



BUILD-OUT ANALYSIS

RYE, NEW HAMPSHIRE

DRAFT | AUGUST 2023

*Prepared by FB Environmental Associates
For the Town of Rye*



BUILD-OUT ANALYSIS RYE, NEW HAMPSHIRE

Prepared as part of the Rye Master Plan 2023-2024 update.

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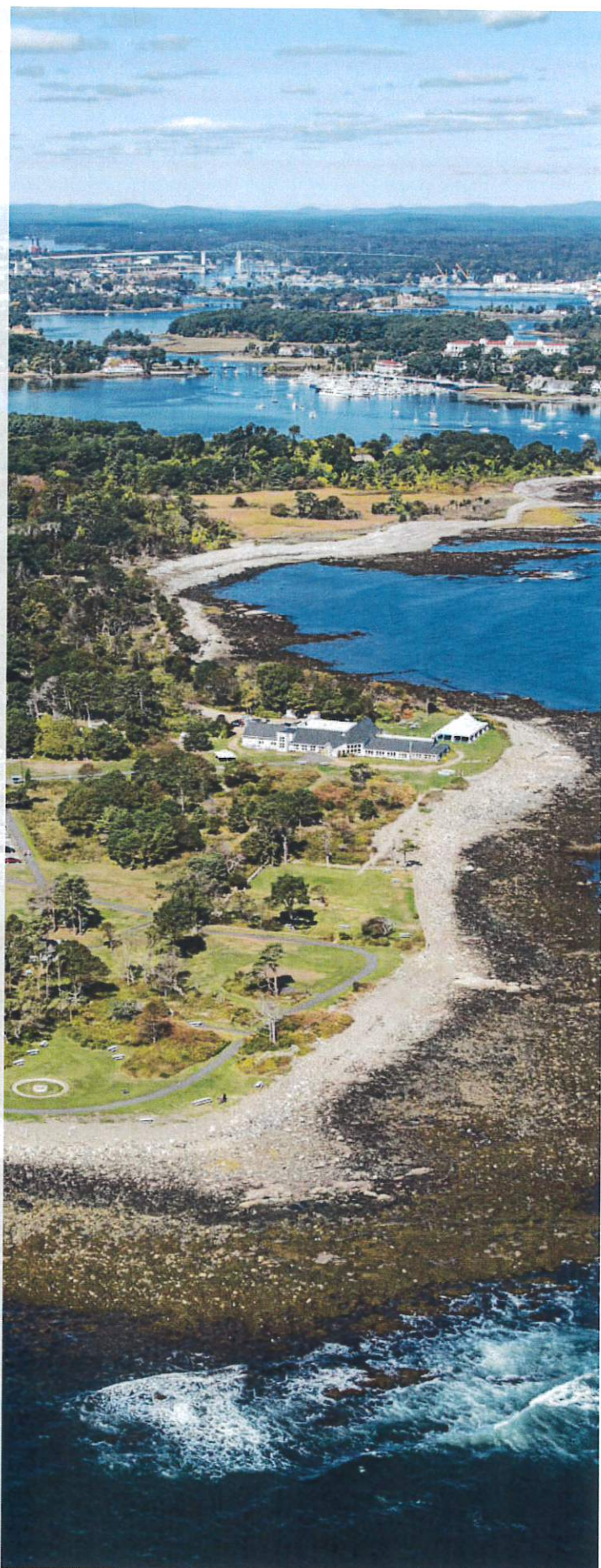
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EXECUTIVE SUMMARY

The build-out analysis for the Town of Rye indicates that the Town has moderate buildable area for future development, and much of the Town is constrained due to large wetland complexes and conserved lands. At current population growth rates, the Town of Rye could reach full build-out in approximately 50 years.

As part of the development of the Rye Master Plan Update, a build-out analysis was completed by FB Environmental (FBE) to understand potential future development in Rye based on current municipal land-use regulations and vacant land areas. The Rye community enjoys stellar beach access and expansive coastal natural resources and the Town is a desirable place to live. Encompassing approximately 13 square miles in coastal New Hampshire, Rye had a population of approximately 5,543 people at the 2020 U.S. Census.

A build-out analysis is a planning tool that identifies areas with development potential and projects future development based on a set of conditions (e.g., zoning regulations, environmental constraints) and assumptions (e.g., building footprint dimensions). The results of the build-out analysis can be used for planning purposes to help guide future development activities in the community, anticipate future demands on infrastructure, as well as identify specific areas for conservation. Note that the analyses presented herein provide a full build-out scenario based on the Rye's current zoning standards (which are subject to amendment) and should be viewed as estimates only. "Full build-out" is a theoretical condition which represents the period when all available land suitable for residential, commercial, and industrial uses has been developed to the maximum conditions permitted by local ordinances.

The Town of Rye has approximately 2,985 individual parcels. The build-out analysis identified that 13% (1,116 acres of approximately 8,407 acres) of the Town is buildable under current zoning regulations. The Single Residence District has the most acreage of buildable area at 877 acres. FBE identified 2,772 existing principal buildings in the Town of Rye, and the build-out analysis projected that an additional 465 buildings could be constructed in the future, resulting in a total of 3,187 buildings in the Town of Rye at full build-out (Figure 1).

Ultimately, this build-out analysis for the Town of Rye indicated that due to extensive environmental development constraints (particularly wetlands), conserved land, and existing buildings, the Town of Rye has moderately low buildable area for future development compared to other New Hampshire communities. However, there is potential for a moderate increase in projected new buildings (17% increase compared to existing buildings), with the highest density areas in central and inland Rye (Figure 1). Furthermore, based on historical population growth rates in Rye, the Town could face full build-out in the mid to late 21st century.



