

FINAL REPORT

Drainage Master Plan

*Prepared for:
Town of Tisbury, Massachusetts*

January 2018

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Environmental  Partners
GROUP

A partnership for engineering solutions

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1. PROJECT SUMMARY

Environmental Partners Group, Inc. (EPG) presents this Drainage Master Plan in accordance with our Agreement dated August 2016. The work to support this Plan was conducted in 2016 and 2017 and involved two main components: 1. Mapping and Assessment Program, and 2. Prioritization Plan.

The Mapping and Assessment Program included:

- Locating drainage system structures (catch basins, manholes, outfalls, and roadside scuppers) and mapping the locations using GPS equipment,
- Inspecting the interior of structures as needed to assist with pipeline connectivity,
- Delineating major catchment areas to support immediate follow-up work, and
- Documenting the structures' conditions for structural and maintenance needs.

The mapping phase anticipated up to 350 drainage structures from initial estimates, but additional field work was provided by EPG to locate over 700 structures and make the first attempt to establish pipeline connectivity between the structures. Because of the poor condition of some of the structures, connectivity could not be established for every drainage area. The Town can make further updates to the mapping once the structures are cleaned and investigated.

In addition to this report and its related mapping, EPG is providing the electronic data and shapefiles for the Town to maintain its drainage mapping. The data can be used to establish a plan to prioritize outfall clearing and catch basin cleaning in areas that have been identified as having sediment problems.

The Prioritization Plan included meetings with the DPW's Stormwater Committee to identify and rank drainage problems. The Committee established a top tier of problem areas to begin the process of solving the drainage issues, which primarily focused on flooding but also included addressing the nitrogen limitations of Lake Tashmoo and Lagoon Pond.

The final solution to each of the drainage problems will be determined after further investigation, modeling of stormwater runoff, and design. The continued contributions of the Stormwater Committee will be valuable as potential solutions are identified and vetted.

2. MAPPING AND ASSESSMENT PROGRAM

2.1 Introduction

Environmental Partners Group, Inc. (EPG) has located over 700 drainage structures. Structures were numbered sequentially in order from when they were recorded. Drainage connectivity was established and mapped from surface observations of the interior of structures. Included with this report are the following:

- Appendix A: Mapbook (under separate cover)
- Appendix B: Mapbook with Maintenance / Repair Items (under separate cover)

EPG field representatives located drainage structures and used a GPS unit (Leica CS25) to identify the locations by longitude and latitude. Pipe connectivity was recorded whenever visible. Gaps in these data exist because some structures were too full of water or debris to be able to determine if the structure has connecting pipes. Some outfalls could not be observed, and some drainage manholes may be buried, which could explain gaps in connectivity.

The Mapbooks present locations that were visually confirmed, as well as confidently estimated locations of some structures. Stormwater treatment features, called Best Management Practices (BMPs), were recorded by location only. Dimensions and design details of BMPs were not recorded.

2.2 Field Results

2.2.1 General Conditions

While mapping the drainage network, general observations were made on the condition of the structures. Recommended maintenance and structural repairs are shown in the Mapbook in Appendix B and are summarized in Table 2.1.

Table 2.1 - Definition of Maintenance / Repair Issues

Condition	Maintenance / Repair Issue	Description
Fair	Clean Grate / Cover	Leaves / debris are clogging / covering the grate / cover. Should be cleaned to maintain operation.
	Clean Out Structure	Debris / sand was observed within the structure and should be removed.
	Cracked / Rusting Frame and / or Cover	The frame / cover of the manhole is cracked or rusting and needs to be replaced.
Poor	Completely full and non-functioning. ⁽¹⁾	Debris / sand was observed within the structure, burying the pipes. Structure is non-functioning until emptied.
	Full – not draining properly ⁽¹⁾	The structure was full of water. Structure is non-functioning. Any existing pipes were unable to be observed.
	Replace frame / grate	The frame / grate is damaged and needs to be replaced.
	Collapsed	The structure is sunken or on the verge of collapse and needs to be replaced as soon as possible.
	Buried. Non-functioning	The catch basin is buried in sediment and is not

Condition	Maintenance / Repair Issue	Description
Poor		functioning.
	Inaccessible	The structure is known to be buried / paved over or is inaccessible. Needs to be made accessible for maintenance and inspection purposes.
	Broken pipe	The outfall was observed to have a broken pipe which should be replaced.
	Redesign	The outfall is in such poor condition that a re-construction and/or re-design are needed. See Table 4 for specific details. Further assessment needs to be made for redesign recommendations.

⁽¹⁾ These two issues are combined in further discussion

This list is not comprehensive and represents the minimum observed maintenance and repair needed for up-keeping the existing drainage system, as observed without entering the structure. Additional maintenance and repair tasks may be needed, which would require further detailed assessment.

2.2.2 Structure Condition Ratings

Table 2.2 presents a summary of structure conditions by structure type. Approximately 75% of identified catch basins (CB), drainage manholes (DMH), and scuppers were considered in Good condition. In contrast, less than 30% of identified outfalls were found to be in Good condition. The condition “No Data” means the structure was not found or was accessible for inspection.

Table 2.2 – Structure Condition Ratings

Condition	CB	DMH	Outfall	Scupper	Totals
Good	355	134	8	20	517
Fair	51	19	7	5	82
Poor	59	29	11	0	99
No Data	6	2	4	0	12
Total Count	471	184	30	25	710

Table 2.3 provides details for the structures that were rated less than Good. Most of the ratings refer to maintenance aspects, which will be easier to control now that the structures are mapped.

