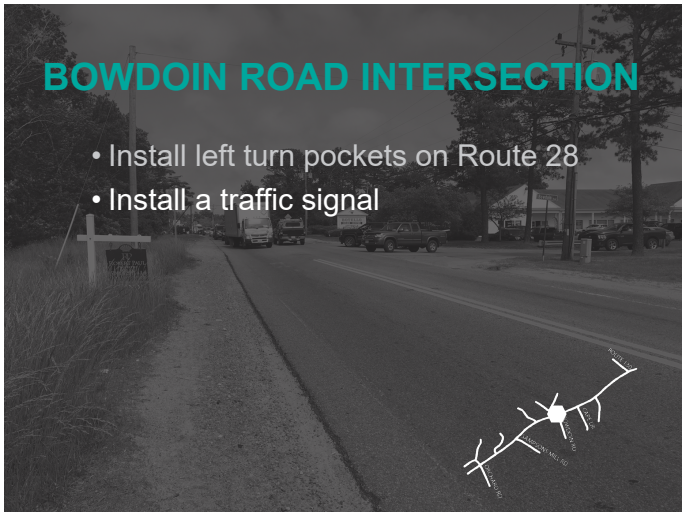
- The ***Manual on Uniform Traffic Control Devices for Streets and Highways*** **(MUTCD)**, published by the Federal Highway Administration, sets standards for installation and operation of traffic control devices nationwide.
- The MUTCD establishes minimum criteria, know as "warrants," for installing a traffic signal.
- A traffic signal should not be installed unless it meets one of the warrants.
- The Cape Drive intersection does not meet any of the traffic signal warrants.



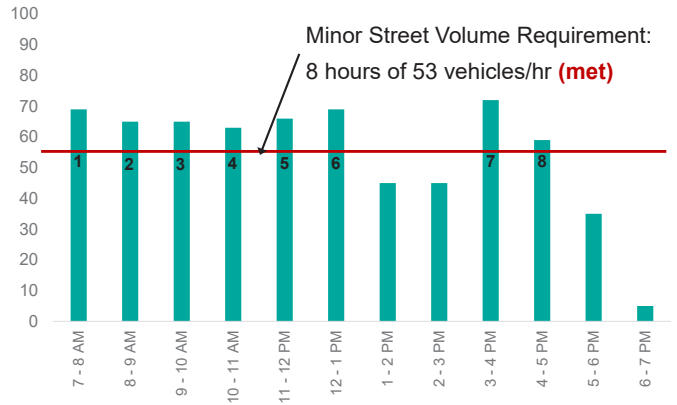
CAPE DRIVE INTERSECTION CONCEPT

LEFT TURN POCKET ON ROUTE 28

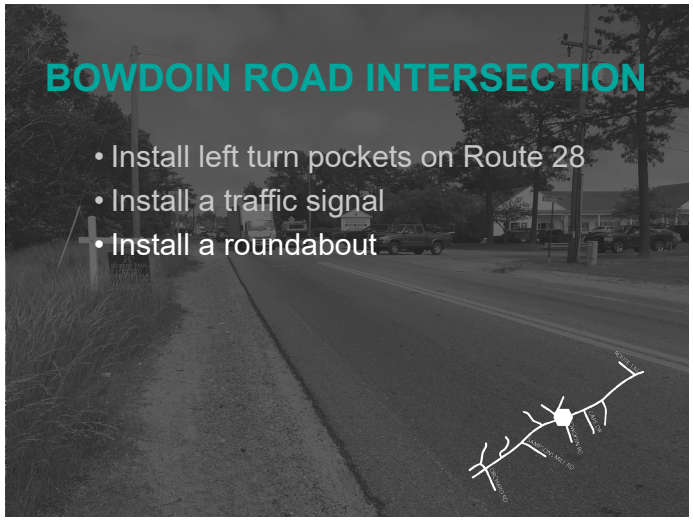
BOWDOIN ROAD INTERSECTION CONCEPT
LEFT TURN POCKET ON ROUTE 28



BOWDOIN ROAD INTERSECTION ANALYSIS
TRAFFIC SIGNAL ANALYSIS – EIGHT HOUR VEHICULAR VOLUME WARRANT



BOWDOIN ROAD INTERSECTION CONCEPT
TRAFFIC SIGNAL



BOWDOIN ROAD INTERSECTION CONCEPT
ROUNDABOUT

NOISY HOLE ROAD/TRINITY PLACE
TRAFFIC SIGNAL ANALYSIS

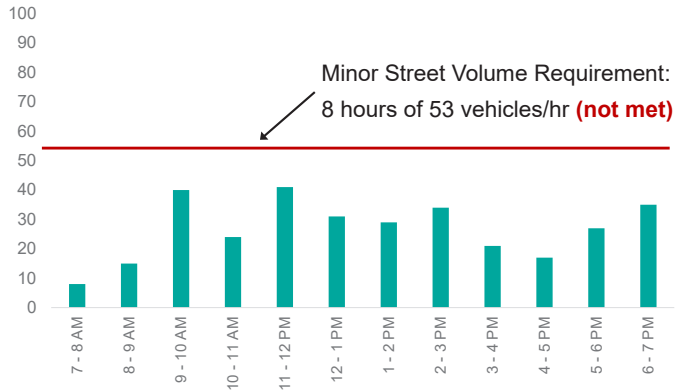
THE COTUIT MEADOWS COMPREHENSIVE PERMIT REQUIRED THE DEVELOPER TO SEEK PERMISSION TO:

- Construct a left-turning lane on Route 28 for traffic moving easterly and turning into Noisy Hole Road
- Signalize the intersection of Route 28 and Noisy Hole Roads
- Install overhead street lighting at that intersection

THE DEVELOPER WAS NOT REQUIRED TO SPEND MORE THAN $150,000 ON PERMITTED IMPROVEMENTS

NOISY HOLE ROAD/TRINITY PLACE ANALYSIS

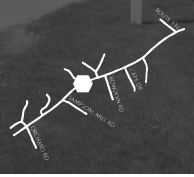
Traffic signal analysis – Eight Hour Vehicular Volume Warrant



NOISY HOLE ROAD/TRINITY PLACE CONCEPT
LEFT TURN POCKET ON ROUTE 28

NOISY HOLE ROAD/TRINITY PLACE INTERSECTION CONCEPTS

- ~~Install a traffic signal or roundabout~~
  - Not warranted based on traffic volumes
- Install left turn pockets on Route 28
- Consider connection to Route 130 using existing town layout



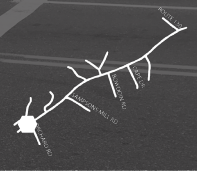
NOISY HOLE ROAD/TRINITY PLACE CONCEPT
CONNECTION TO ROUTE 130

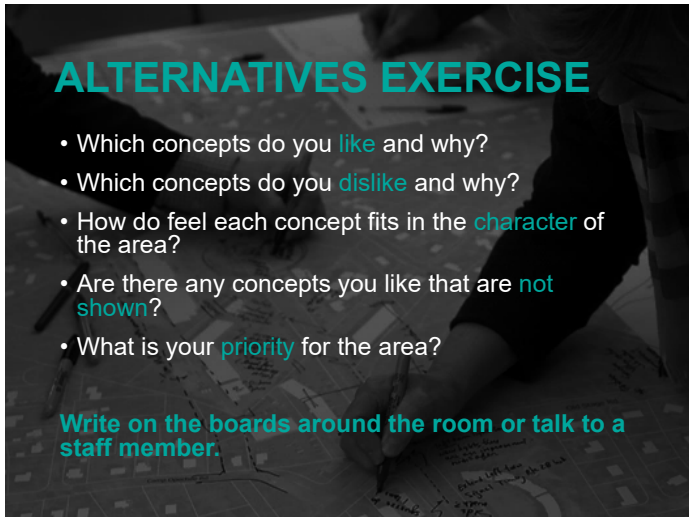
SAMPSONS MILL ROAD INTERSECTION CONCEPTS

- ~~Left turn restriction~~
  - Not recommended unless better left turn location is provided
- ~~Consider connection to Trinity Place~~
  - Not recommended based on property impacts
- Signage and guardrail upgrades
- Realignment and regrading

ORCHARD ROAD/ASHERS PATH INTERSECTION CONCEPTS

- Request review of signal timing
- Pedestrian/bicyclist upgrades





OPTIONS

PEDESTRIAN ACCOMMODATION OPTIONS
- Additional crosswalk near Cape Drive (1A)
- Upgraded crosswalks with RRFBs (1B)
- Sidewalks on both sides in commercial core (1C)
- Sidewalks on both sides of Route 28 (1D)

TRANSIT AND BICYCLIST ACCOMMODATIONS OPTIONS
- Bus stop upgrades (2A)
- Bus pullouts (2B)
- Bike accommodating shoulders (2C)
- Alternate bike route (2D)

BOWDOIN ROAD/CAPE DRIVE OPTIONS
- Left turn pocket at Bowdoin Road (3A)
- Traffic signal at Bowdoin Road (3B)
- Roundabout at Bowdoin Road (3C)
- Left turn pocket at Cape Drive (3D)

NOISY HOLE ROAD OPTIONS
- Left turn pockets at Noisy Hole Road (4A)
- Connect Noisy Hole Road to Route 130 (4B)
- Traffic Signal Warrant Analysis (4C)

SAMPSONS MILL ROAD/ORCHARD ROAD OPTIONS
- Realign and regrade intersection at Sampsons Mill Road (5A)
- Guardrail and signage improvements at Sampsons Mill Road (5B)
- Review signal timing at Orchard Road (5C)
- Pedestrian and bicyclist upgrades at Orchard Road (5D)

NEXT STEPS

- Revise concepts based on input from today's meeting and comments received by October 11th
  - October 2017
- Finalize report (post online)
  - November 2017
- Work with the Towns of Mashpee and Barnstable and the Massachusetts Department of Transportation (MassDOT) to:
  - Implement short-term recommendations (1-2 years)
  - Plan for long-term changes (5+ years) – would involve additional public input

Eastern Tribal Technical Assistance Program at Michigan Tech

Mashpee Wampanoag Tribe of Massachusetts Road Safety Audit

Final Findings Report – May 2016

2016

Prepared by:
Eastern Tribal Technical Assistance Program at Michigan Technological University

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5.2 Sampsons Mill/28 Location

The Sampsons Mill/28 location is an intersection of a two-lane urban principal arterial (MassDOT designated) signed 50MPH and exhibiting rural road characteristics with medium to high traffic volumes (Route 28, also known as Falmouth Road) and a two-lane local road (MassDOT designated) exhibiting rural road characteristics (Sampsons Mill Road, also known as Old Mill Road) (Figure 4). The intersection is located approximately 1.4 miles northeast of the MA RTE28/MA RTE151/Great Neck Road traffic rotary on the south side of the road. Sampsons Mill Road connects a Tribal commercial/agricultural facility to Route 28. The facility generates some commercial vehicle traffic, occasional light vehicle traffic, and rare school bus traffic. Sampsons Mill Road also connects a non-Tribal residential areas to Route 28.

