

Increasing Coastal Resiliency Through Intermunicipal Shoreline Management

A multi-phase project funded through the
MA Office of Coastal Zone Management's
Coastal Resilience Grant Program

Project Team

Town of Wellfleet

Town of Truro

Town of Eastham

Town of Provincetown

Center for Coastal Studies

Sustainable Coastal Solutions, Inc.

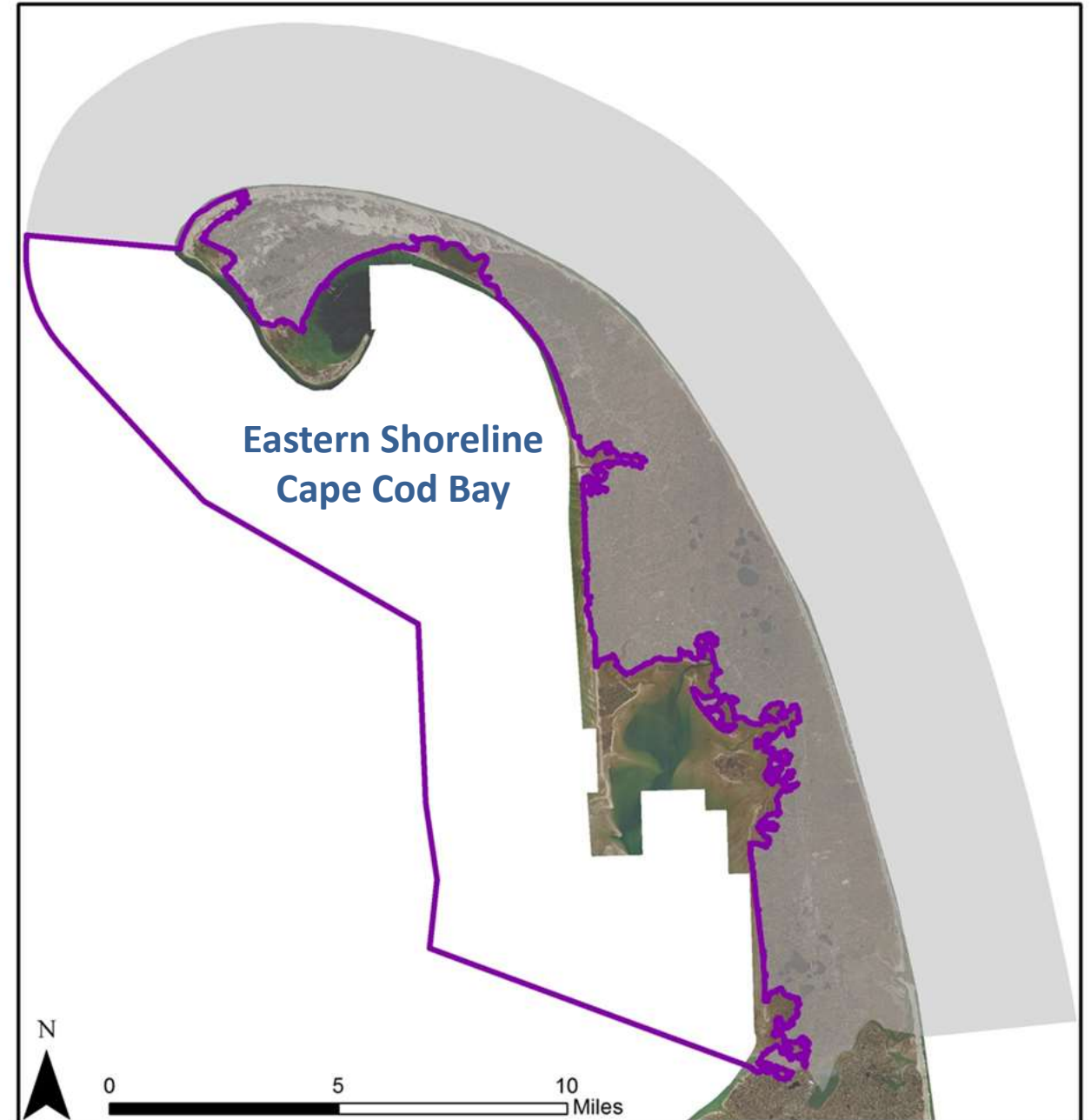
MA Office of Coastal Zone Management

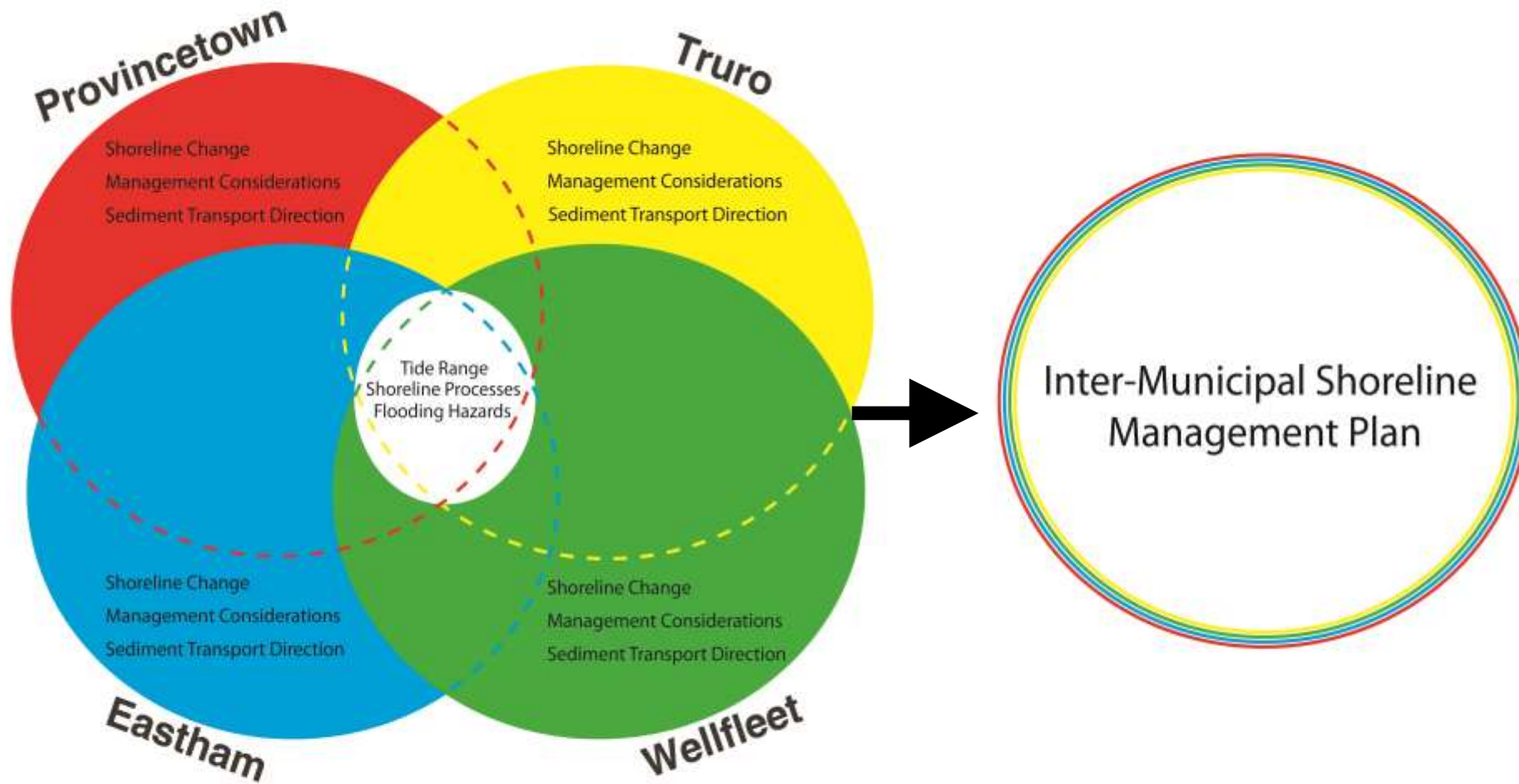
Steve McKenna, Cape & Islands Regional
Coordinator



Project Goal

- Maximize resiliency of Cape Cod Bay shores of **Provincetown, Truro, Wellfleet, and Eastham** with a Regional Management Approach.
- ~128 square miles.
- ~46 miles of shoreline.





Phase 1 (2019-2020)

