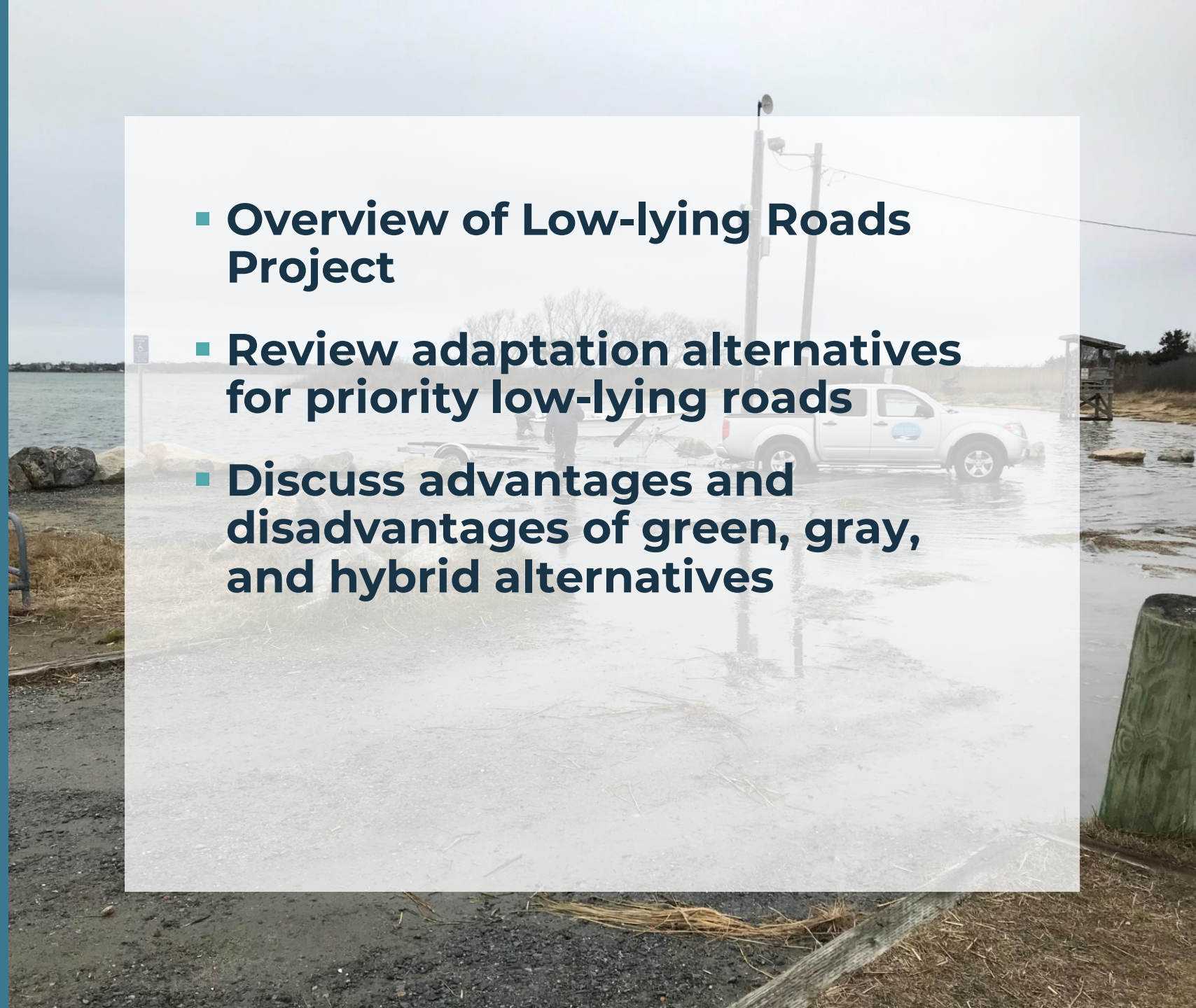
Low-lying Roads: Eastham

Project funded by the Municipal Vulnerability Preparedness Program and the Economic Development Administration

Purpose and Objectives of Public Meeting



- **Overview of Low-lying Roads Project**
- **Review adaptation alternatives for priority low-lying roads**
- **Discuss advantages and disadvantages of green, gray, and hybrid alternatives**

Agenda

- Project Overview
- Town staff comments
- Presentation of conceptual design alternatives
  - Ellis Rd
  - Governor Prence Rd
  - Herring Brook Rd
  - South Sunken Meadow Rd
- Questions, comments, and discussion
- Next Steps

Low Lying Roads

10

TOWNS

Barnstable
Bourne
Brewster
Dennis
Eastham
Orleans
Sandwich
Truro
Wellfleet
Yarmouth

- Flooding vulnerability assessment of low-lying roads and transportation infrastructure
- Support municipal road segment prioritization
- Identify range of potential design solutions, costs

Work performed by Cape Cod Commission and Woods Hole Group

PROJECT TIMELINE

Vulnerability Assessment

Prioritize Roadway Segments

1st Workshop: Vulnerable & At-Risk Roads

Roadway site visits

Roadway analysis & solutions ID

2nd Workshop: Present alternatives

September 2021

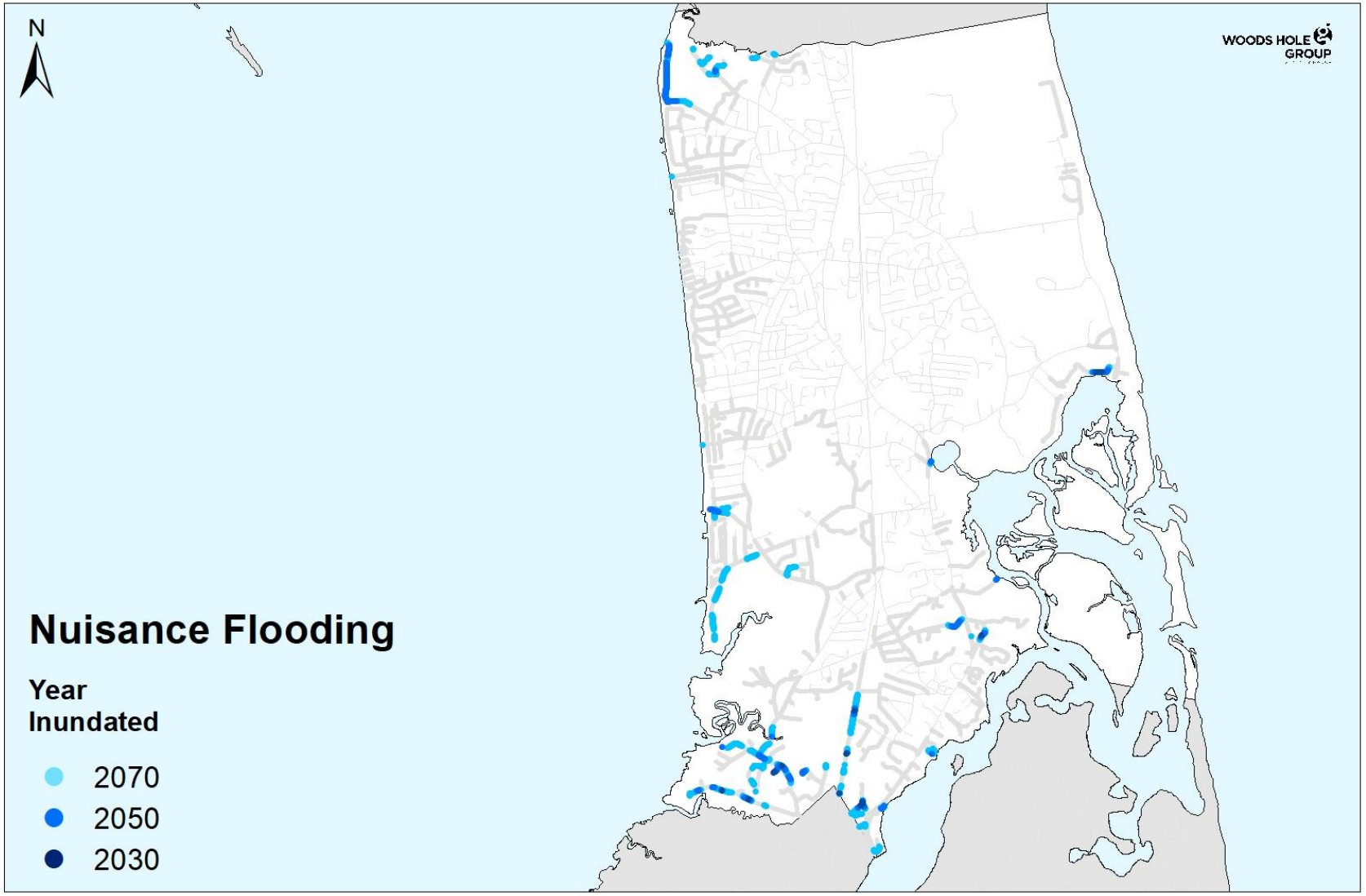
Summer 2022

March 2023

Additional Context & Information

- **Detailed information on webpages:** https://www.capecodcommission.org/our-work/low-lying-roads-project/
- **Other Eastham road projects – town comments?**
- **Clarifying questions**
- **Format for meeting**

Low Lying Roads Nuisance (MHW) Flooding (Eastham)



Road Miles 2030

0.1/145.7

Road Miles 2050

1.4/145.7

Road Miles 2070

4.5/145.7

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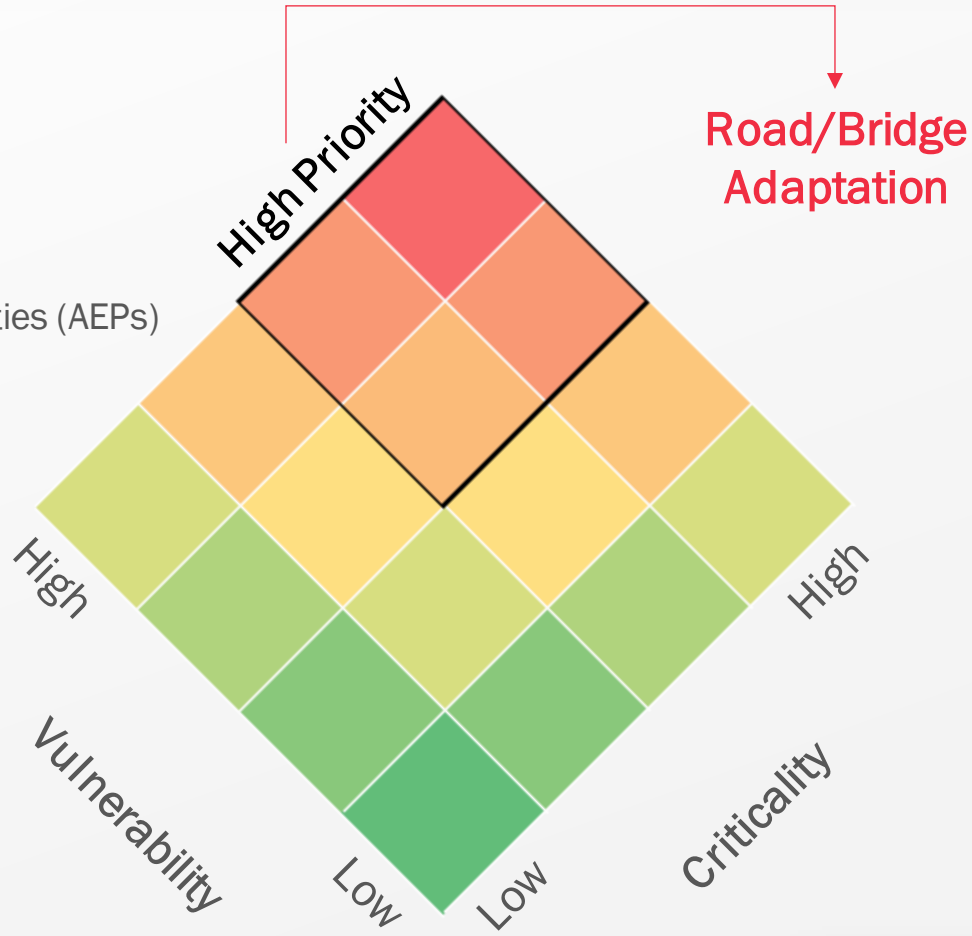
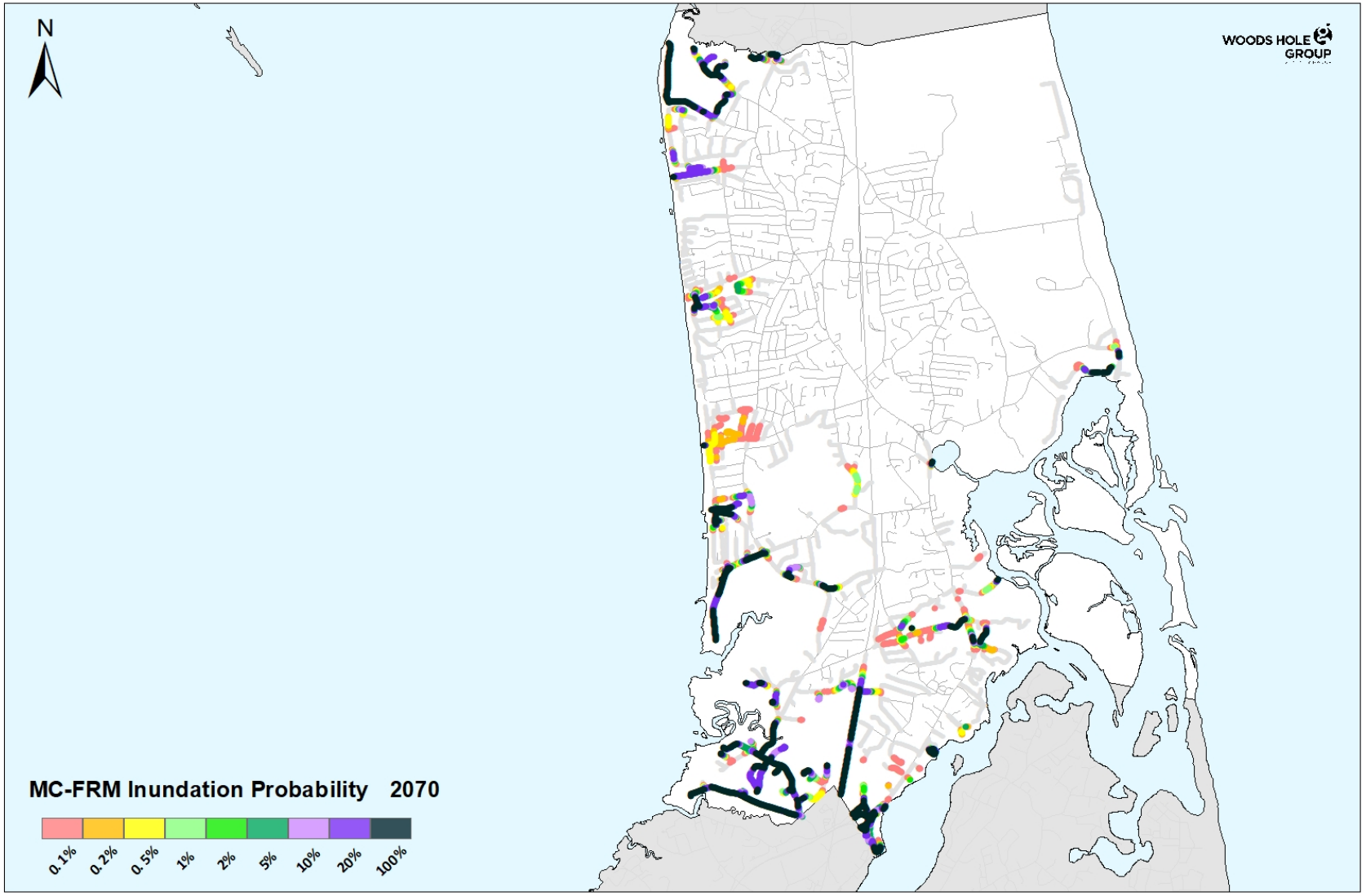
Cape Cod Low Lying Roads Risk Assessment Approach

1. Extract roadway/bridge critical elevations (CEs)
   - From LiDAR at 20m interval along surface
2. Compile 2030/2050/2070 MC-FRM water surface elevations (WSEs)
   - 0.1%, 0.2%, 0.5%, 1%, 2%, 5%, 10%, 20%, 100% Annual Exceedance Probabilities (AEPs)
3. Compare CEs to WSEs to determine vulnerability
   - Highest probability WSE exceeding CE
4. Score road segment criticality
   - Usage/Network Function
   - Economy
   - Vulnerable Populations
   - Community and Emergency Services
5. Probability * Criticality = Risk
6. Prioritize high-risk road segments for community consideration



Low Lying Roads 2070 Inundation Probability (Eastham)



	%	Road miles
	0.1	18.9
	0.2	15.2
	0.5	14.0
	1	12.7
	2	12.1
	5	11.5
	10	10.4
	20	9.4
	100	6.6

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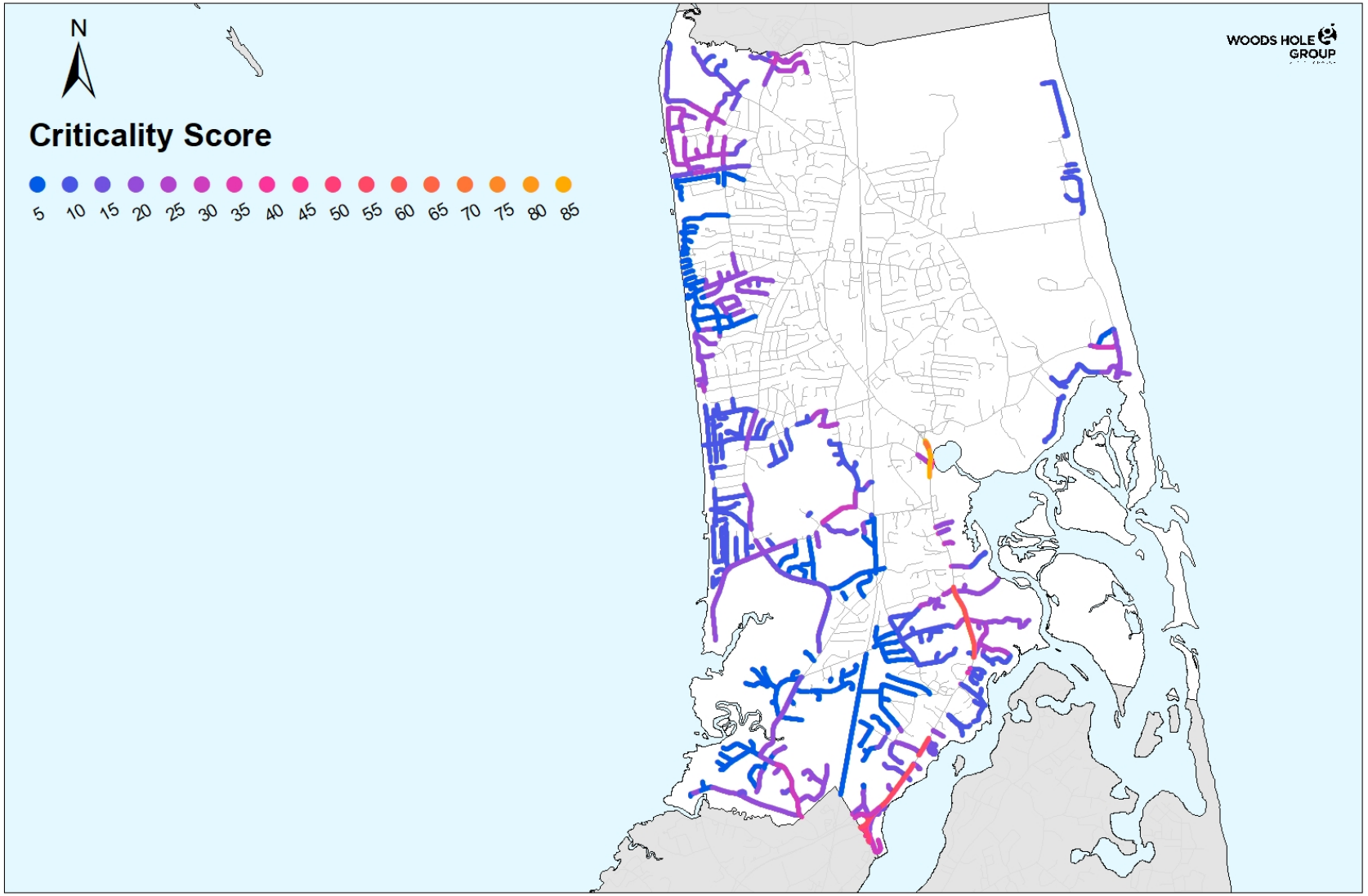
Low Lying Roads Criticality Scoring (Eastham)



