Capital plans, meet comprehensive plans: municipal utility of a new DOT tool for risk-based asset management.

2019 Maine Water Conference
March 19, 2019

Sam Merrill
Martha Sheils

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Funding for this project was made possible in part from the

University of Maine Systems' Research Reinvestment Fund (RRF) seed grant program

Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

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Pilot project:

Use a Maine DOT tool developed for state roads, culverts and bridges in a municipality

Project Partners:

GEI consultants, USM GIS Lab, Maine DOT, Town of Scarborough

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This session will cover

- Local planning process
- The Maine DOT TRAPPD tool
- Town of Scarborough data processing and results from the tool
- How results inform local planning
- Next steps

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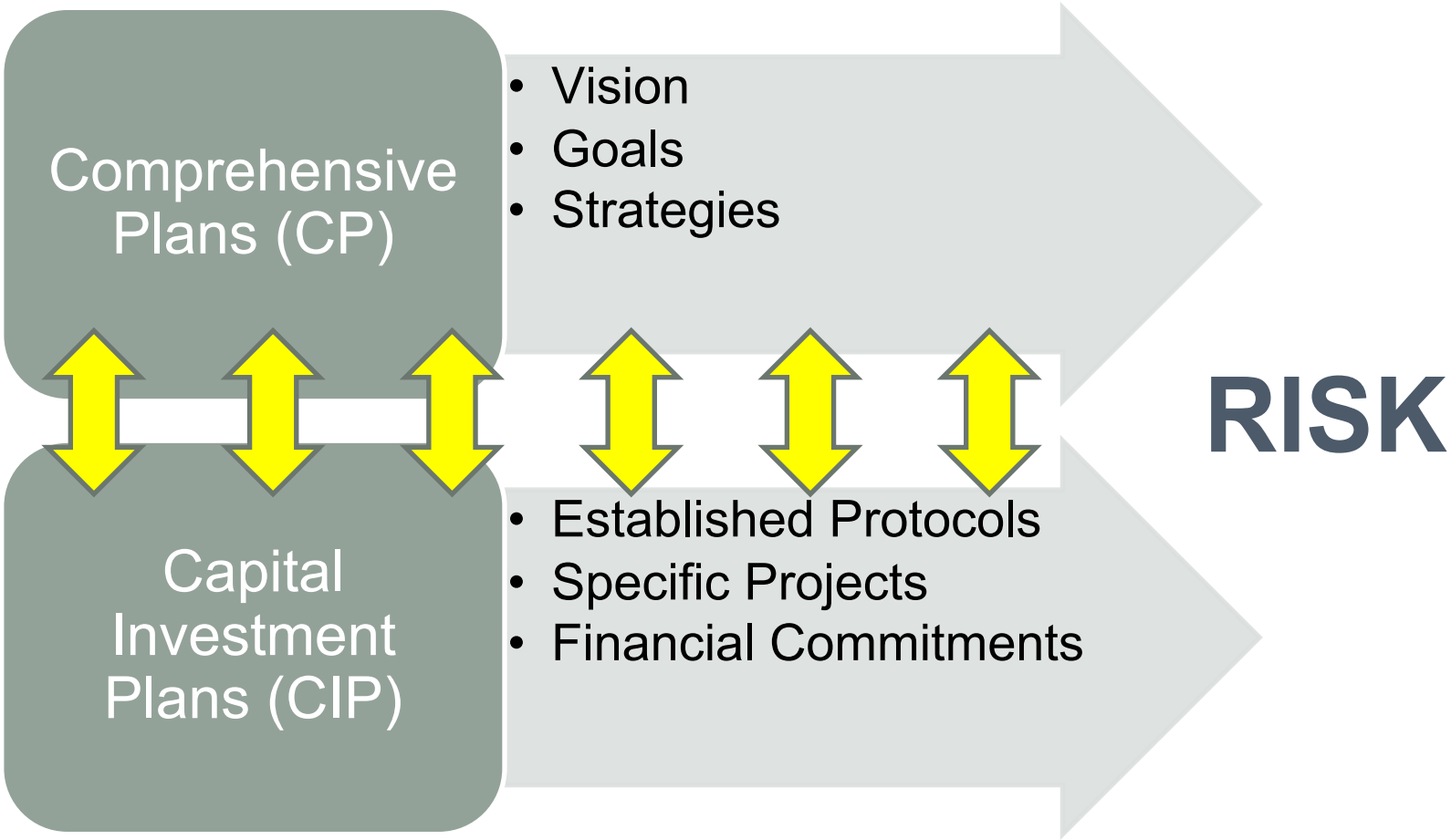
Separate Planning Worlds



Never the 'Twain Shall Meet?

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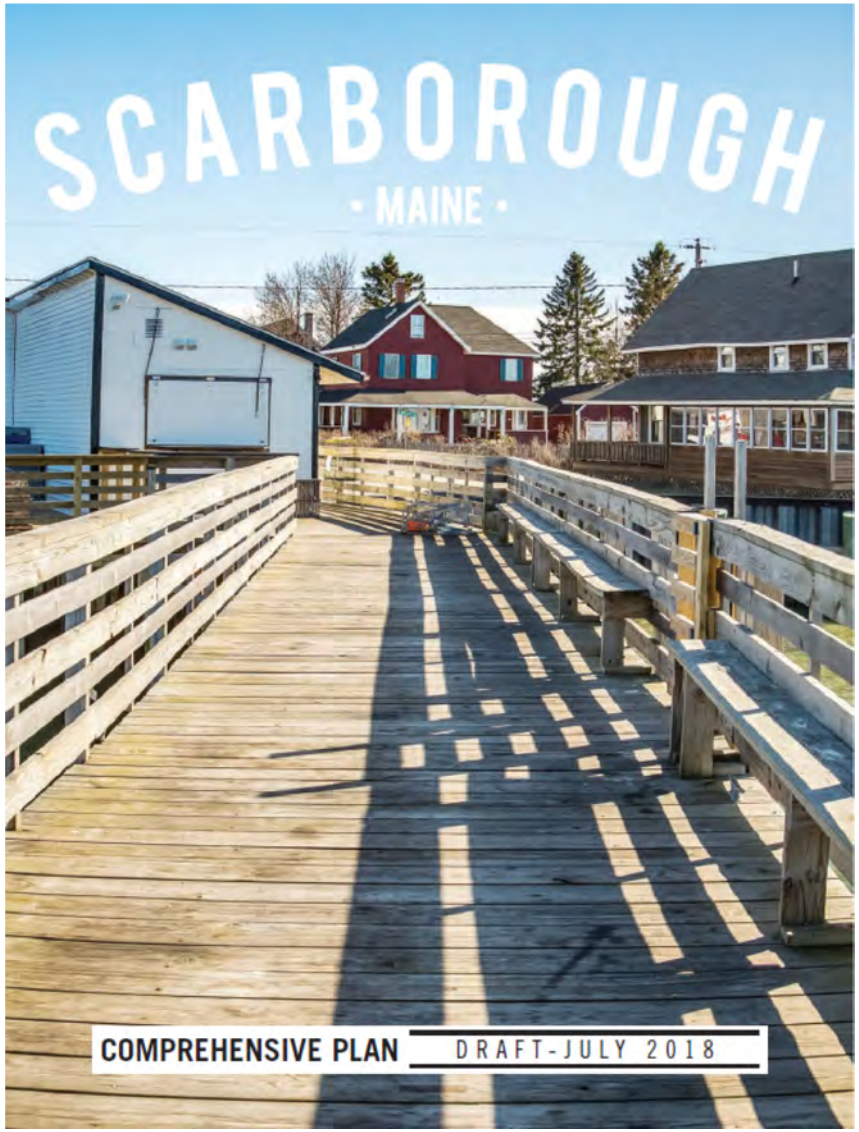
CP Example: Scarborough, ME



- Clear visions, goals, and strategies to get there.
- Very forward-looking and thorough.