- **Compiled database of shoreline resources and management approaches**
 - Compared and contrasted four Towns' myriad approaches.
- **Developed comprehensive management framework**
 - Based on shoreline resources & processes, rather than municipal boundaries.
- **Memorandum of Agreement (MOA)**
 - Common goal of improving long-term coastal resiliency of Cape Cod Bay shore.
 - Work as one coordinated planning area by developing one Intermunicipal Shoreline Management Plan.



Phase 2 (2020-2022)

Comprehensive Management Framework

17 Management Principles & Policies:

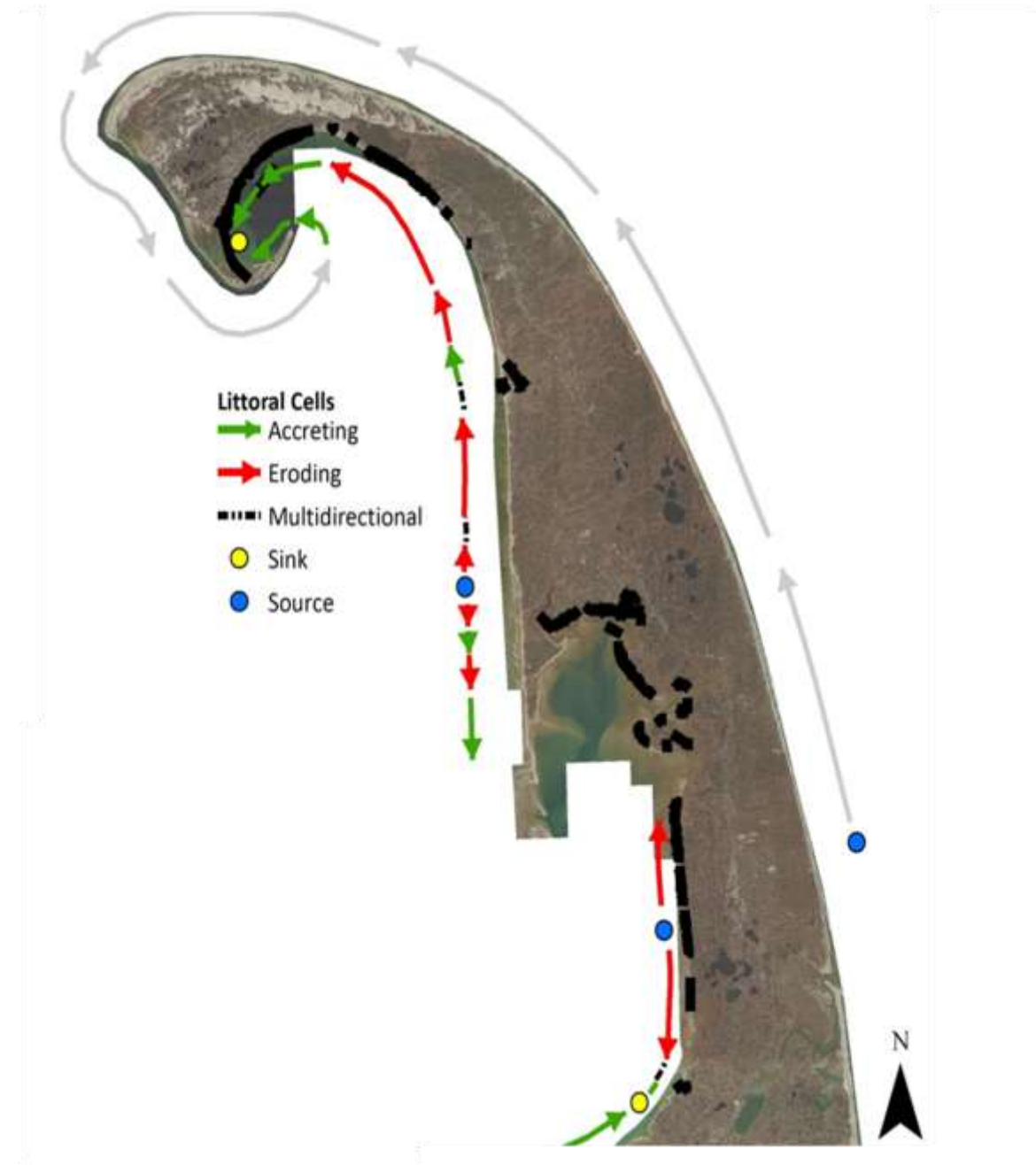
- Application & Plan Requirements & Guidelines
- Standard Project Conditions
- General Design Criteria