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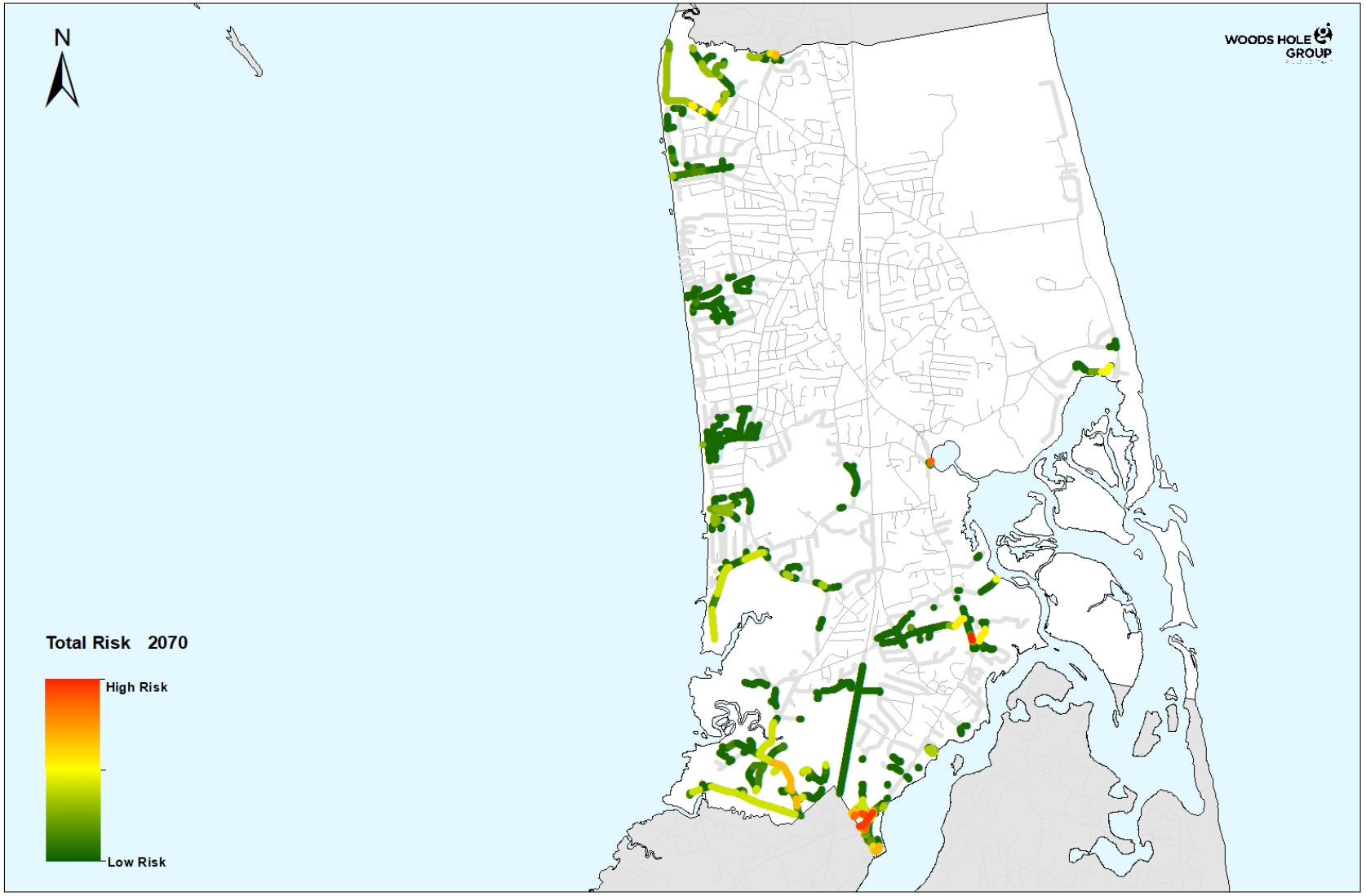
Low Lying Roads 2070 Risk Results (Eastham)



High Risk Road Segments

Bridge Rd & Windjammer Rd (+)
Dyer Prince Rd (+)
Samoset Rd and Sunset Ln (+)
South Sunken Meadow Rd
Governor Prence Rd E
Herring Brook Rd
Massasoit Rd
Ellis Rd
Eldredge Dr and North Sunken Meadow Rd
Bayview Rd
Steele Rd
Grand Army of the Republic*
Eastham Rotary*
Smith Ln*
Governor Prence Rd W
Cole Rd

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Summary/Selection of High Priority Road Segments (Eastham)

		Name	Length (ft)	Description	Segment Storm Probability (%)			Nuisance Length (ft)		
					2030	2050	2070	2030	2050	2070
	A	Bridge Rd & Windjammer Rd (+)	4340	Most of roadway with bridge	0-100	1-100	5-100	20	880	2520
	B	Dyer Prince Rd (+)	3940	Most of roadway	0-100	1-100	5-100	40	500	1400
	C	Samoset Rd and Sunset Ln (+)	4320	Most of roadway	0-100	0-100	0-100			2220
☑	D	South Sunken Meadow Rd	1620	Leading to Sunken Meadow Beach	0.2-100	5-100	20-100		380	880
	E	Governor Pence Rd E	540	East of Route 6	0-20	1-100	100	20	240	440
☑	F	Herring Brook Rd	160	South of Heritage Hill Circle	5-20	20-100	100			40
	G	Massasoit Rd	160	South of Frodigh Lane	0.5-5	10-20	20-100			
☑	H	Ellis Rd	320	Off of Old State Highway	1-5	20-100	100			320
	I	Eldredge Dr and North Sunken Meadow Rd	780	Between Bens Way and Freeman Way	10-20	20-100	100			220
	J	Bayview Rd	220	Leading to Boat Meadow Landing	20	100	100			220
	K	Steele Rd	1380	Leading to Cooks Brook Beach	0.1-20	2-100	20-100			20
	L	Grand Army of the Republic*	180	Route 6	0-0.1	1-2	100			20
	M	Eastham Rotary*	1620	Rotary and Route 6	0-0.1	0.2-2	100			440
	N	Smith Ln*	500	Roadway and on-ramp to Rotary/Route 6	0.1-5	2-5	100			400
☑	O	Governor Prence Rd W	460	West of Route 6	0.1-0.5	2-10	100		300	400
	P	Cole Rd	600	Southeast from Cranberry Lane	0.5-1	10-20	100		160	480

(+) = Prior planning work

* = MassDOT roadway

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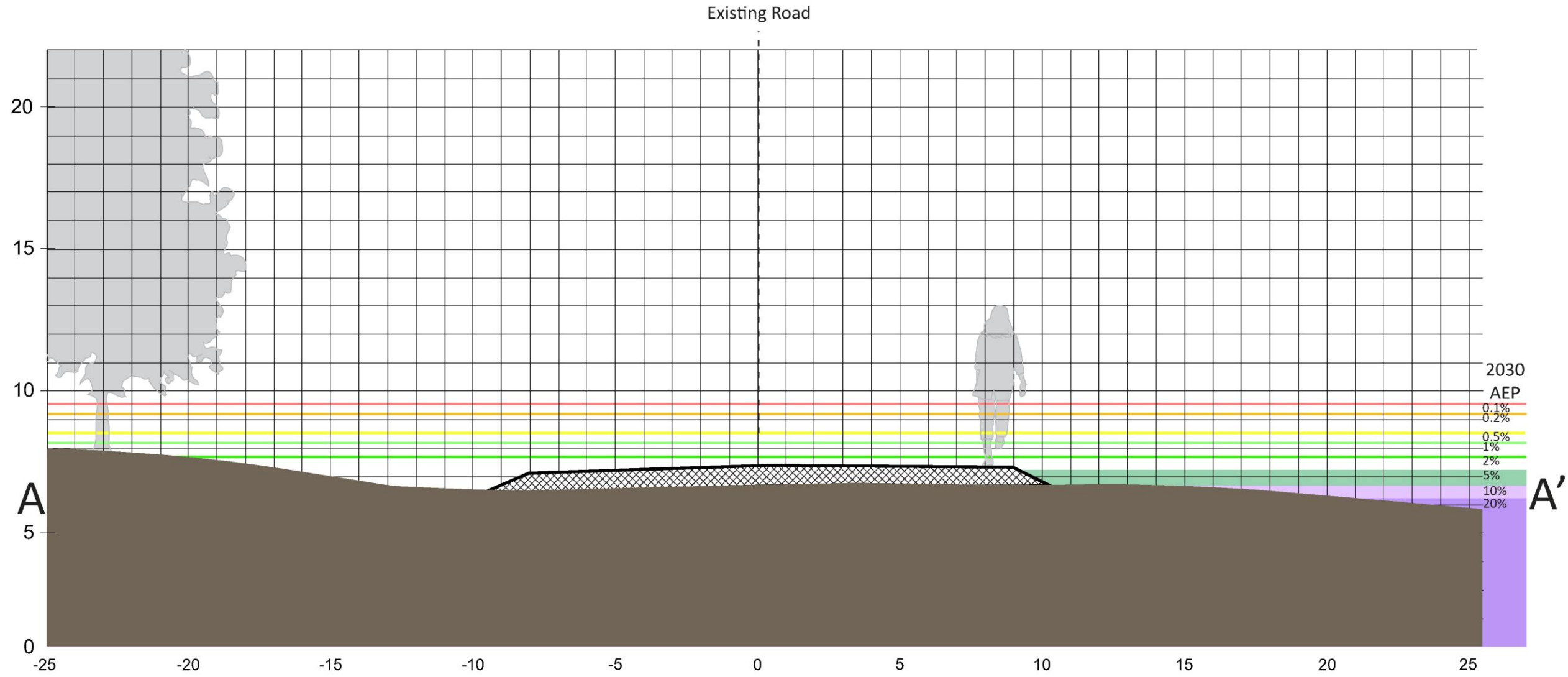
Ellis Road

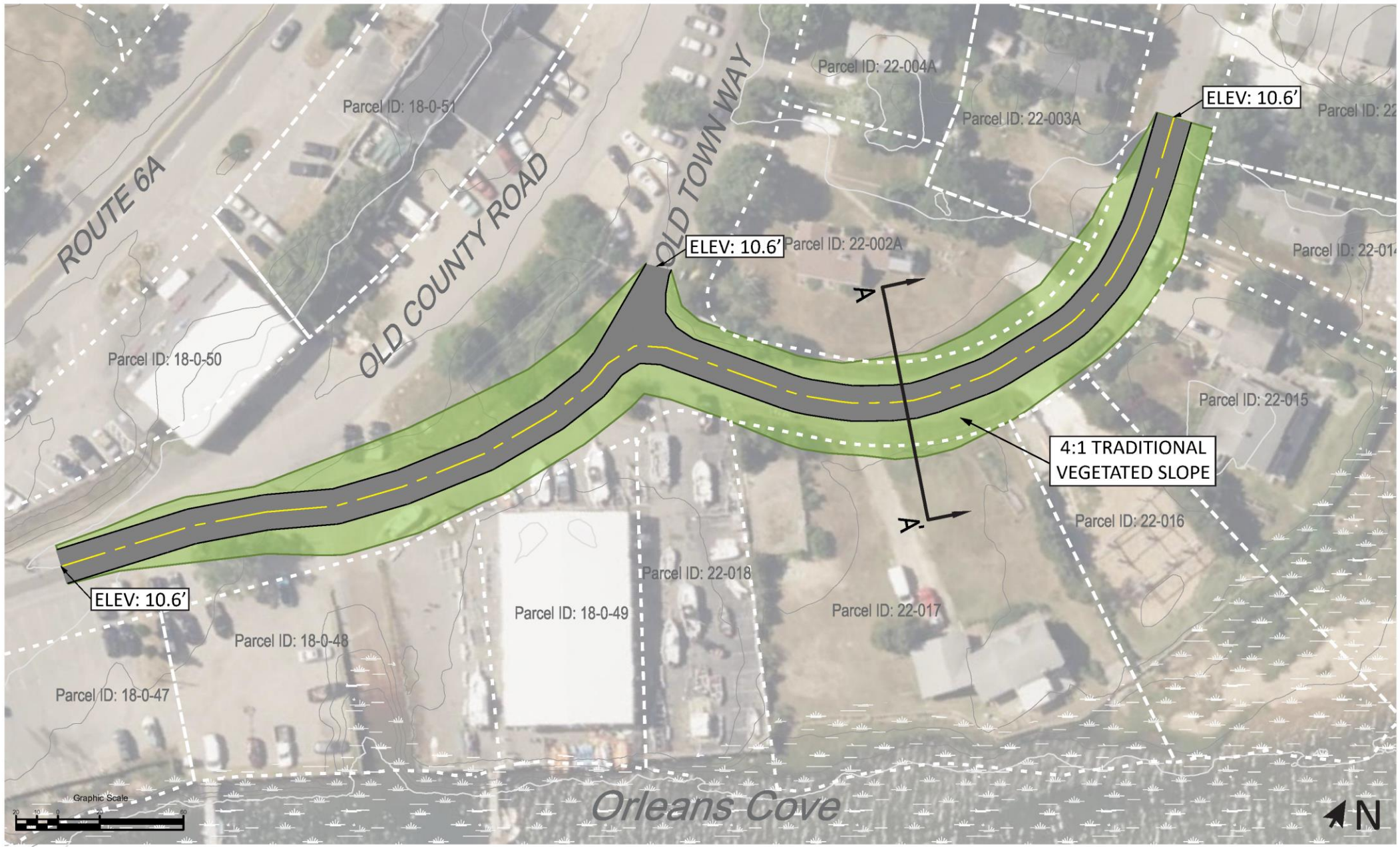
Ellis Road

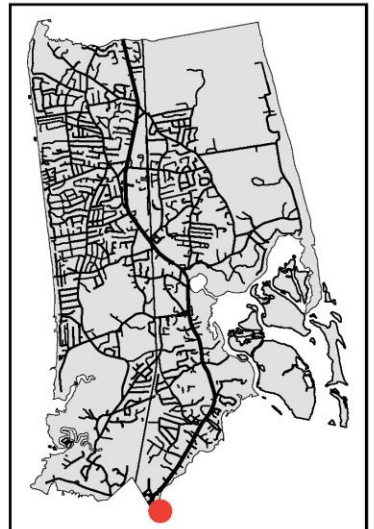


EXISTING CONDITIONS

Ellis Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY





Ellis Road
EASTHAM

ALTERNATIVE 1: GRAY

633 linear feet of Town-owned road are elevated from a lowest point of 6.8 feet to a lowest point of 10.6 feet. This road segment extends into Orleans, and collaboration with both the neighboring town and private property owners is necessary.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

WOODS HOLE GROUP
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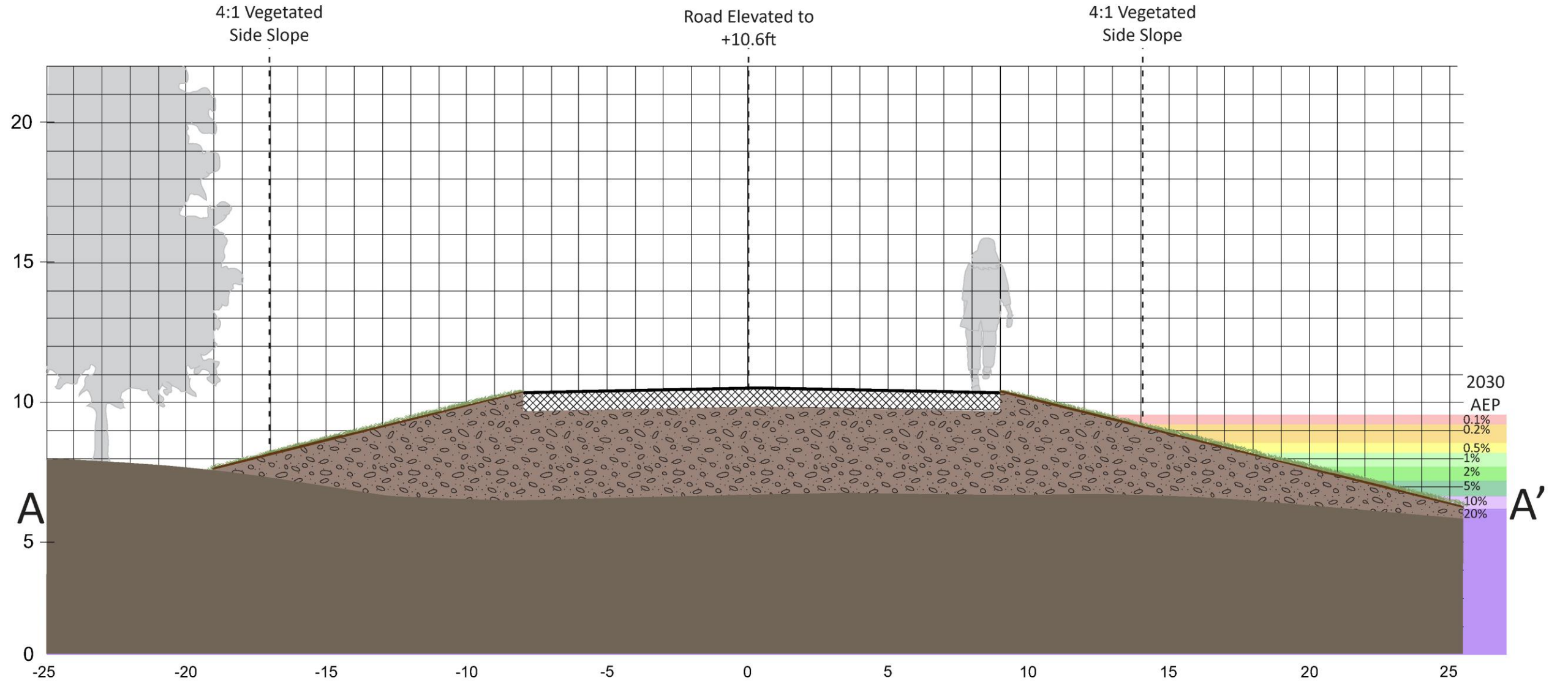