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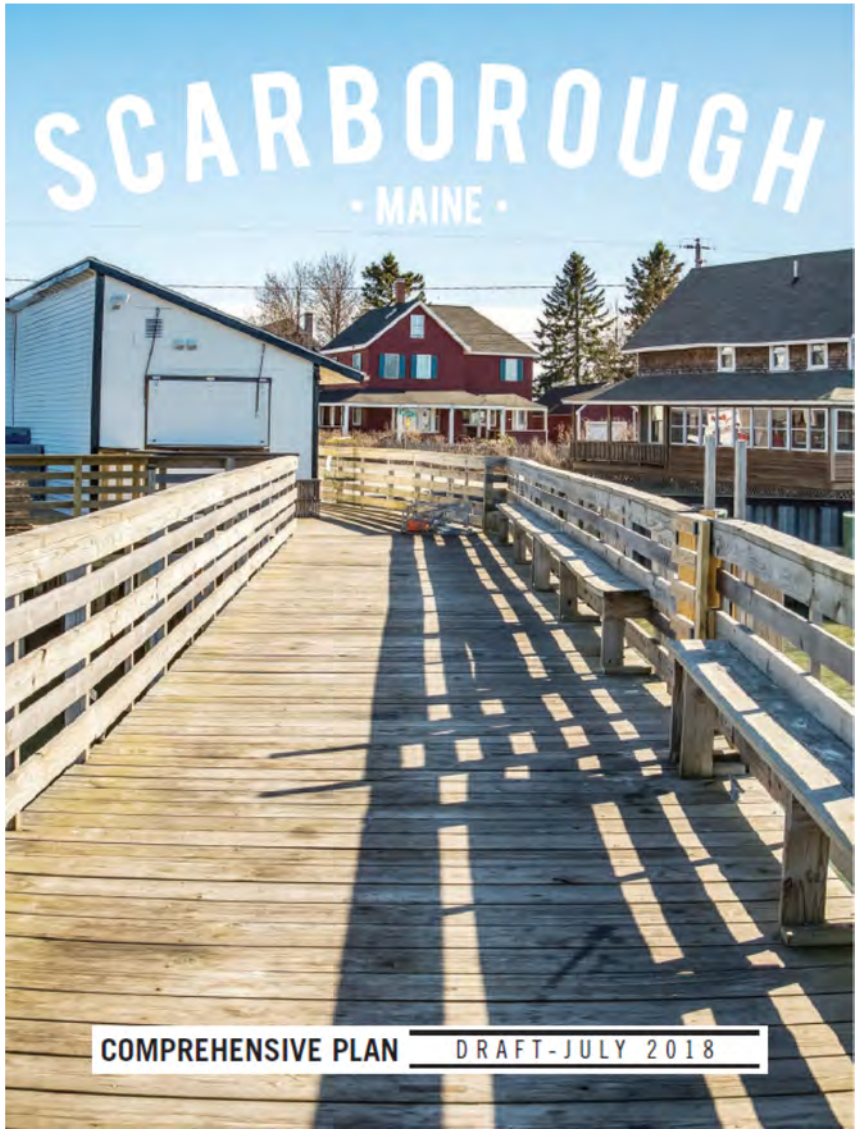
CP Example: Scarborough, ME



Regarding flood risk, stated concerns include:

"Business and critical infrastructure are in locations with increasing threats due to climate change ..."

"King Tides occur twice each … month …. It's easy to overlook the seriousness of risk associated with these 'normal' flood events …"

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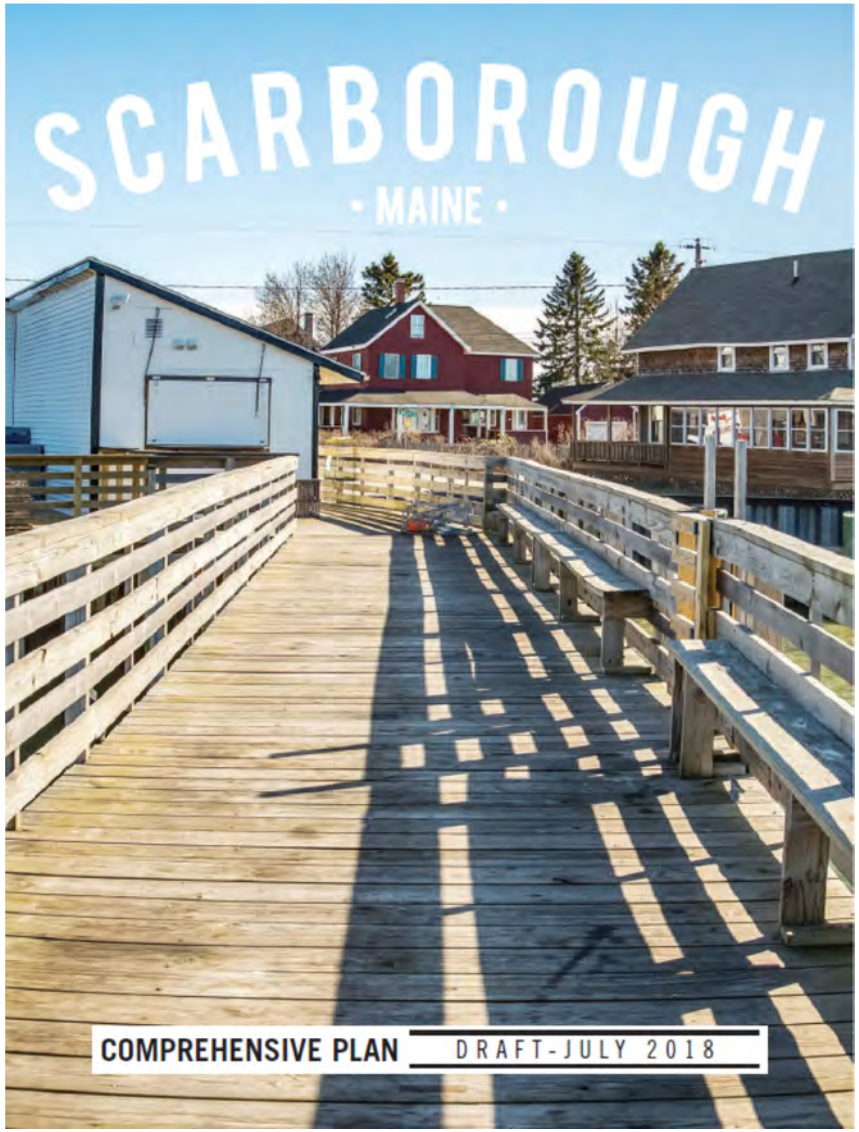
CP Example: Scarborough, ME



Regarding flood risk:

Stated intents include to:

"Identify key roads that warrant flood mitigation upgrades to better function as evacuation corridors as well as critical neighborhood connection points for emergency services vehicles like ambulances, fire trucks and gas and power providers."

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And the CIP Documents note that:

Unanticipated drainage design problems are likely to be the most costly project cost increase factor for large projects.

From the CIP:

1

Narrative for Capital Equipment & Projected 5 Year Plan

Fire Capital Equipment

Description	5-Year Total	2019		2020	2021	2022	2023
Fire Department							
F.D. Replace Rescue Unit (replacement schedule)	$ 503,500	$ 98,500	R			$ 200,000	$ 205,000
F.D. Major Apparatus Refurbishing	$ 165,000	$ 52,500	B	$ 55,000		$ 57,500	
F.D. Rescue Power Stretcher Replacement Program	$ 44,000	$ 44,000	B				
F.D. Replace staff vehicles (replacement schedule)	$ 102,000	$ 50,000	B	$ 52,000			
F.D. New Safety & Personal Protective Equipment	$ 86,250	$ 86,250	B				
F.D. Holding Tank	$ 27,000			$ 27,000			
F.D. Replace Utility Vehicle (used cruiser)	$ 5,000			$ 5,000			
F.D. Replace Engine 4 (replacement schedule)	$ 650,000				$ 650,000		
F.D. Re-chassis Forestry 4 (replacement schedule)	$ 60,000				$ 60,000		
F.D. Replace Pickup & Plow (replacement schedule)	$ 57,500				$ 57,500		
F.D. Replace SCBA Cylinders	$ 192,000					$ 192,000	
F.D. Replace Ladder 1 (replacement schedule)	$ 1,100,000						$ 1,100,000
Total Fire Department	**$ 2,992,250**	**$ 331,250**		**$ 139,000**	**$ 767,500**	**$ 449,500**	**$ 1,305,000**

Note: Equipment with (*) an asterisks indicate FY2019 Budget

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Public Works Department Capital Projects

Description	5-Year Total	2019		2020	2021	2022	2023
Public Works Department - Town-Wide Projects							
Mid-Level Road Rehabilitation **(TBD)**	$ -						
Rte 1: Mill & Pave (Broadturn Rd to Saco Line)	$ 280,000	$ 280,000	B				
Subsurface Drainage Assessment Project	$ 195,750	$ 118,750	B	$ 77,000			
Phase II LED Conversion	$ 215,000	$ 215,000	B				
Adaptive Traffic Lights (Dunstan Intersection)	$ 135,000	$ 135,000	I				
PW Facility Fire Panel Upgrade	$ 25,000	$ 25,000	A				
Traffic - UPS/Generator/Battery Standby Install	$ 36,000	$ 36,000	A				
Final Design Gorham Rd Reconstruction Phase II (Maple Ave - Ridgeway Rd	$ 80,000	$ 80,000	B				
Traffic - Install & Connect Fiber (Oak Hill south - Southgate)	$ 133,000			$ 133,000			
Gorham Rd Reconstruction Phase II Maple Ave - Ridgeway	$ 1,010,400			$ 1,010,400			
Rte.1 Greening Initiative Ph 1 (Sawyer Rd N to Millbrook)	$ 125,000			$ 125,000			
Subsurface Drainage Rehabilitation Project Phase II	$ 1,000,000			$ 250,000	$ 250,000	$ 250,000	$ 250,000
Traffic - Interconnect Traffic Signals w/Fiber (Oak Hill North - ME MEd)	$ 95,000				$ 95,000		
Gorham Rd Reconstruction Phase III Ridgeway - Nonesuch	$ 1,485,108				$ 1,485,108		
Rte.1 Greening Initiative Phase II (Willowdale Rd Area)	$ 125,000				$ 125,000		
Traffic: Fiber Connection (Haigis Pkwy/Rte. 1 - Exit 42)	$ 30,000				$ 30,000		
Pine Point Area Improvement Project	$ 2,500,000					$ 2,500,000	
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Traffic: Install Fire Alarm Cable & Fiber Optic (Haigis/Payne - Gorham Rd)	$ 80,000					$ 80,000	
Payne Rd. Reconstruction (Cabela's -Flaherty Hill) **Tentative -Pending Sewer ext**	$ 1,400,000						$ 1,400,000
Replace Town Hall Generator **(TBD)**	$ -						
Gorham Rd Phase IV (Nonesuch - Mussey) **(in FY 2024)**	$ 1,500,000						
Total Public Works	**$ 10,540,258**	**$ 889,750**		**$ 1,595,400**	**$ 1,985,108**	**$ 2,920,000**	**$ 1,650,000**