Table 2.3 – Structure Maintenance / Repair Tasks

Summary	CB	DMH	Outfall	Scupper	Totals
Clean Grate / Cover	39	5			44
Clean Out Structure	12	7	7	5	31
Cracked / Rusting Frame and / or Cover		7			7
Full and non-functioning. Clean Out Structure	42	4			46
Replace frame / grate	3				3
Collapsed	12				12
Buried in sediment. Non-functioning	2		6		8
Inaccessible		25	4		29

Summary	CB	DMH	Outfall	Scupper	Totals
Broken pipe			1		1
Redesign			1		1
Total Count	110	48	19	5	182

A total of 93 catch basins were observed as requiring maintenance. This count includes the “Clean Grate”, “Clean Out Structure”, and “Full and non-functioning” categories. “Full and non-functioning” includes catch basins full of sand or full of water. Another three catch basins need a new frame or grate, and 12 catch basins were in some state of collapse.

Included in the “Inaccessible” category are drain manholes that were observed to be paved over, and drain manholes whose location was inferred based on surrounding structure connectivity.

2.2.3 Outfalls

The four inaccessible outfalls were located where the actual outfall could not be observed (e.g., under the Steamship pier, in a culvert) or could not be located. Seven outfalls should be cleared of debris that partially blocked the pipe, and six outfalls are completely buried. The completely buried outfalls include one on Lagoon Pond Road, one on Edgartown Road, and the four (or three) outfalls at Beach Street Extension. Only two of the possible four outfalls at the end of Beach Street Extension were located when the sand was cleared from the outfall location. These outfalls will likely be redesigned with the upgrades to the upstream drainage systems to relieve flooding at the Five Corners intersection.

A majority of the 25 identified outfalls should be cleaned of sand and debris to allow unimpeded drainage. The Town regularly clears the two identified outfalls at Beach Street Extension and an outfall on Causeway Road. The remaining outfalls should be added to the regular maintenance program. In particular, Outfall 31 on Lagoon Pond Road should be excavated to locate the end of pipe and remove sediment to allow drainage to Muddy Creek. More frequent maintenance of upstream catch basins, and the installation of deep sump catch basins, would limit the amount of sand and debris that can collect at the outfalls.

Summarized in Table 2.4 are general observations of outfalls that need further maintenance work, assessment, and potential redesign. This table does not include the two outfalls at Beach Road Extension that were not found.

Table 2.4 – Outfall Conditions

ID	Street Name	Comments	Diameter (inches)	Material	Headwall
1	Owen Park Street	half clogged – sand	10	CP	none
4	Causeway Road	half clogged – sediment	18	RC	concrete
5	Dunham Avenue	half submerged	15	CP	no
6	Lamberts Cove Road	covered in brush	unknown	unknown	stone
7	Hines Point	chipped end, submerged	12	CM	no
9	Edgartown Road	completely buried	12	unknown	unknown

ID	Street Name	Comments	Diameter (inches)	Material	Headwall
10	Edgartown Road	clogged – sediment	12	CM	yes
22	State Road	clogged – leaves	12	CP	no
23	State Road	clogged – sediment	18	CP	no
28	State Road	clogged – sediment	19	CP	no
31	Lagoon Pond Road	clogged – sediment	unknown	unknown	unknown
34	Owen Little Way	concrete structure in water	24	RC	yes
35	Owen Little Way	BMP with overflow to concrete structure in water	24	RC	yes
36	Beach Street Extension	buried – beach sand	24	RC	no
37	Beach Street Extension	buried – beach sand	24	DI	no
38	West Spring Street	suspended above grade, significant erosion at base	18	CM	no

CP = corrugated plastic
CM = corrugated metal
DI = ductile iron
RC = reinforced concrete (may not be reinforced)

Some of the outfalls noted above are restricted in their ability to discharge flow due to their low elevation and slope. They should be evaluated for re-design after cleaning and inspection.

2.2.4 Summary of Findings

Maintenance of the upstream drainage structures is essential to prevent sediment from entering the drainage system. Sediment was identified as the most prolific issue, preventing the drainage systems from operating at peak performance. Clogged outfalls and blocked pipes cause runoff to remain on the surface, causing ponding, erosion, and flooding. Overflowing catch basins can cause overland flow in the drainage area, but also cause runoff to redirect in unintended directions.

Approximately 75% of identified catch basins (CB), drainage manholes (DMH), and scuppers were considered in Good condition. In contrast, less than 30% of identified outfalls were found to be in Good condition. To resolve this, the Town should:

- Target the sediment-bound structures as priorities for the next, and every, round of cleaning.
- Clean sand and debris from the identified outfalls to allow unimpeded drainage.
- Increase the frequency of outfall inspections and cleaning.
- Significantly reduce the use of sand in winter applications.
- Increase the frequency of street sweeping where sediment is an issue.
- Monitor construction sites and runoff from private property that contains sand, and enforce erosion and sediment control requirements.

3. PRIORITIZATION PLAN

3.1 Introduction

Once the Mapbooks were produced, EPG met with the DPW’s Stormwater Committee in fall 2017 to identify and rank drainage issues. Meetings were held September 28, November 1, and November 15, 2017. The Stormwater Committee members were:

- Ray Tattersall – DPW Director
- William Austin – Tisbury Waterways Inc.
- Cheryl Doble – Planning Board
- Gerard Hokanson - Tisbury Waterways Inc.
- Melinda Loberg – BOS Clerk
- Pamela Street - Tisbury Waterways Inc.

The goal of the Stormwater Committee was to provide expertise and local knowledge to the identification of stormwater problems and the ranking of priorities for solutions to those problems.