ALTERNATIVE 1: GRAY

Ellis Road, Eastham

WOODS HOLE GROUP
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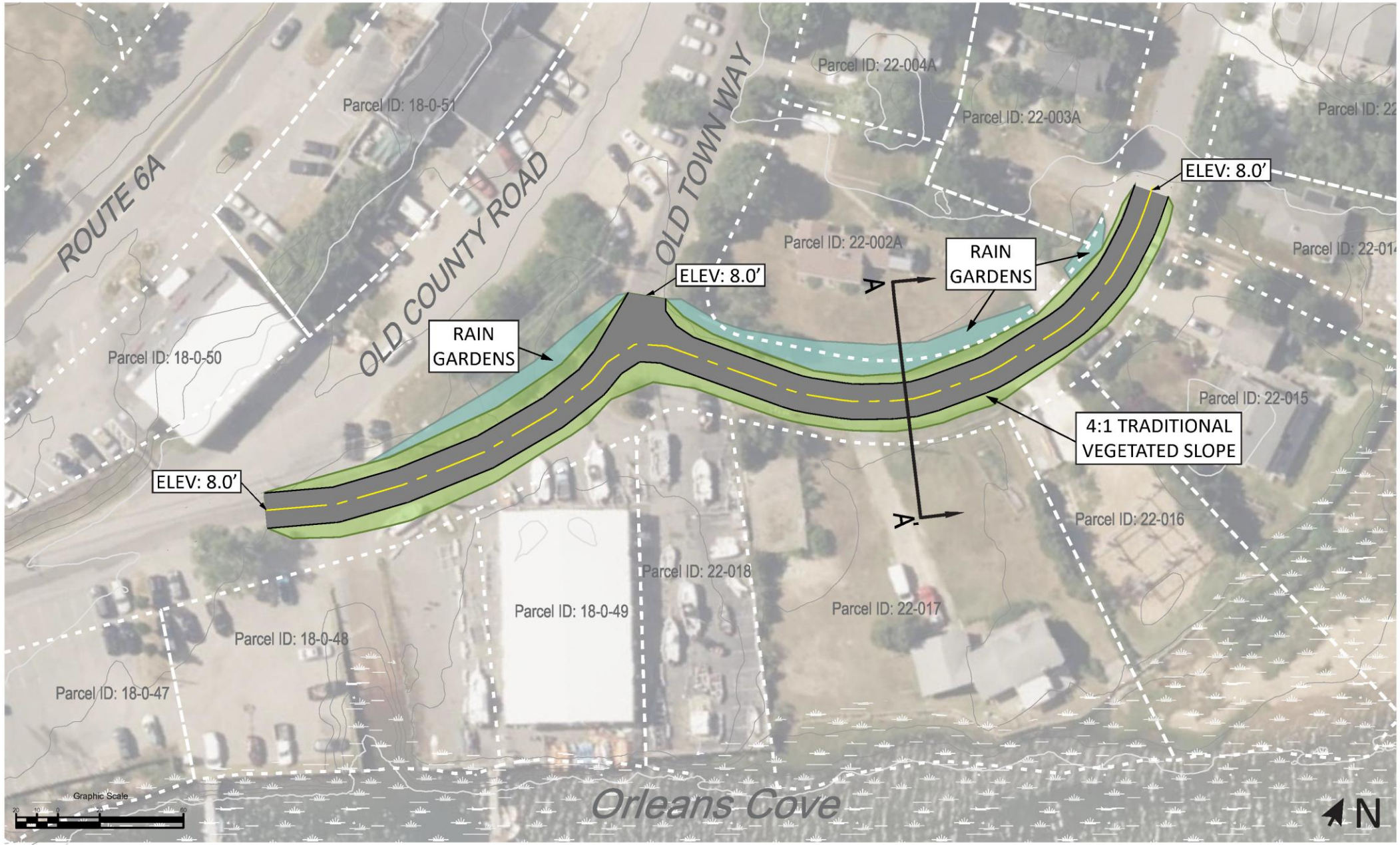

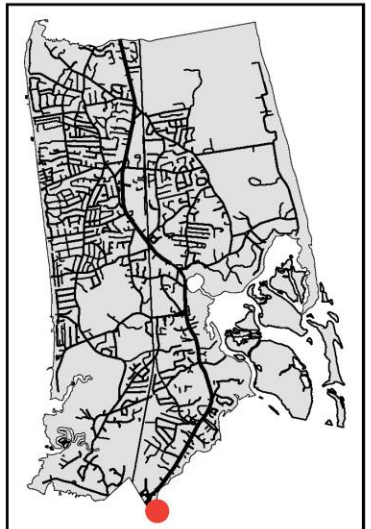

Ellis Road
EASTHAM

ALTERNATIVE 2: HYBRID

591 linear feet of Town-owned road are elevated from a lowest point of 6.8 feet to a lowest point of 8 feet. Rain gardens are added on the road's northern side to manage rainwater. This road segment extends into Orleans, and collaboration with both the neighboring town and private property owners is necessary.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

WOODS HOLE GROUP
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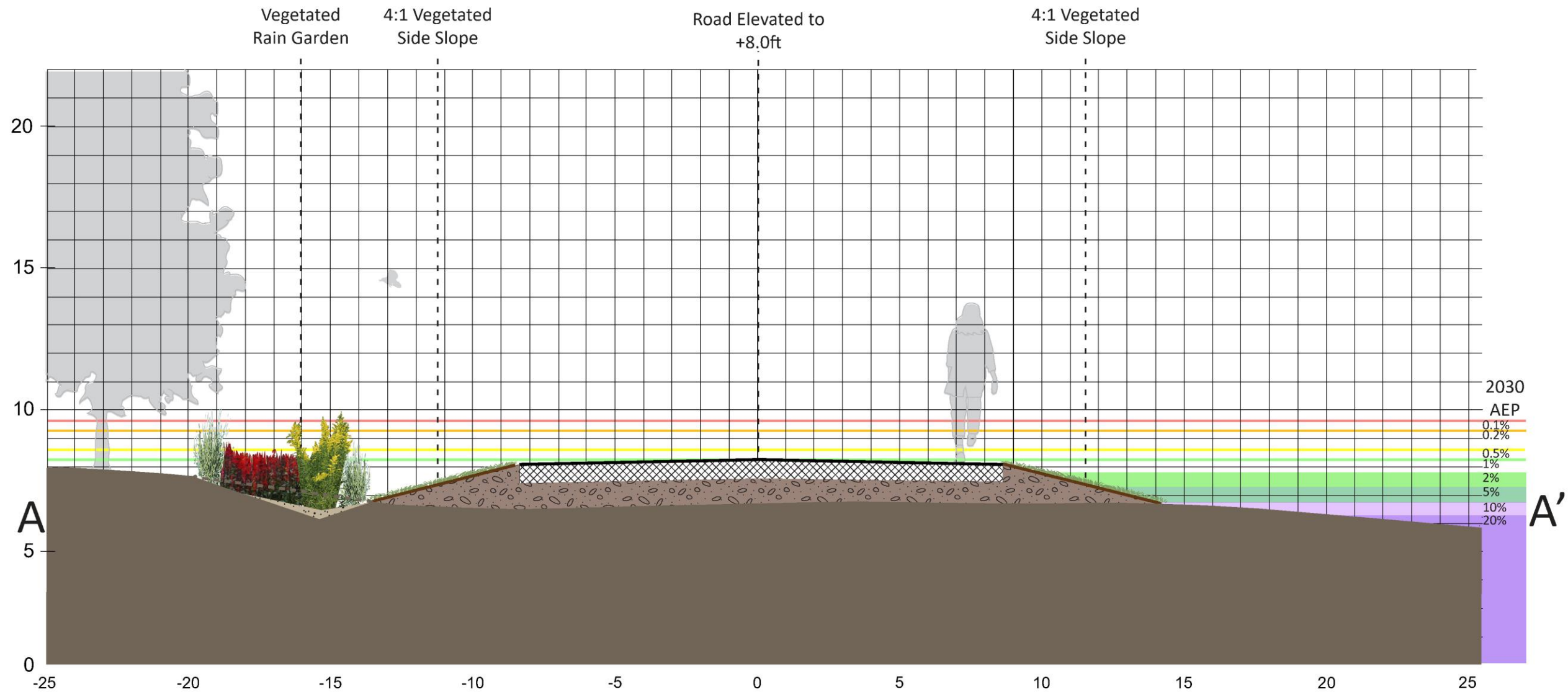

ALTERNATIVE 2: HYBRID

Ellis Road, Eastham

WOODS HOLE GROUP
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ELLIS ROAD, EASTHAM

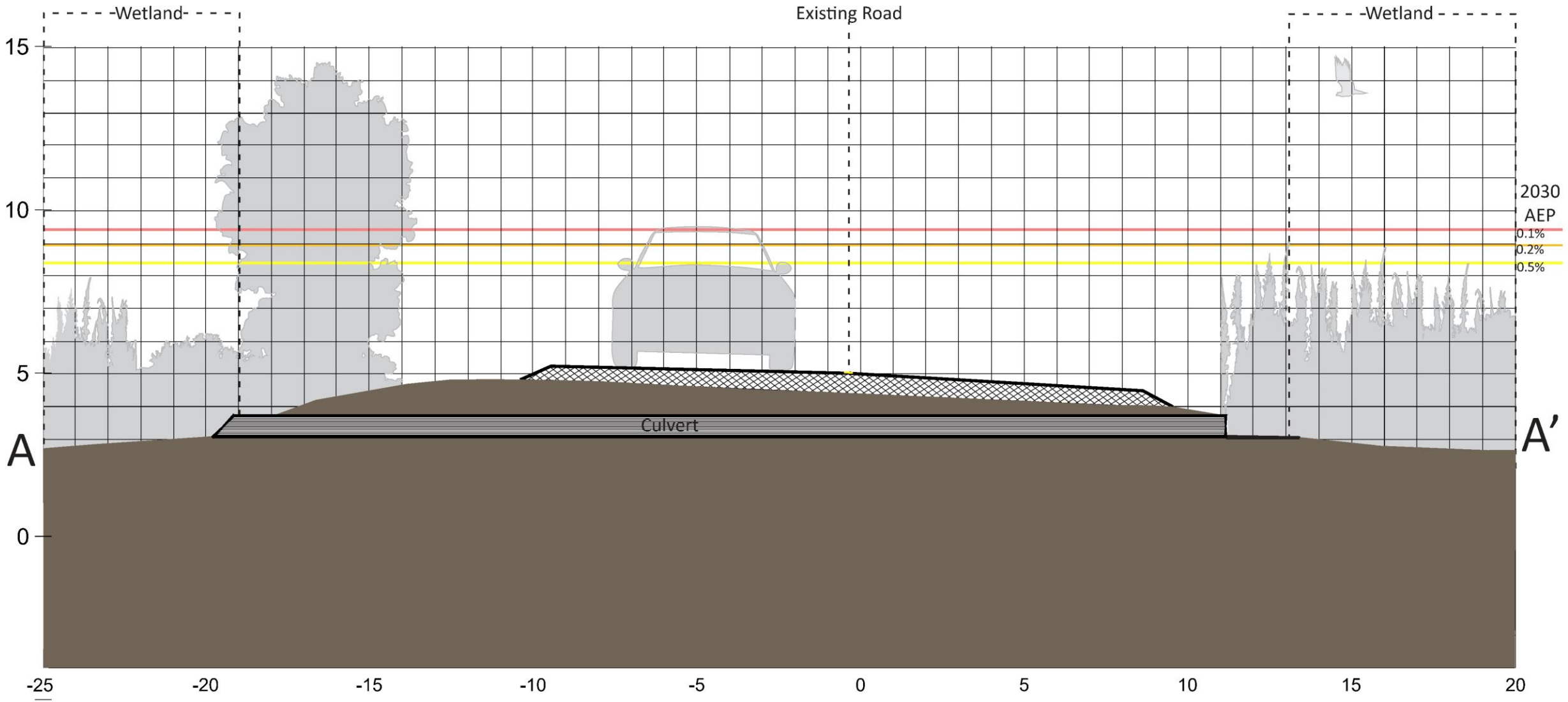
Summary of alternatives

	Description	Critical Elevation	Annual Exceedance Probability			Vulnerable to Tidal Flooding	Impacts to Wetlands	Impacts to Private Property	Estimated Cost
			2030	2050	2070				
EXISTING	A segment of 20ft wide road.	6.8 feet	5%	100%	100%	2070	N/A	N/A	N/A
ALTERNATIVE 1: GRAY	633 linear feet of Town-owned road are elevated from a lowest point of 6.8 feet to a lowest point of 10.6 feet. This road segment extends into Orleans, and collaboration with both the neighboring town and private property owners is necessary.	10.6 feet	0%	1%	10%	N/A	N/A	Yes	$180,000
ALTERNATIVE 2: HYBRID	591 linear feet of Town-owned road are elevated from a lowest point of 6.8 feet to a lowest point of 8 feet. Rain gardens are added on the road's northern side to manage rainwater. This road segment extends into Orleans, and collaboration with both the neighboring town and private property owners is necessary.	8.0 feet	1%	100%	100%	2070	N/A	Yes	$134,000

*Installed material cost +20% contingency. Excludes design, permitting, mobilization, stormwater and wastewater infrastructure, and site controls. Costs based on RSMeans 2021 cost book and adjusted for inflation and region.

Governor Prence Road

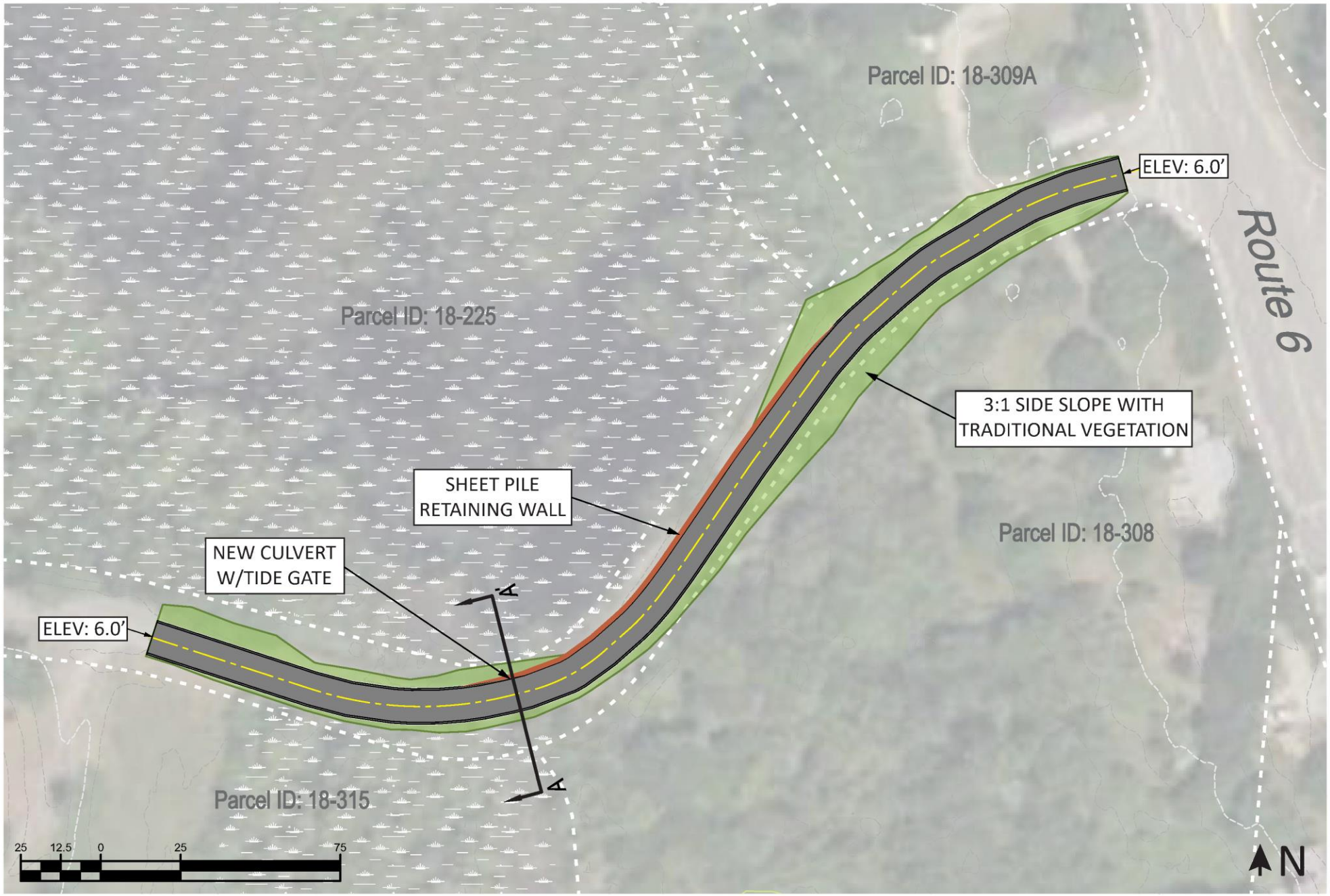
Governor Prence Road



EXISTING CONDITIONS

Governor Prence Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY



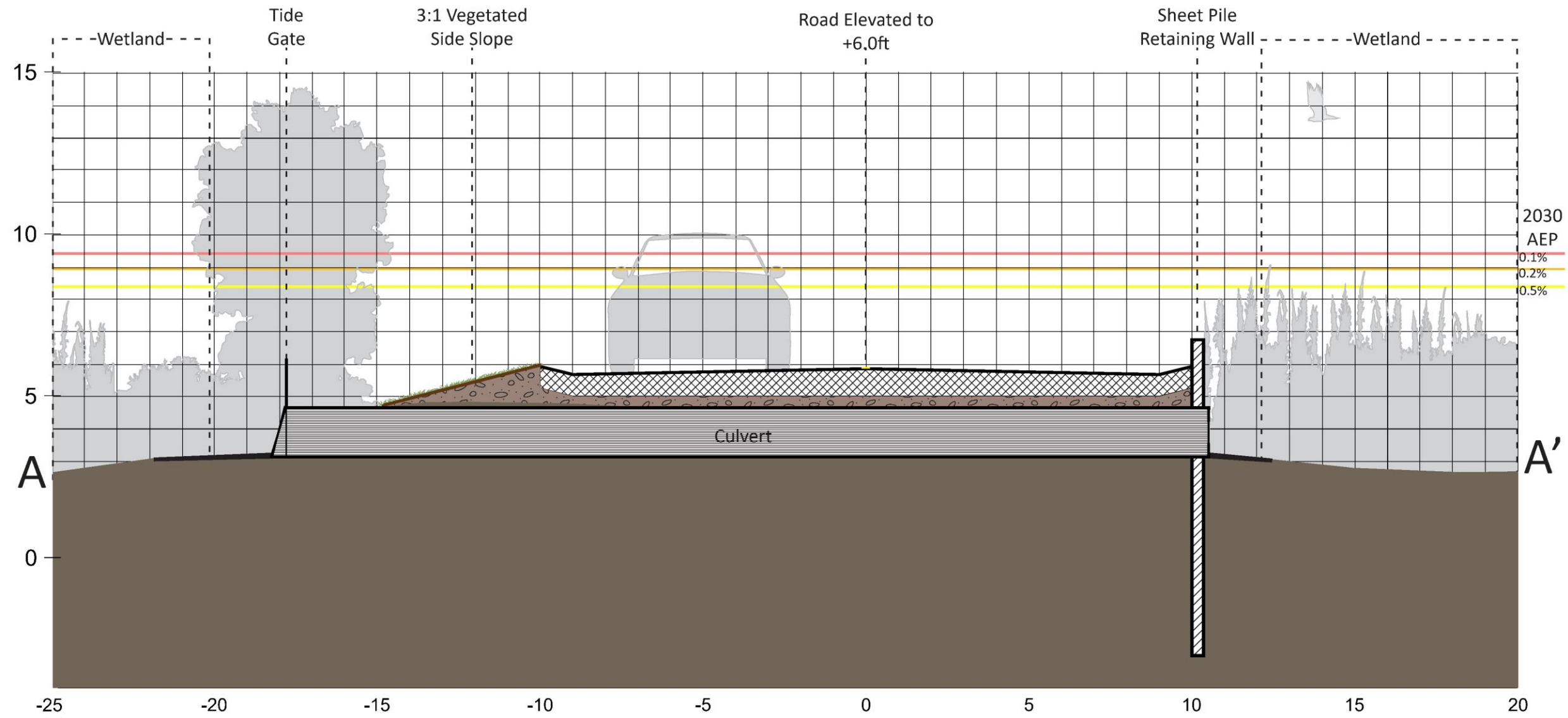
Governor Prence Road EASTHAM

ALTERNATIVE 1: GRAY

672 linear feet of Town-owned road is elevated from a lowest point of 4.1 feet to a lowest point of 6.0 feet. A larger culvert and tide gate are added.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