Portions of Sampsons Mill Road are in Tribal inventory, but the road and right of way (ROW) is owned and maintained by the Town of Mashpee, which is a non-Tribal Massachusetts municipality governed by state and local laws and ordinances. Tribal government staff, elected officials, and public safety represented the Tribal facility owners, and Town of Mashpee staff and public safety represented Sampsons Mill Road owners. Massachusetts Route 28 is a state-owned and maintained arterial. MassDOT staff represented the Route 28 owners. Additional MassDOT and FHWA Division staff represented statewide and federal interests.

Figure 5: Sampsons Mill Road/Route 28 Location

5.2.1 Sampsons Mill/28 Location Safety Issues

Sampsons Mill Road at Route 28: Safety Issue 1		
EXPECTED FREQUENCY	**EXPECTED SEVERITY**	**RISK RATING**
Frequent	**High to extreme**	**E to F**

OBSERVATION: Poor sight distance/difficult intersection angle, incline on Old Sampsons Mill Road adds to poor visibility and difficulty pulling onto Route 28.

SUGGESTION:

Low: Additional warning and guide signs for motorists on Route 28, including trucks entering highway signs from both directions, cut back brush/trees on southwest side of intersection to improve sight distance.

Med: Install overhead intersection warning beacon.

Install overhead intersection lighting.

High: Realign intersection to make it closer to 90°, vertically realign Sampsons Mill Road to reduce the incline pulling onto Route 28, vertically realign Route 28 to reduce the slope that is immediately southwest of the intersection to drastically improve sight distance, and cut back slope on the southwest side of the intersection to increase sight distance.

COMMENTS: This intersection poses a number of difficult challenges. A hill crests on Route 28 just to the southwest of the intersection that creates a compound horizontal/vertical curve, making it difficult to see northbound (NB) Route 28 traffic. In addition, trees and brush, along with the banked shoulder, reduce visibility of the intersection for Route 28 drivers.

Sampsons Mill Road meets up with Route 28 at a severe obtuse angle for NB 28 traffic. This, coupled with the incline of Sampsons Mill, makes it extremely difficult to see southbound Route 28 traffic. Numerous skid marks were observed at the Sampsons Mill/Route 28 intersection, indicating that drivers may have difficulty accelerating to enter gaps, and the group witnessed a vehicle pulling out with spinning tires while trying to overcome the hill and merge into traffic.

NB Route 28 vehicles tend to enter Sampson Mill Road at a high rate of speed given the alignment of the intersection. SB Route 28 vehicles have an extended slow turning movement.

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Sampsons Mill Road at Route 28: Safety Issue 2		
EXPECTED FREQUENCY	**EXPECTED SEVERITY**	**RISK RATING**
Frequent	**High to extreme**	**E to F**

OBSERVATION: Poor intersection visibility when approaching on Route 28 from the Southwest, compounded by posted and observed speeds

SUGGESTION:

Low: Trim landscape to improve sight distance, add/improve warning signs for intersection, add speed advisory signs, add advance street name sign and street name sign at SE intersection corner.

Med: Install overhead intersection warning beacon.

High: Redesign intersection and approaching segments according to expected approach speeds and to reduce vertical curve and significantly increase the visibility of and from the intersection.

COMMENTS: As you approach the intersection on Route 28 from the southwest, there is a sign warning of the intersection, but the compound vertical and horizontal curve of the roadway prevents motorists from seeing the actual intersection, and the posted and observed speeds may exceed current design. The suggestions include changes that may negate each other: The safety issues might be addressed with marking, signing, and clear zone maintenance, or geometric changes may negate the need for additional signing or speed control.

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Sampsons Mill Road at Route 28: Safety Issue 3		
EXPECTED FREQUENCY	**EXPECTED SEVERITY**	**RISK RATING**
Frequent	**High to extreme**	**E to F**

OBSERVATION: Lack of warning and guide signs, missing and bent guardrail reflectors in the corridor from the Sampsons Road intersection heading northeast towards the Mashpee Center on the north side of Route 28, guardrail maintenance needed.

SUGGESTION:

Low: Install warning and guide signs to indicate the presence of access drives and intersection, install/replace guardrail reflectors, and maintain guardrails by clearing buildup of sand/debris.

Med: Install Street lights over the drives.

COMMENTS: Discussion within the group determined that there are concerns not only with the Sampsons Mill Road intersection itself, but also with the corridor heading northeast along Route 28 between the intersection and the Mashpee Center, which is located on the north side of Route 28 a few hundred yards from the intersection. This corridor is flanked by guardrail on both sides, with no signage warning motorists of the drives for either the Mashpee Center, or the Cape Cod Surgery Center on the south side. Furthermore, the drive for the adjacent outpatient clinic is located in close proximity to the Sampsons Mill intersection, potentially causing conflict.

There are no street lights to indicate the presence of the drives. The group also witnessed a vehicle approach the drive for the Mashpee Center at a high rate of speed, then have to quickly slow down to navigate the entrance. In the process, the trailing vehicle had to brake severely, nearly causing a rear-end collision and a chain reaction event with the other trailing vehicles.

The guardrail appears to be installed at the correct height; however, there is a buildup of sand/dirt/other road debris that should be cleared out from under the guardrail. This maintenance would ensure that vehicles contact the guardrail at the proper height. During evening observations, the group noted that the guardrail is not well delineated, as the reflectors were either nonfunctional, damaged, or missing.

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Sampsons Mill Road at Route 28: Safety Issue 4		
EXPECTED FREQUENCY	**EXPECTED SEVERITY**	**RISK RATING**
Frequent	**High to extreme**	**E to F**

OBSERVATION: Improper/missing signs on Sampsons Mill Road Stop sign is installed too low, has poor retroreflectivity, and is bent showing signs of being struck most likely by a taller vehicle such as a truck.

The approach is missing chevrons for curve, a curve warning sign, and missing Stop Ahead sign on approach.

Improper guardrail installation - guardrail is too low, could possibly be extended, should have reflectors.

Available crash data indicated possible winter maintenance needs.

SUGGESTION:

Low: Replace stop sign and install at proper height. Install chevrons, proper curve warning sign, and stop ahead sign. Install reflectors to delineate guardrail. Improve winter maintenance and maintenance of existing signing, marking, and countermeasures.

Correct rail mounting so that posts do not create a snag hazard.

Med: Reinstall guardrail to proper height and evaluate length to ensure proper for vehicles entering the intersection at a high rate of speed (dependency on Geometric Issue 1 for this location – a realignment negates this suggestion).

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COMMENTS: As you approach the intersection heading northeast on Sampsons Mill Rd, there is a fairly long straight away just before the sharp curve and intersection, with no warning to motorists of the approaching curve, stop, or intersection. The geometry of the road prevents motorists from seeing the stop sign until they start to navigate the curve.

The guardrail on Sampsons Mill Road as you approach the intersection appears to be in place to protect a generator and associated gas line/meter that is located on the outside of the curve. The guardrail is installed too low and is missing any sort of delineation. Given the high rate of speed that motorist tend to enter Sampsons Mill Road from Route 28, and the fact that there is a depression closer to Route 28, it is worth considering extending the guardrail towards the intersection.

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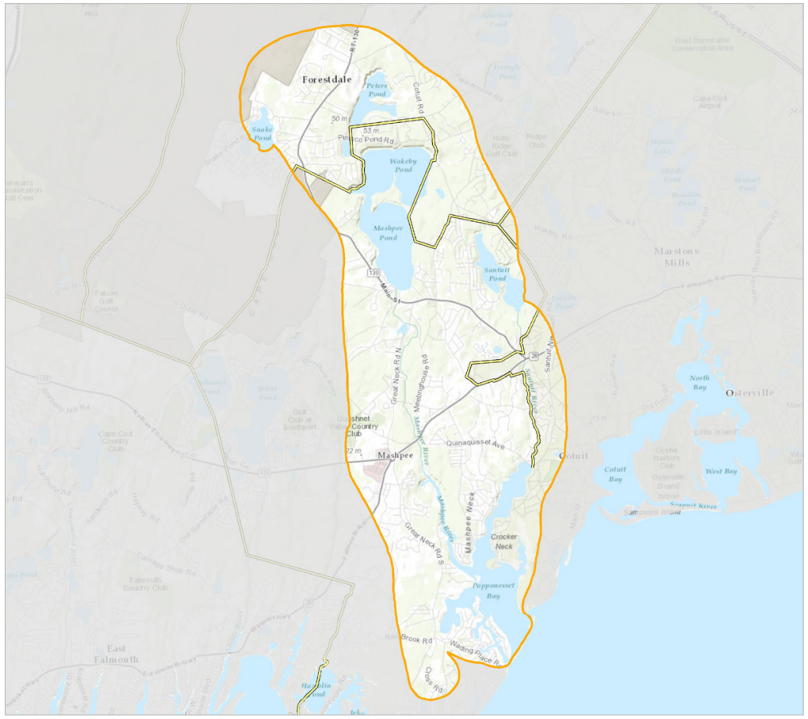
WATERSHED REPORT: UPPER CAPE

Popponesset Bay

MASHPEE, BARNSTABLE & SANDWICH

WATER THREAT LEVEL

HIGH



Popponesset Bay Watershed

Introduction to the Watershed Reports

In 2001, the Massachusetts Estuaries Project (MEP) was established to evaluate the health of 89 coastal embayment ecosystems across southeastern Massachusetts. A collaboration between coastal communities, the Massachusetts Department of Environmental Protection (MassDEP), the School of Marine Science and Technology (SMAST) at the University of Massachusetts-Dartmouth, the US Environmental Protection Agency (US EPA), the United States Geological Survey (USGS), the Massachusetts Executive Office of Energy and Environmental Affairs (EEA), and the Cape Cod Commission, the purpose of the MEP is to identify nitrogen thresholds and necessary nutrient reductions to support healthy ecosystems.