Photo: Aimee Seavey/New England.com



Photo: FBE



Photo: NH Municipal Association

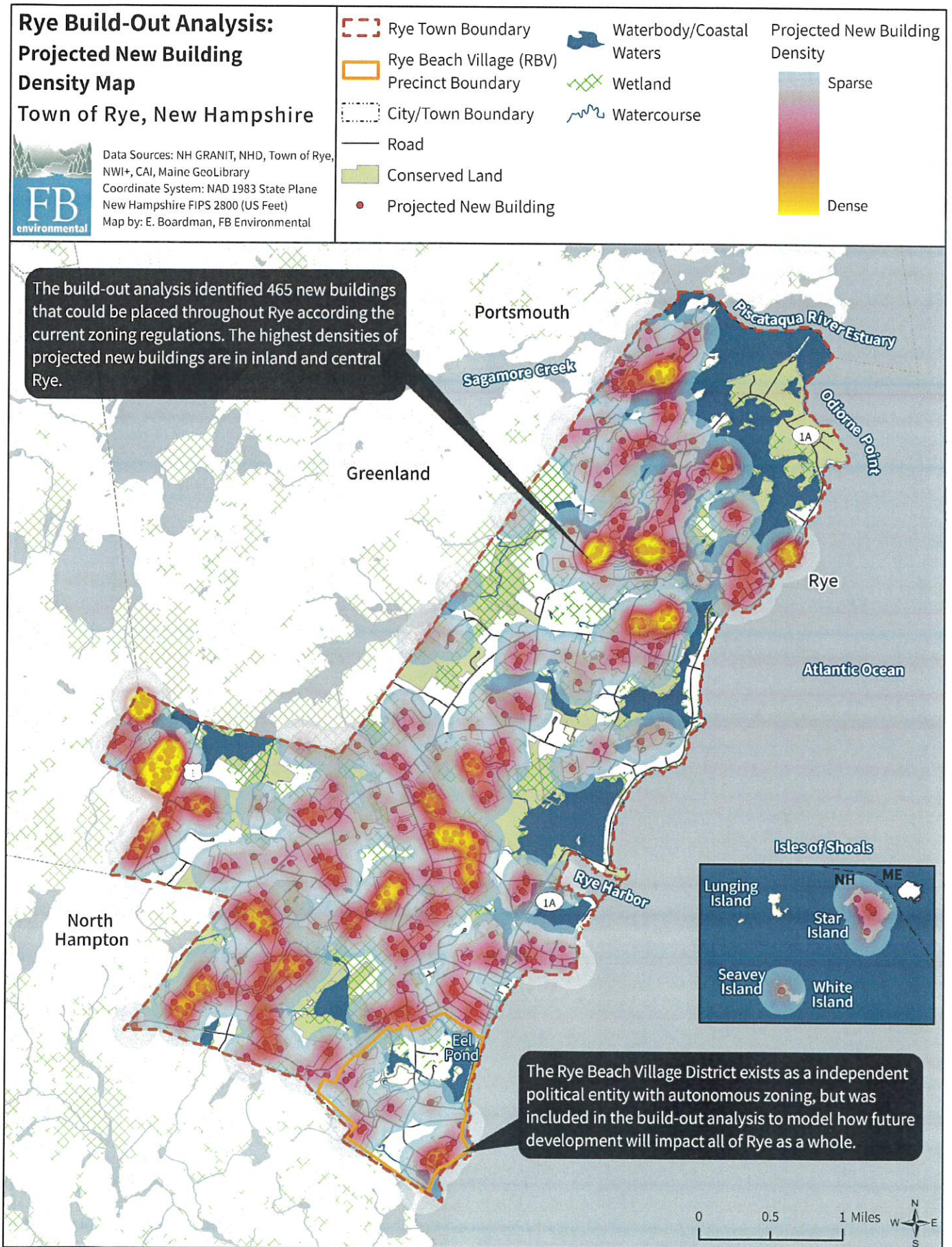


FIGURE 1. Building density map of projected new buildings in Rye based on the build-out analysis results.

INTRODUCTION

The Town of Rye, located in coastal New Hampshire, encompasses approximately 13 square miles and covers 52% of the state's coastline. The Rye build-out analysis describes potential future development in Rye based on current municipal land-use regulations and identified natural resource constraints. Model results provide the community with a powerful educational tool that can guide future planning efforts.

A build-out analysis is a computer model of community growth and development that can be used to investigate how much land is available for development, how a community might change in appearance and function over time, and what the potential impacts from future development might be. Performing a build-out analysis shows a locality what land is available for development, how much development can occur, and at what densities. The results of the analysis provide estimates of the numbers of potential lots and new building units the study area may see developed at some point in the future. "Full build-out" refers to the hypothetical time and circumstances in the future whereby no more building construction may occur, or the point at which lots have been subdivided to the minimum size allowed and there is no more "developable" land.

The build-out analysis presents projected new building placement and density only, and does not assign building use. However, the analysis does not take into account the current public and social services or resource capacity needed to serve the population. Instead, based on projected future development, the analysis can be used plan for future service needs.

A build-out analysis is a powerful tool to understand future development.



- Under current zoning, how much land is available for development?
- How might the Rye's appearance change over time?
- What are the potential impacts from future development?



METHODS

COMMUNITY VIZ SOFTWARE

FBE conducted the build-out analysis using ESRI ArcMap v.10.8 and ArcPro geographic information system (GIS) software and CommunityViz v.5.2 extension. CommunityViz is a GIS-based, decision-support tool designed to help planners and resource managers visualize, analyze, and communicate about important land use decisions. FBE utilized the software's 'Build-out Wizard' to calculate the development capacity of the study area (numerically and spatially), as well as the 'Time Scope Analysis' tool to project and visualize how future development might occur over time.