Planning Department Capital Projects

Description	5-Year Total	2019		2020	2021	2022	2023
Planning Department							
Office Renovations	$ 25,000	$ 25,000	A				
North Scarborough Traffic Signal Improvement Plan	$ 150,000	$ 150,000	I				
Phillips Brook Watershed Management Implementation Ph I	$ 50,000	$ 50,000	B				
Route 1 Corridor Study (Partnership w/Saco, PACTS, & Maine DOT)	$ 10,000	$ 10,000	I				
N Scarborough Traffic Signal Improvement Plan Construction	$ 600,000			$ 600,000			
Mill Brook Watershed Planning	$ 45,000			$ 45,000			
Route 1 Corridor Study Implementation Project Phase I	$ 200,000			$ 200,000			
Route 1 Corridor Study Implementation Project Phase II	$ 400,000				$ 400,000		
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Planning Department	**$ 1,930,000**	**$ 235,000**		**$ 845,000**	**$ 400,000**	**$ 300,000**	**$ 150,000**

And the CIP Documents note that:

Unanticipated drainage design problems are likely to be the most costly project cost increase factor for large projects.

Argument: by bringing in risk information, i.e., identifying flooding risks before designing structures, we could:

- Make risk-informed design decisions
- Meet the goals of the CP through project implementation
- Reduce cost and schedule overruns

Session Overview

- Summarize a new MaineDOT tool that estimates culvert risks.
- Illustrate how results have been useful to MaineDOT.
- Show how Scarborough culverts have been brought on the system and results for Scarborough's culverts.
- Show how the results may
    1. Inform Scarborough's Capital Investment Planning decisions.
    2. Serve as a model for other towns that may wish to get on the system.

TRAPPD Helps Get Connected to Risk

(Transportation Risk Assessment for Project Planning and Delivery)

TRAPPD is a recent innovation by MaineDOT with transferable lessons for asset managers in Maine municipalities. Key principles:

1. Risk is understood to entail many elements: regulatory, administrative, financial, hydrologic, structural, others.
2. TRAPPD encompasses all of these in a summary score (5 – 25) for every MaineDOT culvert. The score reflects overall risk to the agency's ability to complete each project **on budget and on schedule**.

   >> And note the agency mission, to maintain safety, level of service, and condition of assets it owns and manages.

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TRAPPD Builds on Existing Data

TRAPPD is software that reaches out to existing polygons, databases, and other files in several agencies to create the combined risk scores.

1. Data used serve as proxies for each type of risk. This reduces the need to collect or develop new data.
2. Over time, continually updated files can more accurately reflect each risk element.

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Proxy Indicators

Q1: Is the drainage area part of a priority **Atlantic salmon** watershed?

Type of Value	Narrative Scoring	Numeric Score	Proxy Risk Rating
Ecology	Tier 3/Not Applicable	0	1
	Tier 2	1	
	Tier 1	2	

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Proxy Indicators

1. Is the drainage area part of a priority **Atlantic salmon** watershed?
2. Is the project located within a mapped buffer for habitat for a state **endangered, threatened, or special concern species**?
3. Is the feature a **mapped stream barrier**?
4. Is the location identified as a large undeveloped **habitat block connector**?
5. Is the existing structure ≥ the calculated **bank full width**?
6. What is the **drainage area** to (i.e. watershed size of) feature?
7. Is the feature located within an identified FEMA **100-year floodway**?
8. Is the feature subject to **coastal threats** of sea level rise (SLR) and/or storm surge (SS)?
9. What percentage of the drainage area to the feature is developed and/or **impervious**?
10. Is the asset within the watershed of an **urban impaired stream** (UIS) or within a Municipal Separate Stormwater Sewer (**MS4**) community?
11. Is the asset an eligible **historic** resource or within a historic district pursuant to Section 106?
12. Is the road a sole access, hurricane **evacuation route** or emergency access for emergency response vehicles?

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Proxy Indicators

Type of Value	Question Number	Proxy Indicator	Proxy Description	MaineDOT Risk Type	Data source	Data Source Details	Key MaineDOT staff	Narrative Scoring	Numeric Score	Proxy Risk Rating	Risk Rating by Value Type
Ecology	Q1	Is the drainage area part of a priority Atlantic salmon watershed?	The three Maine Atlantic salmon habitat recovery units (SHRUs) have been designated into "tiers" based on habitat value as determined by USFWS, NMFS, and Maine DMR. These designations relate to the Maine Atlantic salmon Programmatic Consultation requirements for design and construction.	budget, process, schedule	GIS layer	MEGIS ASHAB3	Ham	Tier 3/Not applicable	0		
								Tier 2	1		
								Tier 1	2		
	Q2	Is the project located within a mapped buffer for habitat for a state endangered, threatened, or special concern species?	Presence of the habitat and/or any buffers critical to a lifestage of species listed under Maine's Endangered Species Act identifies the potenial need for pre-construction surveys, passage modifications, or post-construction monitoring that may need to be incorporated into project design.	budget, process, schedule	GIS layer	MEGIS	Boyden	No	0		
								Yes	1		
	Q3	Is the feature a mapped stream barrier?	USFWS, in conjunction with other non-government organizations, developed a GIS-data layer showing those stream crossings that have the potential or have been observed to be barriers to aquatic species' movement up and downstream. Mapped barriers may be prioritized for replacement.	budget, schedule	Stream Viewer ENV GIS layer	ENV GIS layer	Ham	No	0		
								Potential or Yes	1		
	Q4	Is the location identified as a large undeveloped habitat block connector?	Presence of GIS-mapped large undeveloped blocks of potential habitat on either side of a road increases the likelihood that terrestrial species will cross roads that may otherwise serve as barriers to movement. Adjacent large habitat blocks may necessitate inclusion of wildlife crossing structures in any reconstruction.	process, schedule	GIS layer	turtles, EBKT, salamanders, moose/deer crash	Ham, Bostwick	No	0		
								Yes	1		
	Q5	Is the existing structure greater than or equal to the calculated bankful width?	Maine's USFWS and USACE consider stream crossing structures with a span equal to or greater than 1.2 times the stream bankfull width (1.2 x bfw) to be fully accessible for all aquatic species. Any crossing less that 1.2 x bfw may need to be upsized or pay in lieu fee mitigation depending on its location.	budget, schedule	StreamStats	StreamStats with MATS [Span_Width]	Hebson	≥1.2x calculated bankful width	0		
								1.0-1.2x calculated bankful width	1		
								<1.0x calculated bankful width	2		