The Cape Cod 208 Plan Update, certified and approved by the Governor of the Commonwealth of Massachusetts and the US EPA in 2015, provides an opportunity and a path forward to implement responsible plans for the restoration of the waters that define Cape Cod.

On Cape Cod there are 53 embayment watersheds with physical characteristics that make them susceptible to nitrogen impacts. In its 2003 report, "The Massachusetts Estuaries Project – Embayment Restoration and Guidance for Implementation Strategies", MassDEP identifies the 46 Cape Cod embayments included in the

MEP. Thirty-three embayments studied to date require nitrogen reduction to achieve healthy ecosystem function. A Total Maximum Daily Load (TMDL) has been established (or a draft load has been identified and is under review) for these watersheds. For those embayments not studied, the 208 Plan Update recommends planning for a 25% reduction in nitrogen, as a placeholder, until information becomes available.

The 208 Plan Update directs Waste Treatment Management Agencies (WMAs) to develop watershed reports within 12 months of certification of the Plan Update. The Watershed Reports outline potential "bookend" scenarios for each watershed that include two scenarios to meet water quality goals in the watershed – a traditional scenario, which relies completely on the typical collection and centralized treatment of wastewater, and a non-traditional scenario, which uses remediation, restoration, and on-site reduction techniques to remove nutrients from raw and treated wastewater, groundwater and affected waterbodies.

The intent of the Watershed Reports is to outline two distinct approaches for addressing the nutrient problem. The reports are not intended to identify preferred and detailed plans for each watershed, but to facilitate discussions regarding effective and efficient solutions, particularly in watersheds shared by more than one town. In some cases, towns have provided information on collection areas and non-traditional technologies that have been specifically considered by that town.

The 208 Update developed a regionally consistent database of the nitrogen load entering each watershed. This data set includes estimates of wastewater, stormwater and fertilizer loads - similar to methodologies used by the MEP. Using this regionally consistent database, the Watershed MVP tool (wMVP) was developed so that different strategies (i.e., bookend scenarios) to reduce excess nitrogen load could be evaluated. The Watershed Reports use the MEP recommendations for the required nitrogen load reductions necessary to meet the threshold loads (that serve as the basis for nitrogen management), and then use the wMVP and the regionally consistent database values to develop bookend scenarios. There are variations of load between the MEP and wMVP, primarily due to differences in comparing older and newer databases.

Terms Defined

Total nitrogen load: the nitrogen load from the watershed contributed by septic, wastewater, fertilizer, stormwater, golf course, landfill, and natural sources.

Attenuated nitrogen load: the nitrogen load from the watershed that reaches the embayment after the effect of natural attenuation in wetlands, ponds or streams.

Threshold: the amount of nitrogen that a water body can receive from its watershed and still meet water quality goals; this number is based on MEP technical reports or Total Maximum Daily Load (TMDL) reports.

Reduction target: an approximation of the amount of nitrogen that needs to be removed from the watershed to achieve the threshold; this number is calculated by subtracting the threshold number from the attenuated total watershed load, and is for planning purposes only.

Percent contribution: the percent of attenuated nitrogen load that a town contributes to the watershed.

Kilogram responsibility: is calculated by applying the percent contribution to the reduction target and indicates the amount of nitrogen, in kg, that a community is responsible for addressing.

Total Maximum Daily Load: a regulatory term in the Clean Water Act, describing a value of the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. Establishing a TMDL is necessary when a water body has been listed on the 303D list of impaired waters.

WATERSHED REPORT: UPPER CAPE

Popponesset Bay

MASHPEE, BARNSTABLE & SANDWICH

WATER THREAT LEVEL

HIGH

The Popponesset Bay estuary is located in the Towns of Mashpee and Barnstable. It is a large shallow embayment that extends from Nantucket Sound nearly three miles to its groundwater fed headwaters. The embayment includes four distinct sub-systems - Shoestring Bay, the Mashpee River, Ockway Bay and Popponesset Creek. The estuary supports a variety of recreational uses including boating, swimming, shell fishing and fin fishing.

The Problem

The Massachusetts Estuaries Project (MEP) technical report (available at http://www.mass.gov/eea/agencies/massdep/water/watersheds/the-massachusetts-estuaries-project-and-reports.html) indicates the Popponesset Bay system exceeds its critical threshold for nitrogen, resulting in impaired water quality. Popponesset Bay is one of the first to have received a MEP technical report. A MEP technical report has been completed and a Total Maximum Daily Load (TMDL) for nitrogen has been developed and approved.

- **MEP TECHNICAL REPORT STATUS:** Final
- **TMDL STATUS:** Final TMDL

Watershed nitrogen load characteristics were published in the 2004 MEP report, reflecting current conditions at the time of writing:

- **TOTAL ATTENUATED NITROGEN LOAD (MEP CHAPTER VIII):** 28,813 kg/Y
- **SOURCES OF ATTENUATED WATERSHED NITROGEN LOAD:**
  - 82% Septic Systems
  - 10% Fertilizer
  - 7% Stormwater From Impervious Surfaces
  - 1% Wastewater Treatment Facilities

Since the MEP report, the Commission compiled the following updated water use and nitrogen loads using the regional wMVP database, enabling a more current estimate of nitrogen loading (see figure on page 1 for watershed boundary delineation):

- **TOTAL WASTEWATER FLOW:** 456 MGY (million gal per year)
  - Treated Wastewater Flow: 61 MGY
  - Septic Flow: 395 MGY
- **TOTAL ATTENUATED NITROGEN LOAD (WMVP):** 31,961 kg/Y

CONTRIBUTING TOWNS

Percent contributions listed below are the aggregate sub-embayment contributions identified in Appendix 8C of the Cape Cod Section 208 Plan Update (contributions are based on attenuated load where available). See Appendix 8C for detailed town allocations by sub-embayment.

A portion of the land area in Sandwich and Mashpee is not in the control of the towns as it is part of Joint Base Cape Cod (JBCC), which is served by a wastewater treatment facility and discharged outside of the watershed.

- **MASHPEE:** 75%
- **BARNSTABLE:** 17%
- **SANDWICH:** 8%

WATERSHED REPORT: Popponesset Bay

Mashpee, Barnstable & Sandwich

The Towns of Barnstable, Mashpee, and Sandwich are currently working through the development of an Inter-Municipal Agreement (IMA) and draft watershed permit, and have developed updated percent contributions based on those efforts (Mashpee - 75%, Barnstable - 16%, Sandwich - 9%). The percentages agreed upon in the IMA will be the basis for the coordinated efforts of the three communities to address nitrogen impacts on Popponesset Bay.

THE MEP RESTORATION SCENARIO

- **WATERSHED TOTAL ATTENUATED NITROGEN REDUCTION TARGET:** 45%
- **WATERSHED SEPTIC REDUCTION TARGET:** 61% (The scenario represents the aggregated sub-embayment percent removal targets from the MEP technical report)

POPPONESSET BAY ESTUARY

- **EMBAYMENT AREA:** 720 acres
- **EMBAYMENT VOLUME:** 119 million cubic feet
- **2014 INTEGRATED LIST STATUS:** Category 4a for estuarine bioassessments and fecal coliform
  - Category 4a: TMDL is complete
  - www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

POPPONESSET BAY WATERSHED

General watershed characteristics according to the current wMVP regional database (see figure on page 1 for watershed boundary) follow.

- **WATERSHED CHARACTERISTICS**
  - Acres: 13,082
  - Parcels: 7,979
  - % Developed Residential Parcels: 78%
  - Parcel Density: 1.6 acres per parcel (approx.)

Freshwater Sources

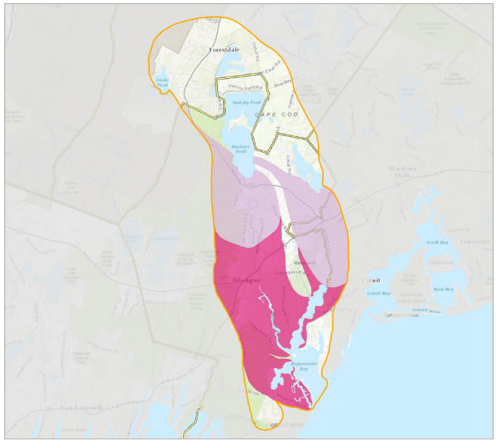
PONDS

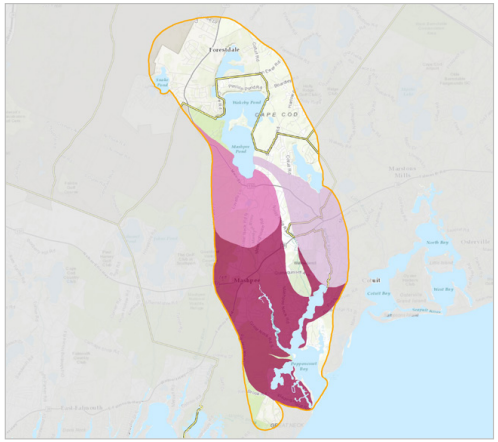
- **IDENTIFIED SURFACE WATERS:** 40
- **NUMBER OF NAMED FRESHWATER PONDS:** 13
- **PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION:** 5
- **2014 INTEGRATED LIST STATUS:** 4 listed

Mashpee recently conducted a pond assessment and installed Solar Bees in Santuit Pond in efforts to restore water quality. Mashpee and Barnstable have participated in the Pond and Lake Stewardship (PALS) program that has helped establish baseline water quality.

STREAMS

- **SIGNIFICANT FRESHWATER STREAM OUTLETS:** 2





0.1% - 9%
9.1% - 38%
38.1% - 62%
62.1% - 86%
86.1% - 100%

Subwatersheds with Total Attenuated Watershed Removal Targets

(Left) Benthic and atmospheric loads directly on embayments are not included.

