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Shoreland Buffer Module for GRANIT Data Mapper

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A Final Report to

The New Hampshire Estuaries Project

submitted by

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Executive Summary

The Complex Systems Research Center at the University of New Hampshire enhanced the GRANIT Data Mapper (http://mapper.granit.unh.edu) by incorporating data describing shoreline buffers in New Hampshire. The project supports an ongoing, comprehensive New Hampshire Estuaries Project (NHEP) outreach initiative that seeks to educate municipal decision-makers about the importance of stream buffers in preserving water quality in coastal New Hampshire. It complements these existing outreach efforts by allowing coastal managers, local land use boards, and the general public to readily visualize the spatial extent of current and/or proposed shoreline regulations in their community.

The primary data source for the analysis was the high-resolution New Hampshire National Hydrography Dataset (NHHD). Using standard GIS tools, six concentric buffers incrementing in 50' widths from 50' to 300' were generated around stream and shoreline features recorded in the NHHD. To provide the greatest flexibility to users, two data sets were generated at each buffer increment – one representing shorelines and streams classified as either perennial or intermittent, and the second comprising shorelines and only streams classified as perennial. The resulting buffers were merged with the GRANIT surface water data, and acreage by town and subwatershed was calculated for each buffer category.

The shoreline buffer data sets were added to the water resources theme of the Data Mapper, thereby providing the public with the ability to view buffers of varying widths in the context of other data layers (including aerial imagery) available through the viewing tool. The associated acreage data tables were added to the water resources theme tool tab.

Findings indicated that aggregated at the HUC-12 level, almost 24,000 acres within the Coastal Basin were covered by 50' buffers when perennial and intermittent streams as well as shorelines were buffered, with over 133,000 acres covered by 300' buffers. When only perennial streams and shorelines were considered eligible for buffering, the totals declined to just under 17,000 acres (50' buffers) and over 96,000 acres (300' buffers).

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Introduction

Protective corridors, or buffer zones, around streams, lakes, and other surface water features are an important planning tool in helping to protect stream water quality and aquatic habitat. Left in a vegetated state, buffers serve a number of important and well-documented services and functions, including filtering and removing pollutants from stream channels, controlling streambank erosion, providing wildlife habitat, providing water storage and floodplain protection measures, shading streams from excessive heat, and delivering recreational opportunities. And they provide these services in both urban and rural settings. In recognition of the importance of vegetative buffers, the NH Estuaries Project (NHEP) has launched a comprehensive campaign to educate coastal watershed towns about the need to enhance local buffer protective measures.

In response to increasing demands from municipal decision-makers, coastal managers, and the public at large for new data sets as well as tools to utilize those data sets, the Complex Systems Research Center (CSRC) at the University of New Hampshire has developed the GRANIT Data Mapper (http://mapper.granit.unh.edu), an online geospatial data viewing and query tool. The Data Mapper comprises a suite of themes, including a base theme, water resources, land conservation, transportation, floodplains, and others. Each theme provides access to a set of related data layers associated with an issue or topic encountered by municipal decision-makers. Users may select a theme, navigate to a particular location, turn on/off data layers of interest, and retrieve information about specific features in data layers. Within each theme, the interface provides users with a number of tools/utilities, including summary reports on feature acreages (where appropriate), online access to data documentation, and the ability to generate small-format maps for download and local printing. This project enhanced the utility of the Data Mapper by incorporating shoreline buffer data sets into the water resources theme, thereby delivering the ability to view, query, and tabulate buffers in the context of associated water resources data layers.

Project Goals and Objectives

The project objectives were to:

- Develop 2 buffers at each of six 50’ buffer increments ranging from 50’ to 300’ wide – one based on perennial and intermittent streams as well as shorelines, and the second based on just perennial streams and shorelines;
- Tabulate the land acreage associated with each buffer increment and report out by town and by subwatershed; and
- Incorporate the buffer data sets as well as the tabular summaries ito a theme of the GRANIT Data Mapper.

Unlike previous buffer mapping efforts, the intent was not to generate buffers for each individual stream segment. Instead, the objective was to develop a single, continuous buffer at each increment around the set of designated surface water features.

The project complements the existing NHEP buffer outreach efforts by allowing the coastal management community to easily view and query current and/or proposed shoreline regulations. Further, it addresses the following buffer protection-related Action Plans from the NHEP Management Plan: LND-2, LND-8A, LND-14, LND-15, LND-20, LND-25, LND-25D, and LND-34.