Regional Sand Management

- Present Annual Nourishment Programs:
 - Parcel-by-parcel approach
 - ~30,000 cubic yards required annually
- Potential regional sand banking program to extend life of upland sand supplies.

Low Lying Roads Inventory

- 214 low lying road segments identified in Phase 1 based on storm surge and number of properties.
- Improvement alternatives and general costs developed for 15 roads identified by project team.



EVERSOURCE Energy Storage Project

- Provincetown Transfer Station, 90 Race Point Rd.
- 25 MW Community Battery
- Backup power for Provincetown, Truro, Wellfleet





Opportunity for Regional “Sand Banking”

- Collaborative effort:
 - Outer Cape town staff
 - Eversource
 - Lawrence Lynch Corp.
 - CCS, Mass. CZM
- 4500 cu. yds. of clean, native sand conserved (220 truckloads)
- Stored at Town of Eastham facility (Nauset Road)
- Uses: Dune Enhancement and Beach Nourishment projects
- Estimated cost savings:
\$120,000-\$135,000

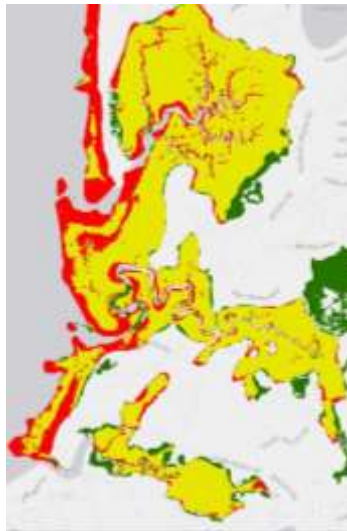
Salt Marsh Datasets

- ↳ Intra_Municipal_Shoreline_Management.gdb
 - ↳ Administrative_Boundaries
 - ↳ BLM_Management_Cells_090221
 - ↳ Orleans_TownLine_2019
 - ↳ ProjectArea
 - ↳ Township_2021
 - ↳ Township_Accession_2021
 - ↳ CCS_Shoreline_Characterizations
 - ↳ CCS_Approximate_Landward_TideLine_Available
 - ↳ CCS_Approximate_Private_TideLine_Limit
 - ↳ CCS_Approximate_Seaward_Limit_Private_TideLine
 - ↳ CCS_Erosion_Deposition_1993_2018
 - ↳ CCS_Littoral_Cell
 - ↳ CCS_Littoral_Cell_NaIPoints
 - ↳ CCS_NeSediment_Transport
 - ↳ CCS_StormTidePathways
 - ↳ CCS_StormTidePathways_ConcentrationAreas
 - ↳ Contemporary_SaltMarsh_Vegetation
 - ↳ Estimated_Flucto_Sedimentation_Rates
 - ↳ Flood_Hazards_SIRIL
 - ↳ Historical_SaltMarsh_Vegetation
 - ↳ LUP_CCR_RoadSegments
 - ↳ LUP_CCR_RoadSurfaceElevations
 - ↳ LUP_CCR_RoadwayProfileElevation
 - ↳ LUP_FoundationScenarios
 - ↳ PE_AccommodationSpace_1mSLR
 - ↳ SaltMarshChange_1993_2018
 - ↳ SaltMarshMigration_AcquisitionPascals
 - ↳ Shoreline_BeachNourishment
 - ↳ ShorelineChange_LongTermRates
 - ↳ ShorelineChange_ShortTermRates
 - ↳ WH_SelfTransport
 - ↳ Coastal_Resources
 - ↳ AnadromousFish
 - ↳ DesignatedShellfishDredgingAreas
 - ↳ EdgewiseDEP
 - ↳ ShellfishSuitability
 - ↳ WatershedsDEP
 - ↳ Dredge_Plans
 - ↳ Human_Use
 - ↳ BeachNourishment
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 - ↳ DredgeLocations
 - ↳ LandExcavationRoutes
 - ↳ Marine
 - ↳ MarineBeaches_Public
 - ↳ MASSDOT_ROADS_2020
 - ↳ MORIS_CS_PUBLIC_AIRCLINE
 - ↳ OFRA_BatRamps
 - ↳ OpenSpace_2019
 - ↳ Potential_CES_Parcel
 - ↳ Potential_LandBankStatus
 - ↳ Pre1978_CoastalBankDevelopment
 - ↳ Structures
 - ↳ TownManaged_CoastalBeaches_PublicAccess
 - ↳ TownManaged_CoastalBeaches_PublicAccess_Paving
 - ↳ Regulated_Areas
 - ↳ ACECS
 - ↳ Approximate_USACE_404Program
 - ↳ CACO
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 - ↳ CIRS
 - ↳ CoastalRiver_Mouths
 - ↳ FloodHazardZones
 - ↳ LHMMA
 - ↳ Local_FloodHazardZones
 - ↳ LocalZoning
 - ↳ MHC_Areas
 - ↳ MHC_Parcel
 - ↳ MPA_2017
 - ↳ NHESP_25THAB
 - ↳ NHESP_PRR-404
 - ↳ OceanManagementPlan_Area
 - ↳ OceanSensuariesAid
 - ↳ ProvincetownLaborPlanningArea
 - ↳ StateDesignatedSeniorBeaches
 - ↳ TMDL_WaterQualityCancellation
 - ↳ TidelandsRestriction_CH01
 - ↳ Shorelines
 - ↳ CapeCodBay_NB_L1_Rates
 - ↳ CapeCodBay_NB_ST_Rates
 - ↳ CCS_Shoreline_2014
 - ↳ USGS_CapeCodBay_Shoreline_2014
 - ↳ USGS_CapeCodBay_Shoreline_1840_2008
 - ↳ AccessionTable_2021
 - ↳ CoastalStructures_2003_ATTACH
 - ↳ CoastalStructures_2003_ATTACHESL
 - ↳ NewEngland_CMGP_SandyLittor_2013_2014
 - ↳ Nourishment_Records
 - ↳ SaltMarshSuitability_1m_SLR
 - ↳ USACE_TopographyLidar_2010
 - ↳ USGS_ColorOrthoImagery_2014
 - ↳ USGS_TopoQuad_Mosaic