Subwatersheds with Septic Attenuated Nitrogen Removal Targets

(Right)

Mashpee River:
- Average Flow: 26,223 cubic meters per day (m3/d)
- Average Nitrate Concentrations: .318 milligrams per liter (mg/L)

Santuit River:
- Average Flow: 13,164 m3/d
- Average Nitrate Concentrations: 0.702 mg/L

Stream data from MEP technical report. Nitrate concentrations higher than 0.05 mg/L background concentrations, evident in public supply wells located in pristine areas, provide evidence of the impact of non-point source pollution on the aquifer and receiving coastal water bodies.

DRINKING WATER SOURCES

- **WATER DISTRICTS:** 3
  - Sandwich Water District
  - Cotuit Water District
  - Mashpee Water District
- **GRAVEL PACKED WELLS:** 9
  - 2 have nitrate concentrations between 0 and 0.5 mg/L
  - 1 have nitrate concentrations between 0.5 and 1 mg/L
  - 3 have nitrate concentrations between 1 and 2.5 mg/L
  - 1 have nitrate concentrations between 2.5 and 5 mg/L
  - 2 have no nitrate concentration data
- **SMALL VOLUME WELLS:** 2

Drinking water data from Cape Cod Commission and MassDEP data sources – nitrate values obtained from drinking water wells are from 2009-2012. The state and federal drinking water limit for nitrate is 10 mg/L. The Cape Cod Commission nitrate loading standard is 5 mg/l.

The MEP report includes contributing areas to the Rock Landing community water supply wells in its watershed map. These wells are located outside the Popponesset Bay watershed.

Degree of Impairment and Areas of Need

For the purposes of the Section 208 Plan Update areas of need are primarily defined by the amount of nitrogen reduction required as defined by the TMDL and/or MEP technical report. These were referred to above as a 61% reduction in septic nitrogen and a 45% reduction in total nitrogen. More specifically, the MEP provides a targeted amount of nitrogen reduction required by subwatershed, as shown in the figures Subwatersheds with Total Attenuated Watershed Removal Targets and Subwatersheds with Septic Attenuated Nitrogen Removal Targets.

The nitrogen load from the watershed exceeds the threshold or TMDL for Popponesset Bay, resulting in impaired water quality. The ecological health of a water body is determined from water quality, extent of eelgrass, assortment of benthic fauna, and dissolved oxygen and ranges from severe degradation, significantly impaired, moderately impaired, or healthy habitat conditions

MEP ECOLOGICAL CHARACTERISTICS AND WATER QUALITY

The MEP report provides the following characterization of the estuary's health:

- **OVERALL ECOLOGIC CONDITION:** Healthy to Severely Degraded
- **LOWER POPPONESSET BAY:** Healthy to Moderately Impaired
- **OCKWAY BAY:** Significantly Impaired to Severely Degraded
- **MASHPEE RIVER:** significantly Impaired to Severely Degraded
- **SENTINEL STATION:**
  - Total Nitrogen Concentration Threshold: 0.38 mg/L
  - Total Nitrogen Concentration Existing: 0.45 mg/L (As reported at the MEP sentinel water-quality monitoring station)

Traditional & Non-Traditional Scenarios

SCENARIO DEVELOPMENT

Through the 208 Stakeholder process, the Commission developed "bookend" scenarios – one looking at a possible solution using traditional collection and treatment, the other examining a possible suite of non-traditional technologies – to address the nitrogen management needs in each watershed. These bookend scenarios provide guidance for communities as they continue to discuss alternatives, priorities, and opportunities for identifying well-considered solutions that will address communities' needs and interests.

REGIONAL DATA

In preparation for this effort, the Commission collected regionally consistent data for the purposes of watershed scenario development. Both parcel data and water use data was identified and collected for the entire region. While the scientific basis for planning is the thresholds identified in the MEP technical reports, each report uses data from different years, and in some cases the MEP data used are 10 or more years old. In addition, there are watersheds on Cape Cod without the benefit of an MEP report; therefore, similar data was not available for planning purposes.

The updated regional data set was used to estimate wastewater, stormwater and fertilizer loads, using the same methodologies as the MEP. This approach allows for a reevaluation of existing development, which may have changed in the last 10 years. Parcel data included in the regional database is from 2010-2012 and water use data is from 2008-2011, depending on the water supplier and based on best available data. This approach allows for regionally consistent watershed scenario development.

WATERSHED SCENARIOS

The watershed scenarios that follow outline possibilities for the watershed. A series of non-traditional technologies that might be applicable are included, as well as the amount of residential load that would need to be collected if a traditional collection system and treatment facility was implemented. The pie charts show the load to be collected for treated effluent disposal both inside and outside the watershed.

Site specific analyses of collection areas may result in the need to collect wastewater from more or fewer parcels to meet the nitrogen reduction target. The scenarios presented are conceptual and are meant to inform discussions regarding effective and efficient solutions; they are not specific recommendations and should be viewed as resource information for additional and more detailed wastewater management planning.

In Popponesset Bay, the Towns of Mashpee and Sandwich have done additional and more detailed planning. Included in the last section of this report is a description of their efforts, along with plan details. The Town of Mashpee scenario is based on their Final Recommended Plan and Final Environmental Impact Report established as part of their Watershed Nitrogen Management Planning efforts.

TOTAL ATTENUATED NITROGEN LOAD VALUES (FROM WMVP)

Popponesset Bay Nitrogen Sources	Total Attenuated Watershed Nitrogen Load (kg-N/yr)
Wastewater[1]	22,729
Fertilizer[2]	3,571
Stormwater	4,143
Other[3]	1,518
TOTAL WATERSHED LOAD	**31,961**
Total Watershed Threshold	13,852
TOTAL ATTENUATED LOAD TO BE REMOVED	**18,109**

1. Includes nitrogen loads from septic systems and wastewater treatment facilities.
2. Includes nitrogen loads from lawns, cranberry bogs, and golf courses.
3. Includes nitrogen loads from landfills and atmospheric deposition to vacant land.

Traditional & Non-Traditional Scenarios

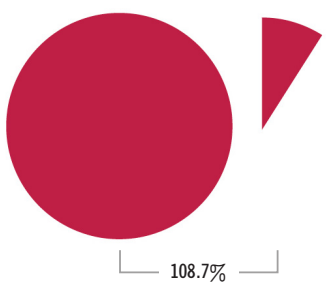
Non-Traditional

UNIT OF APPLIED TECHNOLOGY	ATTENUATED NITROGEN REMOVED IN KG/Y
25 % Nitrogen Reduction - Fertilizer Management	893
25 % Nitrogen Reduction - Stormwater Mitigation	1,036
4,000 Linear Feet - Permeable Reactive Barrier (PRB) (Capture load calculated by wMVP: 3,492.4 kg/Y)	2,532
233 Acres - Fertigation - Turf	653
35 Acres - Fertigation - Cranberry Bogs	425
27 Acres - Aquaculture/Oyster Beds	6,830
1,938 Square Feet - Floating Constructed Wetlands	775
784 Units - Ecotoilets (UD & Compost)	1,448
1,202 Units - I & A Systems	1,448
668 Units - Enhanced I & A Systems	1,448
TOTAL	**17,488**

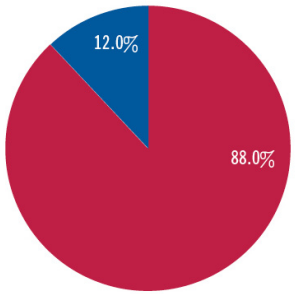
A summary of the approach and methodology that was applied using non-traditional technologies follows at the end of this report.

Traditional

CENTRALIZED TREATMENT WITH DISPOSAL INSIDE THE WATERSHED



CENTRALIZED TREATMENT WITH DISPOSAL OUTSIDE THE WATERSHED



Septic Load to be Removed
Remaining Septic Load

Assumes load to be collected and treated is disposed in the watershed, requiring additional collection to offset the load.

The watershed nitrogen threshold cannot be met by collecting 100% of the septic load in the watershed and returning the treated load to the watershed.

Assumes that the load to be collected and treated is removed from the watershed so no offset is required.

Town of Mashpee Local Progress

The Mashpee Comprehensive Wastewater Management Plan (CWMP) was scoped through a joint Massachusetts Environmental Policy Act (MEPA)/Development of Regional Impact (DRI) review as an Environmental Notification Form (ENF) in 2001. In 2007, the town submitted its Needs Assessment Report entitled, "Town of Mashpee, Popponesset Bay and Waquoit Bay-East Watersheds Needs Assessment Report." Also in 2007, the town completed a technology screening report, which was followed shortly by its draft alternative scenarios and site evaluation report in March 2008.

The Needs Assessment contains a characterization of the nine operating private sewage treatment facilities, including treatment efficiency and excess capacity. This work allowed the town to focus on three potential wastewater scenarios that were developed in 2012. These options were reviewed and served as the basis for development of their preferred alternative. The wastewater scenarios include use of the existing private plants at their planned capacity and either three or four subregional plants with consideration of shared town responsibility. Off-site disposal of effluent outside of the impaired watersheds is an important consideration for the plan's approach. The alternatives analysis included consideration of private effluent disposal sites at New Seabury, Willowbend, and others, in addition to the town's transfer facility site.

The issuance of the final Alternatives Screening Analysis in August 2013 developed the framework of the draft and final plans and identified several alternative approaches to sewering, including shellfish aquaculture and permeable reactive barriers.

In April 2014, the Sewer Commission met with Cape Cod Commission staff to begin the discussion around filing its CWMP. The Recommended Plan includes a significant aquaculture undertaking and an adaptive management approach to achieving water quality goals.

In the fall of 2014, Mashpee adopted local nitrogen-oriented fertilizer management regulations consistent with the Cape-wide Fertilizer Management District of Critical Planning Concern (DCPC).

In September 2014, the Massachusetts Secretary of Energy and Environmental Affair issued a certificate of adequacy for the Draft Environmental Impact Review (DEIR) for Mashpee's Comprehensive Watershed Nitrogen Management Plan. In the Summer of 2015, the Massachusetts Secretary of Energy and Environmental Affair issued a final certificate Mashpee's Comprehensive Watershed Nitrogen Management Plan. The plan is currently under review by the Commission, although the Commission has already notified the town that phase I of its plan is consistent with the 208 Plan Update.