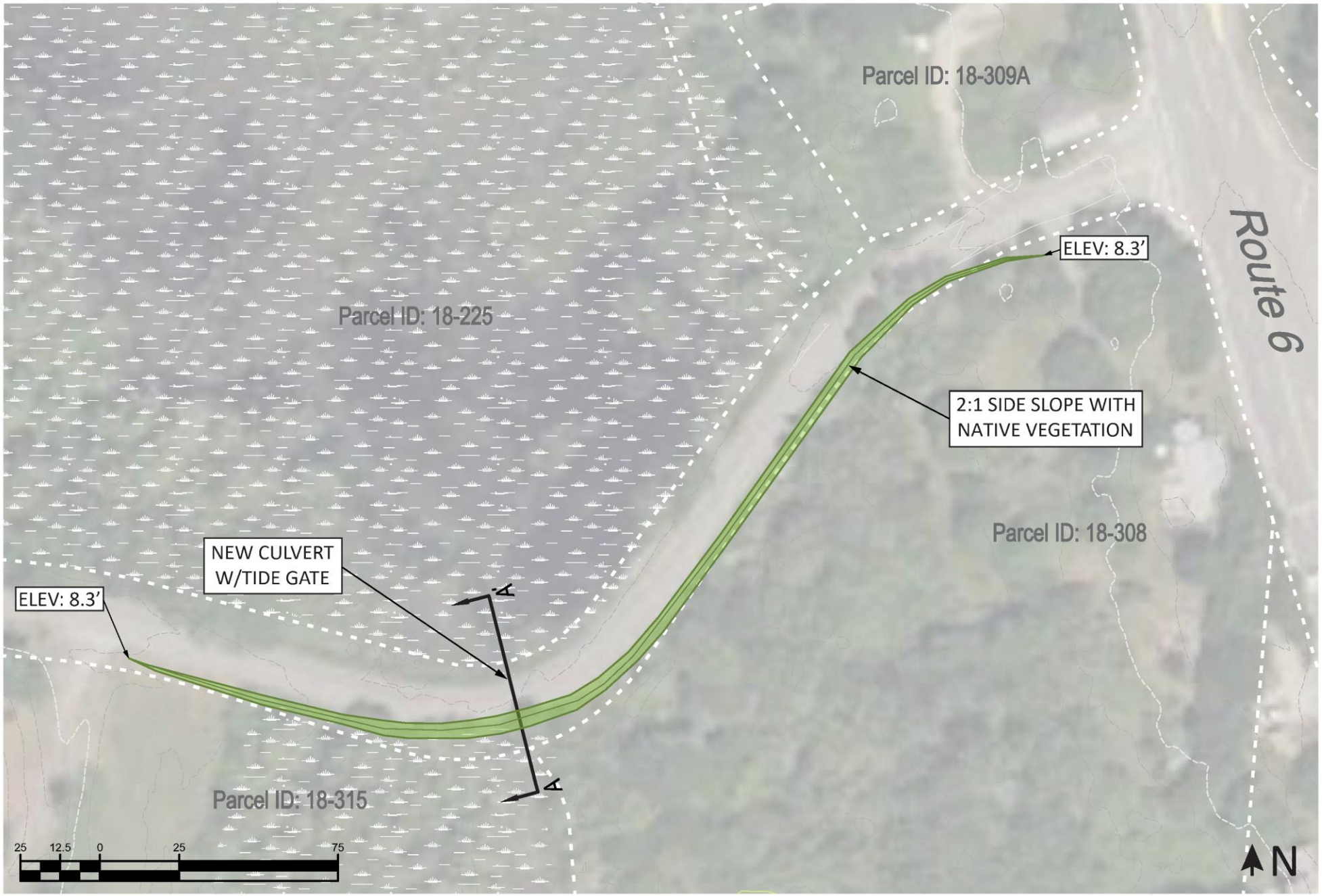
WOODS HOLE GROUP
A CLS COMPANY

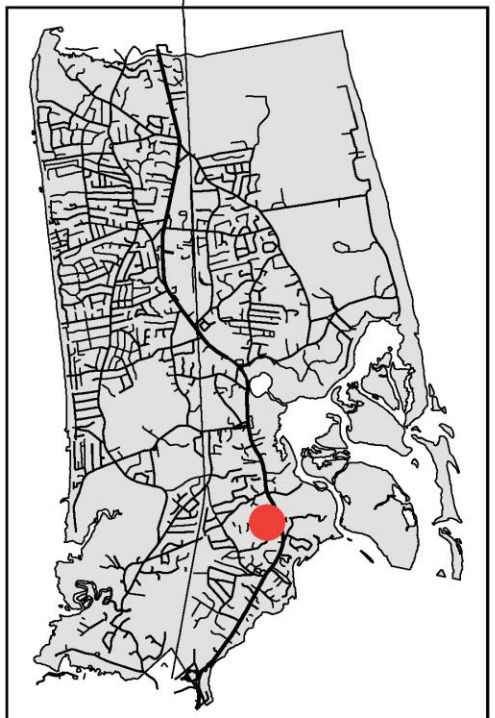


ALTERNATIVE 1: GRAY

Governor Prence Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY





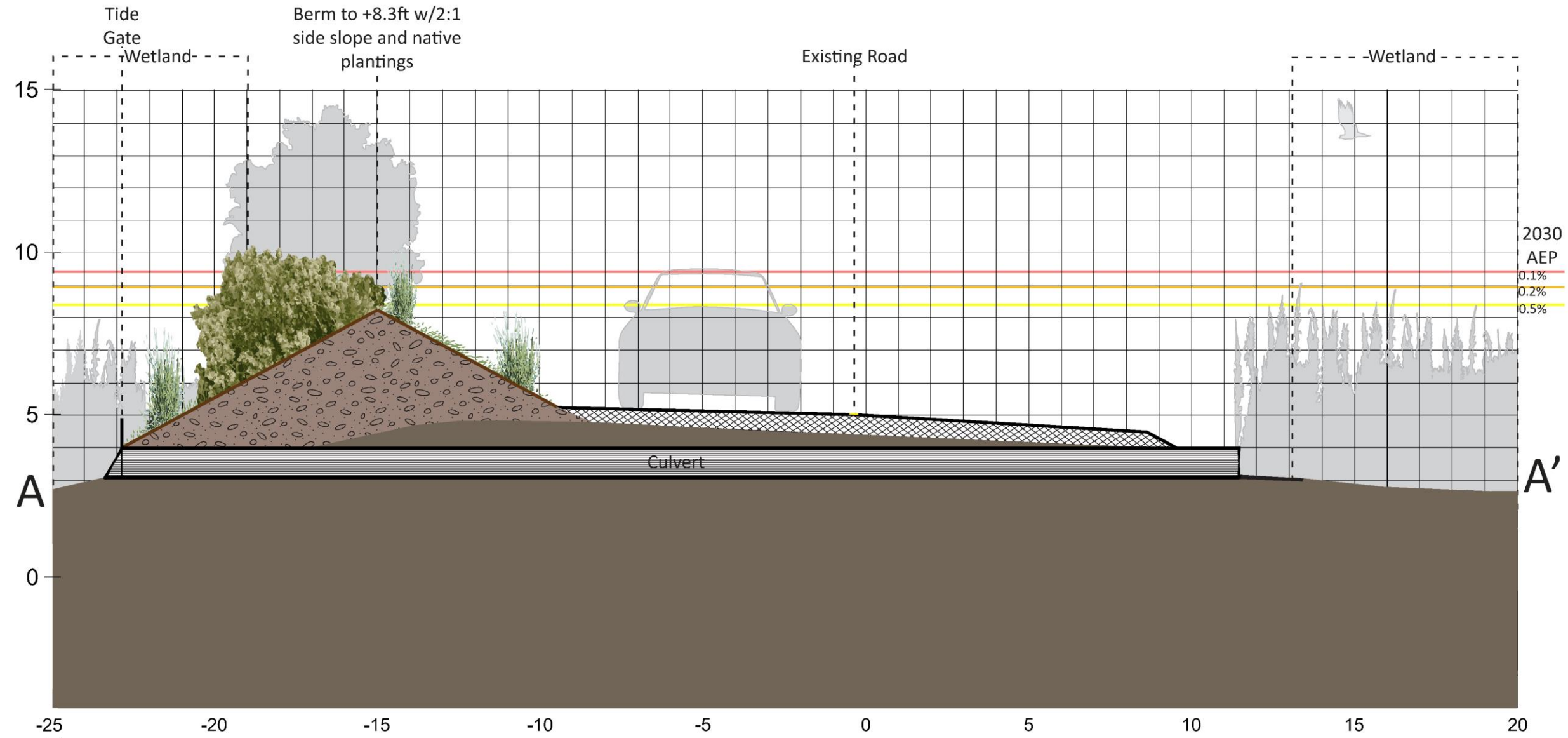
Governor Prence Road EASTHAM

ALTERNATIVE 2: HYBRID

680 linear feet of berm at elevation 8.3 feet is added on the southern side of the road. A 2:1 slope is used to minimize overlap with resource areas and private property, and the berm is planted with native vegetation. A new culvert and tide gate are added.

WOODS HOLE GROUP
A CLS COMPANY

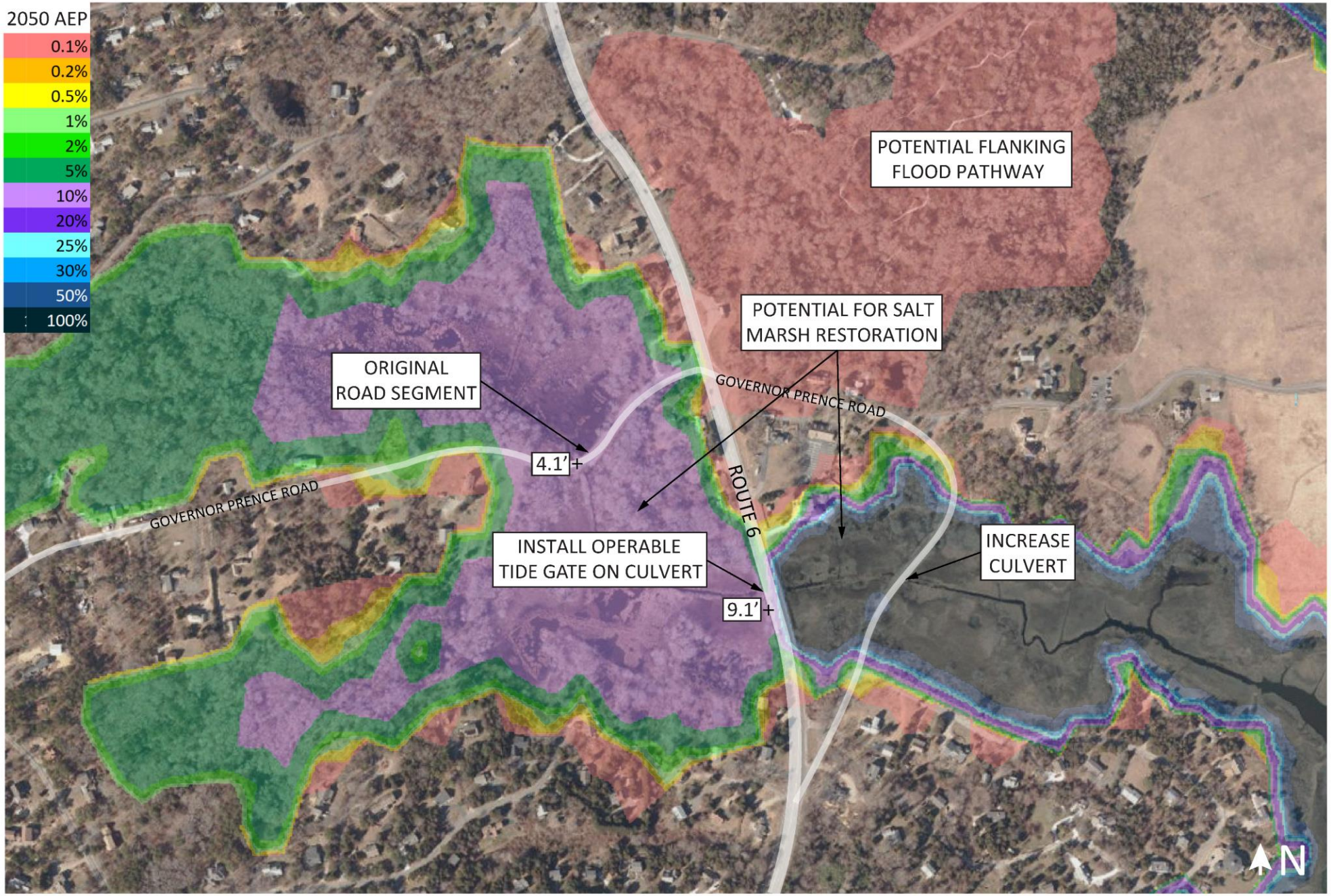
Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

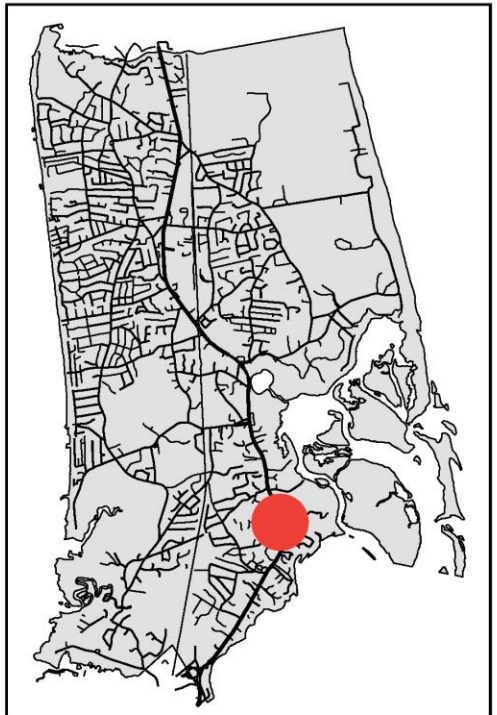


ALTERNATIVE 2: HYBRID

Governor Prence Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY





Governor Prence Road EASTHAM

ALTERNATIVE 3: GREEN

A larger culvert is installed at the eastern tidal creek crossing of Governor Prence Road, and a tide gate is installed at Route 6 to allow the highway to act as a flood protection berm. The low lying road segment is protected to 9.1 feet. 2050 Flood Exceedance Probabilities are shown.