Historical



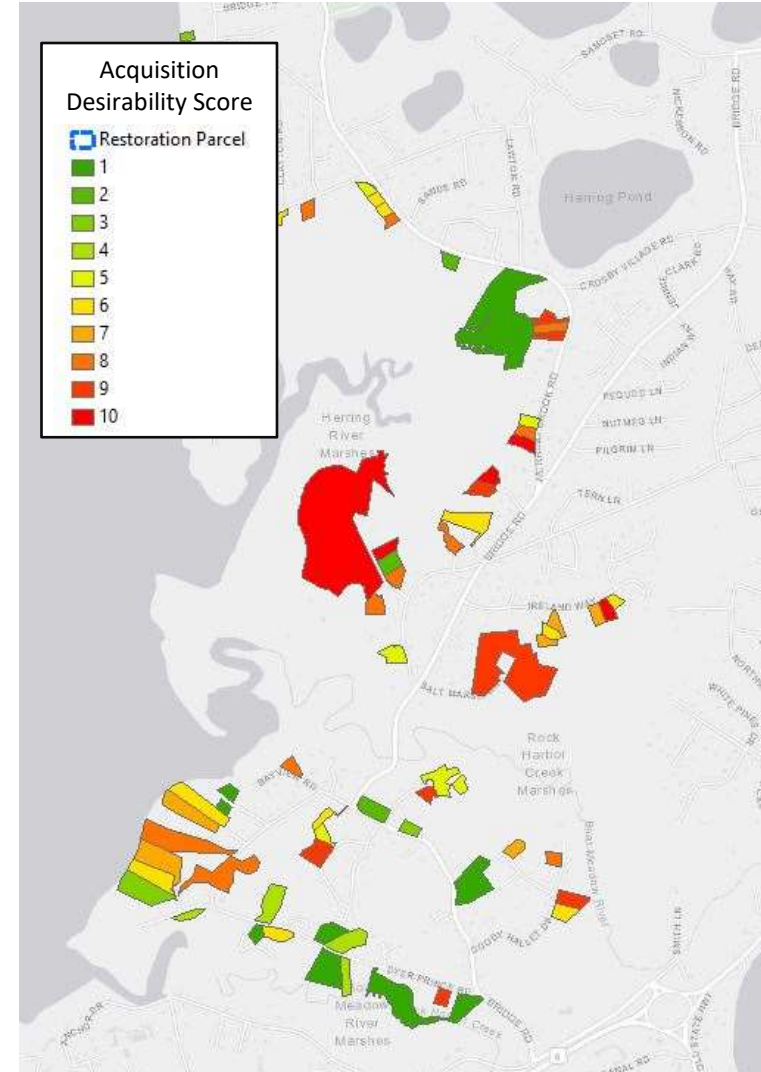
Contemporary



Change (1933-2018)