At the October 2015 Mashpee Town Meeting, the town voted to appropriate $250,000 for shellfish propagation, $32,500 as the first installment on a 3-year monitoring study associated with the shellfish project, funded a full time permanent water quality technician position, $100,000 to reauthorize the Sewer Commission Facilities Study Account and hire a consultant to complete studies and develop a preliminary design for the connection of properties to existing treatment facilities, $80,000 to support the development of inter-municipal agreements with neighboring communities, as well as authorized the use of town-owned land for the purposes of developing wastewater treatment facilities.

In October 2015, the town also approached Barnstable and Sandwich regarding approaches for Popponesset Bay and a potential watershed permit. It is expected that these three towns will collaborate on the first watershed permit in the region in close coordination with the Cape Cod Commission and the Massachusetts Department of Environmental Protection. To accommodate for discussions with Barnstable and Sandwich regarding the watershed permit a DRI extension through the fall has been agreed upon.

In June 2016, Mashpee received $14,600 from the Commission for construction of a floating shellfish seed upweller system to grow quahog seed for initial implementation of their shellfish restoration plan. Funding was part of $142,149 in local grants made by the Commission in support of 208 Plan implementation.

At the Spring 2017 Town Meeting, Mashpee voted to fund monitoring of shellfish aquaculture in Popponesset Bay and Waquoit Bay in the amount of $49,500. Amendments to the Town's nutrient control bylaw were also approved.

Town of Mashpee Watershed Scenario Details

Popponesset Bay	CREDITS		REDUCTION TECHNOLOGIES			REMEDIATION AND RESTORATION TECHNOLOGIES			REMOVAL
NAME OF TECHNOLOGY	% Nitrogen Reduction	Load Reduction (kg-N/yr)	# Properties / Units	Flow Collected (MGD)	Load Reduction (kg-N/yr)	# Units Proposed	Unit Metric	Load Reduction (kg-N/yr)	Total Scenario Load Reduction (kg-N/yr)
Scenario									10,940
Centralized Sewer			1,170	0.157	4,110				
Aquaculture/Oyster Beds						16.32 M	Shellfish	6,830	

Town of Barnstable Local Progress

The Cape Cod Commission and the Town of Barnstable met and discussed the use of WatershedMVP to evaluate targeted watershed approaches for each of the watersheds in which they have jurisdiction. In 2015, the town reformulated its Citizen's Advisory Committee (CAC) for wastewater planning to better address local needs. In addition to local participation, the newly formed committee (the Water Resources Advisory Committee or WRAC) includes state and regional representatives. Town staff provided modifications to Commission-developed watershed scenarios and presented those scenarios to their WRAC for review and discussion. Those scenarios are included in this report.

The Town of Barnstable operates the Hyannis Water Pollution Control Facility (WPCF), located off Bearses Way in Hyannis, which is the primary wastewater treatment facility serving approximately 2,900 properties in Hyannis and Barnstable village. The treatment facility has been upgraded and permitted to treat additional flows up to a total of 4.2 million gallons per day (MGD), upon meeting requirements of an adaptive management plan approved by the Commission in 2007. Property along Route 132 was acquired by the town in 2002 to potentially accommodate future disposal needs. The site is approved under a 2006 Massachusetts Environmental Policy Act (MEPA) certificate to discharge up to 0.5 MGD. The site is not presently in use. However, a force main and sewer has been extended to the site from the WPCF.

The WPCF treats an average daily flow of 1.46 MGD and a maximum monthly average flow of 1.94 MGD. Treatment performance has averaged 5 milligrams per liter (mg/L) total nitrogen in the treated effluent and the facility has a discharge limit of 5 mg/L under the 2007 Development of Regional Impact (DRI) decision and a limit of 10 mg/L under a Groundwater Discharge Permit (GWDP). The facility is also equipped with sludge thickening, storage and dewatering facilities sized for the current process conditions.

The Town of Barnstable also operates two smaller facilities – the Marstons Mills Wastewater Treatment Facility (WWTF) and the Red Lily Pond Cluster System. The Marstons Mills WWTF is limited to a discharge flow of 42,900 gallons per day (GPD) and is intended to service the Barnstable United Elementary School and the Village at Marstons Mills affordable housing development. The Red Lily Pond Cluster System currently serves 17 homes. According to the comprehensive wastewater management plan (CWMP) approved in 2007, no performance sampling of the system occurs and the system is assumed to produce comparable effluent to any conventional single family septic system.

In addition to municipally-owned facilities, there are two privately-owned treatment facilities treating wastewater from the Cotuit Landing shopping plaza and the Cape Regency nursing and rehabilitation facility. These facilities provide high levels of wastewater treatment. The treatment facility at Cotuit Landing was designed with additional treatment capacity beyond the expected needs of the shopping plaza for potential treatment of flows from neighboring properties.

Barnstable is working on a town-wide nutrient management plan that will provide the basis of its CWMP. The plan will address nitrogen and other needs in watersheds draining to Three Bays, Centerville River, and Lewis Bay. A nitrogen total maximum daily load (TMDL) for Barnstable Harbor has not been approved by US EPA. The MEPA certificate scope for the Final Environmental Impact Report (FEIR) includes engagement in a targeted watershed approach, consistent with the 208 Plan Update.

In the fall of 2014, Barnstable adopted local nitrogen-oriented fertilizer management regulations consistent with the Cape-wide Fertilizer Management District of Critical Planning Concern (DCPC).

In 2015, the Town submitted a Statement of Interest to the US EPA for a hydrogeologic site characterization as an initial step toward piloting a permeable reactive barrier in the town. One of three sites proposed by the Town was selected for characterization. The work was completed in 2016. The draft report is presently being reviewed by the Town.

Also in 2015, the Town agreed to work with Mashpee and Sandwich on approaches for the Popponesset Bay watershed and a potential development of a watershed permit. It is expected that these three towns will collaborate on the first

Town of Barnstable Watershed Scenario Details

Popponesset Bay	CREDITS		REDUCTION TECHNOLOGIES			REMEDIATION AND RESTORATION TECHNOLOGIES			REMOVAL
NAME OF TECHNOLOGY	% Nitrogen Reduction	Load Reduction (kg-N/yr)	# Properties / Units	Flow Collected (gpd)	Load Reduction (kg-N/yr)	# Units Proposed	Unit Metric	Load Reduction (kg-N/yr)	Total Scenario Load Reduction (kg-N/yr)
Traditional Scenario - Disposal Outside the Watershed									2,400
Centralized Sewer			500	80,000	2,400				
Non-Traditional Scenario									826
Fertilizer Management	25%	64							
Stormwater Mitigation	25%	132							
Permeable Reactive Barrier (PRB)						654	Linear Feet	414	
I & A Systems			41	Units	108				
Enhanced I & A Systems			75	Units	108				

watershed permit in the region in close coordination with the Cape Cod Commission and the Massachusetts Department of Environmental Protection.

In June 2016, Barnstable received $28,850 from the Commission to fund upgrades to three stormwater treatment BMPs. Funding was part of $142,149 in local grants made available to communities by the Commission in support of 208 Plan implementation.

Town of Sandwich Local Progress

The Town of Sandwich has an established water quality committee to oversee water quality and wastewater planning efforts. In October 2015 town staff and their consultant (Wright-Pierce) met with Cape Cod Commission staff to discuss watershed planning, decision support tools, and scenario development for Sandwich watersheds. In the same month the town was approached by Mashpee regarding approaches for Popponesset Bay, and a potential watershed permit, and has agreed to participate with Mashpee and Barnstable in this shared effort. It is expected that Barnstable, Mashpee, and Sandwich will collaborate on the first watershed permit in the region in close coordination with the Cape Cod Commission and the Massachusetts Department of Environmental Protection.

Previously the committee developed a scope of work for a Comprehensive Wastewater Management Plan (CWMP) and submitted the scope under the Sagamore Lens Natural Resource Damages Assessment, related to past groundwater contamination at the Textron facility at Joint Base Cape Cod (JBCC). The town received an award of $400,000 t0 conduct its water/wastewater plan and completed a comprehensive needs assessment, as well as an interim wastewater solutions plan to accommodate economic development in the South Sandwich Village Center.

The town spent several years working with a private developer on a development project that included a public-private wastewater component for the construction of a facility that would accommodate the private project, in addition to some public wastewater needs. That project will not be completed, but the town is again seeking a private partner to create new economic growth and to potentially participate in infrastructure development.

The town has participated in discussions at JBCC about the potential use of its existing wastewater infrastructure as a regional option for the Upper Cape towns.

In February 2016 the Town of Sandwich requested a meeting with Commission staff to discuss watershed scenarios and potential modifications to watersheds in which Sandwich has jurisdiction. The town provided collection footprints and assumptions for a single treatment facility to serve all three watersheds (Popponesset Bay, Three Bays, and Waquoit Bay), consistent with the Sandwich CWMP, and identified locations for non-traditional approaches, in addition to credits for stormwater and fertilizer reduction. The Town proposes a 25% fertilizer management credit and a 6.25% stormwater management credit. While the proposed interventions, alone, do not meet the nitrogen allocations identified in Appendix 8C of the 208 Plan Update, the town has expressed a preference to rely on nutrient trading or cost sharing to reduce the load allocated to the downgradient towns in the shared watersheds of Popponesset Bay, Three Bays and Waquoit Bay, where nitrogen reductions can be more cost effectively attained.

Town of Sandwich Watershed Scenario Details

Popponesset Bay	CREDITS		REDUCTION TECHNOLOGIES			REMEDIATION AND RESTORATION TECHNOLOGIES			REMOVAL
NAME OF TECHNOLOGY	% Nitrogen Reduction	Load Reduction (kg-N/yr)	# Properties / Units	Flow Collected (gpd)	Load Reduction (kg-N/yr)	# Units Proposed	Unit Metric	Load Reduction (kg-N/yr)	Total Scenario Load Reduction (kg-N/yr)
Traditional Scenario - Disposal Outside the Watershed									1,820
Centralized Sewer			1,328	230,214	1,820				
Non-Traditional Scenario*									47
Fertilizer Management	25%	32							
Stormwater Mitigation	6.25%	15							

NOTES:

* The Town of Sandwich will rely on nutrient trading as an additional measure to meet the TMDL, if necessary.