Integrating Indicators of Risk

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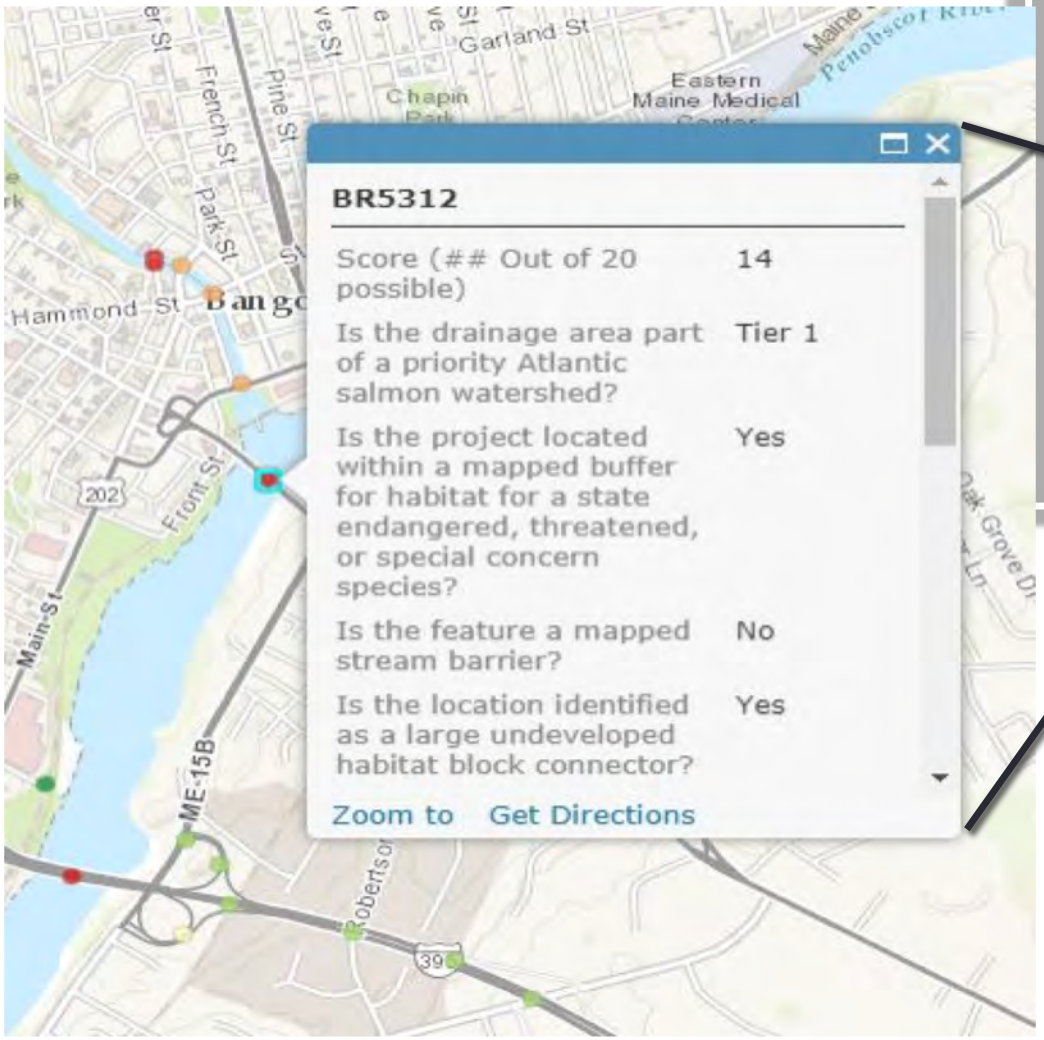
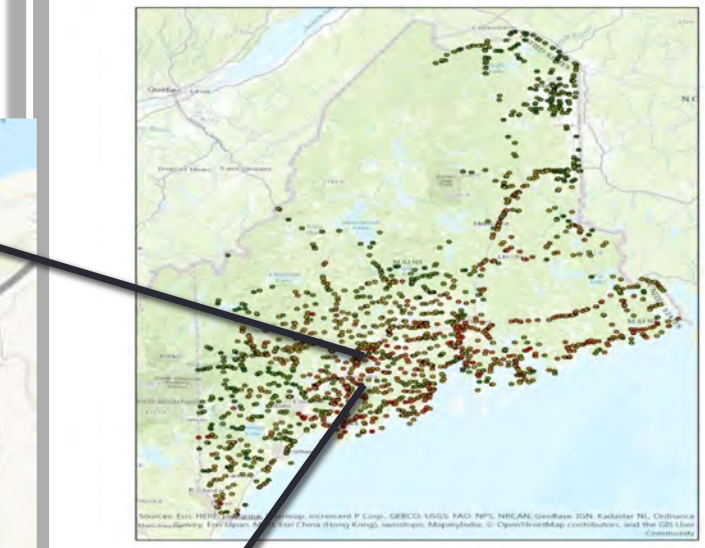
Using Indicators of Risk



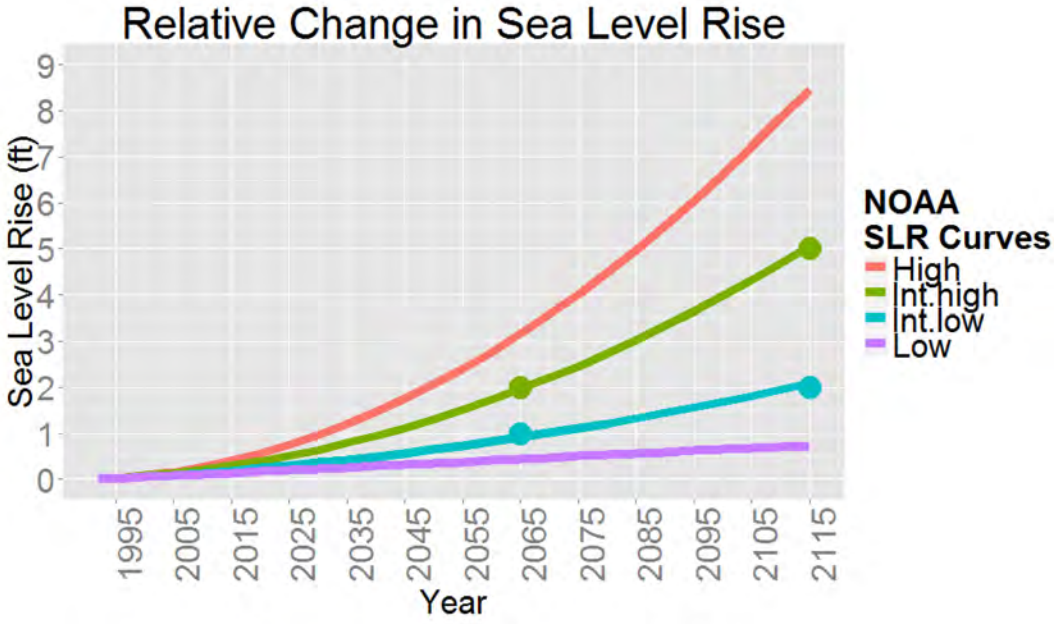


http://maine.maps.arcgis.com/apps/webappviewer/index.html?id=6ab4e4ba36924d0eb872b5c1bdcc31cb

Example: Vulnerability to SLR and Surge

- Coastal assets
  - Large culverts
  - Bridges

- Vulnerabilities
  - Low SLR in 2065 (1 ft)
  - High SLR in 2065 (2 ft)
  - Low SLR in 2115 (2 ft)
  - High SLR in 2115 (5 ft)
  - 100-yr storm surge



Filter Mechanism:

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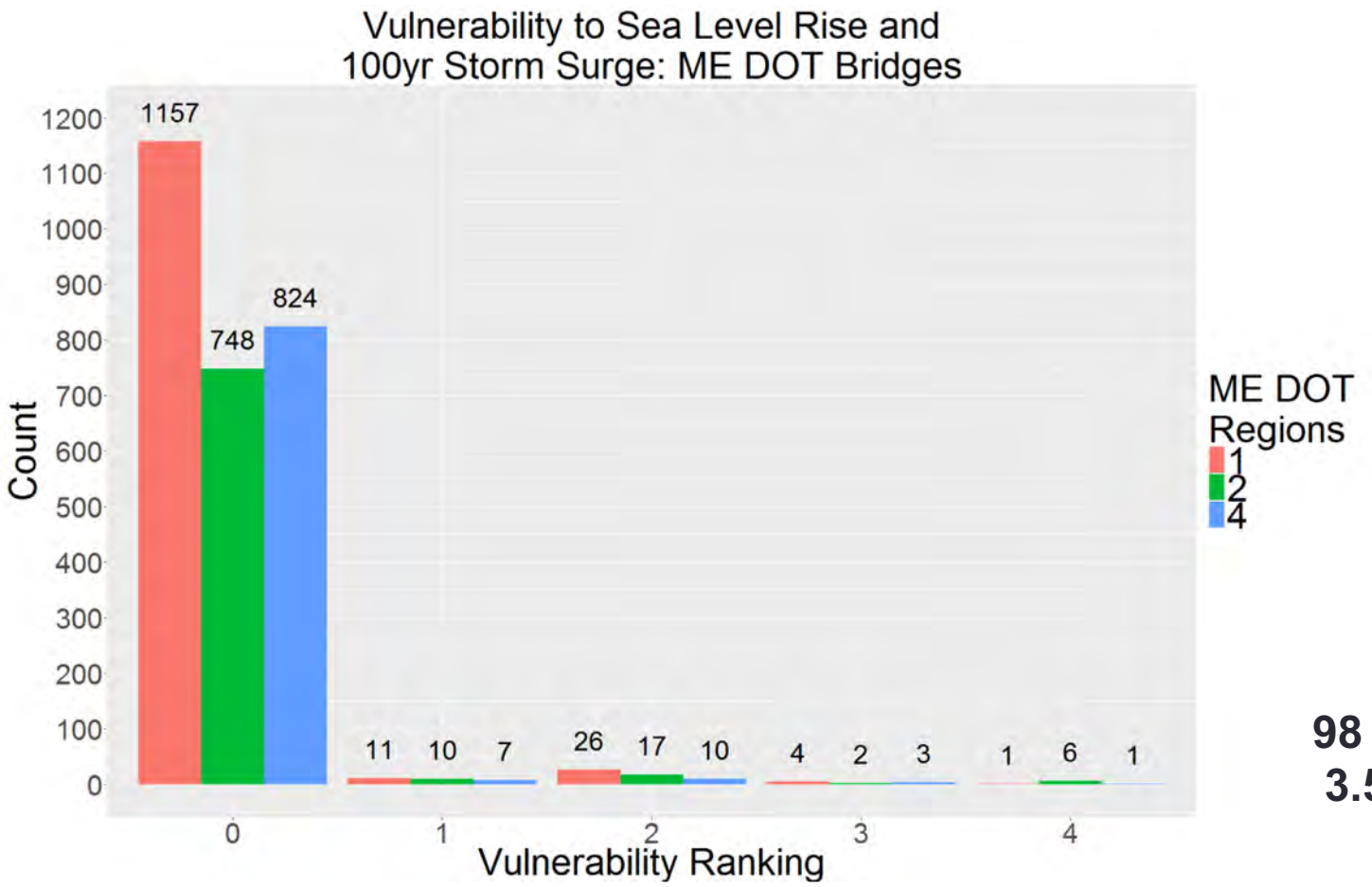
Bridges