The baseline build-out analysis was performed according to the following general steps:

1. Collect data on existing conditions in the study area: existing buildings, zoning, and growth rates.
2. Collect and/or create relevant GIS data (e.g., development constraints layers such as wetlands and conserved lands).
3. Analyze build-out potential using CommunityViz's Build-Out Wizard tool.
4. Determine potential dates at which full build-out is reached using CommunityViz's TimeScope Analysis tool.

DISCLAIMER AND DATA LIMITATIONS

Much of the data used in this analysis were serviced from publicly available datasets obtained from New Hampshire's Geographic Information System online data library (NH GRANIT). Many of these data layers were created from remotely-sensed data (e.g., aerial photography, digital orthophotos, and satellite images) and large, landscape-level mapping projects (e.g., soil units). Due to their inherent levels of accuracy, the data layers were originally intended to be viewed at certain scales (generally 1:24,000 or 1:25,000). Data provided by the Town of Rye was used to increase resolution where possible.

NH GRANIT maintains a continuing program to identify and correct errors in these data but makes no claims as to the validity or reliability or to any implied uses of these datasets. As a result, the data presented herein should be used for planning purposes only. If greater data precision is required, this report should be supplemented with field surveys or other on-the-ground methods of data collection. There may also be minor data discrepancies between datasets used in this analysis due to the variety of source materials and mapping standards used by the original creators of the datasets. The reader is encouraged to refer to the original referenced sources if specific data inconsistencies need to be resolved.

RYE BEACH VILLAGE DISTRICT

Within the boundaries of the Town of Rye, is the Rye Beach Village (RBV) District. The Village was formed by an act of the NH Legislature and encompasses the southeastern portion of Rye. The Village legally exists an independent political entity that has autonomous zoning authority. The Town of Rye continues to have responsibility for emergency service, education and health services, infrastructure oversight, and maintenance of local roadways within the Village. While the Town and Village are distinct political entities, many of the goals of both jurisdictions historically align with similar intents to protect natural resources, preservation of community character, and ensure proper investment in community services and capital expenses. A key difference between the Town and Village are that they maintain separate master plans and zoning ordinances as they have separate authority to enact zoning regulations and land use decisions. The Rockingham Planning Commission provided FBE with RBV zoning files and information. The RBV is included in the build-out analysis as future development will impact the rest of Rye, though it is acknowledged that the RBV has separate legal authority.

EXISTING BUILDINGS

FBE used 2022 ESRI World Imagery and 2023 Google Earth Aerial Imagery to create a GIS layer of existing buildings within the study area. Examination of aerial imagery resulted in the creation of a shapefile with 2,722 points representing principal structures such as homes and office buildings (secondary structures such as garages and sheds were not included; Figure 2). In areas where it was difficult to discern the presence of a dwelling (typically due to shadows or the presence of trees), FBE referred to parcel data from the Town of Rye and the Building Footprint Data sourced from Microsoft Office. This provided increased accuracy in the development of the existing buildings layer.

POPULATION GROWTH RATES

According to the US Census Bureau, the Town of Rye has experienced steady but slow population growth in the last 50 years (Tables 1-2), increasing from 4,083 people in 1970 to 5,543 people in 2020. Rye has experienced a slightly slower growth rate than the State of New Hampshire over the last 50 years, though at a similar pace with the state over the past 10 years.

TABLE 1. US Census Bureau population for Rye from 1970-2020. Data from www.census.gov.

Town	Population					
	1970	1980	1990	2000	2010	2020
Town of Rye	4,083	4,508	4,612	5,182	5,298	5,543
New Hampshire (for reference)	737,681	920,610	1,109,252	1,235,786	1,316,470	1,377,529

TABLE 2. Compound annual growth rates for Rye over 10- year, 20-year, and 50-year spans.

Town	Compound Annual Growth Rate		
	50 Year (1970-2020)	20 Year (2000-2020)	10 Year (2010-2020)
Town of Rye	0.61%	0.34%	0.45%
New Hampshire (for reference)	1.26%	0.54%	0.45%

ZONING

The process of modeling zoning requirements by the Town of Rye to create spatial datasets of development restrictions is critical to a build-out analysis (Table 3). There are ten relevant zones within the study area. FBE obtained a digital layer of zoning and parcels from CAI Technologies via the Town of Rye, and zoning requirements from the town's zoning code. Rye Beach Village District files were obtained from the Rockingham Planning Commission and zoning code was accessed via the Town of Rye website.

TABLE 3. Base zoning standards used in the build-out for the Town of Rye.

Zone	Front Setback (ft)	Side/Rear Setback (ft)	Minimum Lot Size (sq. ft)	Minimum Lot Size (acres)
Rye				
Single Residence District (SR)	40	20/30	66,000	1.55
General Residence District (GR)	30	20/30	44,000	1.01
Business District (B)	30	20/30	44,000	1.01
Commercial District (C)	30 / 60*	20/24	44,000	1.01
Public Recreation District (PREC)	<i>Recreational purposes only.</i>			
Public Recreation and Conservation District (PRAC)	<i>Recreational purposes only.</i>			
Conservation District (CON)	<i>Residential, commercial, and industrial uses prohibited.</i>			
Rye Beach Village (RBV) District				
RBV Low Density Residential District	40	25	60,000	1.38
RBV Medium Density Residential District	40	25	43,560	1
RBV Recreational District	50	30	217,800	5
*Along Lafayette Road, the front setback is 60 feet.				
When the side and rear setback differ, the smaller of the two is used in the model.				