Scenario Maps

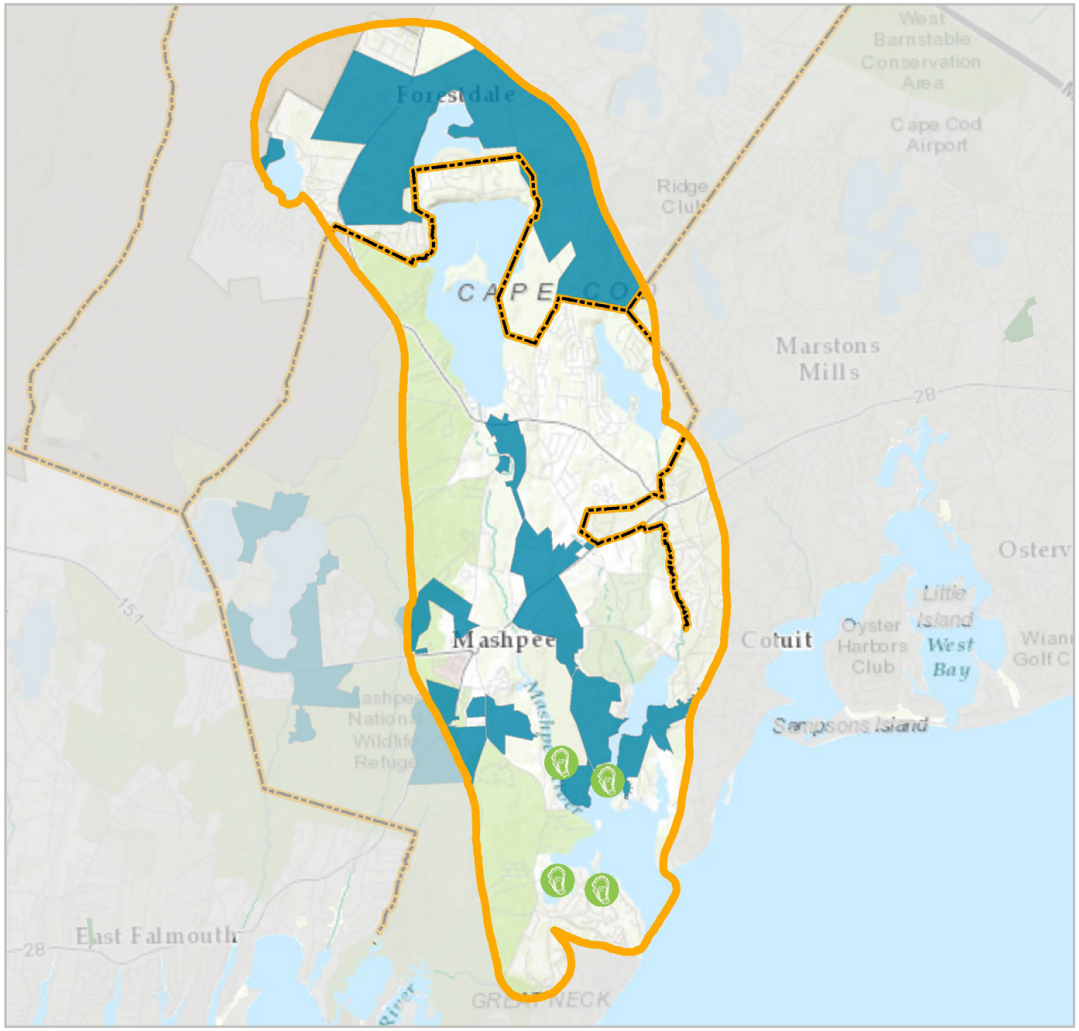
Popponesset Bay Watershed
Traditional Scenario

MASHPEE, BARNSTABLE & SANDWICH

Representative locations of conceptually proposed infrastructure

Legend

- Aquaculture
- Town Lines
- Embayment Watersheds
- Proposed Sewershed



Scenario Maps

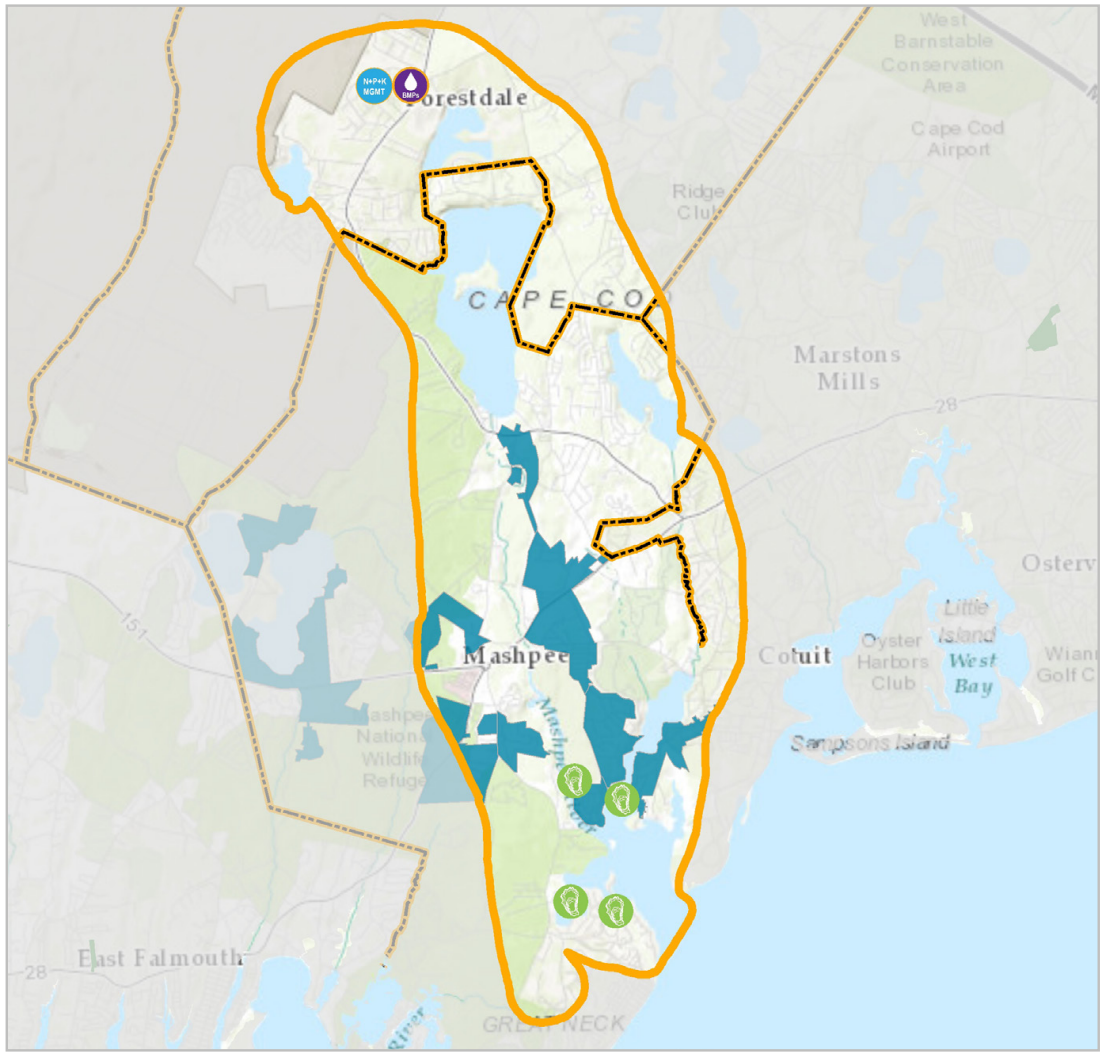
Popponesset Bay Watershed
Non-Traditional Scenario

MASHPEE, BARNSTABLE & SANDWICH

Representative locations of conceptually proposed infrastructure

Legend

- Stormwater Management
- Fertilizer Management
- Aquaculture
- Town Lines
- Embayment Watersheds
- Proposed Sewershed



Methodology for Selecting Non-Traditional Technology Scenarios

This section summarizes the approach and methodology that was applied during the 208 Update to develop plans for reducing nitrogen loading to estuaries using non-traditional (NT) technologies. It includes descriptions of regional credits for stormwater and fertilizer reductions, regional screening for potential sites for several technologies, and site-specific analyses for others. Nitrogen attenuation rates for each technology were derived from the Technologies Matrix. The nitrogen thresholds for each embayment were determined from the Massachusetts Estuaries Project (MEP).

This section summarizes the approach and methodology that was applied during the 208 Update to develop plans for reducing nitrogen loading to estuaries using non-traditional (NT) technologies. It includes descriptions of regional credits for stormwater and fertilizer reductions, regional screening for potential sites for several technologies, and site-specific analyses for others. Nitrogen attenuation rates for each technology are noted below, based on the Technologies Matrix or newer data. The nitrogen thresholds for each embayment were determined from the Massachusetts Estuaries Project (MEP).

Regional credits were developed for potential stormwater retrofits and fertilizer reductions. They were calculated as a percent reduction of existing nitrogen loads as identified in the MEP reports and updated GIS data developed by the Cape Cod Commission.

- **STORMWATER MANAGEMENT:** Most Cape communities have already begun the process of identifying significant untreated stormwater discharges and developing appropriate mitigation projects. With the prospect of the MS4 regulatory requirements it was assumed that additional mitigation efforts would be implemented. Based upon the evidence developed by the University of New Hampshire Stormwater Center that several vegetated stormwater management practices (including bioretention and constructed wetlands) are able to achieve nitrogen reductions of 50% or more and the assumption that only a portion (estimated at 50%) of identified sites would be retrofitted a 25% nitrogen reduction credit was assumed for each watershed. Specific locations and number of locations were not identified; this was deferred to individual towns to consider as part of the suite of nitrogen management strategies.
- **FERTILIZER REDUCTIONS:** Based upon the success of most Cape Cod towns to implement either regulatory or non-regulatory fertilizer management programs and the efforts of the Cape Cod Extension Service in educating homeowners a 25% reduction in fertilizer applications was assumed for each watershed.

Regional GIS screening methods were developed to identify locations for some non-traditional technologies. A GIS viewer was developed as an on-line tool for staff and consultants to utilize during the watershed planning process.