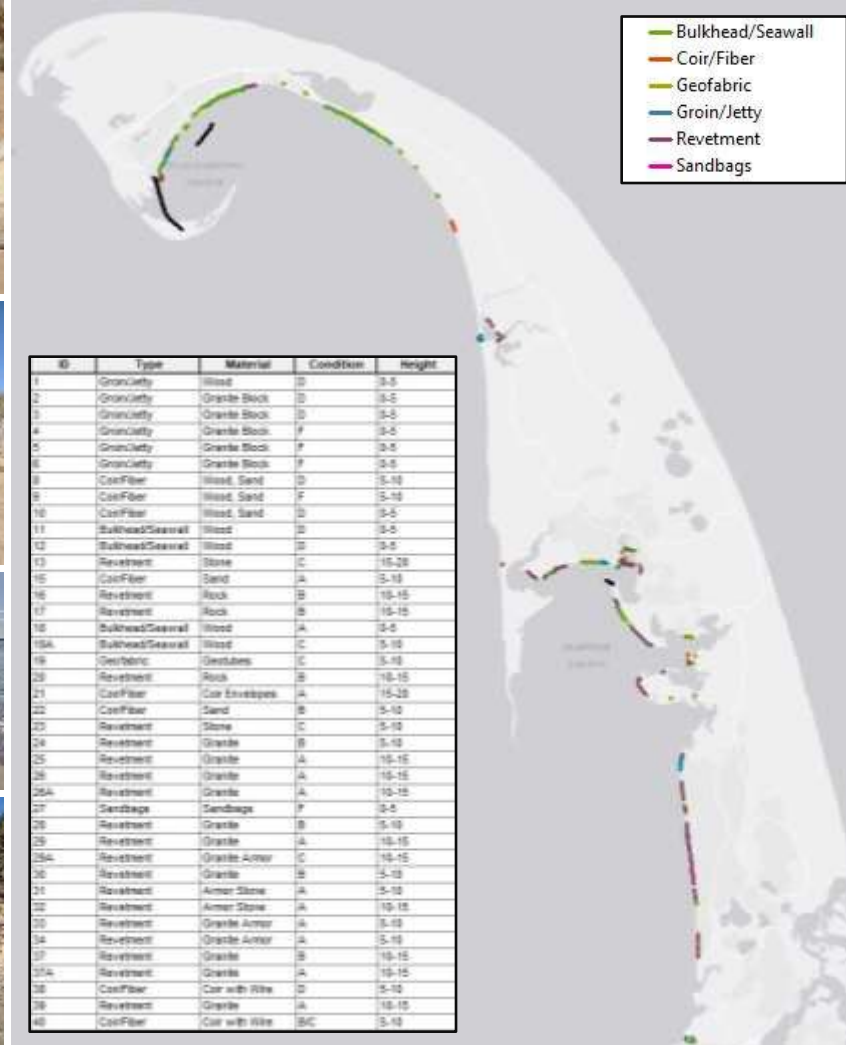


Potential Migration Space



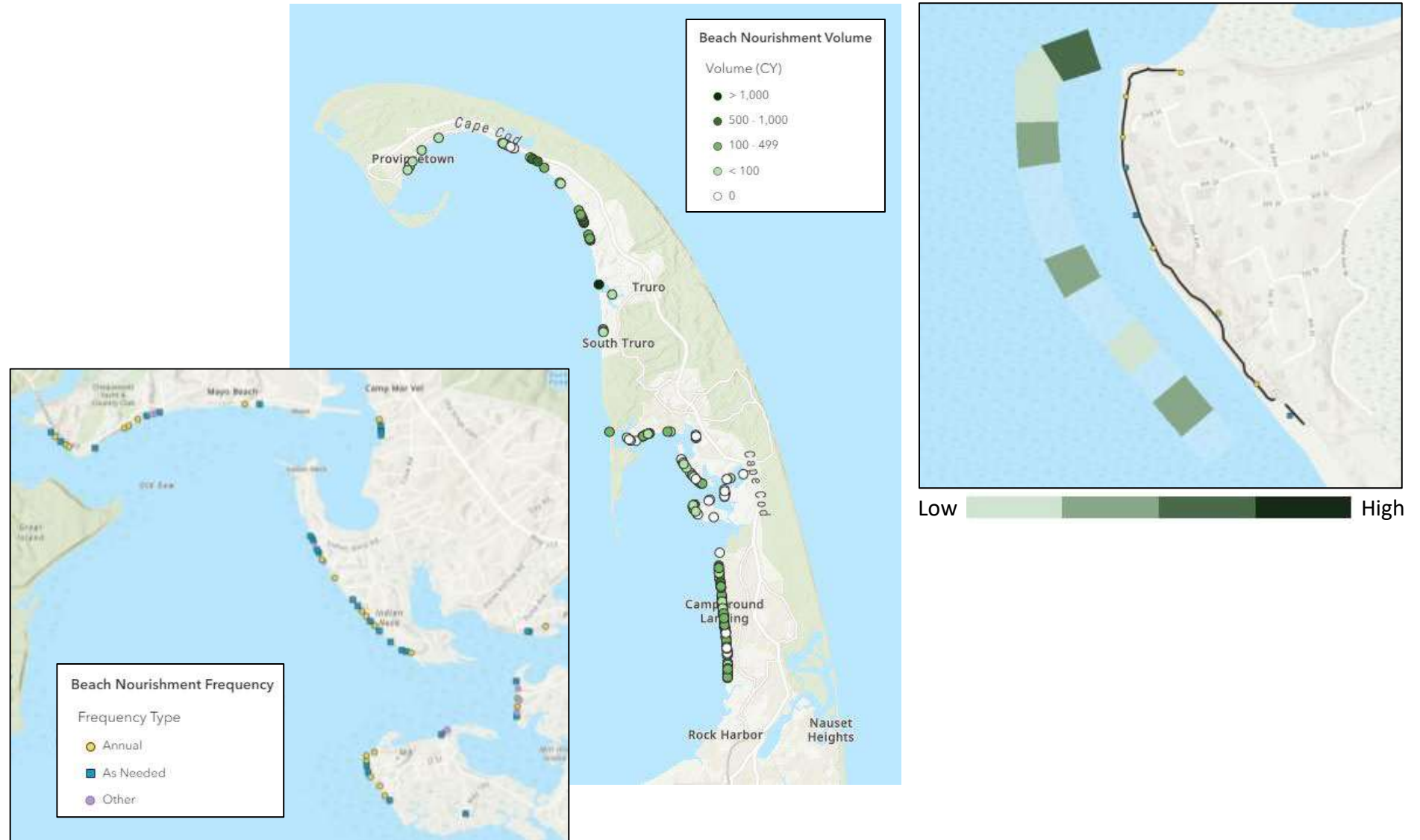
Migration Parcels

Coastal Structure Inventory



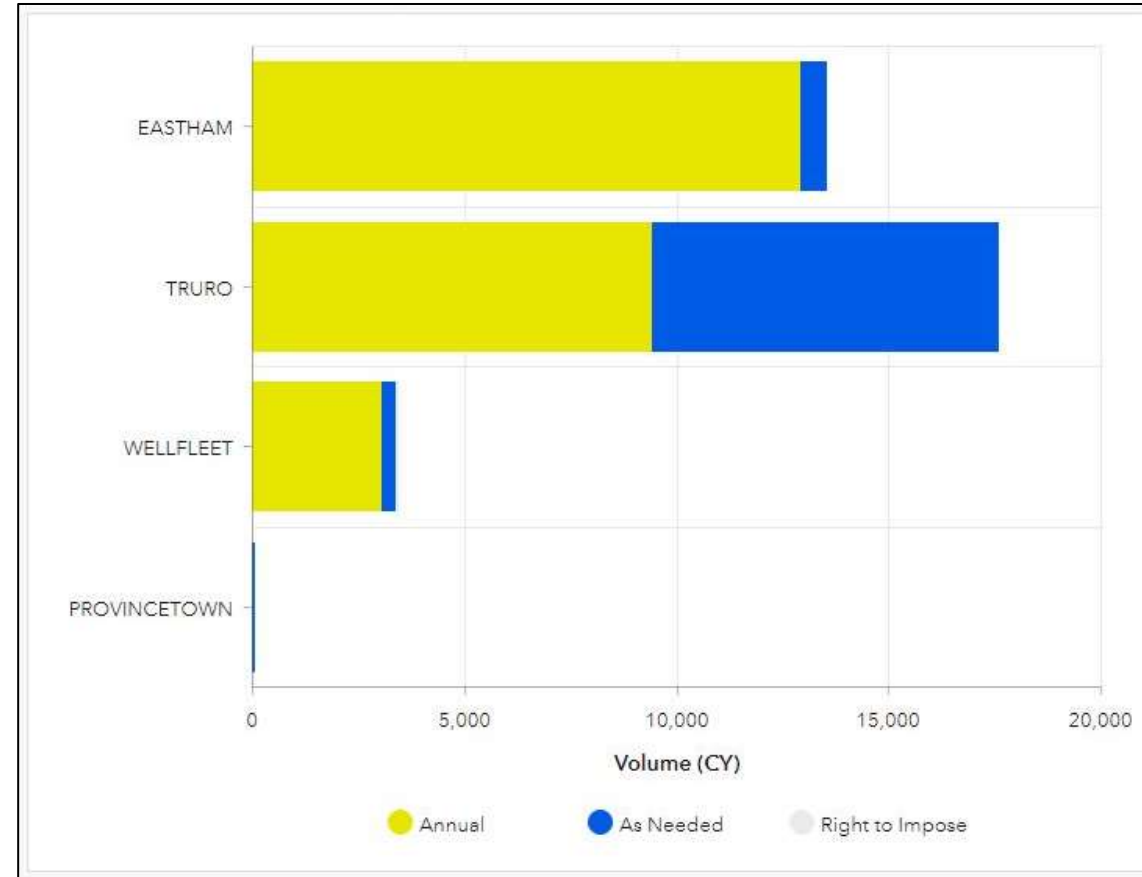
- Intro_Municipal_Shoreline_Management.pdf
- Administrative_Boundaries
 - BIM_Management_Cells_092021
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 - ProjectArea
 - TownParcel_2021
 - TownParcel_Accessory_2021
- CCS_Shoreline_Characterizations
 - CCS_Approximate_Landward_TideLine_Auxiliary
 - CCS_Approximate_Private_TideLine_Limit
 - CCS_Approximate_Seaward_Limit_Private_TideLine
 - CCS_ErosionDeposition_1993_2010
 - CCS_Lithology
 - CCS_Lithology_NaIPoints
 - CCS_NeSedimentTransport
 - CCS_StormTidePathways
 - CCS_StormTidePathways_ConcentrationAreas
 - Contemporary_SaltMarsh_Vegetation
 - Estimated_HistoricSedimentationRates
 - FloodHazard_SIRE
 - Historical_SaltMarsh_Vegetation
 - LLR_CCR_RoadSegments
 - LLR_CCR_SouthSideRoads
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 - LLR_FoundationScenarios
 - PL_AccommodationSpace_1mSLR
 - SaltMarshChange_1993_2010
 - SaltMarshMigration_AcquiescencePascals
 - Shoreline_BeachNourishment
 - ShorelineChange_LongTermRates
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 - WH_SelfTransport
- Coastal_Resources
 - AvianNestFish
 - DesignatedShellfishHarvestingAreas
 - Edgwood
 - ShellfishGrowthability
 - Watershed
- Dredge_Plans
- Human_Use
 - BeachNourishment
 - CoastalInfrastructure_2020
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 - Marinas
 - MannedBeaches_Public
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 - OTBA_BeachRamps
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 - LocalZoning