Methods

a. Project Study Area

The project study area comprised the 48 towns that are wholly or partially within the Piscataqua/Coastal Basin of New Hampshire (Figure 1), extending across 759,673 acres in the coastal area of the state.

Figure 1. Project study area - Piscataqua/Coastal Basin in New Hampshire, HUC 01060003.

b. Data Sources

The project relied on three data sets archived in the GRANIT database (http://www.granit.sr.unh.edu) maintained by CSRC. These data sets include:

- Hydrography (1:24,000) – extracted from the New Hampshire National Hydrography Dataset (NHHD);
- Political/Town Boundaries (1:24,000) – derived from USGS 7.5-minute topographic quads; and
- Subwatersheds (1:24,000) – based on Natural Resources Conservation Service (NRCS) HUC-12 delineations.

c. Data Processing and Analysis

Using ArcGIS 9.x software, a series of standard GIS analyses was conducted to generate the two data sets – one for buffers around perennial/intermittent streams and shorelines and the second for buffers around only perennial streams and shorelines. First, surface water features were extracted from the NHHD based on their feature code, or FCODE. Table 1 presents a listing of the features used as a basis for the perennial stream and shoreline iteration. Note that the input features comprised both linear features (flowlines) and polygon features (water bodies and area features).

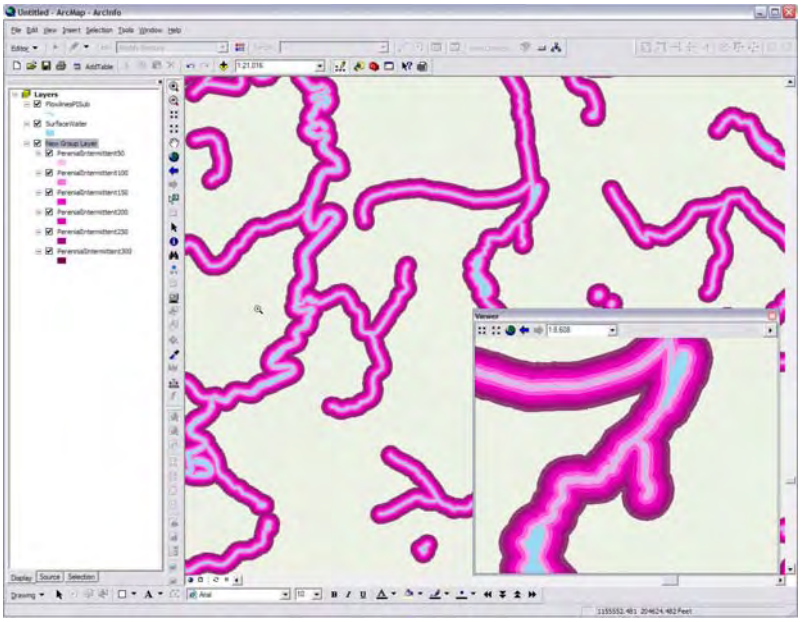
Table 1. Input features for perennial stream/shoreline buffering operation.

NHHD Feature Type	FCODE	Description
Flowlines	33600	Canal/Ditch-no attributes
	33601	Canal/Ditch-aqueduct
	33400	Connector
	46006	Stream/River-hydrographic category perennial
Water Bodies	39004	Lake/Pond-hydrographic category perennial
	39009	Lake/Pond-hydrographic category perennial; stage|average water elevation
	43613	Reservoir-water storage-hydrographic category unspecified
	43615	Reservoir-water storage-hydrographic category perennial
Area Features	33600	Canal/Ditch-no attributes
	36400	Foreshore
	43100	Rapids
	44500	Sea/Ocean
	46006	Stream/River-hydrographic category perennial

For the perennial/intermittent stream and shoreline iteration, intermittent streams (FCODE 46003) were also selected for buffering.

Once the 2 hydrography input data sets were established, buffers at each of the 6 preset increments – 50', 100', 150', 200', 250', and 300' – were generated. Because buffers generated around polygons include the originating feature, an "erase" was required to eliminate the surface water area itself from the host buffer polygon. The final buffer data set included just the land area surrounding the input surface water features (Figure 2).

Figure 2. Surface water buffers in vicinity of Newmarket, Newfields, and Epping, NH.



The last processing step was to combine both buffer data sets with the town boundary and subwatershed data sets, and to calculate the resulting acreages by buffer width and by each geographic unit.