- **CONSTRUCTED WETLANDS/ PHYTOREMEDIATION:** A GIS-based screening method was developed by the Cape Cod Commission to identify and rank parcels of land that have potential for the location of constructed wetlands and phytoremediation. The ranking utilized parcel size and ownership, depth to groundwater, suitable soils, distance from wetlands, and undeveloped parcels. A nitrogen removal rate of 500 kg/Y/acre and 532 kg/Y/acre was used for Constructed Wetlands and Phytoremediation, respectively.
- **PERMEABLE REACTIVE BARRIERS (PRBS):** A GIS-based screening method was developed to identify existing roads that are proximate to receiving waters, downgradient of high density development, run perpendicular to groundwater flow (to have the highest potential to intercept nutrients in groundwater), and where the depth to groundwater is relatively shallow to maximize the area of saturated thickness treated in the aquifer.

Methodology for Selecting Non-Traditional Technology Scenarios

- **FERTIGATION WELLS:** Golf courses were mapped to identify areas where fertigation wells could be utilized to recapture nitrogen-enriched groundwater and re-apply it to the managed turf areas to serve both irrigation and fertilization needs. Most golf courses were assumed to be eighteen holes with a fertilized area of 75 acres. Fertigation water was assumed to have an average concentration of 5 mg/liter. An uptake/attenuation rate of 80% was applied resulting in an assumed nitrogen reduction of 300 kg/year for each golf course with effectively located fertigation wells. In some cases other irrigated areas (such as athletic fields and cemeteries) were identified as potential fertigation locations. A nitrogen removal rate of 4 kg/Y/acre was used.

The MVP tool and other site-specific tools were utilized to quantify nitrogen load reductions for several potential NT interventions.

- **PERMEABLE REACTIVE BARRIERS:** for each PRB that was identified during the prior GIS-screening process an approximate capture area was identified using available water table maps and the wMVP tool. Upgradient contributing areas were digitized within wMVP and the nitrogen load was calculated. A nitrogen reduction of 72.5% was applied (calculated as an average of the reported attenuation range from the Technologies Matrix).
- **CONSTRUCTED WETLANDS (WITH COLLECTION):** Constructed wetlands were considered as a tertiary, polishing treatment for existing wastewater treatment plants. This included small-scale wastewater treatment systems. A nitrogen removal rate of 500 kg/Y/acre was used.
- **AQUACULTURE/OYSTER REEFS:** Potential areas for aquaculture and/or oyster reef restoration were considered based upon discussions with town representatives and review of maps to identify potential areas for these operations without significant conflicts to navigation. In some cases actual recent aquaculture expansions were included where they were developed after the MEP reports were prepared. An assumption of 1 million oysters per acre was used with a nitrogen removal rate of 250 kg/Y/acres.
- **FLOATING CONSTRUCTED WETLANDS:** Potential areas for floating wetlands were considered in areas where no conflicts with navigation or swimming areas were identified. A nitrogen removal rate of 0.4 kg/Y/sq foot was used.
- **INLET WIDENING AND COASTAL HABITAT RESTORATION:** Only considered in areas where these projects were identified by towns or state agencies and where detailed hydrologic investigations and modeling had been performed due to wide variations in nitrate load reduction, flushing impacts, impacts on flooding, and costs (dredging only, replacing infrastructure, removing and replacing roadways or bridges, etc.). Nitrogen removal rates were based on MEP or other studies.
- **INNOVATIVE & ALTERNATIVE SEPTIC SYSTEMS AND ECOTOILETS:** In most cases specific locations for these technologies were not identified. Rather general estimates for the percent adoption were provided based upon discussions with the stakeholder groups and their views on potential adoption rates. In some watersheds a 5% adoption rate was included based upon this stakeholder input. In a limited number of instances specific locations for these technologies were included based upon town input and suggestions. A nitrogen removal rate of 1.658 kg/Y for each system was used for I&A Septic Systems, and 2.984 kg/Y for enhanced I&A systems. A removal rate of 2.542 kg/Y was used for each home installation of an Ecotoilet, and 0.467 kg/Y for installation of urine diversion toilets in public settings.

Finally, the locations of specific technologies were discussed during the 208 stakeholder engagement process. Stakeholders across the Cape 'groundtruthed' potential NT locations and NT scenarios were adjusted accordingly.

4

REMEDIATION

Stormwater BMPs

SCALE: CAPE WIDE
APPROACH: REMEDIATION

SCENARIO PLANNING: SELECTED FOR USE

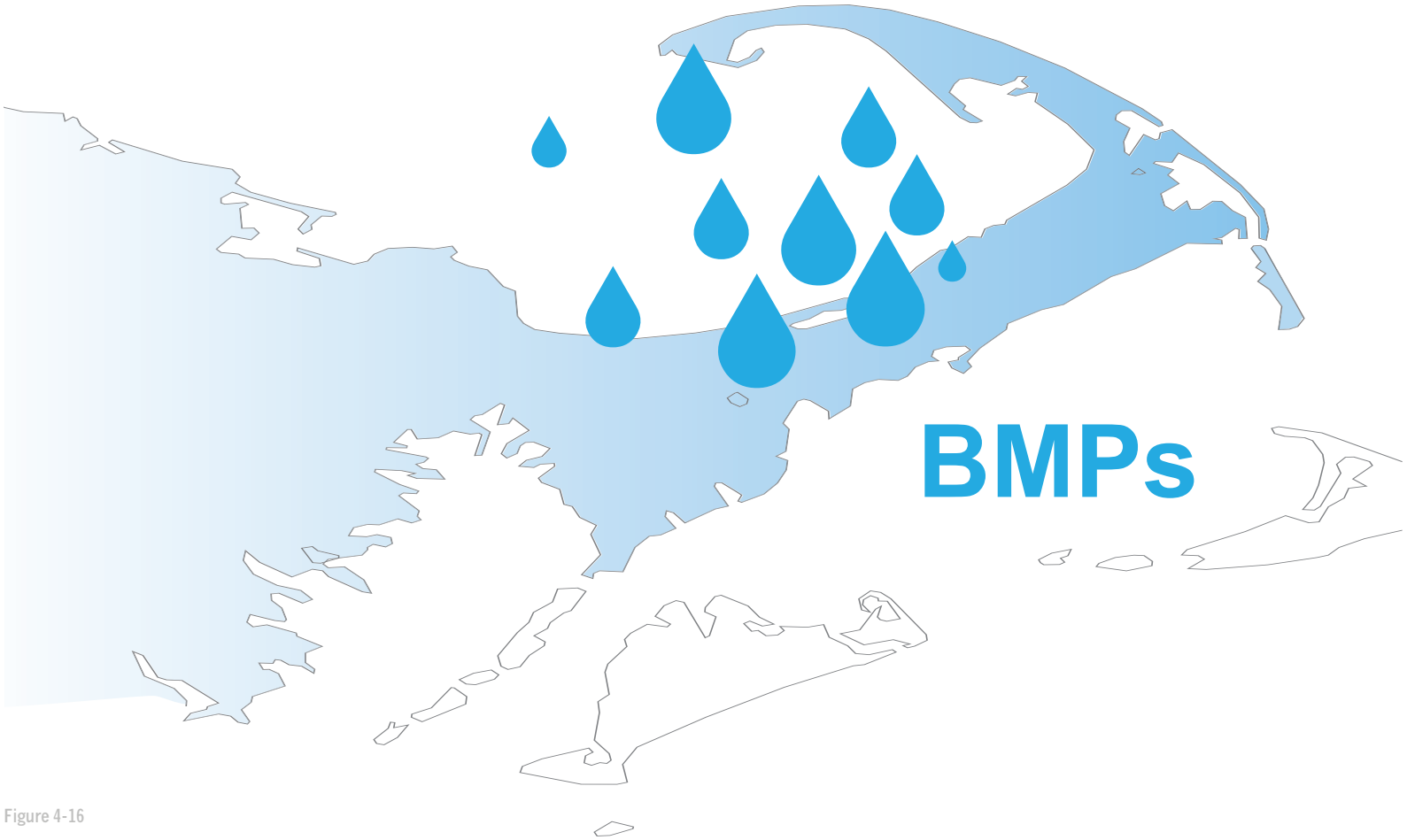


Figure 4-16

Stormwater BMPs

SCALE: CAPE WIDE
APPROACH: REMEDIATION

SCENARIO PLANNING: SELECTED FOR USE

DESCRIPTION

Non-Structural Stormwater strategies. These strategies include street sweeping, maintenance of stormwater utilities, education and public outreach programs, land use planning, and IC reduction and control.

SITING NEEDS

- Varies

ECO-BENEFITS

- Enhances Habitat / Wildlife / Biodiversity
- Promotes Green Space / Conservation / Recreation
- Improves Management of Flooding / Extreme Events

PERFORMANCE CHALLENGES

- Requires the creation and enforce of stormwater regulations and policies

CLIMATE RESILIENCE: RISKS

- Reduced effectiveness of biological processes as a result of more frequent inundation or exposure to saline water (surface or ground water

CLIMATE RESILIENCE: SOLUTIONS

- Ensure frequent maintenance inspections to monitor condition and performance of technology (e.g. achieving nutrient removal targets, health of vegetation)
- Project design and species selection to ensure adequate performance in increasingly saline environments

Permitting

POTENTIAL PERMITTING AUTHORITIES

- Municipal Conservation Commission
- Massachusetts Department of Environmental Protection

Technology Performance

Nitrogen Removal 25% to 75%

Phosphorus Removal 1% to 8%

$695	$51,470
Removal Cost per kg N (avg life cycle)	Removal Cost per kg P (avg life cycle)
20 years	1 to 10 years
Useful Life	Time to See Results