98 >0
3.5%

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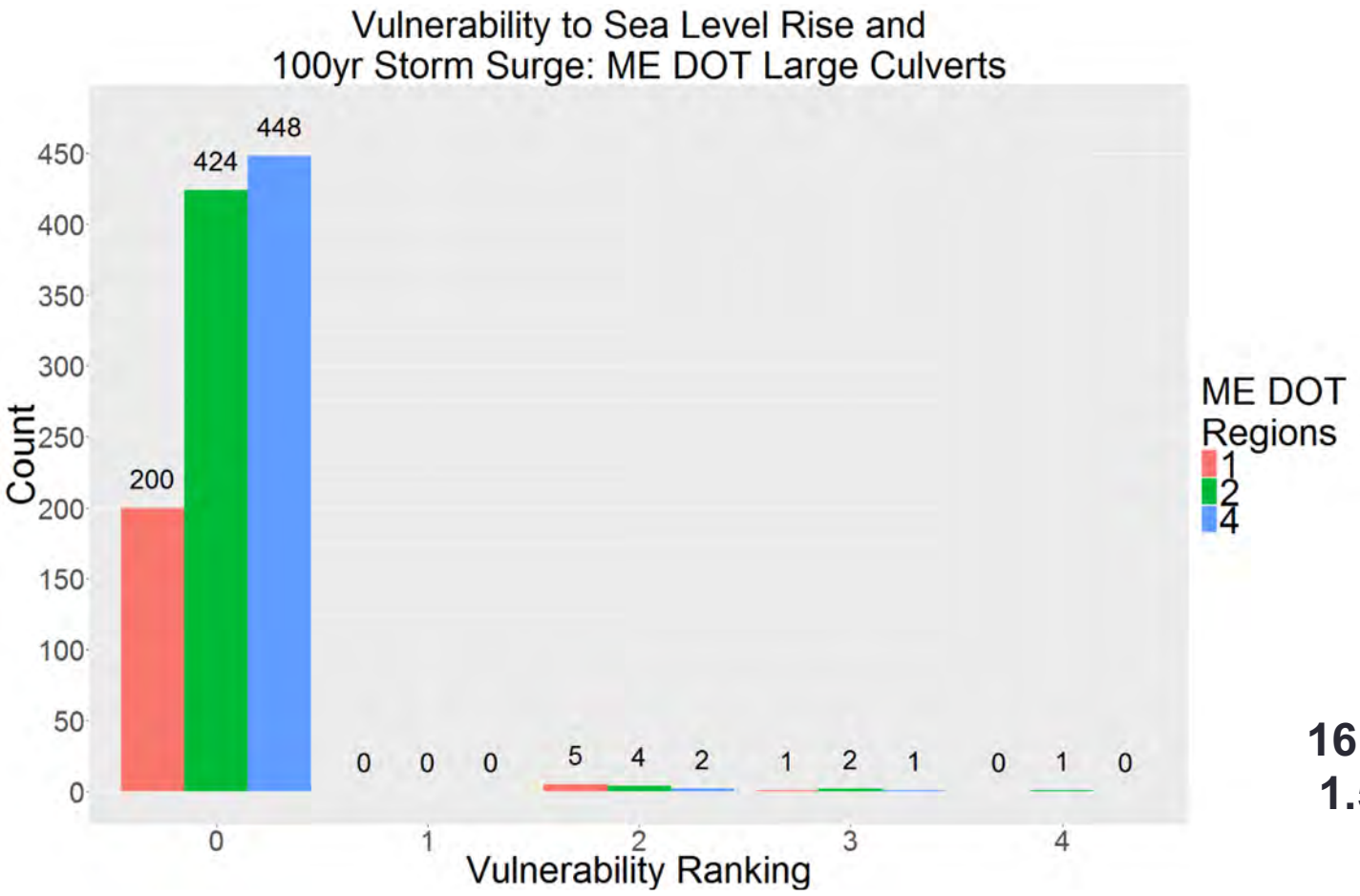
Culverts



16 >0
1.5%

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So Now to Scarborough

There were only 6 MaineDOT culverts in Town

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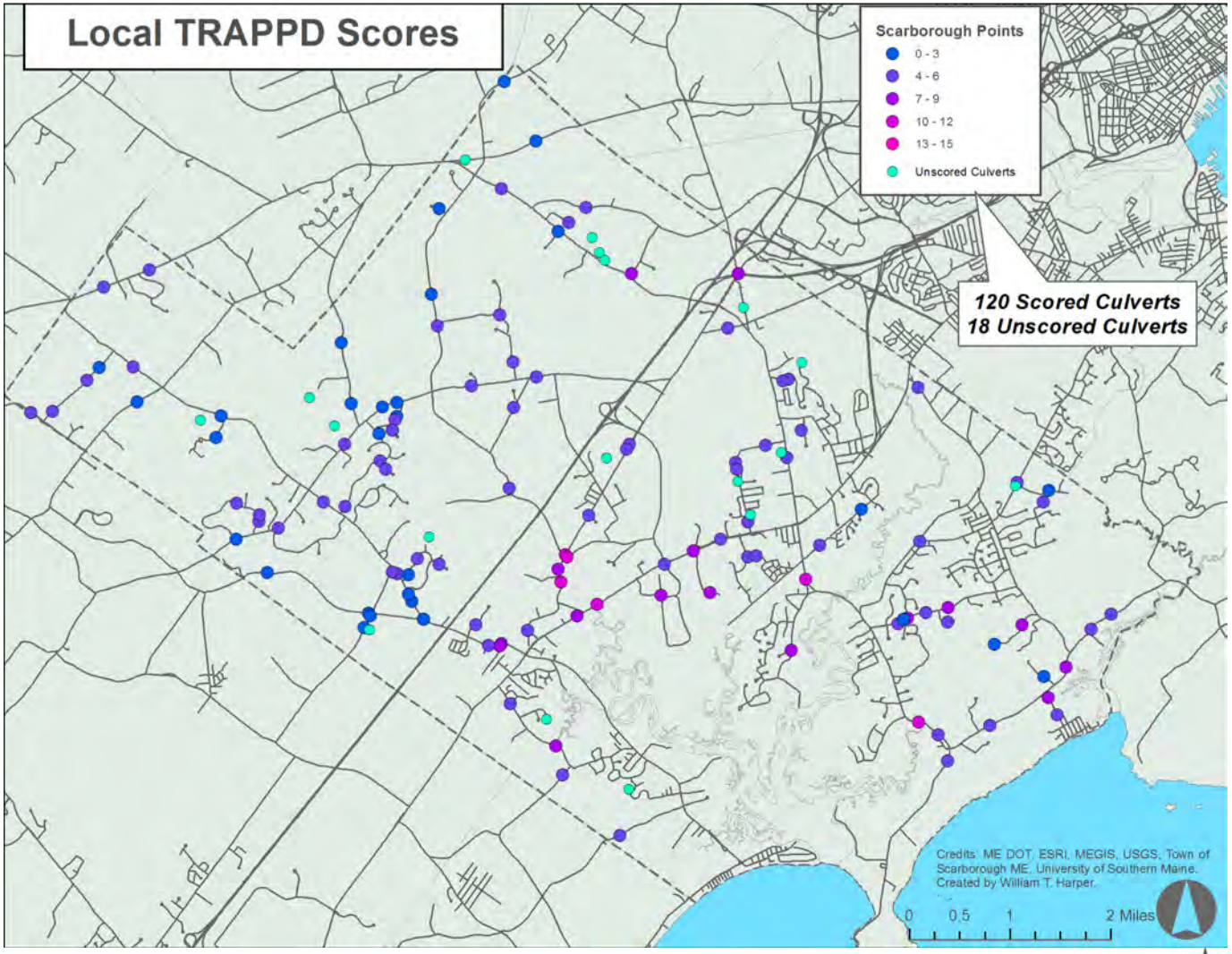
120 Culverts Added in Scarborough:



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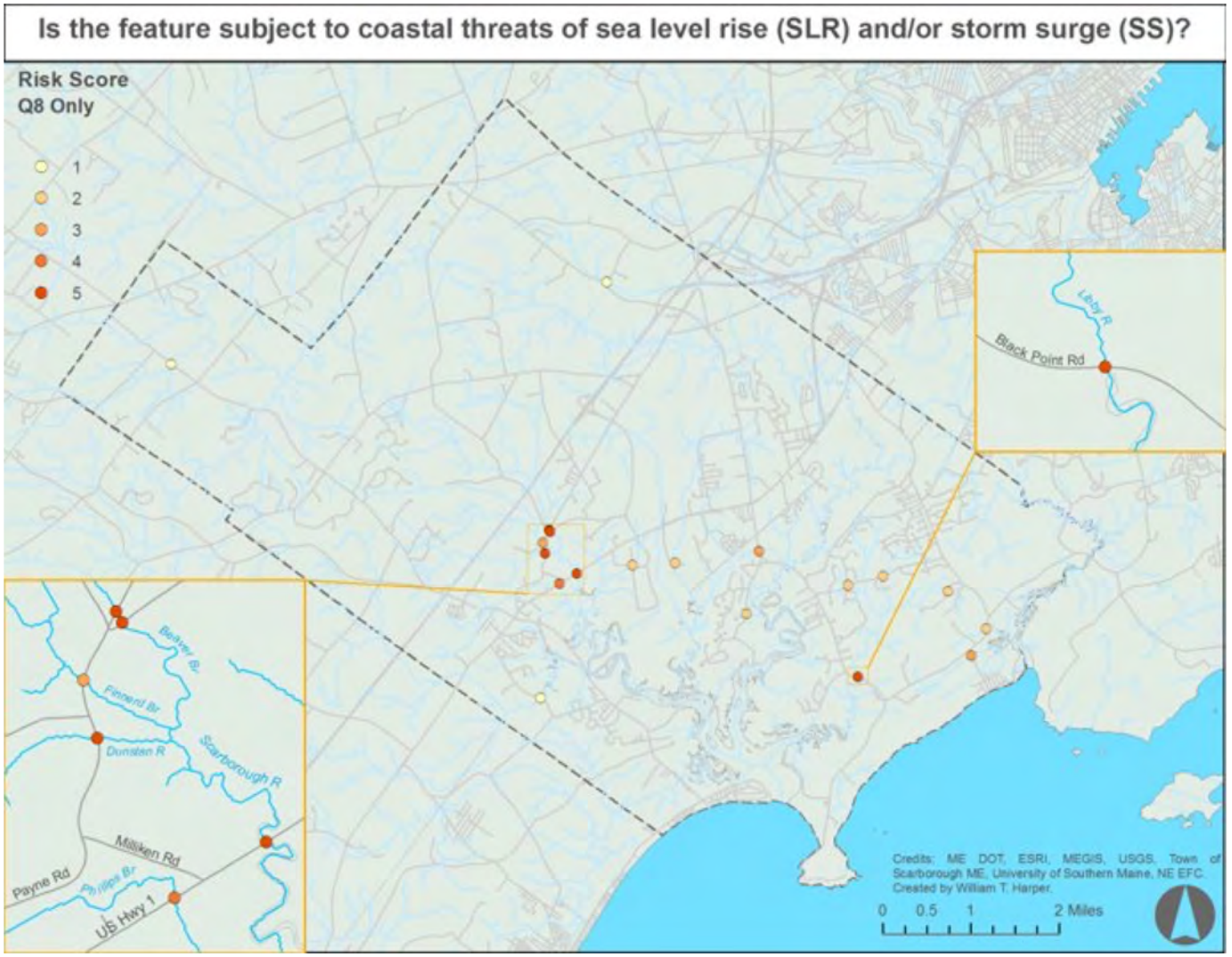
Risk from Sea Level Rise / SS



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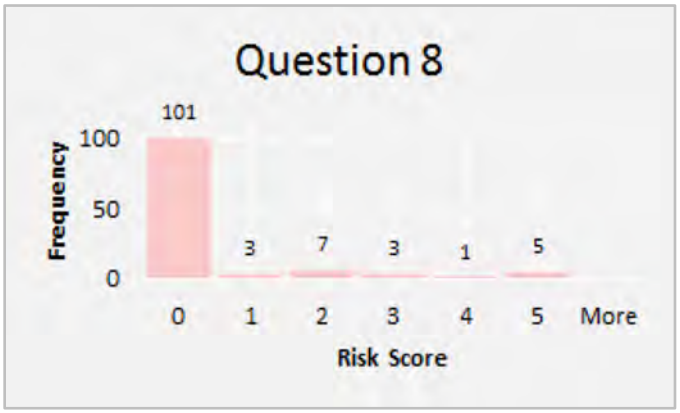
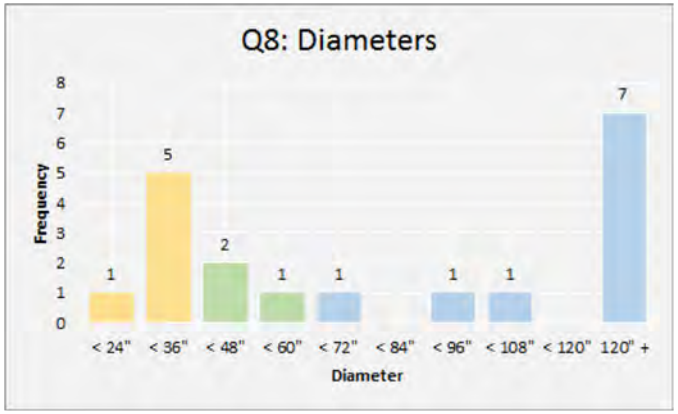
Sea Level Rise / Storm Surge



Is the feature subject to coastal threats of sea level rise (SLR) and/or storm surge (SS)?

Narrative Scoring	*Numeric Score*
Not coastal, No	0
100-yr SS	1
High 100-yr SLR (+6 ft)	2
High 50-yr SLR (+3.3 ft)	3
Low 100-yr SLR (+2 ft)	4
Low 50-yr SLR (+1 ft)	5



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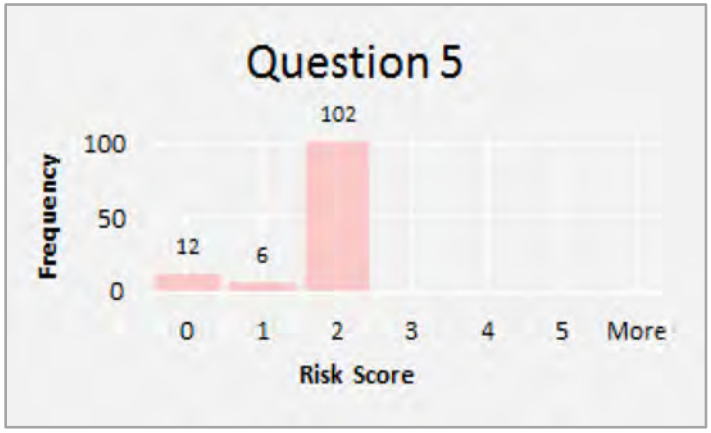
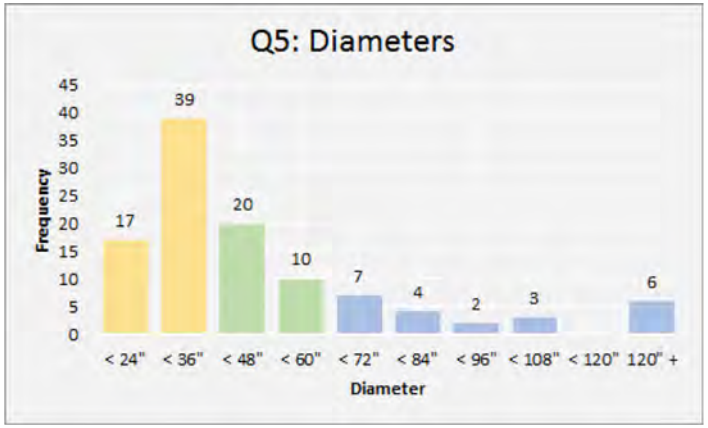
Undersized Culverts



Is the structure greater than or equal to the calculated bankfull width?

Narrative Scoring	Numeric Score
≥ 1.2x calculated bankfull width	0
1.0-1.2x calculated bankfull width	1
<1.0x calculated bankfull width	2