3.2 Meetings Summary

At the first meeting, the Committee discussed the areas that experienced drainage problems and the criteria that could be used to prioritize the Town’s actions. Locations of drainage issues were discussed and reasons for inclusion in this program were itemized.

The list of areas experiencing drainage issues can be extensive. The Committee decided to focus on the following 15 areas, listed alphabetically in Table 3.1:

Table 3.1 – Locations of Drainage Problems

Location	Problem
Crocker Ave	Runoff from Havenside overwhelms drain pipes and outfall (may be clogged), drain pipe failure, and ponding on private property.
Delano Road	Surface runoff (severe) through private property and leaking pipe onto second property. Sediment clogging pipelines.
Fairfield Ave / Main Street	Roadway runoff carries sediment that clogs drainage system and causes local flooding.
Five Corners	Frequent flooding in intersection and on commercial properties especially in high intensity storms and high tides. Large drainage area. Heavy pedestrian and vehicle traffic area. High sediment loads.
Grove Ave	Drainage structures cannot handle volume of water. Runoff to beach causes erosion and washout.
Hines Point Road	Localized flooding due to damaged outfall pipe.
Iroquois Ave / Franklin Street	Localized flooding onto private property.
Iroquois Ave / Main Street	Localized flooding at cross walk.
Lagoon Pond Road	Local flooding due to clogged outfall.
Lake Street / Clough Lane	Failing structures and roadway runoff not entering catch basins. Ponding at intersection. Traffic and pedestrian hazard.
Lake Street - Lower	Runoff does not enter BMP, instead causing erosion at tennis courts and

Location	Problem
	boat landing.
Look Street / Center Street	Collapsing structures (temporarily repaired) and roadway runoff not entering catch basins from Look St. Ponding at intersection. Traffic and pedestrian hazard.
Main Street / Union Street	Surface runoff does not enter catch basins and runs down Union Street in the center of the commercial district.
Owen Little Way	Roadway runoff. Drainage system may not have capacity.
Spring Street / West Spring Street	Frequent flooding at corner near elementary school and EMS building. Traffic and pedestrian impacts.

Several criteria were combined or eliminated, resulting in the general consensus of a two phase decision-making process. Phase 1 evaluated the basic screening criteria for each of the drainage problem areas:

- Duration of Problem – length of impact for each storm event
- Number of people affected – community, neighborhood, street or single property problem
- Town’s liability – property damage / accidents
- Frequency of problem – constant, rain dependent, or extreme rain events
- Economic impact – impact on business traffic, customers, or commercial property
- Environmental impact – runoff pollution, nitrogen impaired waters, short term or long term
- Complaints – may point to frequent and impactful events

After the drainage issues were screened in Phase 1 and a general consensus of the severity of the criteria for each was reached, a “practicality” process was applied under Phase 2. The Committee evaluated the feasibility of resolving the drainage issues, the cost and ability to fund repairs, and the urgency of the proposed work. Screening criteria under Phase 2 are:

- Leverage of funds – combine with other projects or partners; funding programs available
- Ease of solution – simple fix or multiple iterations of modeling, multiple projects, disruptions
- Opportunity for LID or innovative solutions – focus on infiltration and nitrogen removal
- Condition of system – immediate repairs to prevent injury or damage

3.3 Ranking of Problem Areas

The second and third meetings focused on the assessment of each area and the weight of each criterion. The number of people affected, the economic impact and the frequency of the problem weighed more heavily than other criteria. However, each Committee member created their own ranking of criteria and problems based on their personal knowledge of the drainage problems.

At the third meeting each Committee member provided a list of the greatest drainage problems using the criteria listed above. Each list was limited to the top five problems, recognizing that this would likely represent at least a 5-year rehabilitation plan. In all, the six Committee members selected eleven locations for consideration. Table 3.2 provides the summary of the results.

Table 3.2 – Committee Selections and Ranking

Rank	Location	Total Votes	Average Rank
1	Five Corners	6	1
2	Main Street / Union Street	3	2.7
3	Delano Road	3	3.7
4	Spring Street / West Spring Street	3	3.7
5	Lake Street - Lower	3	4.7
6	Grove Ave	2	3
7	Lagoon Pond Road	2	3
8	Look Street / Center Street	1	2
9	Lake Street / Clough Lane	1	3
10	Fairfield Ave / Main Street	1	5
11	Owen Little Way	1	5
	Total	26	--

The locations were ranked by the total number of votes, and then by the average rank for locations receiving the same number of votes. The Five Corners area was the clear consensus for priority.

The Town can address the drainage issues in conjunction with other projects such as roadway improvements, the Complete Streets program, and other drainage work identified in the Prioritization Plan. Table 3.3 presents the identified problem areas that should/will be coordinated other projects, as well as the status of the program if the area is already targeted for rehabilitation.