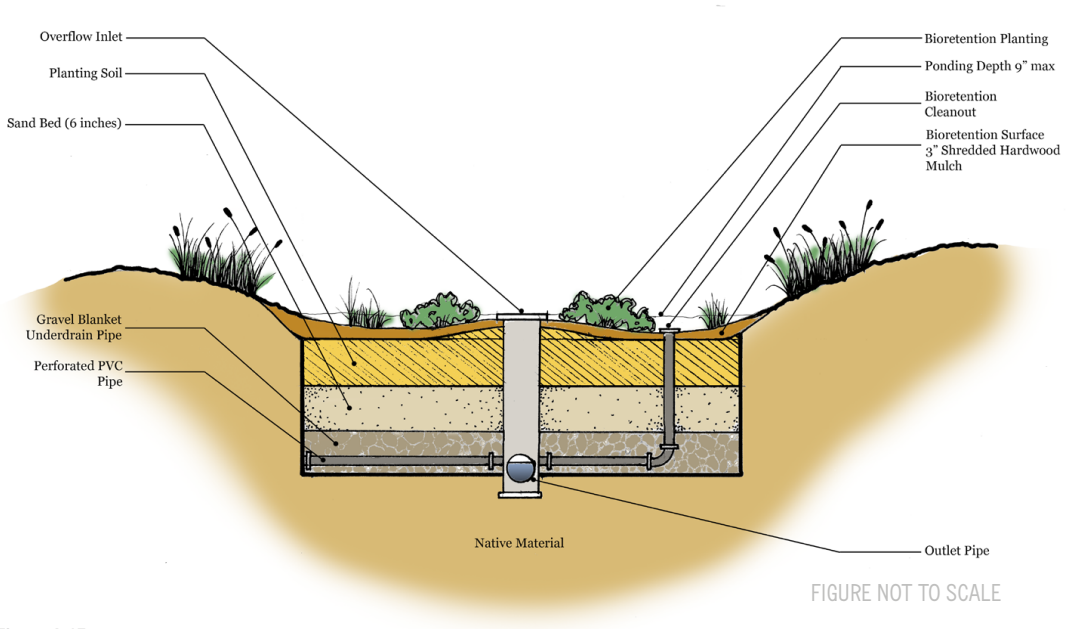


FIGURE NOT TO SCALE

Figure 4-17

Stormwater Bioretention Soil Media Filters

SCALE: SITE
APPROACH: REMEDIATION

SCENARIO PLANNING: NOT SELECTED FOR USE
IDENTIFIED FOR PILOTING

DESCRIPTION

Bioretention is the process in which contaminants and sedimentation are removed from stormwater runoff through physical, biological and chemical treatment processes. Stormwater is collected into the treatment area which consists of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. Runoff passes first over or through a sand bed, which slows the runoff's velocity, distributes it evenly along the length of the ponding area, which consists of a surface organic layer and/or groundcover and the underlying planting soil. The ponding area is graded, its center depressed. Water is ponded and gradually infiltrates the bioretention area or is evapotranspired. The bioretention area is graded to divert excess runoff away from itself. Stored water in the bioretention area planting soil exfiltrates over a period of days into the underlying soils.

Technology Performance

Nitrogen Removal 25% to 45%

Phosphorus Removal 20% to 30%

$2,241	$20,912
Removal Cost per kg N (avg life cycle)	Removal Cost per kg P (avg life cycle)
20 years	1 to 10 years
Useful Life	Time to See Results

Stormwater Bioretention Soil Media Filters

SCALE: SITE
APPROACH: REMEDIATION
SCENARIO PLANNING: NOT SELECTED FOR USE
IDENTIFIED FOR PILOTING

SITING NEEDS

- GW depth > 4 feet
- Footprint is greatly scalable

ECO-BENEFITS

- Enhances Habitat / Wildlife / Biodiversity
- Promotes Green Space / Conservation / Recreation
- Improves Management of Flooding / Extreme Events

PERFORMANCE CHALLENGES

- Open space required for construction

CLIMATE RESILIENCE: RISKS

- Reduced effectiveness of biological processes as a result of more frequent inundation or exposure to saline water (surface or ground water)

CLIMATE RESILIENCE: SOLUTIONS

- Ensure frequent maintenance inspections to monitor condition and performance of technology (i.e. achieving nutrient removal targets, health of vegetation)
- Species selection to ensure adequate performance in increasingly saline environments

4

REMEDIATION

Stormwater Constructed Wetlands, BMPs

SCALE: CAPE WIDE
APPROACH: REMEDIATION

SCENARIO PLANNING: SELECTED FOR USE
PHYTOBUFFERS IDENTIFIED FOR PILOTING

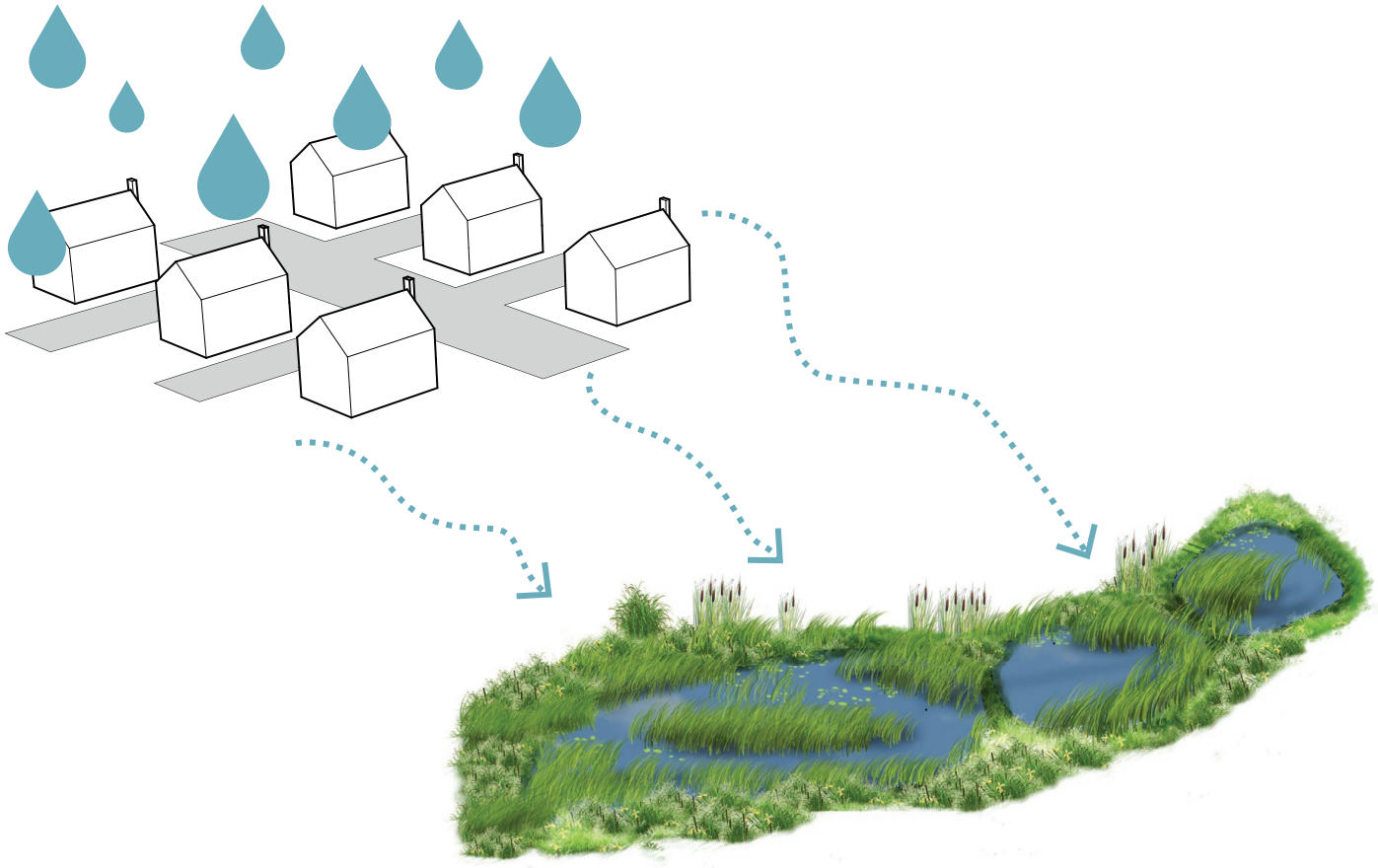


Figure 4-18

Stormwater Constructed Wetlands, BMPs

SCALE: CAPE WIDE
APPROACH: REMEDIATION

SCENARIO PLANNING: SELECTED FOR USE
PHYTOBUFFERS IDENTIFIED FOR PILOTING

DESCRIPTION

There are several types of structural stormwater BMPs, such as phytobuffers, vegetated swales, and constructed wetlands, which can contribute to nutrient removal. These approaches typically employ an excavated elongated basin engineered to accommodate the requirements of the site, together with components designed to enhance nutrient attenuation. These components may include: a swale to convey runoff; a system of chambers that allow for filtration, sediment settling, aerobic and anaerobic activity; and vegetation for nutrient uptake. Vegetated swales are typically grassed parabolic basins with relatively flat side slopes. Phytobuffers employ fast growing poplars and willow trees to remove nutrients and other contaminants. Constructed wetlands filter stormwater as it flows horizontally through a sediment forebay and a series of gravel-bottomed wetland cells, where algae and microbes grow in abundance. Constructed wetlands can be engineered to mimic natural systems, but designed to improve residence time within anaerobic chambers, allowing for year round nitrogen removal.

SITING NEEDS

- Varies

ECO-BENEFITS

- Enhances Habitat / Wildlife / Biodiversity
- Promotes Green Space / Conservation / Recreation
- Improves Management of Flooding / Extreme Events

PERFORMANCE CHALLENGES

- Requires the creation and enforcement of stormwater regulations and policies

CLIMATE RESILIENCE: RISKS

- Reduced effectiveness of biological processes as a result of more frequent inundation or exposure to saline water (surface or ground water)

CLIMATE RESILIENCE: SOLUTIONS

- Ensure frequent maintenance inspections to monitor condition and performance of technology (e.g. achieving nutrient removal targets, health of vegetation)
- Project design and species selection to ensure adequate performance in increasingly saline environments

Permitting

POTENTIAL PERMITTING AUTHORITIES

- Municipal Conservation Commission
- Massachusetts Department of Environmental Protection

Technology Performance

Nitrogen Removal % 25 to 90

Phosporous Removal %1 to 80

$156 to $1,900 Removal Cost per kg N (avg life cycle)	$6,483 to $74,143 Removal Cost per kg P (avg life cycle)
20 years Useful Life	1 to 10 years Time to See Results

PREPARED BY:

CAPE COD COMMISSION

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