 - MHC_Areas
 - MHC_Parcel
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 - NHESP_PRR-408
 - OceanManagementPlan_Area
 - OceanSanctuariesAct
 - ProvincetownLaborPlanningArea
 - StateDesignatedBeneficialBeaches
 - TMDL_WaterQualityContribution
 - TideLandRestriction_CH01
- Shorelines
 - CapeCodBay_NB_1T_Rates
 - CapeCodBay_NB_3T_Rates
 - CCS_Shoreline_2014
 - USGS_CapeCodBay_Shoreline_2014
 - USGS_CapeCodBay_Shoreline_1840_2000
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- NewEngland_CMGP_Sandy_Lake_2013_2014
- Nourishment_Records
- SaltMarshStability_1m_SLR
- USACE_Topography_Lidar_2010
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Beach Nourishment Inventory



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 - CCS_Approximate_Seaward_Limit_Private_TideLine
 - CCS_ErosionDeposition_1931_2018
 - CCS_LittoralCells
 - CCS_LittoralCells_NaIPoints
 - CCS_NeSedimentTransport
 - CCS_StormTidePathways
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 - FloodHazards_SIREL
 - Historical_SaltMarsh_Vegetation
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 - USGS_CokeOrthoImagery_2014
 - USGS_TypeQuad_Mosaic

Beach Nourishment Inventory



Type	Volume (CY)	Sites (Count)
Annual	25,414	122
As Needed	9,125	97
Right to Impose	40	9
Total	34,580	228

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Looking Forward with a Regional Approach

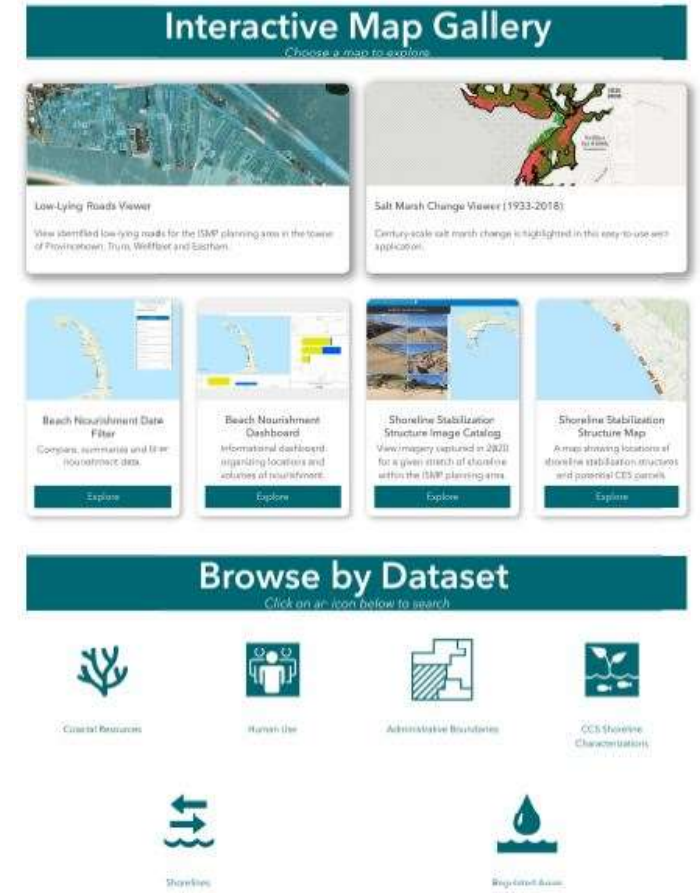
Regional Sand Management Program



Conceptual Low Lying Roads Design Solutions



Public Data Portal



Sediment and Long-term Shoreline Resiliency

A sand shortage? The world is running out of a crucial but under appreciated commodity.