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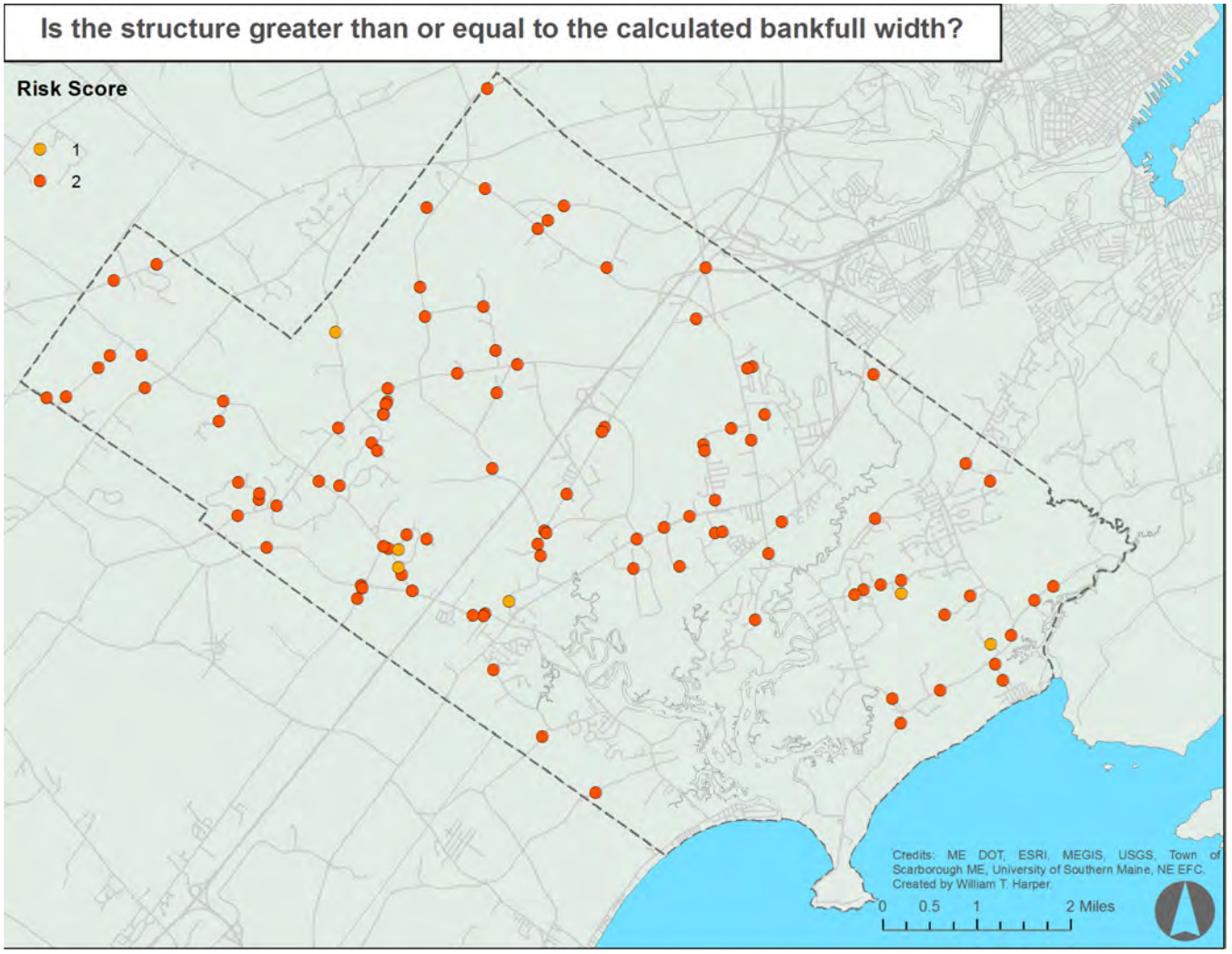
Risk from Undersized Culverts



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TRAPPD for Towns & Cities

Local Assets:

GIS Layers
ID Risk
Factors

Measure and Total Risk Factors, e.g. flood risks, SLR, fish passage, etc.

ASSET NAME	RISK SCORE
Culvert A-001	3
Culvert A-002	0
Culvert A-003	4

Compare to Scheduled Projects for Red Flags on Design, Budget, Timing

Project	CIP Year	Period	Budget	RISK SCORE
Dustan Culvert 6	2019	3 mos.	$5,000	1
Oak Hill Culvert 2	2019	3 mos.	$5,000	0
Culvert A-003	2020	3 mos.	$5,000	4
Route 1 Ramp @ MMC	2020	4 mos.	$45,000	2
Etc.				

Red Flag—Time, Budget May Not Be Sufficient; Design Change May Be Needed...

Goal:

Link the goals of the Comprehensive Plan with its Capital Planning activities.

Argument:

By bringing in risk information, i.e., identifying flooding risks before designing structures, we could:

- Make risk-informed design decisions
- Meet goals of the CP through implementation of projects

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Public Works Department Capital Projects

Description	5-Year Total	2019		2020	2021	2022	2023
Public Works Department - Town-Wide Projects							
Mid-Level Road Rehabilitation **(TBD)**	$ -						
Rte 1: Mill & Pave (Broadturn Rd to Saco Line)	$ 280,000	$ 280,000	B				
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Total Public Works	**$ 10,540,258**	**$ 889,750**		**$ 1,595,400**	**$ 1,985,108**	**$ 2,920,000**	**$ 1,650,000**

Planning Department Capital Projects

Phillips Brook Watershed Management Implementation Phase II Scheduled at $50,000 in 2022

Descriptio							
Planning Depart							
Office Renovation							
North Scarborou							
Phillips Brook Wa							
Route 1 Corridor							
N Scarborough Traffic Signal Improvement Plan Construction	$ 600,000			$ 600,000			
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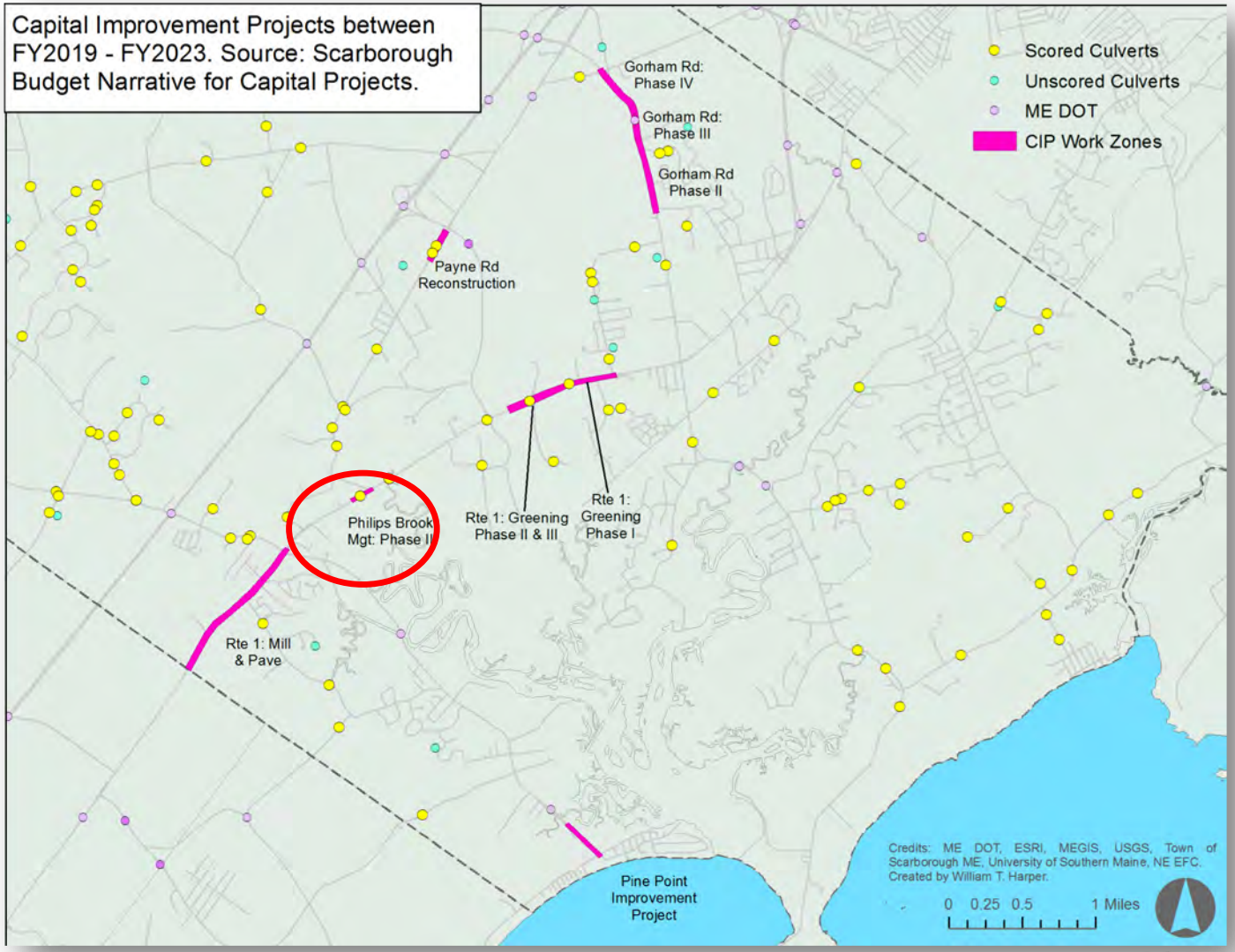
CIP Areas with Culverts and Bridges