DEVELOPMENT CONSTRAINTS

To determine where development may occur, the build-out analysis first subtracts land unavailable for development due to physical constraints, including environmental restrictions (e.g., wetlands), zoning restrictions (e.g., Wetland Conservation District, overlay districts, street Right-of-Ways, etc.), and practical design considerations (e.g., lot layout inefficiencies). Existing buildings also reduce the capacity for new development (displayed on the map in Figure 2 on the following page). FBE created the existing buildings layer and obtained town zoning information and/or setback requirements from the town zoning ordinances and the Rockingham Planning Commission. All other data were acquired from CAI Technologies, NH GRANIT, the National Hydrography Dataset, and the National Wetland Inventory to model the development constraints. A list of development constraints used in the analysis is described below, and summarized in Table 4.

- Conserved land areas, sourced from the Town of Rye via CAI Technologies, were cross checked against the NH state database and a list of recently updated conserved parcels from the Town of Rye.
- Existing building locations constrain where future development may be placed. Only primary buildings are identified (i.e., main houses, condo buildings, etc., but not garages, sheds, hotel/motel units, etc.).
- Per the Wetland Conservation District, there is a 100-foot setback from the edges of all tidal marshes, bays, estuaries, rivers, river tributaries and creeks, natural perennial streams, vernal pools, freshwater wetlands (i.e., emergent marshes), ponds one acre in size or larger, and specifically Eel Pond, Burke's Pond, Brown's Pond, and East Rye Pond; a 75-foot setback from all wetlands one contiguous acre or larger in size; and a 100-foot setback from wetlands one continuous acre in size within the Berrys Brook watershed. FBE used the National Wetland Inventory Plus dataset to determine wetland type and size, and buffer it appropriately.
- Soils that are poorly drained or very poorly drained (typically referred to as hydric soils) were obtained from the Rye Natural Resource Inventory (NRI) and the United States Department of Agriculture Web Soil Survey dataset.
- Slopes that are steeper than 20% are considered a development constraint, however there are no steep slopes within the Town of Rye large enough to be detected from topographic datasets.
- Roads are considered a development constraint and are buffered by 30 feet to adequately model this constraint.
- Rye zoning overlays were reviewed for relevant development constraints, including the Coastal Area Overlay District, Historic District, Rye Beach Precinct, Multi-Family Dwelling Overlay District, Rye Landfill Groundwater Management Zone, and Aquifer and Wellhead Protection District. Though constraints exist - such as building heights and/or additional permit requirements, no additional development constraints were included in the model from these zoning overlay districts.
- The Public Recreation District, Public Recreation and Conservation District, and Conservation District do not allow residential, commercial, or industrial development.

TABLE 4. Summary of development constraints for the Town of Rye.

Development Constraint Description	Constraint
Conserved Land	No development
Road	No development
Hydric Soils	No development
Water Resources	100-foot setback of the edges of all tidal marshes, bays, estuaries, rivers, river tributaries and creeks, natural perennial streams, vernal pools, freshwater wetlands (i.e., emergent marshes), ponds one acre in size or larger, and specifically Eel Pond, Burke's Pond, Brown's Pond, and East Rye Pond.
	75-foot setback from all wetlands one contiguous acre or larger in size.
	100-foot setback from wetlands one continuous acre in size within the Berrys Brook watershed.
Public Recreation District, Public Recreation and Conservation District, and Conservation District.	No development

Building setbacks were estimated based on the average front and rear setbacks specified by the zoning ordinance (Table 3). Setbacks are measured from building center points in CommunityViz. To account for this, building footprints need to be estimated to avoid building overlap. FBE estimated the dimensions of the minimum building footprint to be 35 feet x 35 feet. This number was added to the average front/rear setback for each zone to estimate the “Minimum Separation Distance” used in CommunityViz. Minimum lot sizes were based on the requirements for each zone (Table 3). Future lots were made the smallest size allowable for the zoning district, and unit types (e.g., residential house, commercial building) were not specified.

Building density is difficult to predict with precision in a build-out analysis because the exact siting of construction and development occurs in a somewhat unpredictable fashion. A wide range of factors (in addition to those mentioned above) can decrease the permitted density: stormwater drainage facilities, right-of-ways, road frontage, conservation restrictions, etc.. A standard approach to account for these density losses is to use an “efficiency factor,” a simple multiplier that adjusts the “lot efficiency,” the amount of land on a parcel that is available for construction after addressing all constraints. Simply stated, an efficiency factor is used to account for information that can only be obtained upon on-the-ground inspection of parcels. Efficiency factors are entered as a percentage, where 100% means complete efficiency (no density lost) and 0% means no buildings are estimated for a zone. Based on professional experience, FBE used an efficiency factor of 66% for all zones to account for these unknown factors that will affect the exact siting of construction.

PROJECTED NEW BUILDINGS

The build-out analysis is comprised of a numeric and spatial build-out. A numeric build-out is completed first in order to obtain a number of total projected new buildings based on minimum lot size and total area of buildable land. A spatial build-out is then run to place building points on the map, converting numeric building counts into points representing individual structures. The spatial build-out considers the size of projected new buildings, geometry of lots, and setbacks to various spatial features incorporated into the build-out (e.g., lot lines, roads, natural features). For example, an oddly shaped lot may have enough total area for two buildings, but due to setback rules or minimum separation distances, it may only fit one unit. Along with development constraints and lot size, the spatial build-out also considers the minimum allowable separation distance between buildings or parcel shapes. The build-out does not consider the conversion of small camps to larger residential buildings or redevelopment projects. During the placement of projected new buildings onto buildable area, the user has control over whether the spatial build-out building points are distributed in a random or grid pattern, and if the points should follow existing roads. The grid pattern is best suited for new urban-type development, and the random layout is best for suburban-type development. For the Town of Rye, the random layout was deemed most appropriate.