CNBC online, Sam Meredith, Mar 5, 2021

Erosion-control efforts raise concerns over Nantucket sand supply.

Cape Cod Times, Brian Bushard, Dec 22, 2019

A never-ending Commitment: The high cost of preserving vulnerable beaches.

ProPublica. Song, L. & A. Shaw, Sep 27, 2018

***A looming tragedy of
the sand commons.***

Science, Torres, A., et al. Sep 8, 2017

The mining of sand, a non-renewable resource.

United Nations Environment Programme (UNEP), October 30, 2015

Sand is Gold.

Series of Climate Change Essays.
Vineyard Gazette. Liz Durkee, 2011

Present Sand Management Approach

- Town-by-town, parcel-by-parcel
- CES impacts offset w/ OOC reqs. for nourishment
- Material typically from upland sources of beach compatible sand
- Vols. = CES Length x Height x Erosion Rate



Regional Sand Management Program

- Goal: to extend the life of regional upland sand supplies
- Sand banking/ recycling program
- Cost-effective, science-based nourishment approach that promotes optimum placement of sand within a littoral cell



Long-Term (2050) Coastal Flood Mitigation Strategies

- Based on storm surge potential and # of properties served, SCS developed improvement alternatives and general costs for 15 roads identified
- Working with each town, SCS will be developing detailed preliminary designs for priority low-lying roadways

• Roadway Elevation

- Eastham South Sunken Meadow Road
- Wellfleet King Philip Road

• Beach Nourishment

- Truro Shore Road (Town Line east)
- Provincetown Commercial Street (Town Line west)

Sustainable Coastal Solutions, Inc.

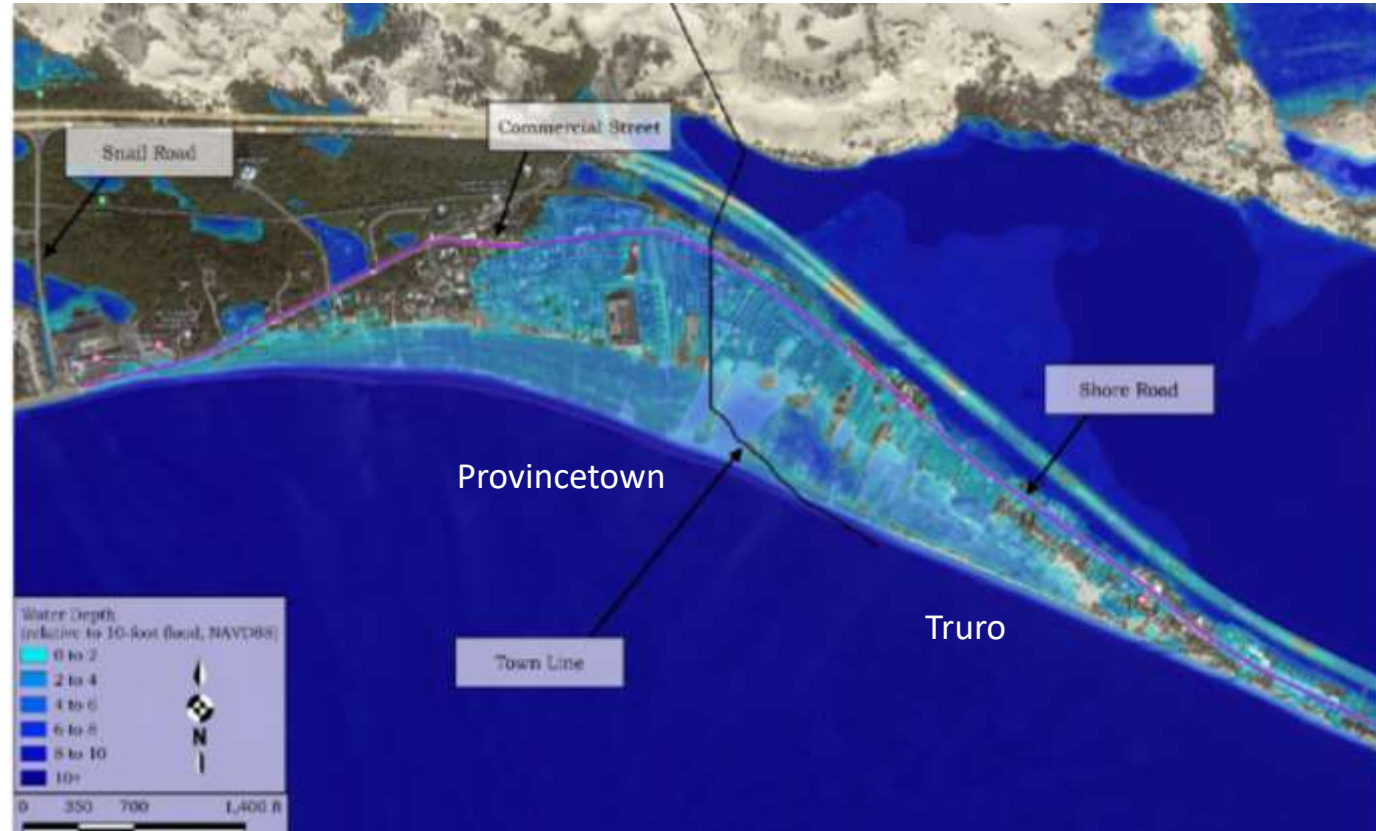
North Falmouth, Massachusetts

Table 3. List of focus roads with potential improvement alternatives and approximate cost