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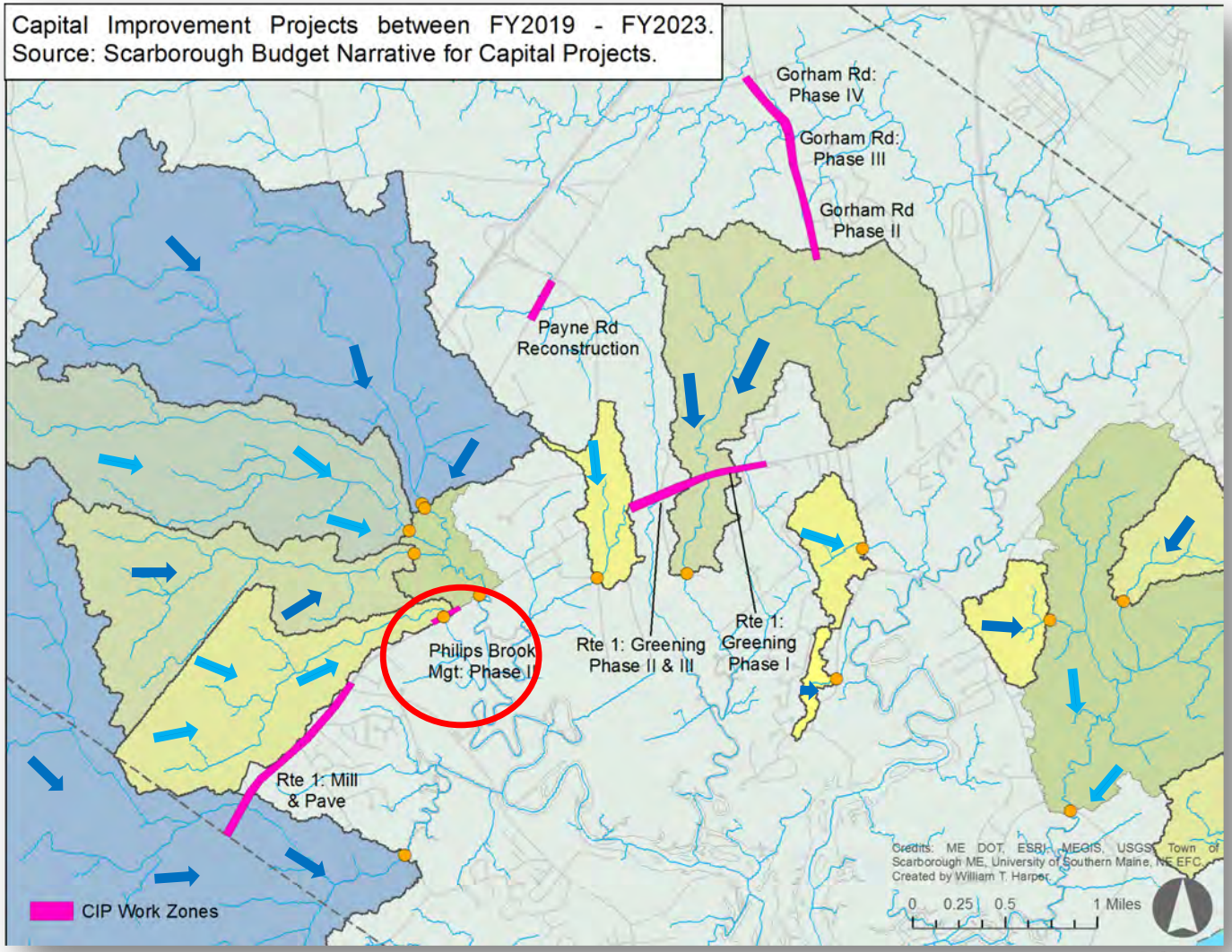
Watershed Flow



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Major CIP Investments

Subsurface Drainage Assessment Project: (2020) Scarborough has approximately 70 miles of stormwater drainage pipe. The size, age and type of pipe varies greatly. This would be the final year of the inventory for this very extensive system. This four year project is designed to:

- **Create a condition assessment** - Using industry standards an inspection will catalog the condition of the pipe. From this inspection a LoF (likelihood of Failure) is determined.
- **Risk Assessment** - The next step in the assessment project would be to create the CoF (consequence of failure) matrix.

These two inputs will help prioritize future CIP projects not only based on condition and location but by calculating the actual consequence of a failure. The end result is a complete report and inventory that helps make informed decisions on future CIP in a more predictable and sustainable manner.

Public Works Department Capital Projects

Description	5-Year Total	2019		2020	2021	2022	2023
Public Works Department - Town-Wide Projects							
Mid-Level Road Rehabilitation **(TBD)**	$ -						
Rte 1: Mill & Pave (Broadturn Rd to Saco Line)	$ 280,000	$ 280,000	B				
Subsurface Drainage Assessment Project	$ 195,750	$ 118,750	B	$ 77,000			
Phase II LED Conversion	$ 215,000	$ 215,000	B				
Adaptive Traffic Lights (Dunstan Intersection)	$ 135,000	$ 135,000	I				
PW Facility Fire Panel Upgrade	$ 25,000	$ 25,000	A				
Traffic - UPS/Generator/Battery Standby Install	$ 36,000	$ 36,000	A				
Final Design Gorham Rd Reconstruction Phase II (Maple Ave - Ridgeway Rd	$ 80,000	$ 80,000	B				
Traffic - Install & Connect Fiber (Oak Hill south - Southgate)	$ 133,000			$ 133,000			
Gorham Rd Reconstruction Phase II Maple Ave - Ridgeway	$ 1,010,400			$ 1,010,400			
Rte.1 Greening Initiative Ph 1 (Sawyer Rd N to Millbrook)	$ 125,000			$ 125,000			
Subsurface Drainage Rehabilitation Project Phase II	$ 1,000,000			$ 250,000	$ 250,000	$ 250,000	$ 250,000

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Other Municipal Issues

- WHY use TRAPPD locally
- WHEN to use TRAPPD locally

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Next Steps for TRAPPD local:

- Funding
- Phase II to test:
  - Scale

  - Value

New England Environmental Finance Center GEI Consultants

Thank You!

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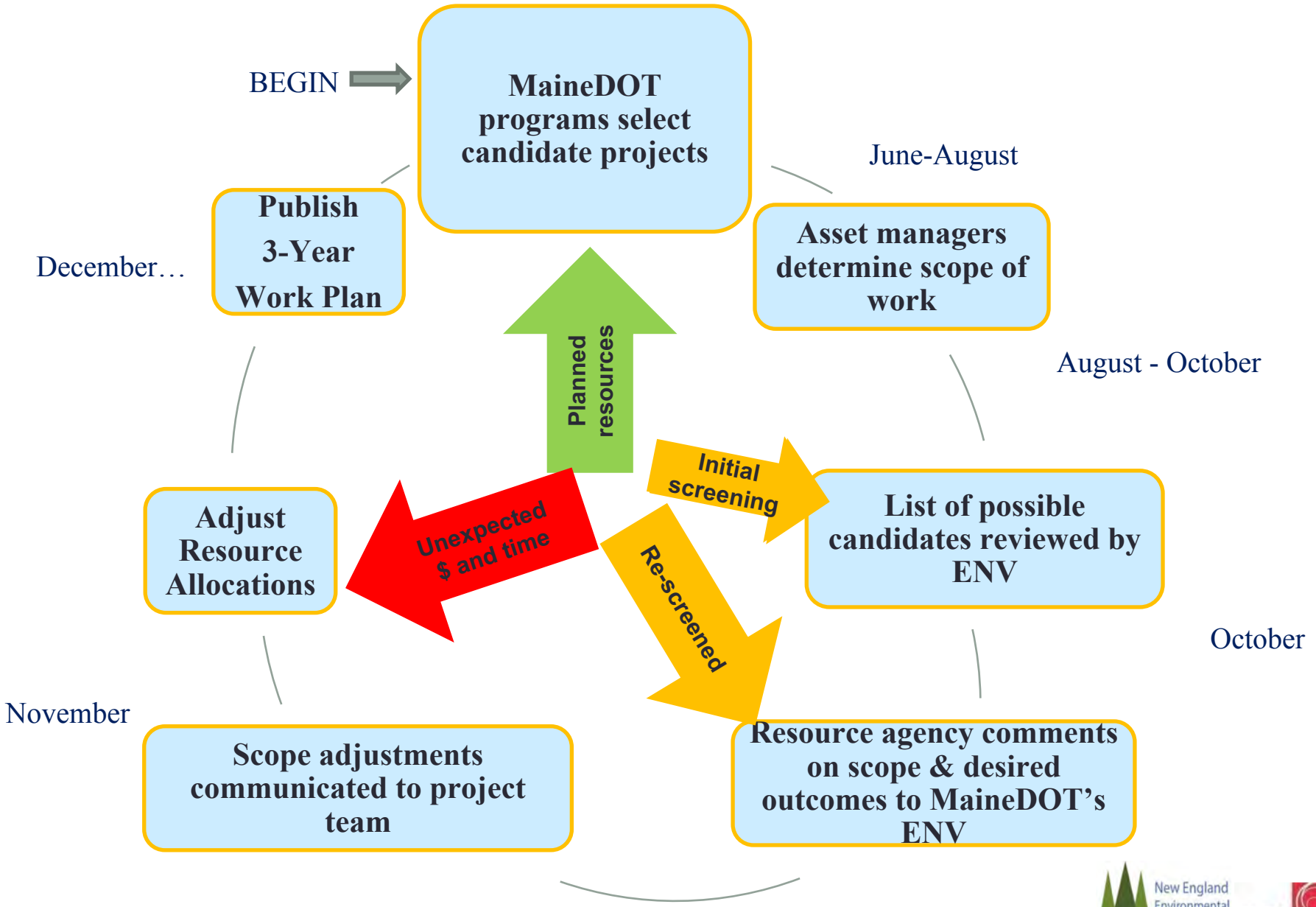
BEGIN
MaineDOT programs select candidate projects
June-August
Asset managers determine scope of work
August - October
List of possible candidates reviewed by ENV
October
Resource agency comments on scope & desired outcomes to MaineDOT's ENV
November
Scope adjustments communicated to project team
December…
Publish 3-Year Work Plan
Adjust Resource Allocations
Planned resources
Initial screening
Re-screened
Unexpected $ and time