Table 3.3 – Program Status and Related Projects

Rank	Location	Program Status and/or Related Project
1	Five Corners	Stormwater modeling and conceptual design of drainage improvements pending Town Meeting vote, spring 2018
2	Main Street / Union Street	Coordinate catch basin improvements with Main Street improvements project (conceptual design stage). Schedule funding for modeling and conceptual design of additional repairs if needed
3	Delano Road	Ongoing modeling and conceptual design of drainage improvements. Design phase is pending Town Meeting vote, spring 2018. Construction phase funding in spring 2019.
4	Spring Street / West Spring Street	Schedule funding for initial phase at Town Meeting, spring 2019. Coordinate with proposed school building.
5	Lake Street - Lower	Coordinate with Town Landing improvements
6	Grove Ave	Schedule with full road reconstruction
7	Lagoon Pond Road	DPW project to clear outfall and cross-road pipe from the single catch basin
8	Look Street / Center Street	Ongoing investigation of drainage connectivity – Center Street roadway improvements (upstream of Main Street /

		Union Street)
9	Lake Street / Clough Lane	Ongoing investigation of drainage connectivity – Center Street roadway improvements (upstream of Main Street / Union Street)
10	Fairfield Ave / Main Street	N/A
11	Owen Little Way	DPW project to clean and inspect pipelines, BMP and outfall structure
--	Crocker Ave	DPW project – clean and inspect downstream pipe and outfall. Repair is pending investigation work
--	Iroquois Ave / Franklin Street	DPW project – repair/replace infiltrating catch basin
--	Iroquois Ave / Main Street	DPW project – repair/replace infiltrating catch basin
--	Hines Point Road	DPW project – replace outfall pipe

Appendix C contains the full assessment of the top six (6) priority areas. An assessment sheet is provided for each area detailing the full program of recommended investigation, modeling, design, and public bid of construction. An opinion of probable capital cost is provided for the next phases for each area. The probable budgetary costs are summarized in Table 3.4. Construction costs are presented as a relative range represented by dollar symbols, from a minimally expensive project (\$) to the most expensive project (\$\$\$\$).

Table 3.4 – Summary of Expected Budgetary Costs

Drainage Area	Model and Conceptual Design ⁽¹⁾	Data Collection and Field Work	Design / Bidding	Construction (\$ - \$\$\$)
Five Corners ^{(2) (4)}	\$60,000	\$10,000 – Survey at intersection only \$10,000 – Clean and CCTV drainage outfalls	TBD	\$\$\$ TBD
Main Street / Union Street ⁽²⁾	\$50,000	\$35,000 – Survey entire area \$10,000 – Survey Main St and Union St only	TBD	\$\$\$ TBD
Delano Road ⁽³⁾	\$25,000	\$30,000 – Survey \$13,000 – Borings / Test Pits \$7,000 – CCTV	\$50,000	\$\$\$ TBD
Spring Street / West Spring Street	\$30,000	\$7,000 – Survey at intersection	TBD	\$\$ TBD
Lake Street – Lower ⁽⁴⁾	\$35,000	\$25,000 – Survey \$5,000 – Wetlands \$15,000 – Borings, test pits	\$60,000	\$\$ TBD
Grove Ave ⁽⁴⁾	\$25,000	\$25,000 – Survey \$5,000 – Wetlands	\$70,000	\$\$\$ TBD

(1) Assumes modeling of the entire catchment

(2) Extent of upstream BMPs, and survey costs, is unknown until conceptual phase is complete

- (3) Does not include easement acquisition
- (4) Permitting may be a substantial component of the design effort costs

A summary assessment sheet is provided in Appendix C for the lower ranking problem areas. Several of these areas are designated for the DPW, which can provide the equipment, labor, and expertise to investigate and construct the solution.

3.4 Capital Improvement Projects Schedule

The projects schedule reflects the priority ranking of the problem areas and establishes a 5-year Capital Improvement Plan. However, the schedule for any project could shift because of other work in the area. Any project can be delayed or expedited to coordinate with other town projects. For example, the Main St / Union St drainage area may be included with the Main Street improvements project, which could expedite the drainage design. The Lake St project could be expedited to coincide with Town Landing work. Also, the Five Corners project may require coordination with other transportation initiatives, including by MassDOT, which may delay any implementation of drainage improvements. The schedule is summarized as follows, and presented in Figure 3.1.

- Assumes a yearly progression of projects beginning with spring Town Meeting appropriations:
 - One project each in the conceptual design phase, design phase, and under construction
- In FY 2018 (beginning 2018 quarter 1):
 - Complete the stormwater modeling and conceptual design of the Delano Road drainage area
- In FY 2019 (beginning 2018 quarter 3):
 - The Delano Road project will be in the design phase
 - The Five Corners project will be in the conceptual design phase
- In FY 2020 (2019 beginning quarter 3):
 - The Delano Road project will be scheduled for bidding and construction
 - The Five Corners project will be in the design phase
 - The Main St / Union St project will be in the conceptual design phase
- In FY 2021 (2020 beginning quarter 3):
 - The Five Corners project will be scheduled for bidding and construction
 - The Main St / Union St project will be in the design phase
 - The Spring St / West Spring St project will be in the conceptual design phase
- In FY 2022 (2021 beginning quarter 3):
 - The Main St / Union St project will be scheduled for bidding and construction
 - The Spring St / West Spring St project will be in the design phase
 - The Lake St project will be in the conceptual design phase
- In FY 2023 (2022 beginning quarter 3):
 - The Spring St / West Spring St project will be scheduled for bidding and construction
 - The Lake St project will be in the design phase
 - The Grove Ave project will be in the conceptual design phase

The projects earmarked for the DPW can proceed independently from the publically bid projects. The 5-year schedule anticipates a single project per year, except for the Iroquois Ave catch basins, which would be constructed concurrently. Figure 3.1 provides the schedule graphically.