Road	Town	Abuts Upland	Improvement	Cost
Bridge Road	Eastham	yes/no	Elevate Road	moderate
Commercial Street (Town Line)	Provincetown	yes	Nourishment	high
Commercial Street (600 block)	Provincetown	yes	Nourishment	high
Cove Road	Wellfleet	yes	Elevate Road	moderate
Herring Brook Road	Eastham	yes	Elevate Road	moderate
High Head Road	Truro	no	Floodable	minimal
King Phillip Road	Wellfleet	yes	Elevate Road	moderate
Lieutenant Island Road	Wellfleet	no	Floodable	minimal
Province Lands Road	Provincetown	yes	Elevate Road	moderate
Rt. 6	Wellfleet	no	Elevate Road	moderate
Samoset	Eastham	yes	Elevate Road	moderate
Shore Road	Truro	yes	Nourishment	high
S. Sunken Meadow Road	Eastham	yes	Elevate Road	moderate
Stotts Crossing	Truro	yes	Elevate Road	moderate
Truro Center Road	Truro	yes	Elevate Road	moderate

Benefitting from a Regional Approach

- Nourishment is a feasible design solution
- ↑ Project efficiencies & cost savings
- ↑ Leveraging of Grant Opportunities w/ multiple applicants



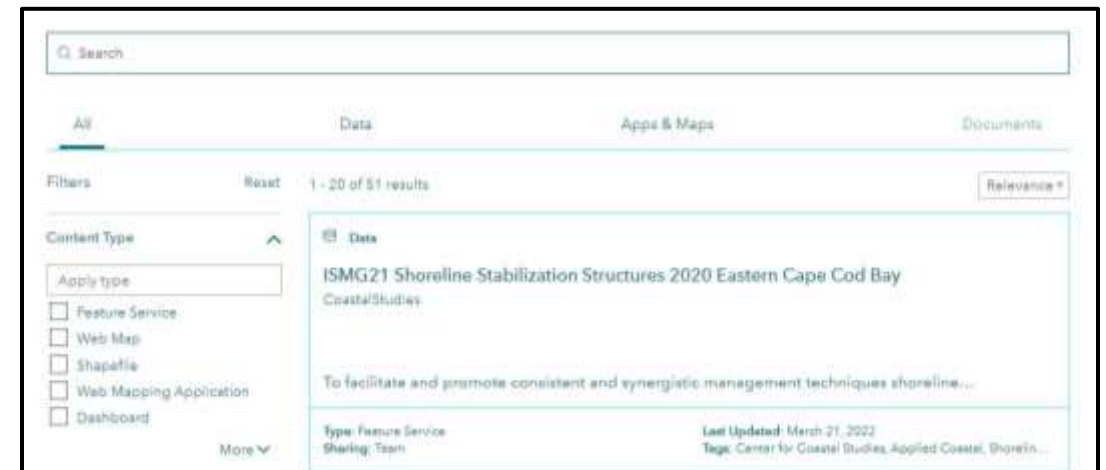
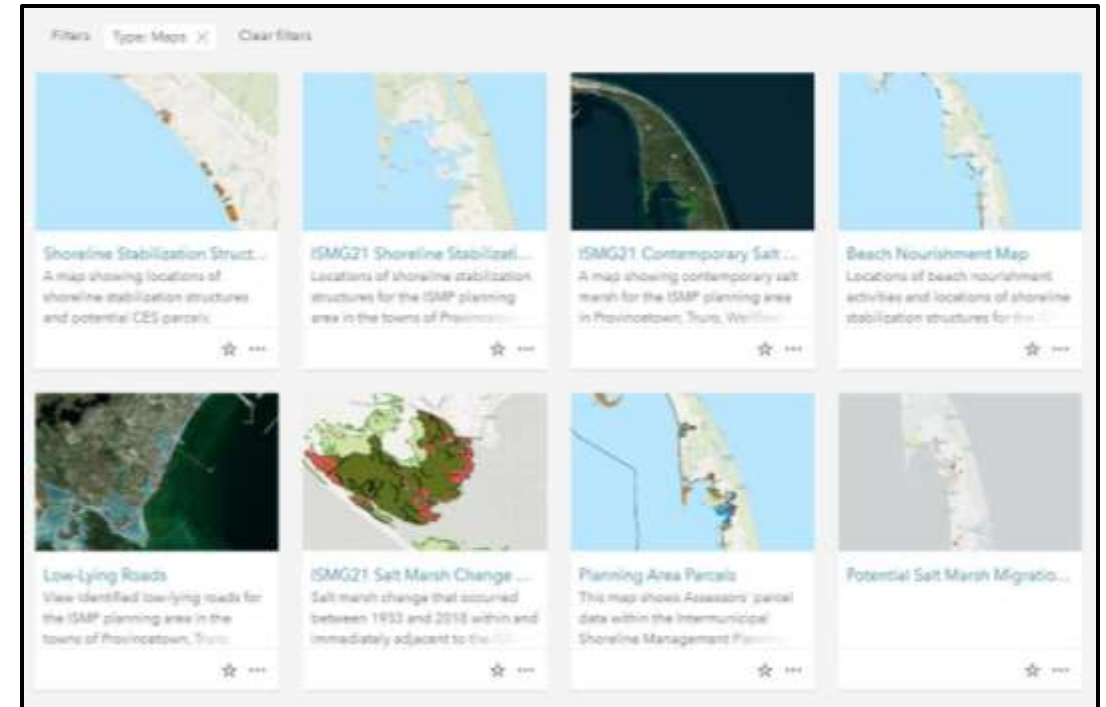
Public Data Portal

Online resource for

- Sharing data
- Interactive maps
- Applications that aid in the visualization/interpretation of spatial relationships found within coastal zone data

Designed to

- support collaboration between the town partnership and other organizations
- share data with non-GIS users
- maximum use of data by town staff and the public without the need for specialized software





Questions?