TIMESCOPE ANALYSIS

The TimeScope Analysis is a computer model of community growth that simulates change over time in a study area. In our analysis, each projected new building within the town was assigned a hypothetical future build date based on a population growth rate for Rye. FBE used compound annual growth rates representing 10-, 20-, and 50-year periods, from 2010-2020 (0.45%), 2000-2020 (0.34%), and 1970-2020 (0.61%), respectively, to run three iterations of the TimeScope Analysis. The projection also provides a date of full build-out based on each historical population growth rate, to provide a range of estimated dates.

This tool provides an analysis of how the number of buildings within the Town might grow based on projected population rates, but it does not take into account future zoning amendments or design considerations as the population grows, which may increase or decrease population changes (e.g., changes in residential zoning or land conservation). It is also important to note that the growth rates used in the TimeScope Analysis are based on town-wide census statistics. Using census data to project population increase and/or decrease for development planning has the inherent limitation of projecting future growth based on past conditions. As such, the TimeScope Analysis might over- or under-estimate the time required for the study area to reach a hypothetical full build-out. Numerous social and economic factors influence population change and development rates, including policies adopted by federal, state, and local governments. The relationships among the various factors are complex and therefore difficult to model.

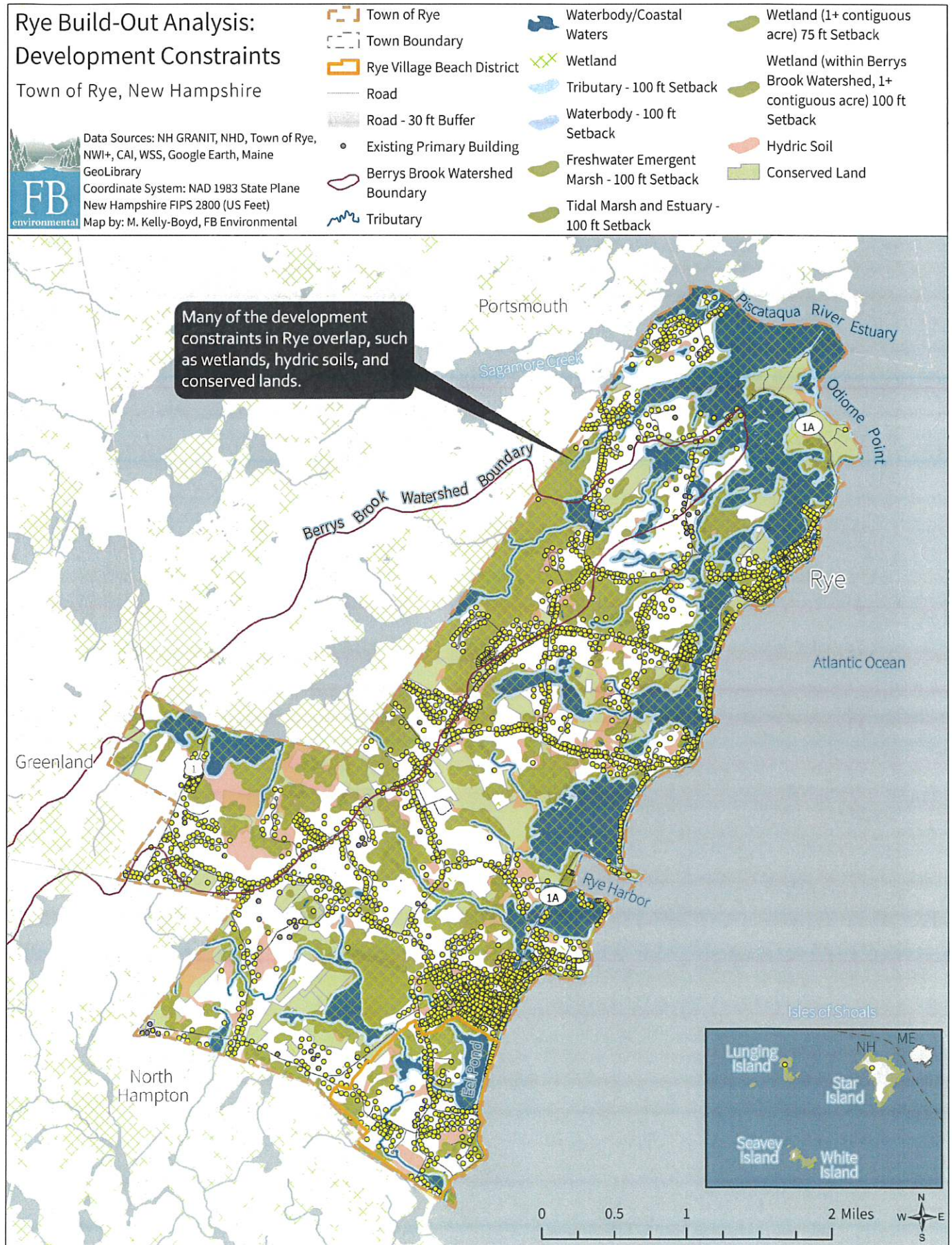


FIGURE 2. Development constraints (including existing buildings) in Rye.

RESULTS

PARCELS

There are approximately 2,958 individual parcels in the Town of Rye. Of note, within the assessor's database, some parcels are listed more than once (due to multiple ownership, such as under a condo association), but only distinct parcels were included in the analysis.

BUILDABLE AREA

Based on the current input parameters, the build-out analysis showed that approximately 13% (1,116 acres) of the Town is buildable under current zoning regulations (Table 5, Figure 4). The zone in the Town of Rye with the most acreage of buildable area is the Single Residence District zone with 877 acres of buildable area. The zone with the highest percentage of buildable area remaining in the Town of Rye is the Commercial District with 39% buildable area, and within the Rye Beach Village District, the Recreational District has the highest percent buildable area remaining at 52%.