Figure 3.1 - 5-Year Stormwater Capital Improvement Schedule by Calendar Year Quarter

Project Task	2018				2019				2020				2021				2022			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Stormwater Model and Conceptual Design</i>																				
1 Five Corners																				
2 Main Street / Union Street																				
3 Spring St / West Spring St																				
4 Delano Road																				
5 Lake Street - Lower																				
6 Grove Ave																				
<i>Final Design</i>																				
1 Five Corners																				
2 Main Street / Union Street																				
3 Spring St / West Spring St																				
4 Delano Road																				
5 Lake Street - Lower																				
6 Grove Ave																				
<i>Construction</i>																				
1 Five Corners																				
2 Main Street / Union Street																				
3 Spring St / West Spring St																				
4 Delano Road																				
5 Lake Street - Lower																				
6 Grove Ave																				
<i>DPW Projects:</i>																				
7 Lagoon Pond Road																				
11 Owen Little Way																				
Crocker Ave																				
Iroquis Ave / Franklin St																				
Iroquis Ave / Franklin St																				
Hines Point Road																				

APPENDIX C
ASSESSMENT SHEETS

Tisbury Drainage Master Plan Assessment Sheet

Five Corners Intersection

Description:

- Several drain pipes discharge at end of Beach St Ext
- Includes runoff from Edgartown Road and State Road that bypasses Causeway Road drainage
- Some runoff from Water Street, if that drainage system is overwhelmed
- Catch basin at Stop 'n Shop is covered by a steel plate
- Three outfall pipes (36", 24", 18", and according to Tisbury Waterways, Inc., a 12" overflow that may connect the 18" and 24" drains)

Observations / Concerns:

- Ponding/flooding of stormwater at the intersection
- Outfall regularly blocked by sand is opened by DPW
- Large areas of impervious cover, including commercial buildings and parking lots
- High groundwater and surface water due to tides
- Significant impacts to businesses and traffic in a heavily used intersection
- Collapsing structures in intersection and at supermarket
- Sediment buildup from winter sanding and beach sand

Discussion of Alternatives:

- Hold /Infiltrate runoff
 - Low impact development techniques and leaching areas along State Road, in Post Office parking lot, old fire station lot, or in supermarket parking lot
 - Re-use of Steamship's former leaching area
- Redirect flow
 - Redirect State Road drainage to Causeway Road drainage system
 - Upgrade the Water Street drainage system to prevent backups into Five Corners
- Infrastructure to capture uphill sediment and flow
 - Additional deep sump catch basins, possibly with double grates
- Infrastructure to convey additional flow downstream
 - Combine drainage pipes and outfall into one structure
 - May need to pump out during high tides



From Martha's Vineyard Times (7/7/17)



Undermined Structures at Intersection

Hyannis:

396 North Street, Hyannis, MA 02601
 TL 508.568.5103 • FX 508.568.5125

Headquarters:

1900 Crown Colony Drive, Suite 402, Quincy, MA 02169
 TL 617.657.0200 • FX 617.657.0201

Woburn:

18 Commerce Way, Suite 2000, Woburn, MA 01801
 TL 781.281.2542 • FX 781.281.2543

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Recommendations:

- **Model stormwater runoff**
 - Redirection alternatives
 - Evaluate upstream controls (leaching chambers and catch basins, swales, etc.)
 - Include tide impacts
- Data Collection
 - Detailed Survey at corner to optimize runoff to catch basins
 - **Boings and/or test pits at infiltration locations**
 - Clean and inspect pipelines to determine condition and size
 - Locate ends of all 3 (or 4) outfall pipes
- Design
 - **Maximize upstream infiltration** and/or redirection
 - Maintain positive outflow to overcome tides either through an overflow pipe or pump
 - Coordinate with intersection improvements
 - Coordinate with MassDOT work on Beach Road



Sediment Buildup at Catch Basin



Two Outfalls Uncovered on Beach

Probable Budgetary Costs:

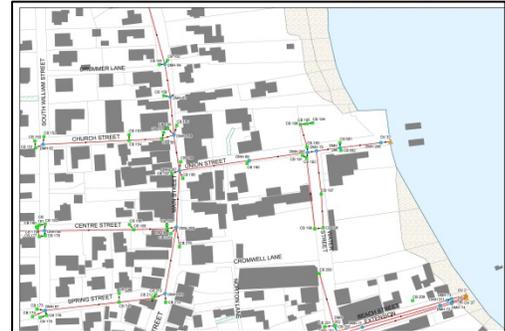
- Model and Conceptual Design
 - \$60,000 entire drainage area with LID options
- Data Collection and Field Work
 - \$10,000 – Survey at intersection
 - \$10,000 – Clean and CCTV drainage outfalls
- Design – TBD
- Construction – TBD (Probable \$\$\$\$)

Tisbury Drainage Master Plan Assessment Sheet

Union Street / Main Street

Description:

- Drainage system from downtown and beyond to Steamship Authority pier
- Drainage area includes other areas of concern:
 - Center Street
 - Lake Street / Clough Lane Intersection
- Hillside flow to harbor
- High density development with several parking lots
- Outfall is a 36-inch diameter pipe, with large pipes in Main Street, Union Street and across Water Street



Downtown Drainage System

Observations / Concerns:

- Overland flow in Union Street
- Runoff misses catch basins in downtown area
- Large impervious areas cause severe peak flow
- Water Street runoff interacts with the Five Corners drainage system
- No identified private property or commercial impacts
- Potential risk from flowing water in Union Street



Center St / Main Street Sediment

Discussion of Alternatives:

- Hold /Infiltrate runoff
 - Low impact development techniques and infiltration areas in Main Street, in Church Ave tennis courts parking lot, other uphill parking areas, or in supermarket parking lot
 - Remove curbs/berms in upper Main Street and intersecting streets to allow runoff into swales
 - Infiltrate large private contributors to run-off
 - Re-use of Steamship's former leaching area
- Redirect flow
 - Upgrade Five Corners drainage system to prevent backup into Water Street
- Infrastructure to capture uphill sediment and flow
 - Additional deep sump catch basins
 - Add sediment bays or swales at LID areas
- Infrastructure to convey additional flow downstream
 - Re-locate or add catch basins, including double grate basins, to capture more runoff