WOODS HOLE GROUP
A CLS COMPANY

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

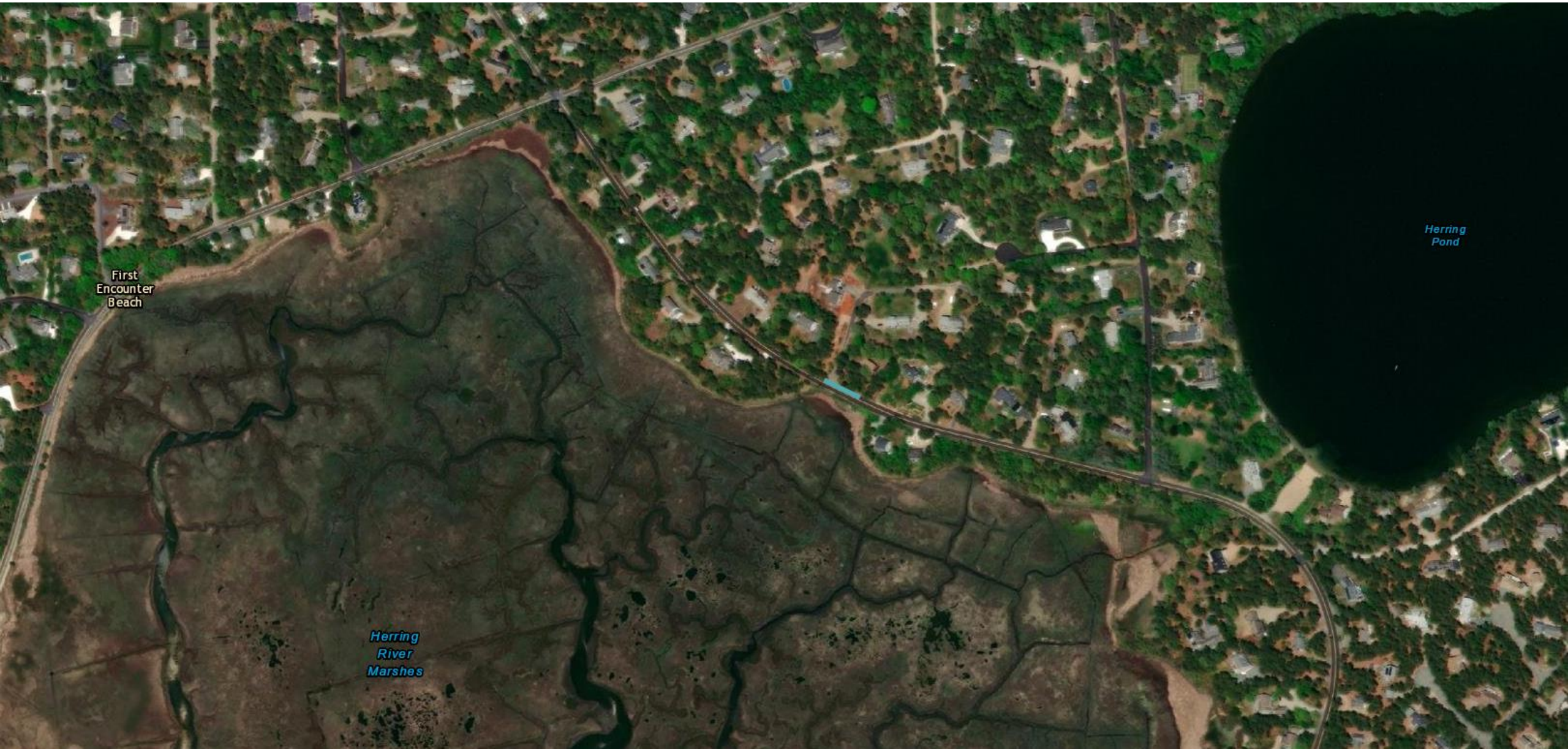
GOVERNOR PRENCE ROAD, EASTHAM

Summary of alternatives

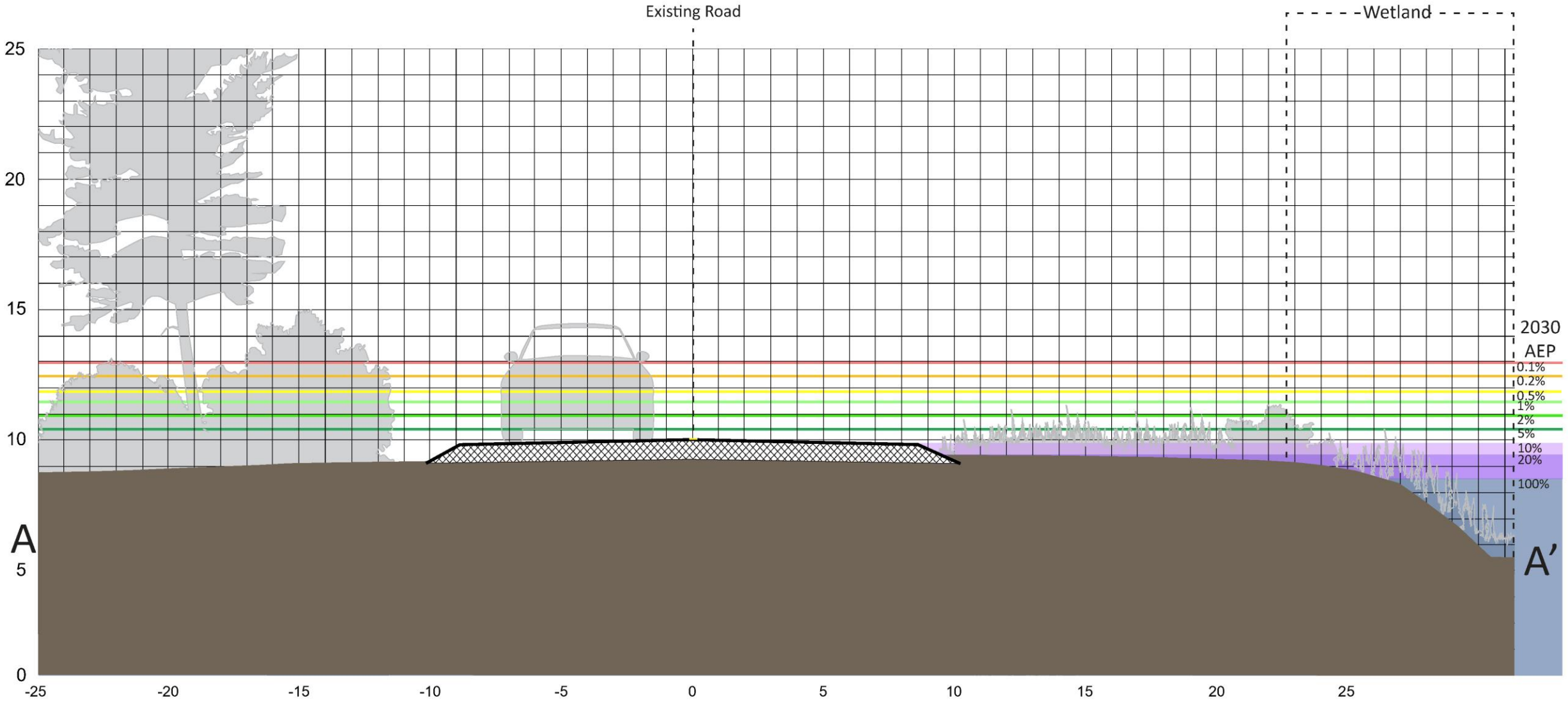
	Description	Critical Elevation	Annual Exceedance Probability			Vulnerable to Tidal Flooding	Impacts to Wetlands	Impacts to Private Property	Estimated Cost*
			2030	2050	2070				
EXISTING	A segment of 19ft wide road with adjacent marsh and a culvert crossing.	4.1 feet	0.5%	10%	100%	2050	N/A	N/A	N/A
ALTERNATIVE 1: GRAY	672 linear feet of Town-owned road are elevated from a lowest point of 4.1 feet to a lowest point of 6.0 feet. A larger culvert and tide gate are added.	6.0 feet	0.5%	10%	100%	2070	Possible Negative	Yes	$195,000
ALTERNATIVE 2: HYBRID	680 linear feet of berm at elevation 8.3 feet are added on the southern side of the road. A 2:1 slope is used to minimize overlap with resource areas and private property, and the berm is planted with native vegetation. A new culvert and tide gate are added.	8.3 feet	0.5%	10%	100%	N/A	Possible Negative	Yes	$96,000
ALTERNATIVE 3: GREEN	A larger culvert is installed at the eastern tidal creek crossing of Governor Prence Road, and a tide gate is installed at Route 6 to allow the highway to act as a flood protection berm. The low lying road segment is protected to 9.1 feet with no modifications.	9.1 feet	0.2%	2%	100%	N/A	Possible Positive	No	$50,000

*Installed material cost +20% contingency. Excludes design, permitting, mobilization, stormwater and wastewater infrastructure, and site controls. Costs based on RSMeans 2021 cost book and adjusted for inflation and region.

Herring Brook Road



Herring Brook Road



EXISTING CONDITIONS

Herring Brook Road, Eastham

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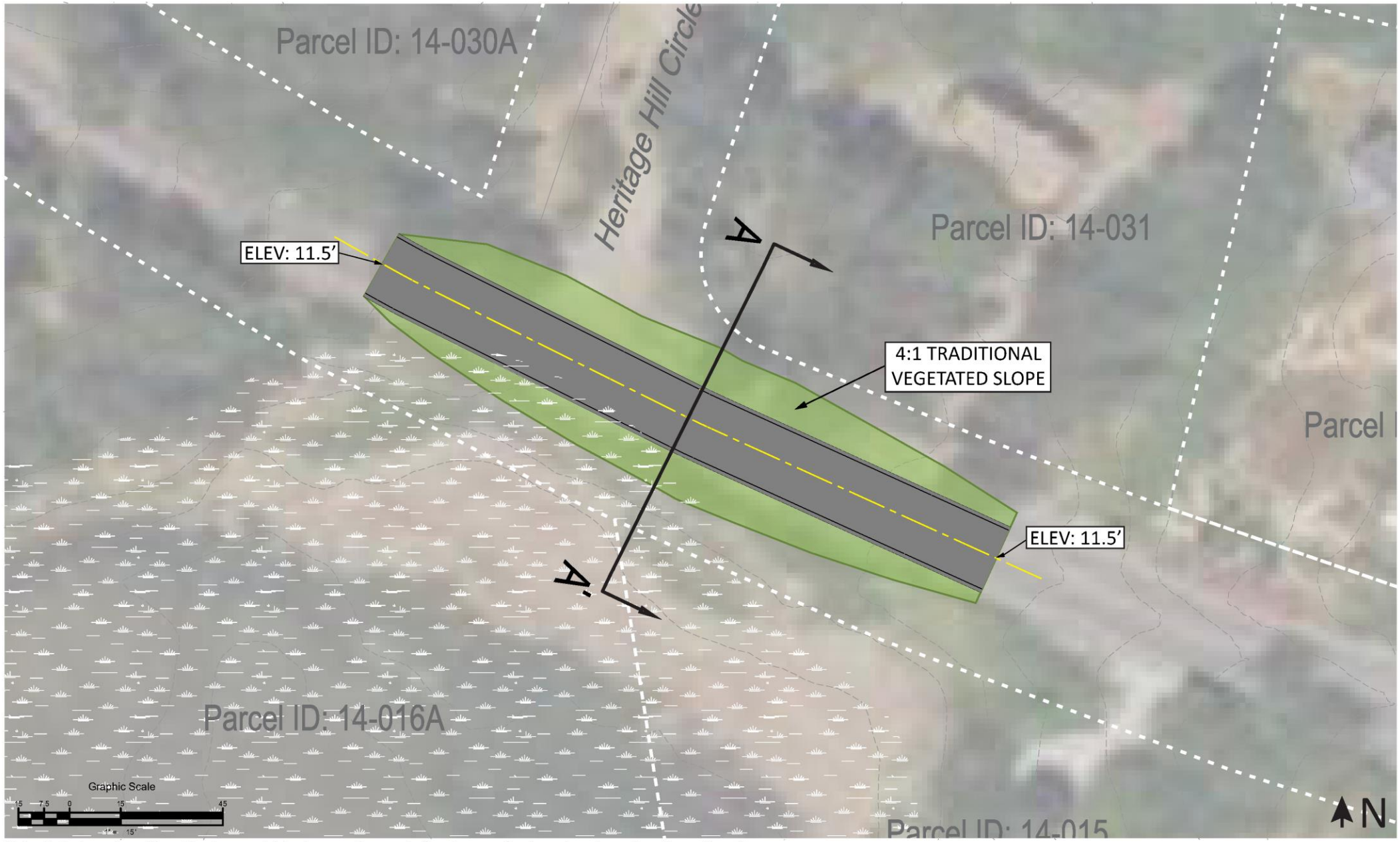

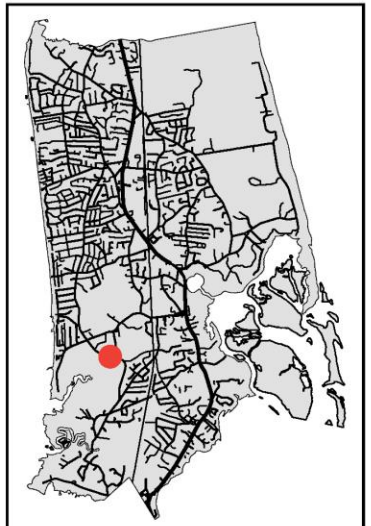

Herring Brook Road
EASTHAM

ALTERNATIVE 1: GRAY

200 linear feet of Town-owned road are elevated from a lowest point of 9.3 feet to a lowest point of 11.5 feet.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

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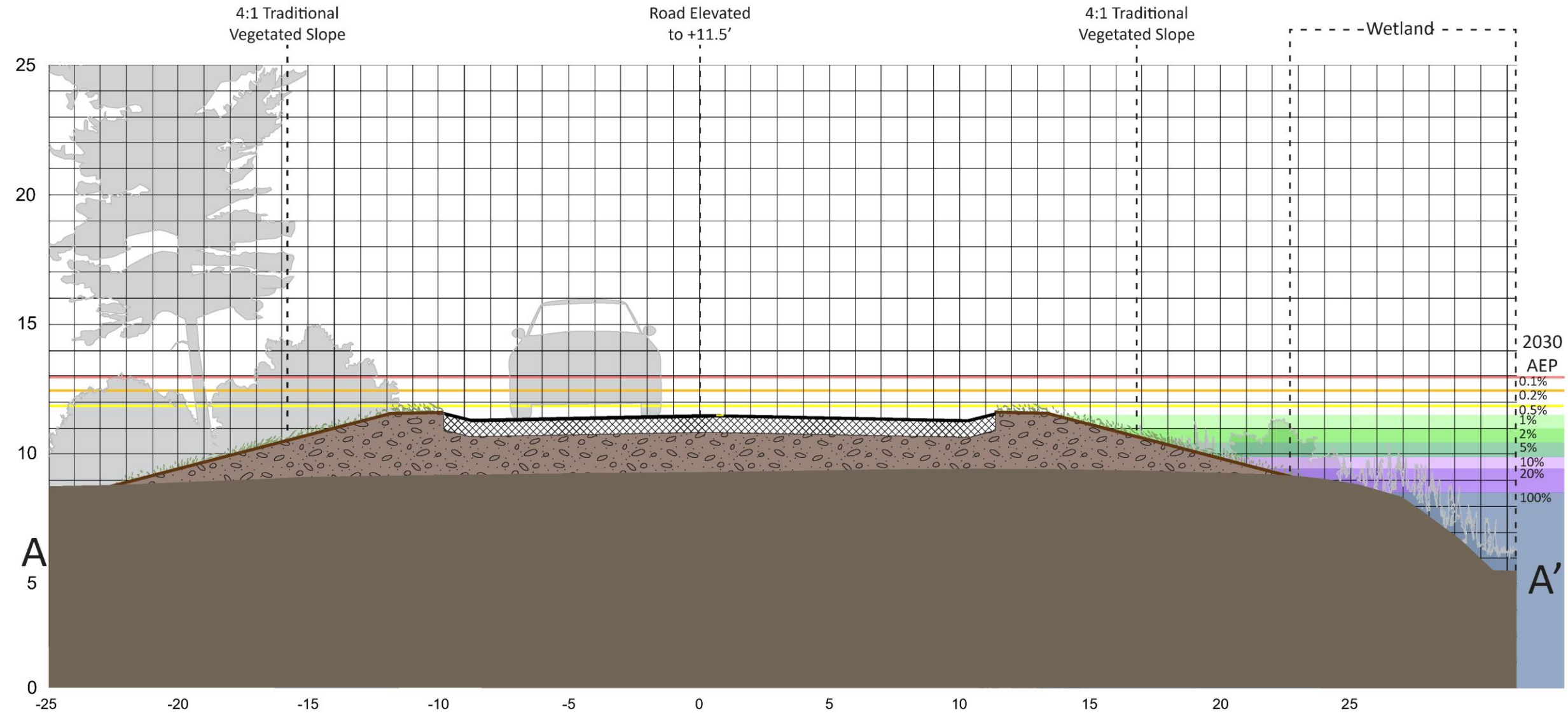

ALTERNATIVE 1: GRAY

Herring Brook Road, Eastham

WOODS HOLE GROUP
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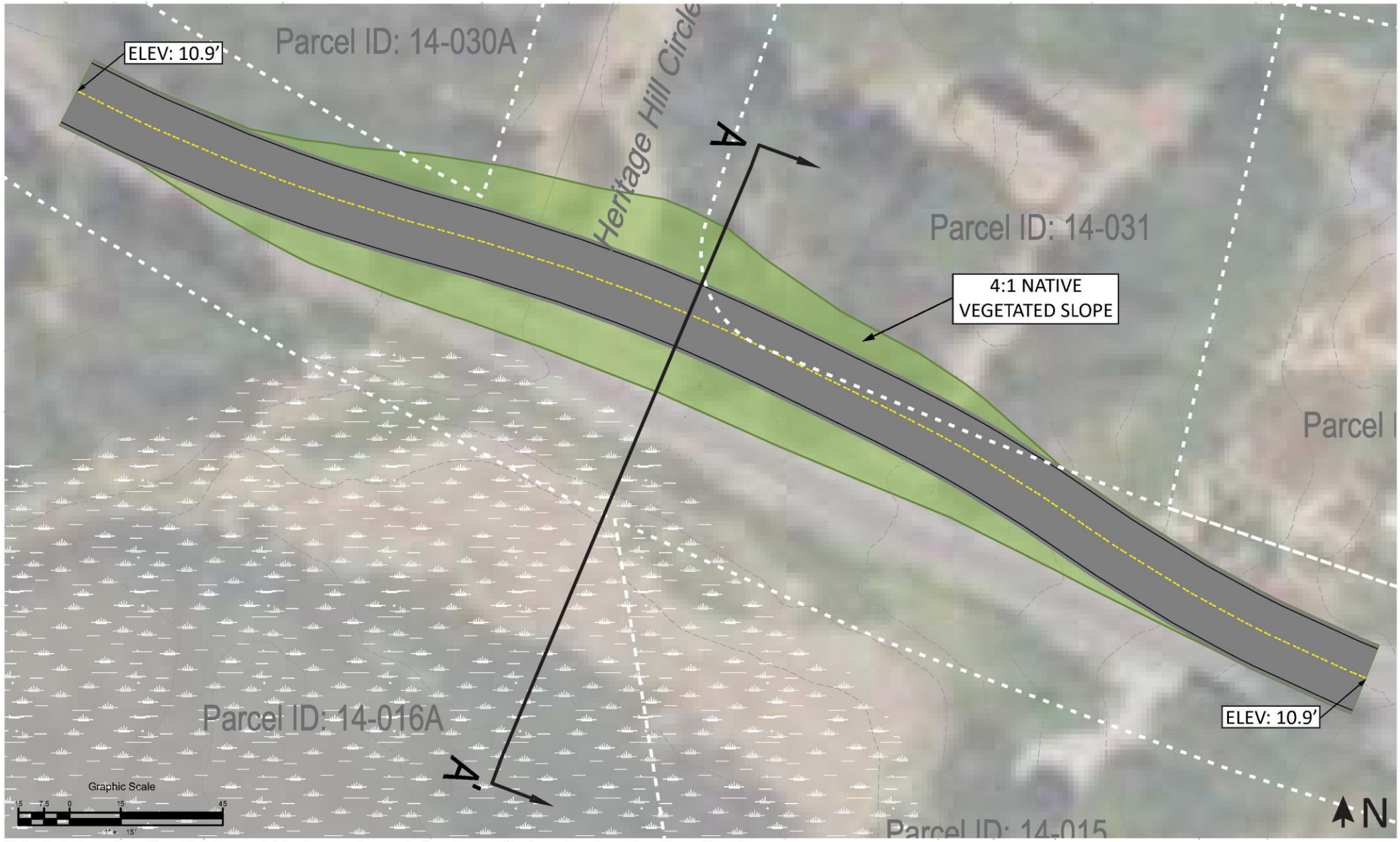
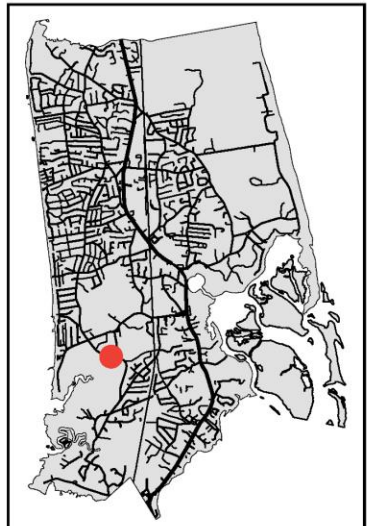




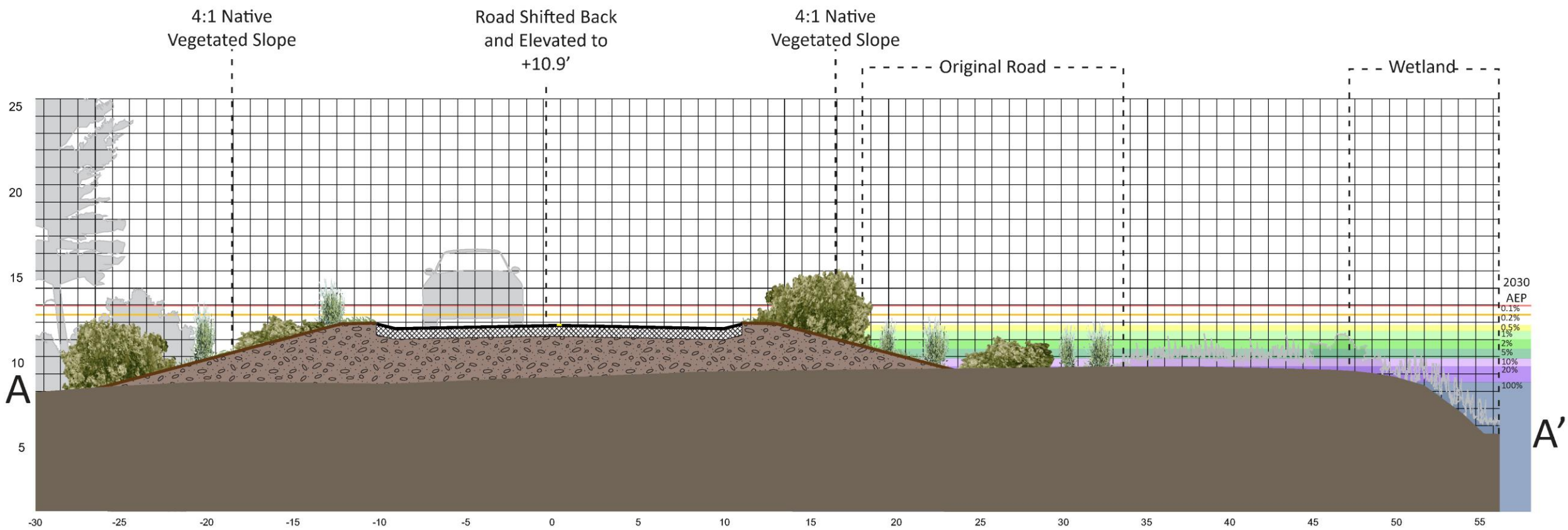
Herring Brook Road
EASTHAM

ALTERNATIVE 2: HYBRID

405 linear feet of Town-owned road are shifted back and elevated from a lowest point of 9.3 feet to a lowest point of 10.9 feet. Wetland impacts are mitigated, but project boundaries intersect with private property.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