TABLE 5. Amount of buildable land in the Town of Rye.

Zone	Total Area (Acres)	Buildable Area (Acres)	Percent Buildable Area
Rye			
Single Residence District (SR)	5,929	877	15%
General Residence District (GR)	457	52	11%
Business District (B)	48	3	6%
Commercial District (C)	276	108	39%
Public Recreation District (PREC)	78	-	0%
Public Recreation and Conservation District (PRAC)	368	-	0%
Conservation District (CON)	701	-	0%
Rye Beach Village District			
RBV Low Density Residential District	282	20	7%
RBV Medium Density Residential District	184	13	7%
RBV Recreational District	84	43	52%
Total	8,407	1,116	13%

PROJECTED NEW BUILDINGS

The existing buildings layer contains 2,722 principal buildings. Based on the current input parameters, the build-out analysis projected that an additional 465 projected new buildings could be constructed in the future, resulting in a total of 3,187 buildings (Table 6, Figure 5). The Single Residence District zone has the largest number of projected new buildings at 322 buildings.

TABLE 6. Projected increase in buildings by zone in Rye.

Zone	No. Existing Buildings	No. Projected New buildings	Total No. Buildings	Percent Increase
Rye				
Single Residence District (SR)	1,466	322	1,788	22%
General Residence District (GR)	836	58	894	7%
Business District (B)	74	4	78	5%
Commercial District (C)	144	62	206	43%
Public Recreation District (PREC)	13	-	13	0%
Public Recreation and Conservation District (PRAC)	1	-	1	0%
Conservation District (CON)	4	-	4	0%
Rye Beach Village District				
RBV Low Density Residential District	63	7	70	11%
RBV Medium Density Residential District	117	10	127	9%
RBV Recreational District	4	2	6	50%
Total	2,722	465	3,187	17%

TIMESCOPE ANALYSIS

Three iterations of the TimeScope Analysis were run using compound annual growth rates (CAGR) for 10-, 20-, and 50-year periods, from 2010-2020 (0.45%), 2000-2020 (0.34%), and 1970-2020 (0.61%), respectively (Table 2). Full build-out is projected to occur in 2060 at the 10-year CAGR, 2072 at the 20-year CAGR, and 2050 for the 50-year CAGR (Figure 3).

This analysis shows that if the Town of Rye population continues to grow at recent rates identified in the 10-, 20-, and 50-year period, and current zoning and other development constraints remain the same, full build-out would hypothetically occur in the mid to late 21st century.

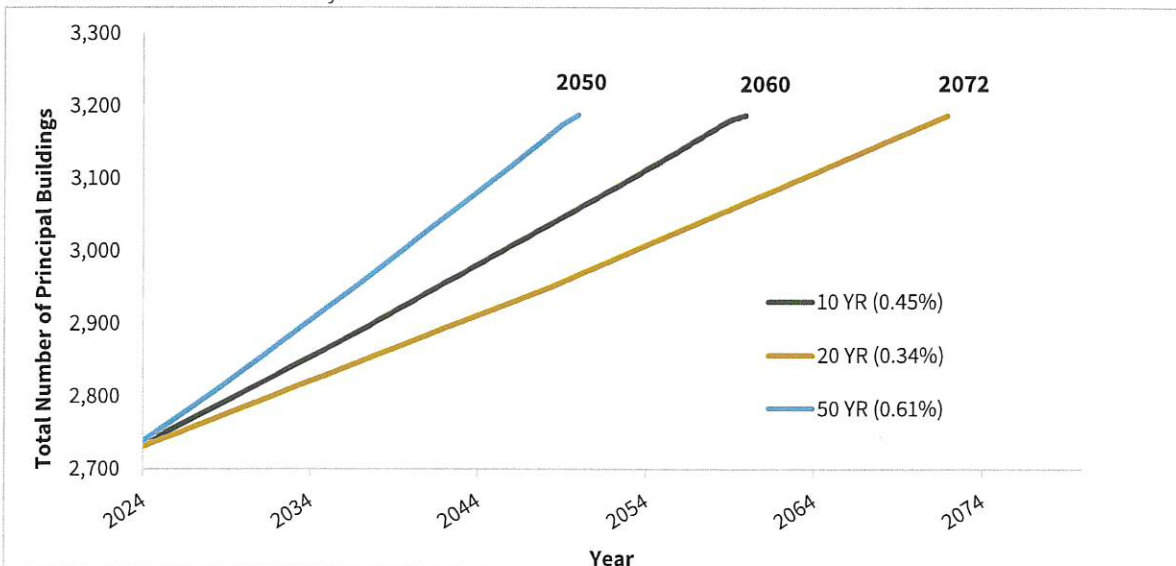


FIGURE 3. Full build-out projects for the Town of Rye (using the population growth rates in Table 2).

Rye Build-Out Analysis: Buildable Area Map

Town of Rye, New Hampshire



Data Sources: NH GRANIT, NHD, Town of Rye, NWI+, CAI, Maine GeoLibrary
 Coordinate System: NAD 1983 State Plane
 New Hampshire FIPS 2800 (US Feet)
 Map by: E. Boardman, FB Environmental

Rye Town Boundary	Single Residence District (SR)
Rye Beach Village (RBV) Precinct Boundary	General Residence District (GR)
City/Town Boundary	Business District (B)
Conserved Land	Commercial District (C)
Wetland	Conservation District (CON)
Waterbody/Coastal Waters	RBV Low Density Residential District
Watercourse	RBV Medium Density Residential District
Road	RBV Recreational District