Impervious Surfaces – Main Street



Potential Main Street Improvements

Hyannis:

396 North Street, Hyannis, MA 02601
TL 508.568.5103 • FX 508.568.5125

Headquarters:

1900 Crown Colony Drive, Suite 402, Quincy, MA 02169
TL 617.657.0200 • FX 617.657.0201

Woburn:

18 Commerce Way, Suite 2000, Woburn, MA 01801
TL 781.281.2542 • FX 781.281.2543

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Recommendations:

- Model stormwater runoff
 - Evaluate upstream controls (leaching chambers and catch basins, swales, etc.)
 - Include tide impacts
 - Coordinate with / include upstream areas of concern to address entire catchment area
- Data Collection
 - Detailed survey at Main St and Union Street to Water Street (minimum)
 - Boings and/or test pits at infiltration locations
 - Clean and inspect pipelines to determine condition and size
- Design
 - Maximize upstream infiltration and/or redirection
 - Coordinate with Main Street and Water Street improvements or reconfiguration
 - Coordinate with Steamship Authority as needed



Clogged Catch Basin 195 – Union St

Probable Costs:

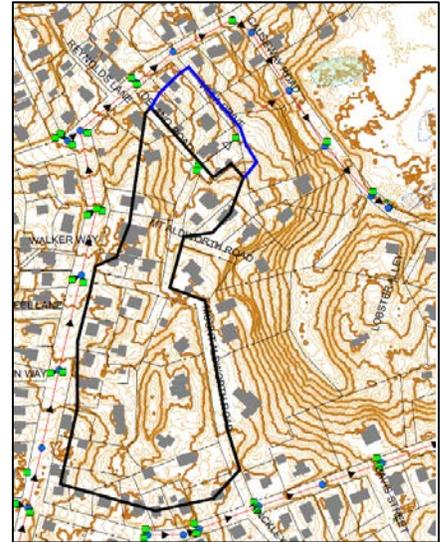
- Model and Conceptual Design
 - \$50,000 entire drainage area
 - \$30,000 Main St, Union St, Water St
- Data Collection and Field Work
 - Survey
 - \$35,000 entire area
 - \$10,000 Main St and Union Street only
- Design – TBD
- Construction – TBD (Probable \$\$\$)

Tisbury Drainage Master Plan Assessment Sheet

Delano Road / Causeway Road

Description:

- Surface drainage area from Mt. Aldworth Rd south of Skiff Ave and near the intersection of Mt. Aldworth Rd and Edgartown Rd, and Delano Rd just east of State Rd
- Large catch basin structure collects surface runoff and conveys flow via pipeline under private property and Villa Rd to Causeway Rd
 - Structure overflows onto private property
- Surface runoff on Villa Dr joins via catch basin
- Downstream CMP leaks onto private property
- Discharge is to Mud Creek off of Causeway Rd, and eventually to Lagoon Pond
 - Lagoon Pond is nitrogen limited



Delano Road Drainage Area

Observations / Concerns:

- No drainage infrastructure upstream of Delano Rd and Villa Dr intersection
- Runoff overtops structures at Delano Rd and Villa Dr and conveys through private property
- Property from Delano Rd to Villa Dr – easement?
- Report of sink hole in driveway of property between Delano Rd and Villa Dr
- Discrete runoff locations from uphill private properties
- Sand in runoff, and deposits in several locations
- Downstream pipeline location is unclear
- Current route along edge of South End Cemetery is tightly bound by graves, fence and buildings
- CMP drain west and north of cemetery is above ground
- CMP pipe has split/leak near Causeway Rd
- CMP pipe bolted couplings limit trenchless options



Delano Road at Villa Drive

Discussion of Alternatives Part 1:

- Hold /infiltrate runoff
 - Verify road ROWs – limited area for leaching systems
 - Potential for roadside swales on Mt. Aldworth Rd and maybe Delano Rd
- Redirect Flow
 - No options in public ROW
 - Drainage follows natural drainage pattern



Runoff Location on Mt. Aldworth Rd

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Discussion of Alternatives Part 2:

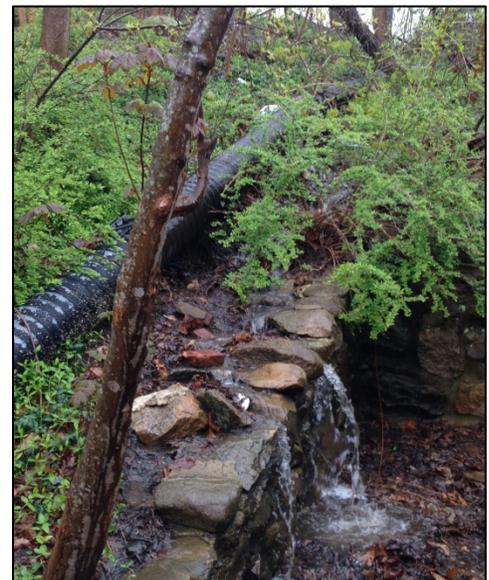
- **Infrastructure to capture uphill sediment and flow**
 - Leaching basins/chambers in two locations (private property?)
 - Deep sump catch basins at discrete runoff locations
 - Potential swales with check dams
 - Pave Villa Dr at Delano Rd to reduce sand runoff
 - Resurface Delano Rd at Villa Dr to capture more flow
- Infrastructure to convey additional flow downstream
 - Clean and inspect pipe interior via camera
 - Obtain easements for pipeline upgrades
 - Difficult construction in hill between Villa Dr and Causeway Rd