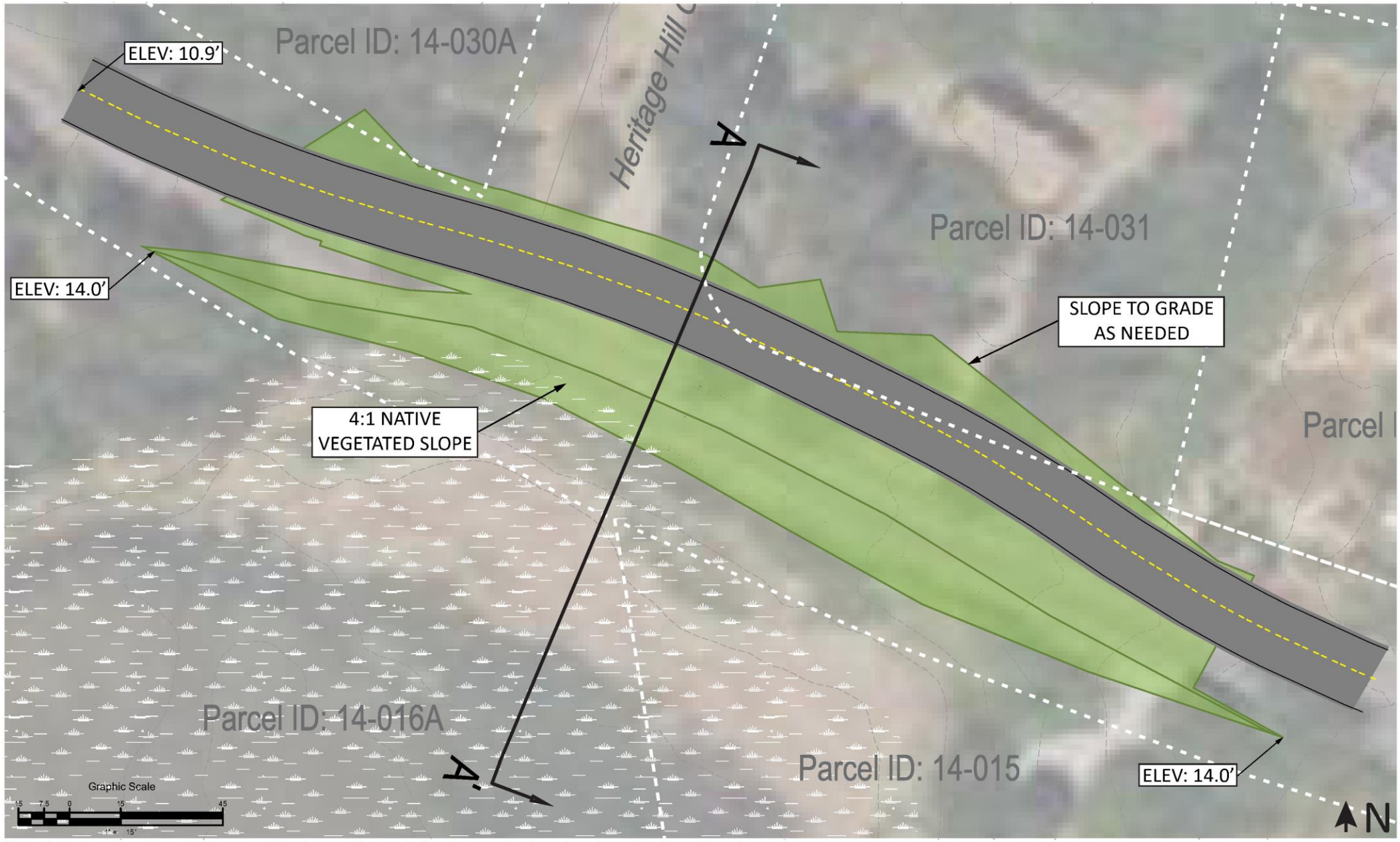
WOODS HOLE GROUP
A CLS COMPANY

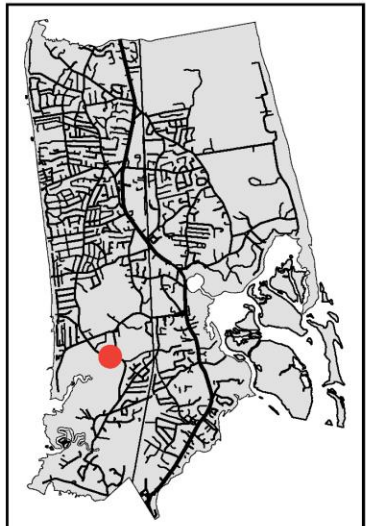


ALTERNATIVE 2: HYBRID

Herring Brook Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY





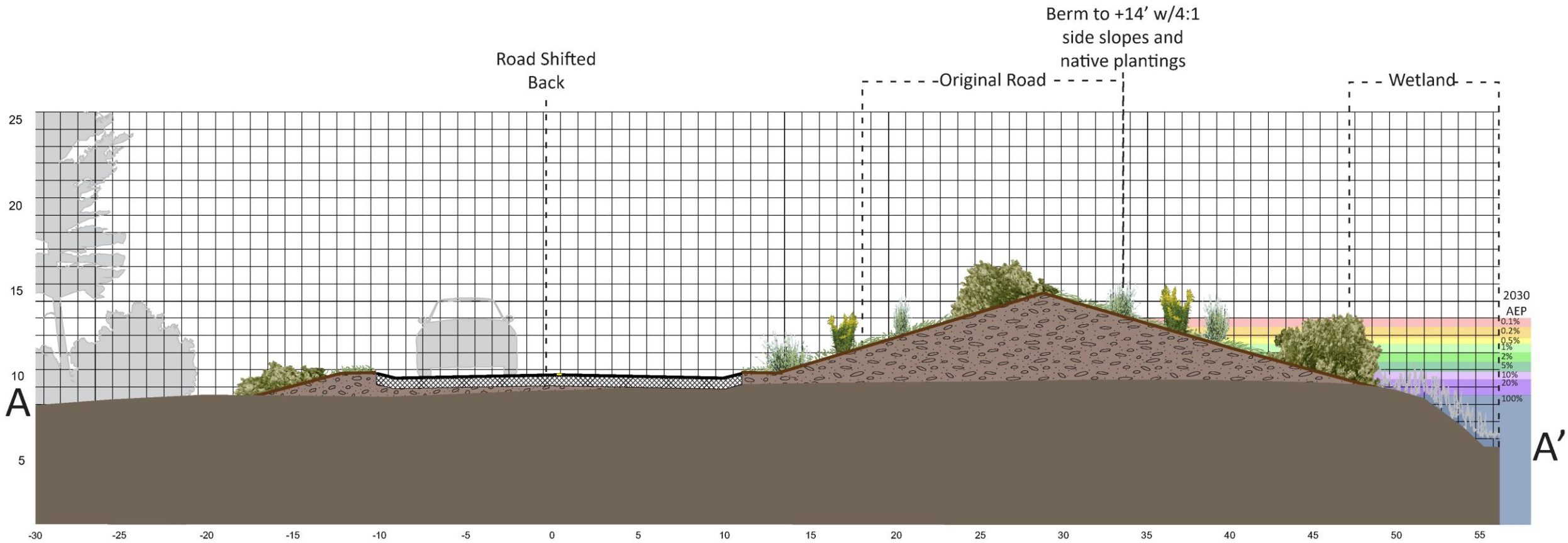
Herring Brook Road
EASTHAM

ALTERNATIVE 3: GREEN

405 linear feet of Town-owned road are shifted back from the water. A berm to 14.0 feet is constructed with a 4:1 slope on the seaward side of the road. Wetland impacts are mitigated, but project boundaries intersect with private property.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

WOODS HOLE GROUP
A CLS COMPANY



ALTERNATIVE 3: GREEN

Herring Brook Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY

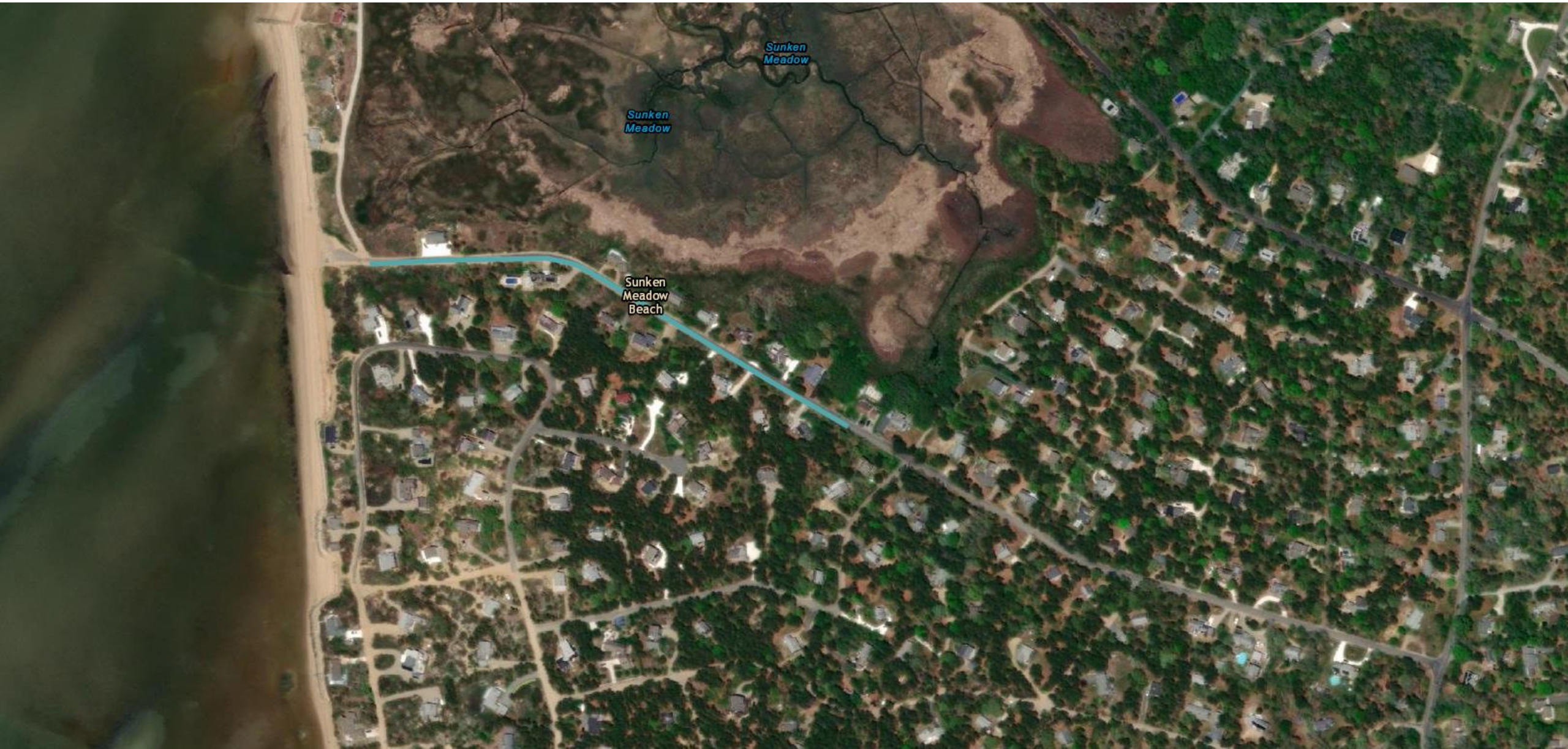
HERRING BROOK ROAD, EASTHAM

Summary of alternatives

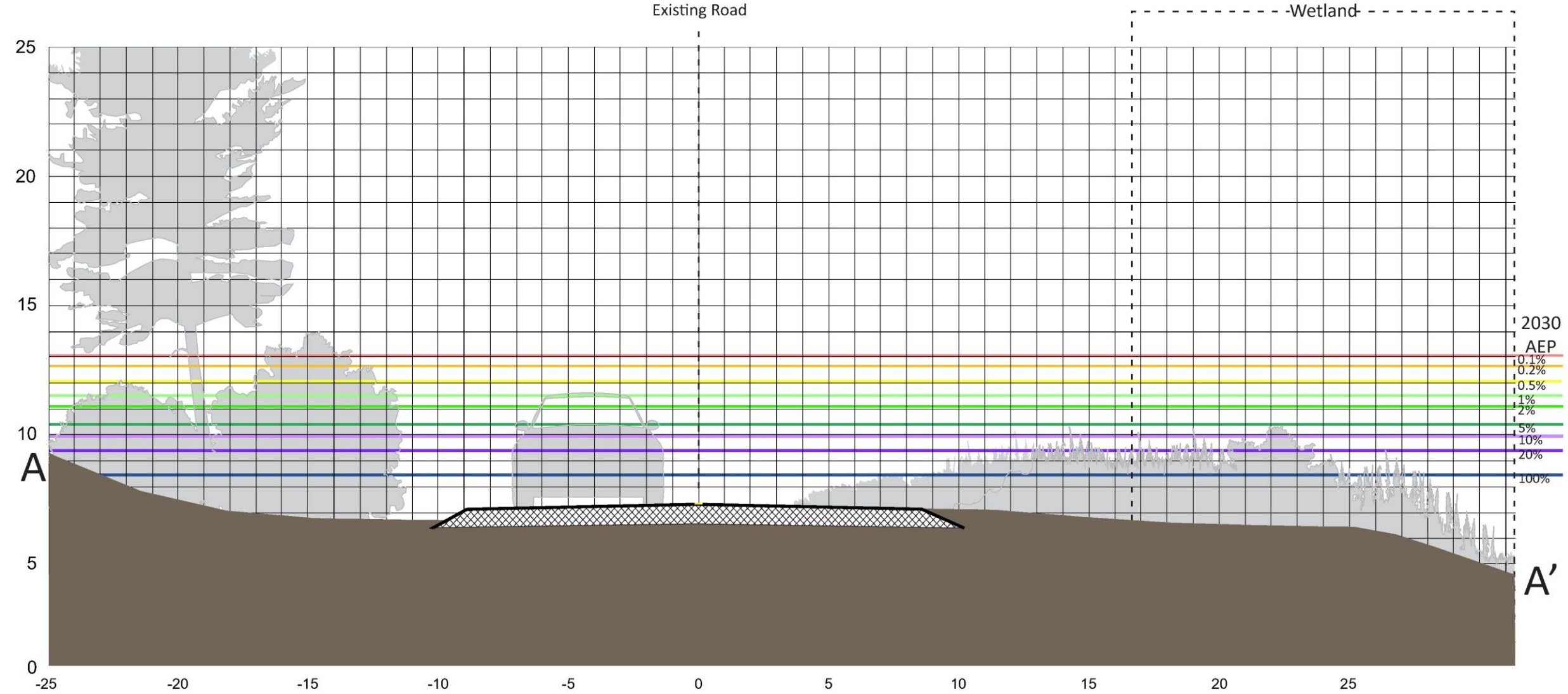
	Description	Critical Elevation	Annual Exceedance Probability			Vulnerable to Tidal Flooding	Impacts to Wetlands	Impacts to Private Property	Estimated Cost*
			2030	2050	2070				
EXISTING	A segment of 20ft wide road with adjacent coastal bank and salt marsh.	9.3 feet	20%	100%	100%	2070	N/A	N/A	N/A
ALTERNATIVE 1: GRAY	200 linear feet of Town-owned road are elevated from a lowest point of 9.3 feet to a lowest point of 11.5 feet.	11.5 feet	1%	10%	100%	N/A	Negative	No	$65,000
ALTERNATIVE 2: HYBRID	405 linear feet of Town-owned road are shifted back and elevated from a lowest point of 9.3 feet to a lowest point of 10.9 feet. Wetland impacts are mitigated, but project boundaries intersect with private property.	10.9 feet	2%	20%	100%	N/A	None	Yes	$131,000
ALTERNATIVE 3: GREEN	405 linear feet of Town-owned road are shifted back from the water. A berm to 14.0 feet is constructed with a 4:1 slope on the seaward side of the road. Wetland impacts are mitigated, but project boundaries intersect with private property.	14 feet	0%	1%	5%	N/A	Possible Negative	Yes	$174,000

*Installed material cost +20% contingency. Excludes design, permitting, mobilization, stormwater and wastewater infrastructure, and site controls. Costs based on RSMeans 2021 cost book and adjusted for inflation and region.