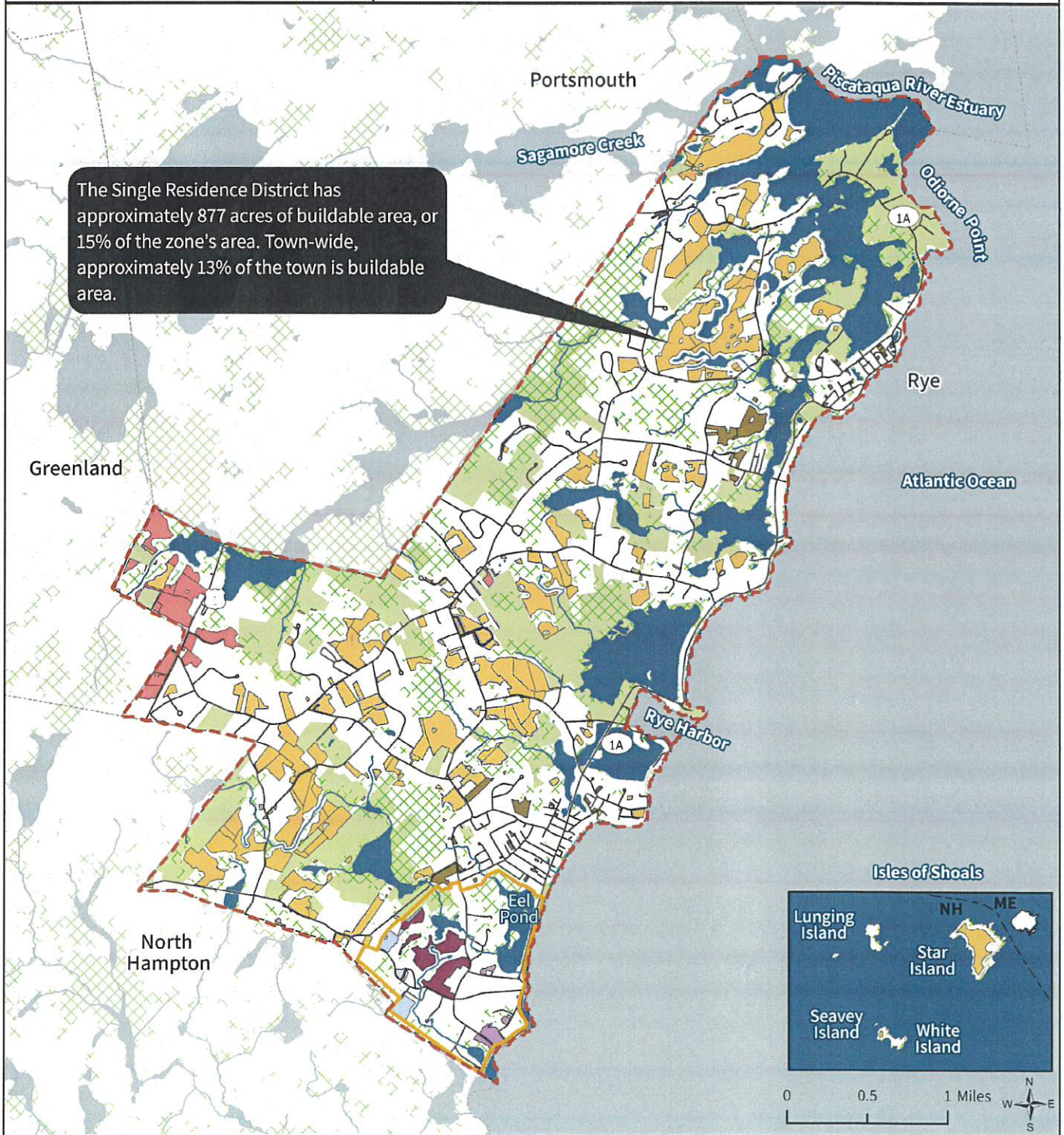


FIGURE 4. Buildable area in the Town of Rye.

Rye Build-Out Analysis: Projected Buildings Map Town of Rye, New Hampshire



Data Sources: NH GRANIT, NHD, Town of Rye, NWI+, CAI, Maine GeoLibrary
 Coordinate System: NAD 1983 State Plane New Hampshire FIPS 2800 (US Feet)
 Map by: E. Boardman, FB Environmental

- Rye Town Boundary
- Rye Beach Village (RBV) Precinct Boundary
- City/Town Boundary
- Parcel Boundary
- Conserved Land
- Waterbody/Coastal Waters
- Wetland
- Watercourse
- Road
- Projected New Building
- Existing Building