Catch Basin at South End Cemetery

Recommendations:

- Model stormwater runoff
 - Determine pipe sizes
 - Evaluate upstream controls (leaching chambers and catch basins, swales, etc.)
- Data Collection
 - Survey and soils exploration
 - Research and obtain drainage easements
 - Cleaning and camera inspection of pipelines to determine condition, size and location
- Design a two phase program
 - Phase 1 – Delano Road to Causeway Road
 - Phase 2 – Delano Road and Mt. Aldworth Road



Leaking CMP pipe at Causeway Rd

Probable Costs:

- Model and Conceptual Design
 - \$25,000 including LID options
- Data Collection and Field Work
 - Survey - \$30,000
 - Borings / Test Pits - \$13,000
 - CCTV - \$7,000
 - Easement costs not included
 - Town Counsel fees not included
- Phase 1 Program
 - Phase 1 Design – \$25,000
 - Phase 1 Construction – TBD
- Phase 2 Program
 - Phase 2 Design – \$25,000
 - Phase 2 Construction – TBD

Tisbury Drainage Master Plan Assessment Sheet

Spring St – West Spring St – Pine Tree Rd Intersection

Description:

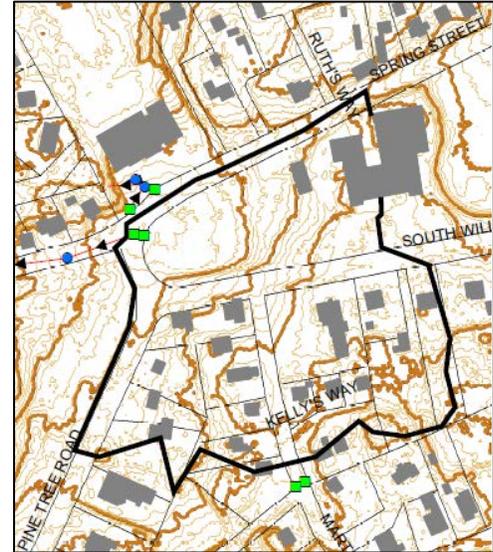
- Drainage area may extend from West William Street to Pine Tree Road and West Spring Street, north and east of the intersection
- West Spring Street drainage discharges through a structural BMP to Lake Tashmoo (nitrogen impaired)
- Local drainage on EMS driveway

Observations / Concerns:

- Ponding/flooding of stormwater at the intersection
- Sediment buildup along curb near school property
- Crosswalk ramp blocks gutter flow
- Curb catch basin appears to be too high to capture all runoff
- Drainage pipe is connected from catch basin to catch basin without a manhole
- Very large catchment area tributary to West Spring St outfall

Discussion of Alternatives:

- Hold /Infiltrate runoff
 - Low impact development techniques and potential leaching area on School grounds, American Legion property, or Council on Aging parking area
 - Pavement grooves/riffling on EMS driveway
- Redirect flow
 - Potential to redirect drainage to EMS building property
- Infrastructure to capture uphill sediment and flow
 - Catch basins on West William St and Pine Tree Rd
 - Catch basins along curb in intersection
 - Relocate crosswalk ramp out of curb line
- Infrastructure to convey additional flow downstream
 - New structures to add flow into West Spring St drainage system



Preliminary Local Drainage Area



Pine Tree Road to Spring Street



Spring Street to West Spring Street

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Recommendations:

- Model stormwater runoff
 - Determine if West Spring St pipes and BMP are adequate
 - Tie existing curb catch basin and new catch basin(s) to New School drainage leaching area.
 - Evaluate upstream controls (leaching chambers and catch basins, swales, etc.)
 - Research design of existing BMP
- Data Collection
 - Detailed Survey at corner to optimize runoff to catch basins
 - Clean and inspect pipelines to determine condition and size
- Design
 - Select continued discharge to West Spring St BMP and add local leach field
 - Simplest solution may be to add catch basins along the curb gutter, reset the crosswalk ramp, and connect to the New School leaching system or West Spring St drainage
 - Comprehensive solution may be to infiltrate and intercept runoff upstream



Catch Basin to Catch Basin



Catch Basin at School Curb

Probable Costs:

- Model and Conceptual Design
 - \$30,000 entire drainage area
- Data Collection and Field Work
 - Survey \$7,000 at intersection
- Design – TBD
- Construction – TBD (Probable \$\$)

Tisbury Drainage Master Plan Assessment Sheet

Lake Street – Tennis Courts to Landing

Description:

- Drainage area extends from approximately 2,000 feet up Lake Street from tennis courts
- Moonstone Way runoff
- An underground infiltration chamber/BMP is located at the tennis courts near the intersection with Moonstone Way
- Runoff is toward Lake Tashmoo – nitrogen limited

Observations / Concerns:

- Sand/Sediment buildup in parking areas
- Washout in gravel area under power lines. Runoff from Moonstone Way may overtop curbing
- Runoff blocked from entering existing BMP from sediment buildup (possibly from plowing gravel area)
- BMP type, capacity and outlet location are uncertain
- Washout at the boat landing on both sides of the road
- Trench drain clogged. Outlet uncertain

Discussion of Alternatives:

- Hold /Infiltrate runoff
 - Possible bio-swale with check dams along east side of Lake Street
 - Direct runoff to existing BMP, add sediment forebay/trap at BMP
- Redirect flow
 - Add leaching chamber between parking areas at tennis court
 - Pave road to provide crown in center
- Infrastructure to capture uphill sediment and flow
 - Add deep sump catch basins on road between gravel and paved parking areas
 - Add bio-swale along east side of Lake Street north of power lines
 - Direct swale flow through pipe to existing BMP with sediment trap/forebay
- Infrastructure to convey additional flow downstream
 - Add deep sump catch basins with double grates to replace trench drain
 - Add deep sump catch basins at boat landing



Lake Street to Tennis Courts



Lake Street Berm above Tennis Courts



Infiltration BMP Behind Parking Area

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Recommendations:

- Model stormwater runoff
 - Evaluate upstream swale
 - Capture all upstream flow and redirect to BMP
- Data Collection
 - Determine existing BMP type and capacity
 - Find outfall(s)
 - Survey and soils exploration
 - Clean and inspect pipelines to determine condition and size
- Design
 - Maximize flow to BMP(s) with sediment capture prior to BMP
 - Add catch basins at boat landing on both sides of the road
 - Add a crown to the road to direct runoff to catch basins

Probable Costs:

- Model and Conceptual Design
 - \$35,000
- Data Collection and Field Work
 - Survey – \$25,000
 - Wetlands – \$5,000
 - Borings, Test Pits – \$15,000
- Design – \$60,000
 - Permitting: Discharge to Lake Tashmoo
- Construction – TBD (Probable \$\$)



Washout at Landing – East Side



Trench Drain Across Lake Street



Sediment beyond BMP at Tennis Courts

Tisbury Drainage Master Plan Assessment Sheet

Grove Ave Neighborhood

Description:

- Drainage area extends to Harbor View Lane, Oak Tree Lane and Pine Tree Lane
- Drainage structures in poor condition and not connected by drain pipes
- Limited infiltration capacity in structures likely due to clogging
- Overland/road flow to Grove Ave



Preliminary Local Drainage Area

Observations / Concerns:

- Sediment carried to bottom of Grove Ave
- Paving is in poor condition throughout the neighborhood
- Washout at the beach due to curbing directing overland flow to edge of road
- Grove Ave beyond Harbor View Lane is used as a parking area
- Beach is heavily used – not just by neighborhood



Grove Ave Discharge Location

Discussion of Alternatives:

- Hold /Infiltrate runoff
 - Low impact development techniques and infiltration along road edges in neighborhood
 - Remove pavement at bottom
 - Create a sediment trap
 - Use pervious material
 - Add infiltration chambers
 - Pavement grooves/riffling on Grove Ave at Harbor View Lane to slow runoff
- Redirect flow
 - No feasible redirection other than Grove Ave
- Infrastructure to capture uphill sediment and flow
 - Add deep sump catch basins on Grove Ave
 - Add a swale on the side of Grove Ave
- Infrastructure to convey additional flow downstream
 - Connect catch basins with drainage pipes



Erosion at Beach

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Recommendations:

- Model stormwater runoff
 - Determine total volume and peak flow to determine the size of structures and pipelines
 - Evaluate upstream controls (leaching chambers and catch basins, swales, etc.)
- Data Collection
 - Identify potential infiltration locations
 - Determine rights-of-way for infiltration locations
 - Neighborhood outreach
- Design
 - Add infiltration structures and LID uphill and at bottom of Grove Ave
 - Assume sediment trap and pervious surface at bottom of Grove Ave
 - Full detailed survey to capture edges of pavement and rights-of-way
 - Coordinate with paving and possibly water system improvements



Catch Basin / Potential Swale Location



Lower Grove Ave

Probable Costs:

- Model and Conceptual Design
 - \$25,000 entire drainage area
- Data Collection and Field Work
 - Survey \$30,000 for entire drainage area
 - Wetlands - \$5,000
- Design
 - Design & Permitting – \$65,000
 - Bidding – \$5,000
- Construction – TBD (Probable \$\$\$)

Tisbury Drainage Master Plan Assessment Sheet

Additional Drainage Improvements

DPW Projects:

- Iroquois Ave / Franklin Street
 - Replace leaching catch basin
 - Add crushed stone surrounding basin to add infiltration volume
- Iroquois Ave / Main Street
 - Replace leaching catch basin
 - Add crushed stone surrounding basin to add infiltration volume
 - Re-pave/re-slope at crosswalk and catch basin
- Hines Point Road
 - Replace outfall pipe
- Owen Little Way
 - Two 24-inch outfalls, one with infiltration BMP at Yacht Club and overflow pipe to outfall.
 - Clean and inspect catch basins, drains and BMP
- Crocker Ave
 - Drainage pipe failure on private property
 - Clean and inspect downstream pipe and outfall
 - Pending investigation:
 - Re-lay pipe in ROW and reinstall outfall / infiltration structure
 - Re-size catch basin and drain pipe to capture Havenside drainage



Iroquois Ave / Franklin Street



Iroquois Ave / Main Street

Future (Other) Projects:

- Lagoon Pond Road
 - Improve roadway runoff collection and discharge to Muddy Creek
- Look Street / Center Street
 - Currently under investigation to determine drain pipe connectivity
 - Complete drainage upgrades as part of Center Street upgrade project
- Lake Street / Clough Lane Intersection
 - Combine with Look St / Center St investigation
 - Upgrade structures and paving
- Fairfield Ave / Main St
 - Ponding and sediment/sand deposits
 - Remove curbs/berms, or install cutouts, and construct roadside swales



Havenside Drainage at Crocker Ave

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