South Sunken Meadow Road



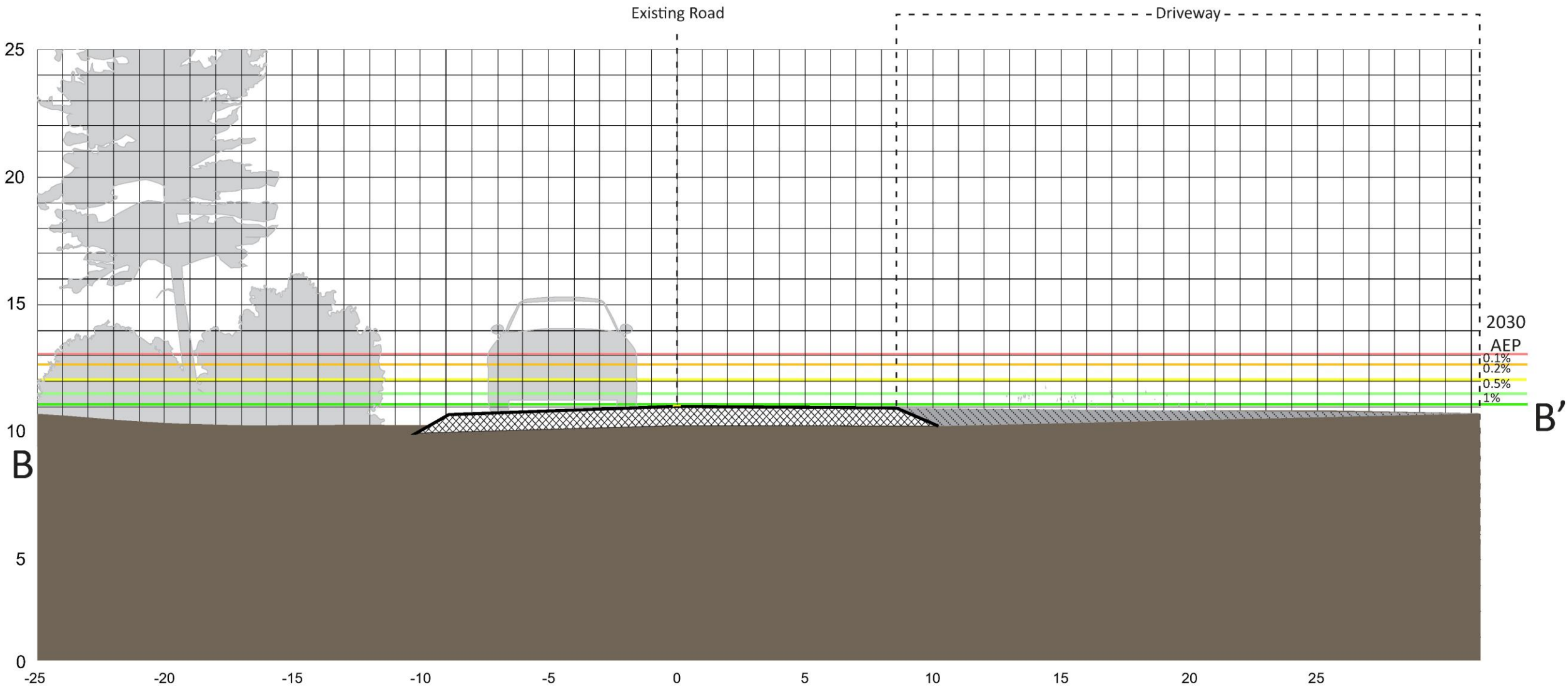
South Sunken Meadow Road



EXISTING CONDITIONS

South Sunken Meadow Road, Eastham

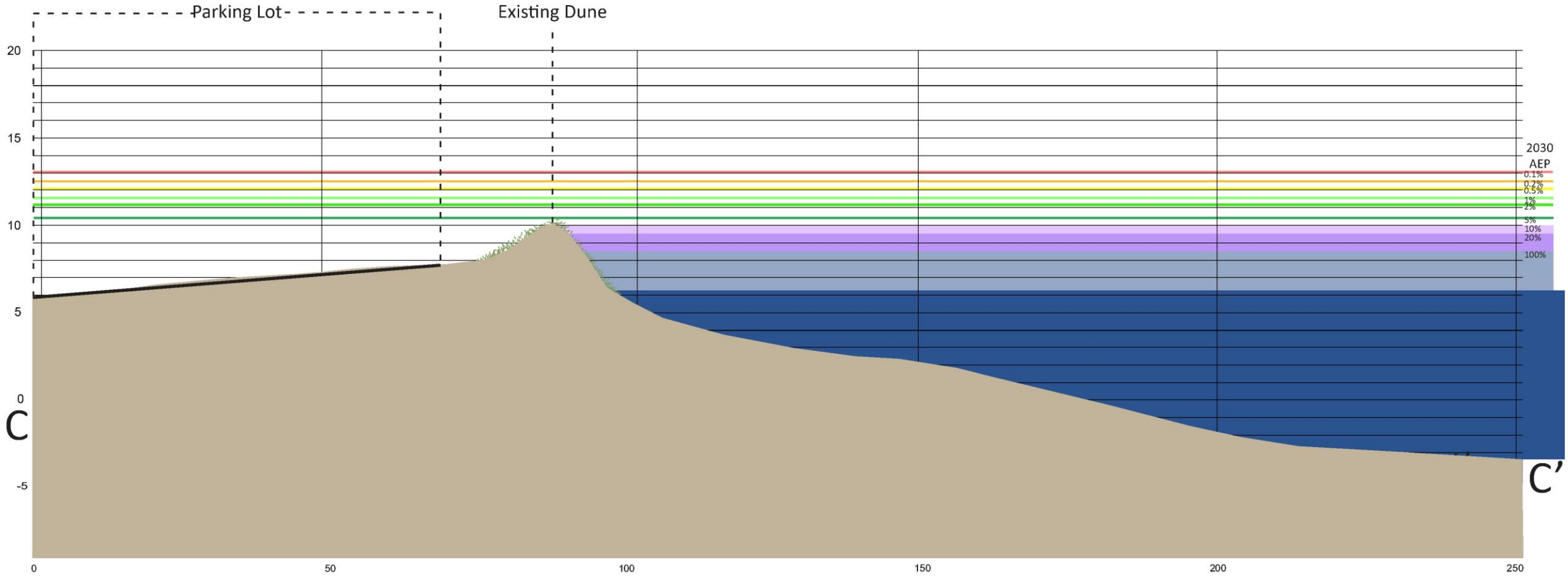
WOODS HOLE GROUP
A CLS COMPANY



EXISTING CONDITIONS

South Sunken Meadow Road, Eastham

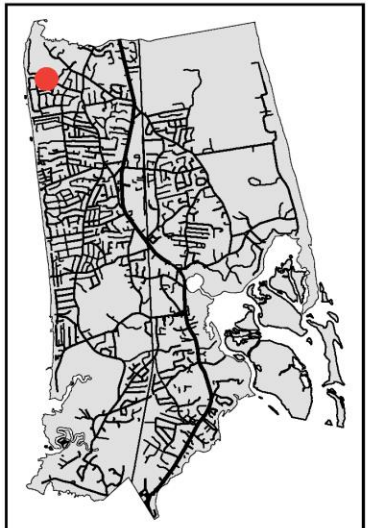
WOODS HOLE GROUP
A CLS COMPANY



EXISTING CONDITIONS

South Sunken Meadow Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY



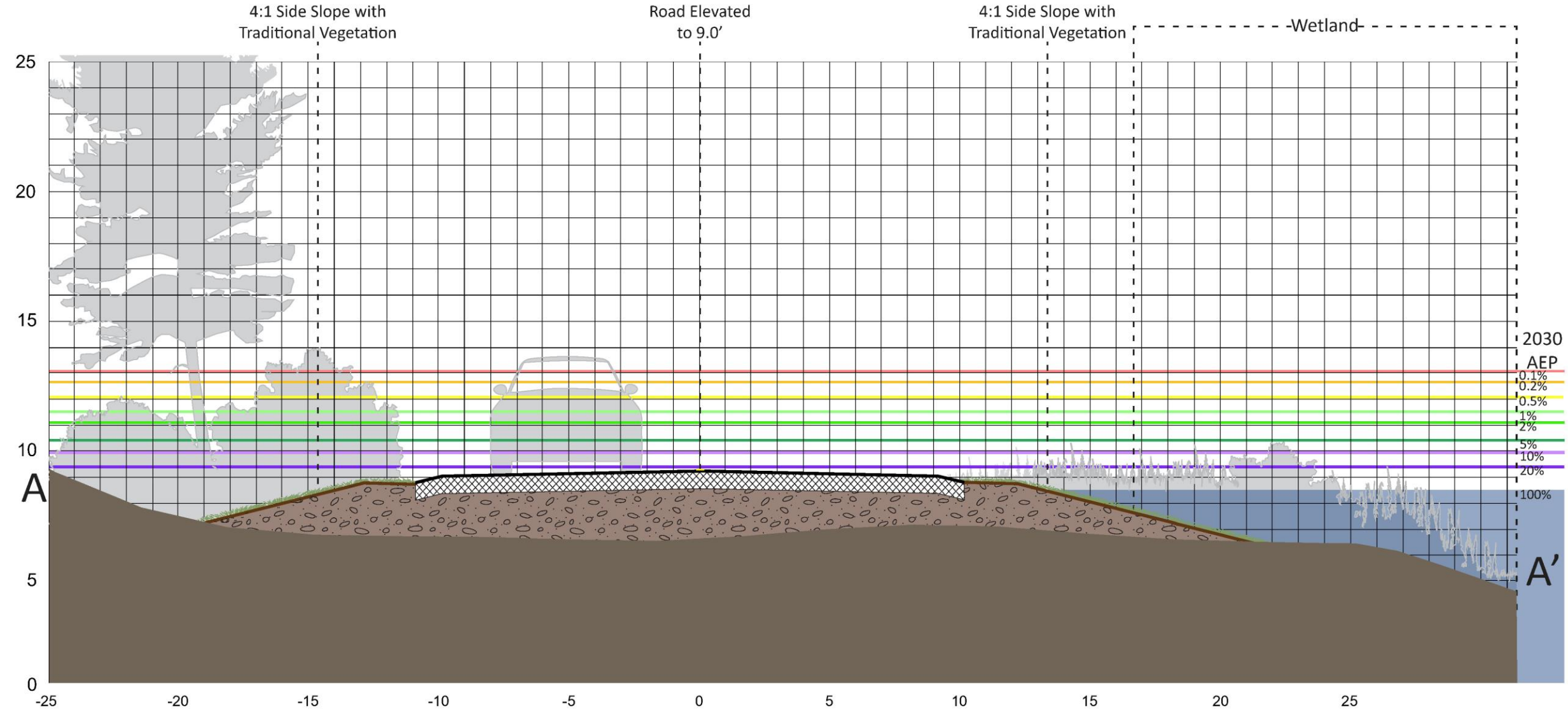
South Sunken Meadow Road
EASTHAM

ALTERNATIVE 1: GRAY

1721 linear feet of Town-owned road are elevated from a lowest point of 6.3 feet to a lowest point of 9 feet with a 4:1 traditionally vegetated side slope. Driveway tie-ins in the eastern part of the road are necessary.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

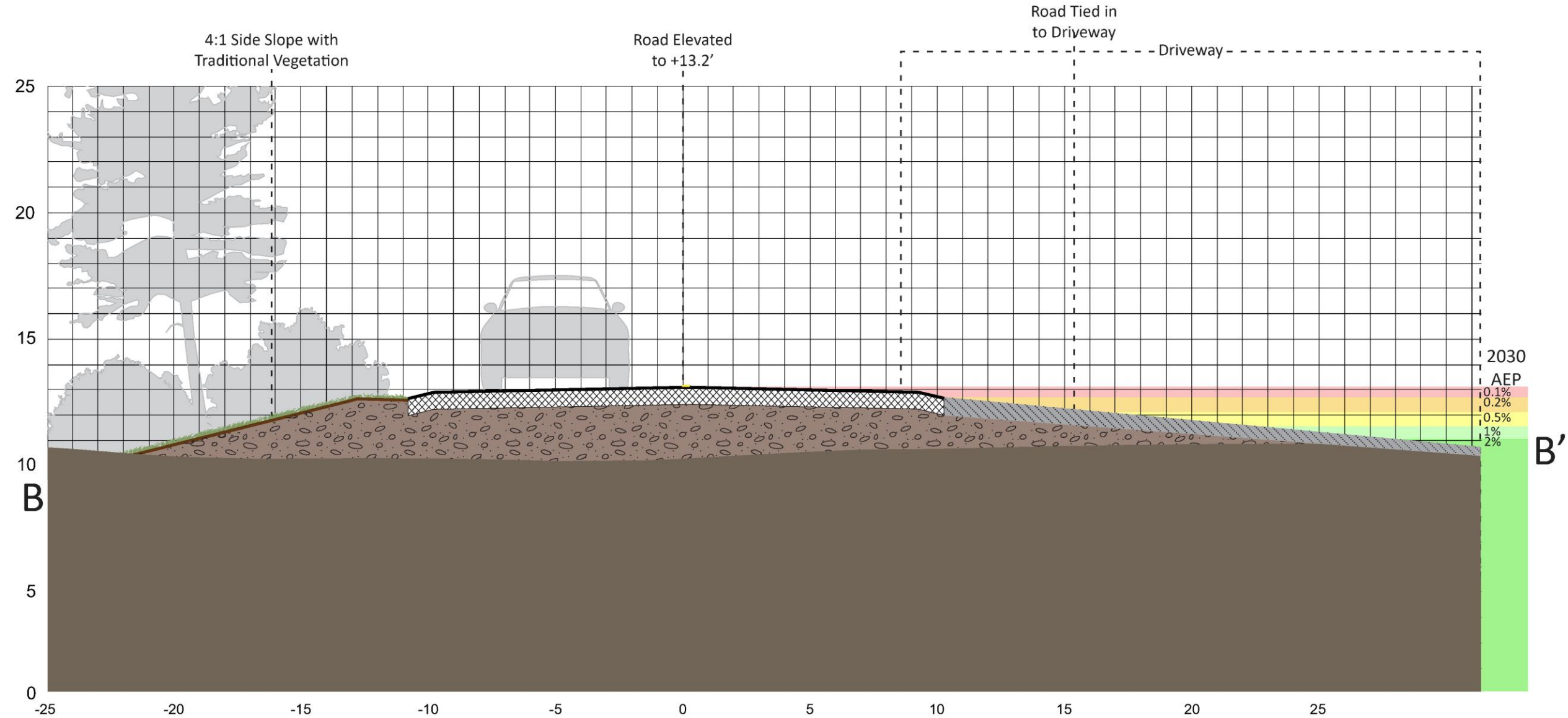
WOODS HOLE GROUP
A CLS COMPANY



ALTERNATIVE 1:GRAY

South Sunken Meadow Road, Eastham

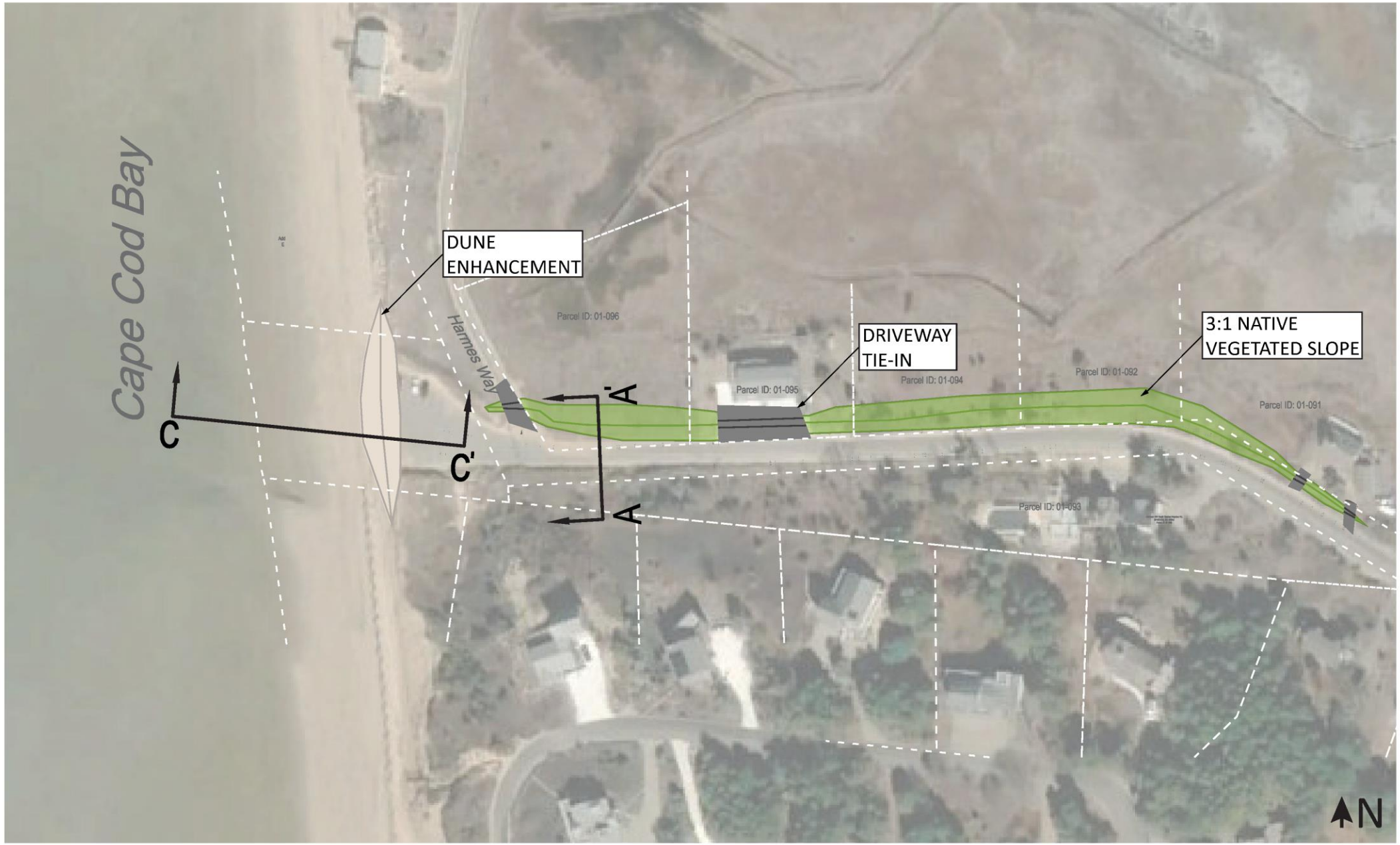
WOODS HOLE GROUP
A CLS COMPANY

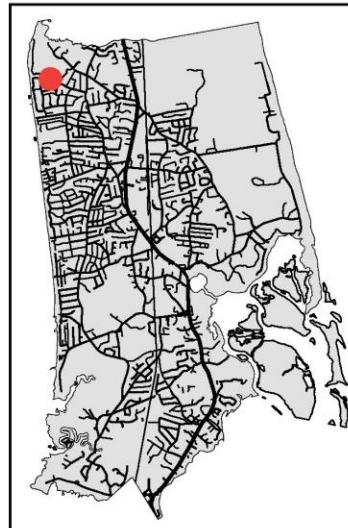


ALTERNATIVE 1:GRAY

South Sunken Meadow Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY



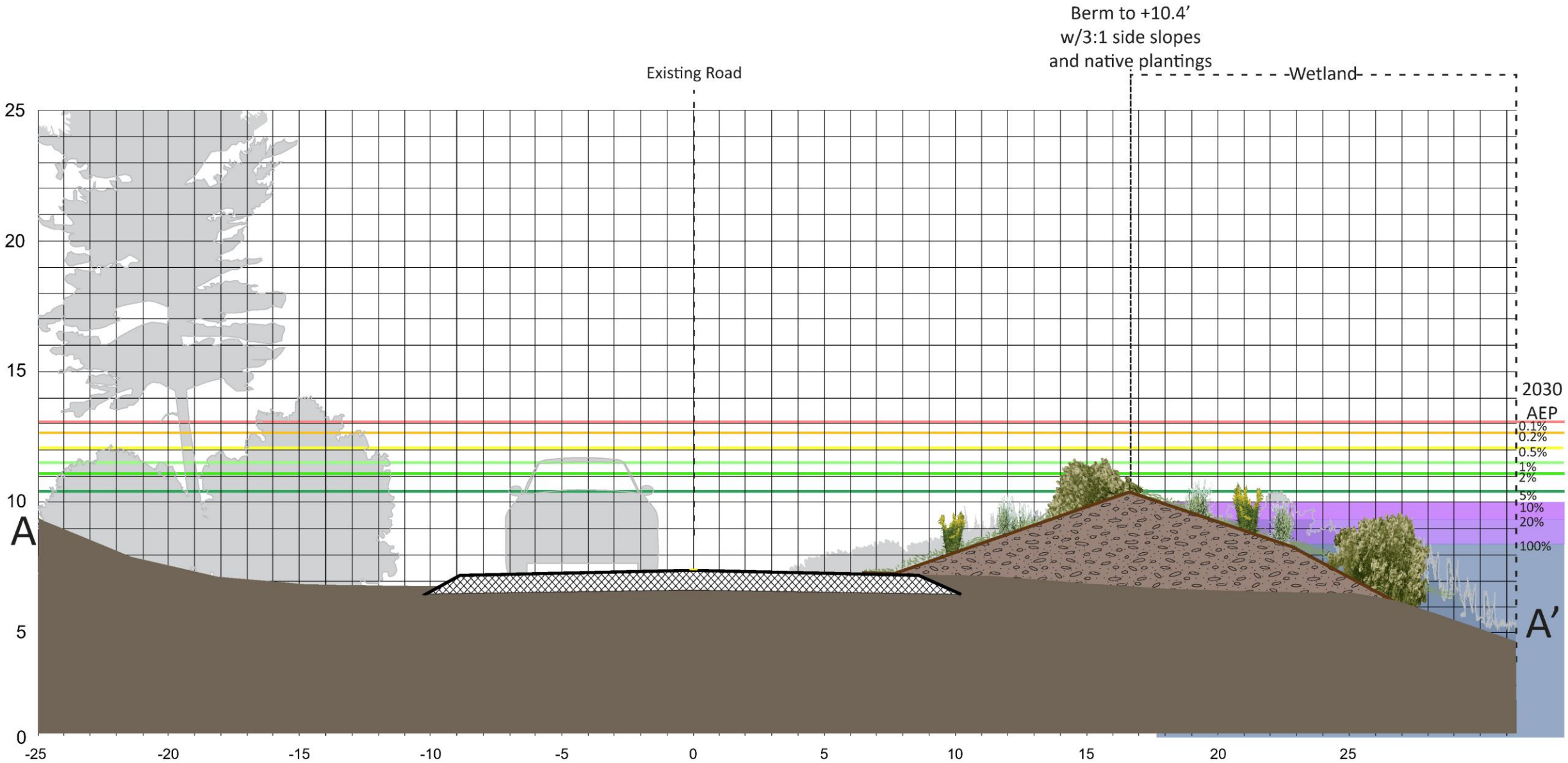


South Sunken Meadow Road
EASTHAM

ALTERNATIVE 2: HYBRID

A berm to 10.4 feet with a 3:1 side slope planted with native vegetation is added on the northern side of the road. The dune is also enhanced to an elevation of 10.4 feet, and one row of parking spaces is eliminated. Driveway tie-ins at the eastern end of the berm are necessary.