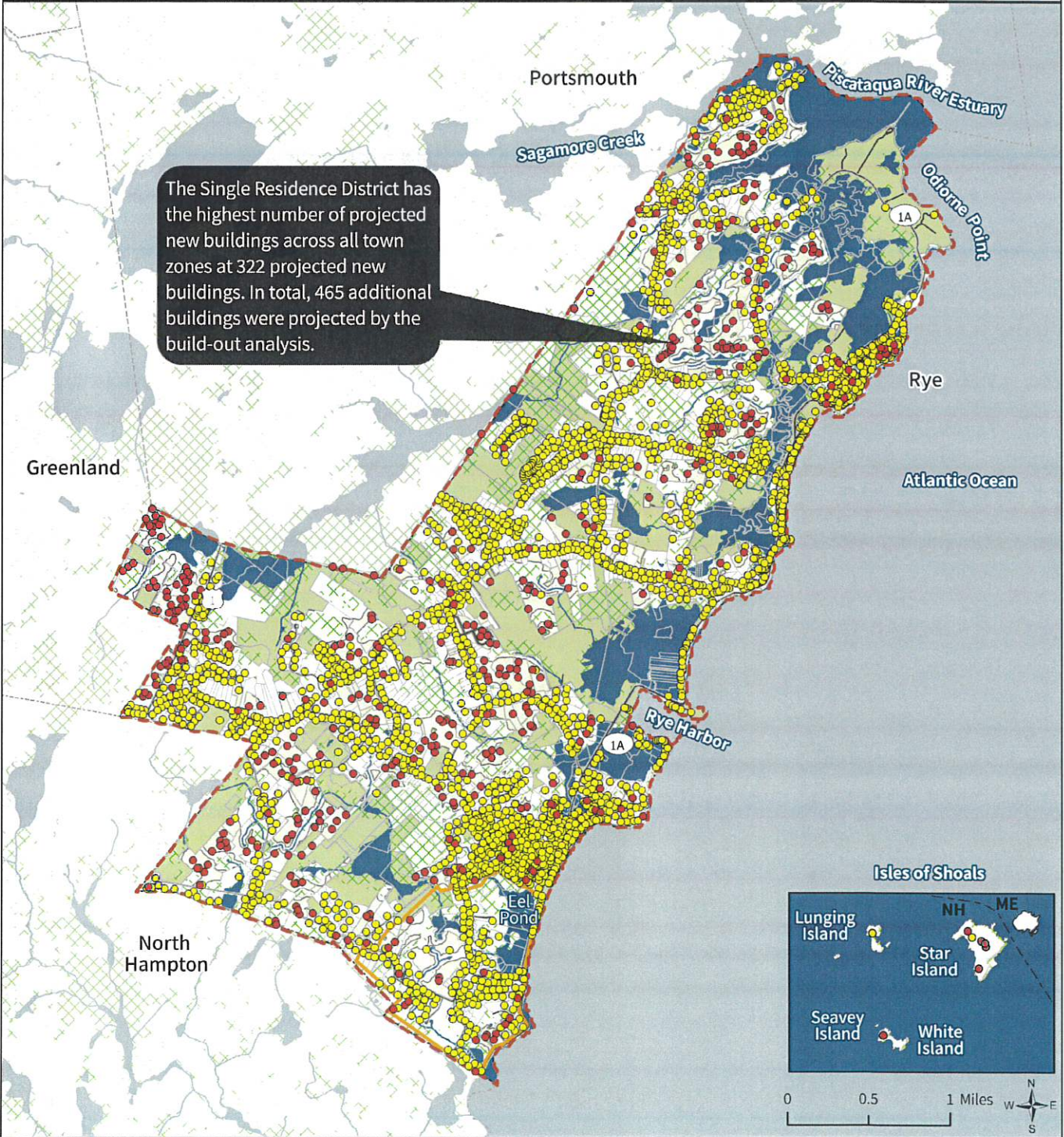


FIGURE 5. Projected new buildings in the Town of Rye.

CONCLUSION

The build-out analysis completed for the Town of Rye can be a helpful planning tool to envision future growth in the Town during the master planning process. While the build-out analysis serves as a useful planning tool, the reader is cautioned that the spatial and numerical information provided herein are estimates and should be treated accordingly. Furthermore, the build-out lays the groundwork for understanding future development in the Town but does not incorporate how community services will need to be increased to meet community needs.

The Town of Rye has extensive development constrictions, particularly large wetland complexes and conserved lands. The tidal marshes of Rye behind the Town's beaches provide unique character to the town and add to its desirability, while also naturally restricting buildable area. In addition, the Town of Rye has numerous large tracts of conserved land that protect its natural resources while restricting development. Between these two constraints, future buildable area in Rye is lower than many other New Hampshire communities.

Ultimately, the Town of Rye has moderate buildable area at approximately 13%. While FB Environmental typically sees 25%-50% buildable area in build-out models for more rural New Hampshire communities, the buildable area in the Town of Rye is in line with expectations given the current level of development in the Town. With 2,722 existing buildings and an additional 465 projected new buildings, the Town of Rye may experience redevelopment or infill development (such as accessory dwelling units) to meet the future development pressures in addition to the projected new primary buildings.

RECOMMENDED NEXT STEPS

FBE recommends the following next steps for the Town to consider during the Master Planning process:

- » Consider projected development hotspots (Figure 1) and areas with buildable area (Figure 4) in context of current issues facing the Town. Questions to consider exploring could include:
 - Which areas of Rye could be a good fit for meeting affordable housing needs?
 - Which areas of the Town projected to experience future growth are at increased risk from effects of climate change due to sea level rise, storm surges, inundation during flooding, or being cut off from emergency services?
- » Explore potential changes to the Town's zoning and ordinance regulations using alternative scenarios.
- » Consider any natural resources not adequately protected during projected future development. For example, considering future tidal marsh migration due to sea level rise, are there any areas of the Town that would benefit from an increased buffer to allow coastal marshes to migrate inland?
- » Use the projected development estimations to understand how Town services such as sewer, public water, emergency services, and school systems may be impacted. For example, can the sewer district support any expansions to its service area to accommodate growth while protecting natural resources and water quality?

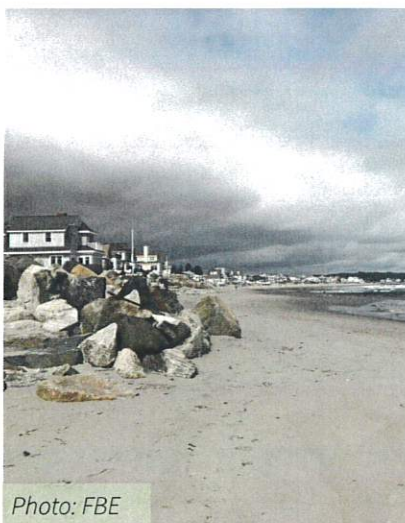


Photo: FBE



Photo: Aimee Seavey/New England.com

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