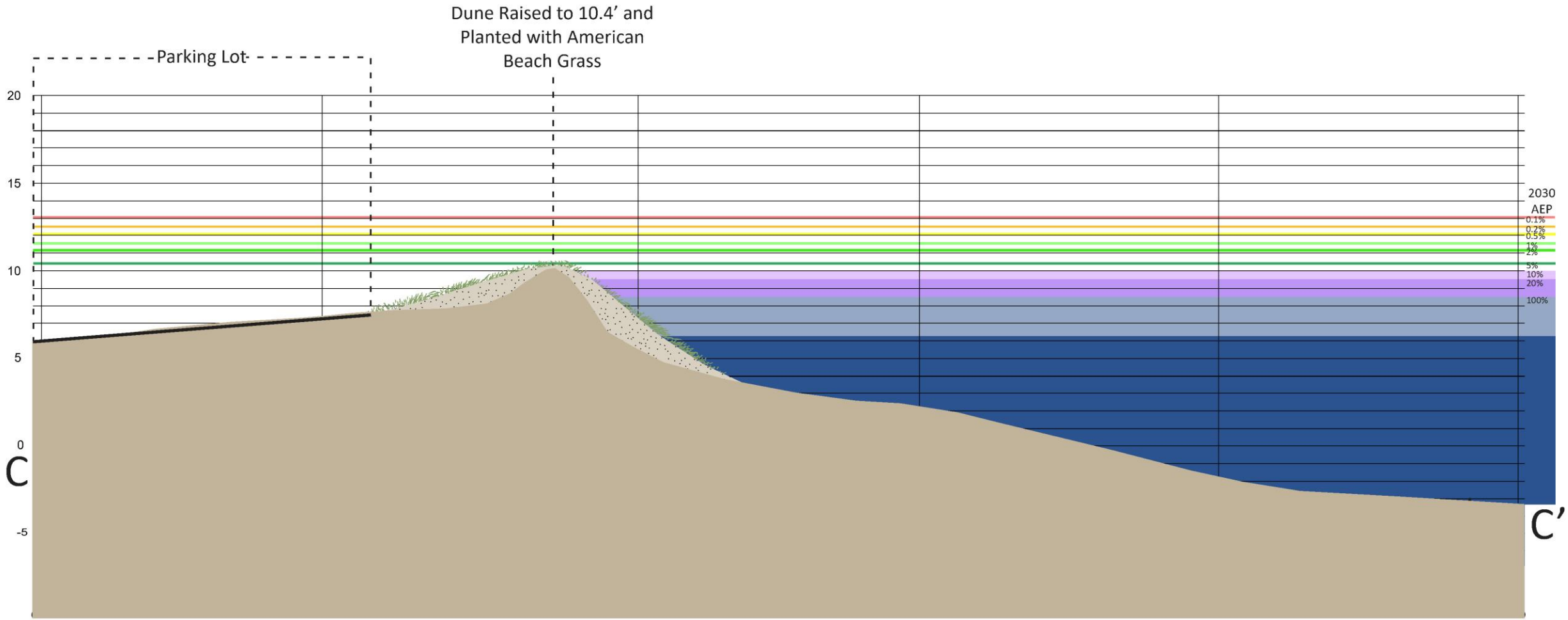
Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey



ALTERNATIVE 2: HYBRID

South Sunken Meadow Road, Eastham

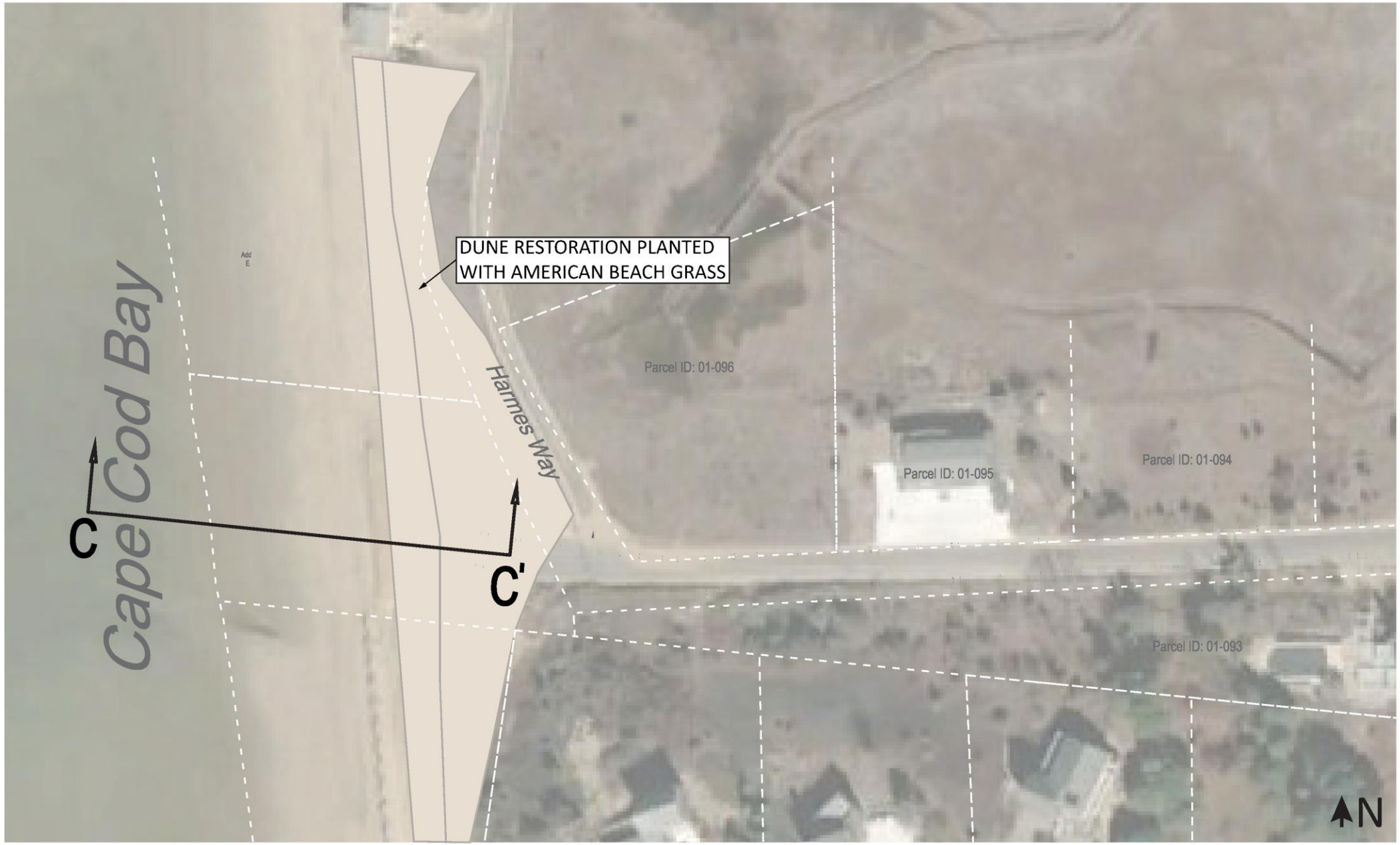
WOODS HOLE GROUP
A CLS COMPANY

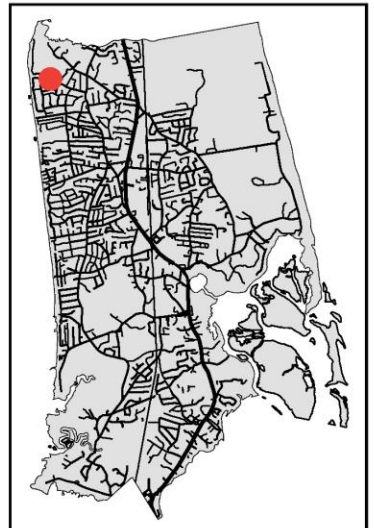


ALTERNATIVE 2: HYBRID

South Sunken Meadow Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY



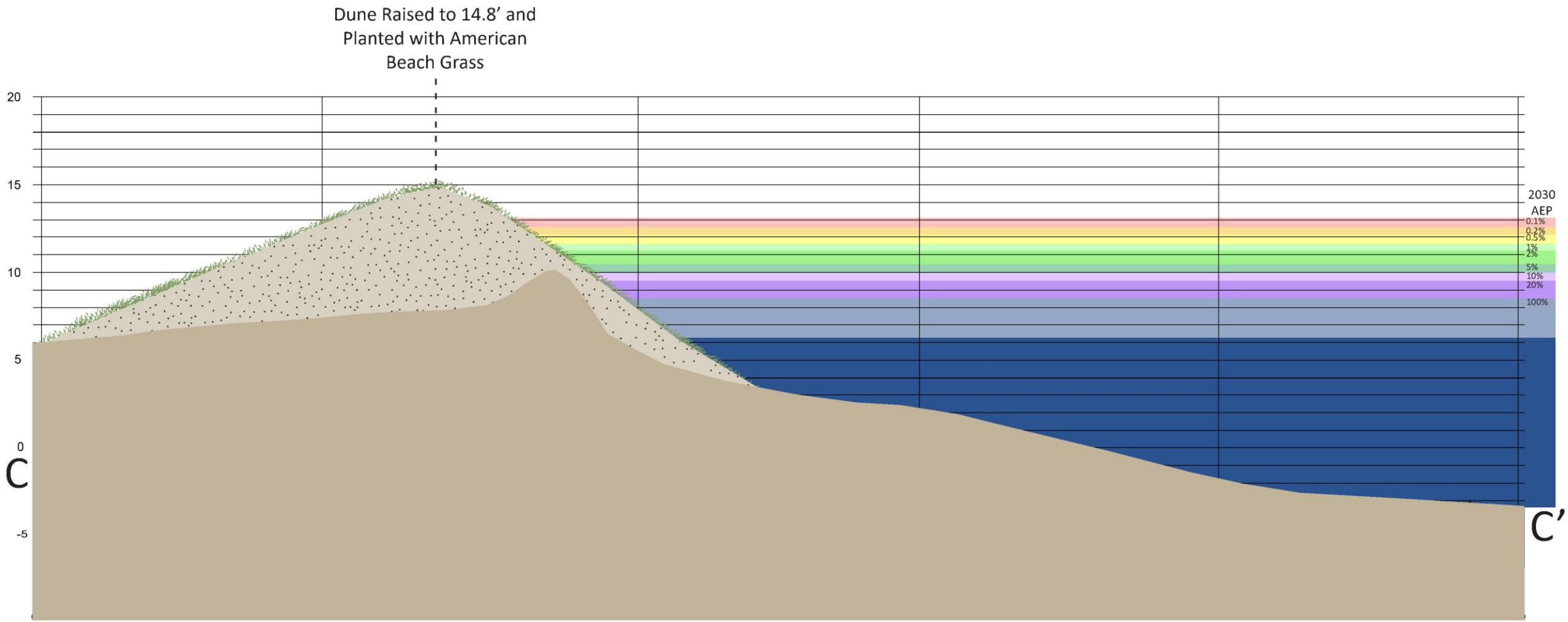


South Sunken Meadow Road
EASTHAM

ALTERNATIVE 3: GREEN

The beach parking lot is eliminated, and the dune is restored to 14.8 feet. Alternative parking locations would need to be explored.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey



ALTERNATIVE 3: GREEN

South Sunken Meadow Road, Eastham

WOODS HOLE GROUP
A CLS COMPANY

SOUTH SUNKEN MEADOW ROAD, EASTHAM

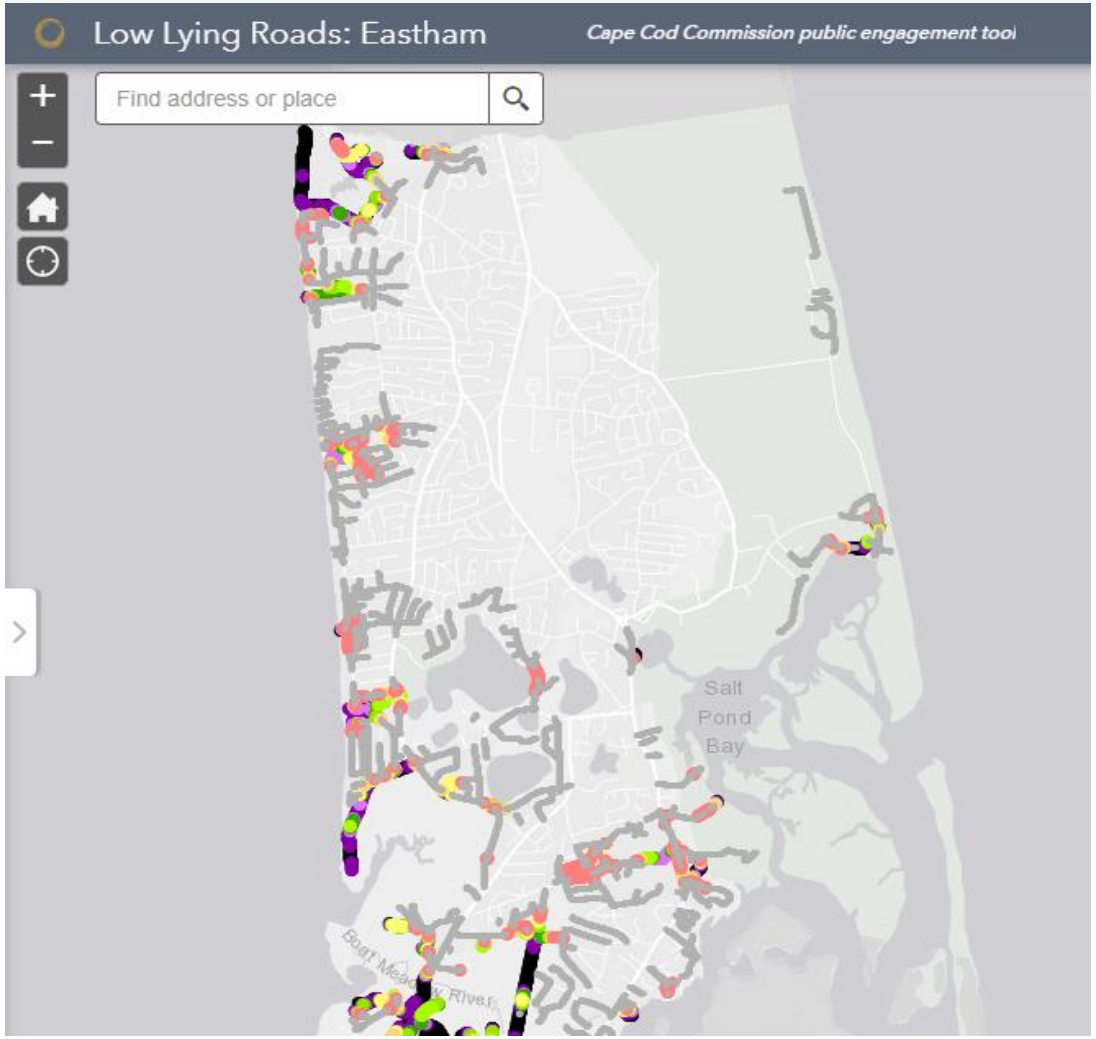
Summary of alternatives

	Description	Critical Elevation	Annual Exceedance Probability			Vulnerable to Tidal Flooding	Impacts to Wetlands	Impacts to Private Property	Estimated Cost*
			2030	2050	2070				
EXISTING	A 20ft wide road adjacent to a marsh that ends in a beach parking lot.	6.3 feet	100%	100%	100%	2050	N/A	N/A	N/A
ALTERNATIVE 1: GRAY	1721 linear feet of Town-owned road are elevated from a lowest point of 6.3 feet to a lowest point of 9 feet with a 4:1 traditionally vegetated side slope. Driveway tie-ins in the eastern part of the road are necessary.	9.0 feet	20%	100%	100%	2070	Negative	Yes	$529,000
ALTERNATIVE 2: HYBRID	A berm to 10.4 feet with a 3:1 side slope planted with native vegetation is added on the northern side of the road. The dune is also enhanced to an elevation of 10.4 feet, and one row of parking spaces is eliminated. Driveway tie-ins at the eastern end of the berm are necessary.	10.4 feet	5%	20%	100%	N/A	Possible Negative	Yes	$76,000
ALTERNATIVE 3: GREEN	The beach parking lot is eliminated, and the dune is restored to 14.8 feet. Alternative parking locations would need to be explored.	14.8 feet	0%	0.2%	1%	N/A	None	No	$138,000

*Installed material cost +20% contingency. Excludes design, permitting, mobilization, stormwater and wastewater infrastructure, and site controls. Costs based on RSMeans 2021 cost book and adjusted for inflation and region.

LOW LYING ROADS

Discussion



- **Ellis Road**
- **Governor Prence Road**
- **Herring Brook Road**
- **South Sunken Meadow Road**

NEXT STEPS

- Comments! Use form on project webpages
  https://www.capecodcommission.org/our-work/low-lying-roads-project/
- Town staff to determine which projects, designs
  - Review of community input
  - Engineering, permitting
- Identify funding

FUNDING OPPORTUNITIES

Federal Bipartisan Infrastructure Law (BIL)

Federal Highway Administration

- PROTECT – Competitive Resilience Improvement and Planning grants
- Culvert Aquatic Organism Passage Program - competitive grants for the replacement, removal, and repair of culverts or weirs that meaningfully improve or restore fish passage for anadromous fish

[NEW] PROTECT Grants (discretionary)

Purpose	Planning, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure
Funding	$1.4 B (FY 22-26) in Contract Authority from the HTF
Eligible entities	• State (or political subdivision of a State) • MPO • Local government • Special purpose district or public authority with a transportation function • Indian Tribe • Federal land management agency (applying jointly with State(s)) • *Different eligibilities apply for at-risk coastal infrastructure grants*
Eligible projects	• Highway, transit, intercity passenger rail, and port facilities • Resilience planning activities, including resilience improvement plans, evacuation planning and preparation, and capacity-building • Construction activities (oriented toward resilience) • Construction of (or improvement to) evacuation routes
Other key provisions	• Higher Federal share if the eligible entity develops a resilience improvement plan (or is in a State or area served by MPO that does) and the State or MPO incorporates it into its long-range transportation plan • May only use up to 40% of the grant for construction of new capacity

FUNDING OPPORTUNITIES

Nature Based Solutions, Ecological Restoration, Culverts

- Municipal Vulnerability Preparedness Program (MVP)
- Division of Ecological Restoration (DER) Culvert Replacement Municipal Assistance Grant Program
- FEMA Building Resilient Infrastructure and Communities (BRIC)
- National Coastal Resiliency Fund (NCRF) through National Fish and Wildlife Fund
- Natural Resources Conservation Service (NRCS) through the Cape Cod Conservation District