Finally, the buffer data sets were incorporated into the GRANIT Data Mapper in the water resources theme. (At the initiation of the project, the concept was to develop an independent buffer theme in the Data Mapper. However, subsequent discussions led to the realization that incorporating the buffer data in the existing water resources theme, and thereby providing access to the data in the context of related water resources features, would provide maximum utility to our users.) The geospatial data were symbolized and added as a layer to the theme (Figure 3), and the corresponding acreage summaries were incorporated as options in the "theme tools" (Figure 4). A basic metadata record was developed to describe the contents of the data set, and was posted to the Data Mapper metadata library.

To access the data in the GRANIT Data Mapper, point your browser to: **mapper.granit.unh.edu**

- Select the water resources theme
- Zoom in to a scale of at least 1:45,000, as buffers are not available for display at smaller scales
- Turn on the buffers of interest

(Note: In order to maintain the statewide mapping extent of data in the GRANIT Data Mapper, external resources were utilized to extend the data development to statewide coverage.)

Figure 3. Water resources theme in GRANIT Data Mapper – zoomed to area in Exeter, NH.

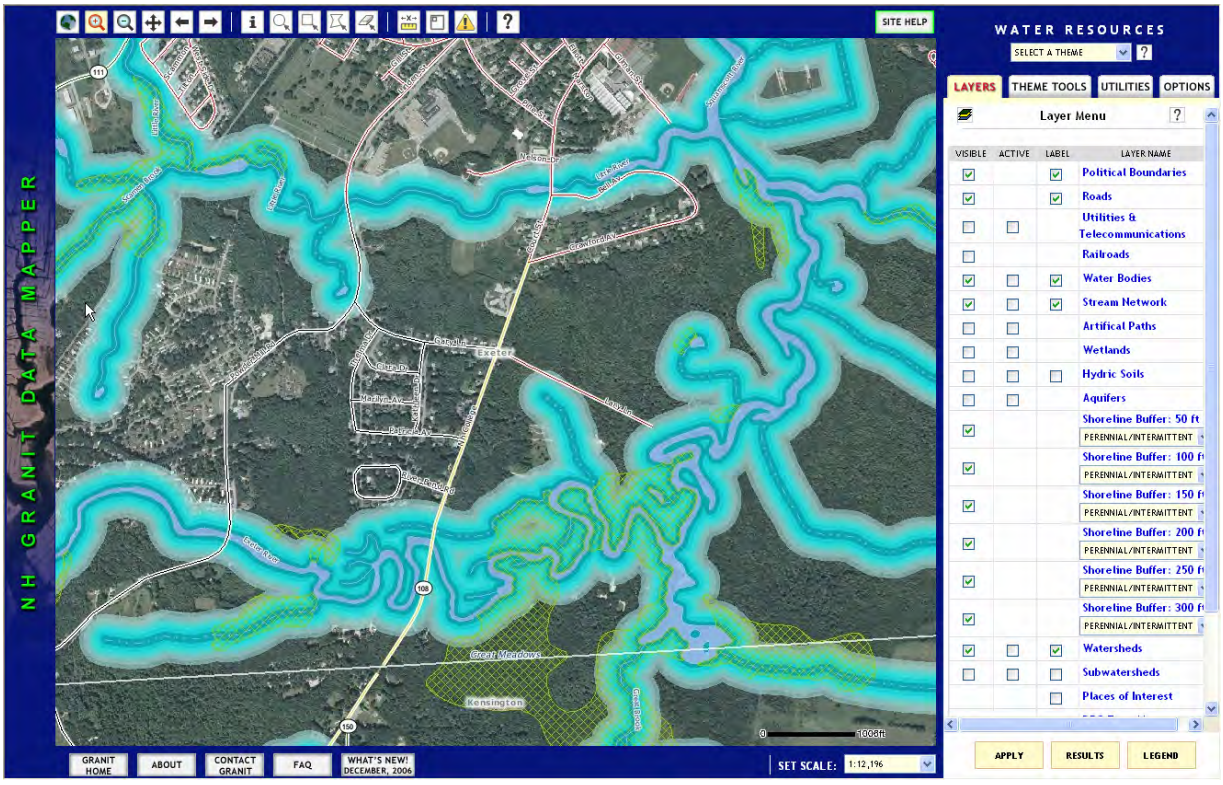


Figure 4. Summary shoreline buffer acreage report for Great Brook-Exeter River Watershed, NH.

Summary Shoreline Buffer Acreage Report

Date Generated: 01/03/2007

Reporting Units: acres

Great Brook-Exeter River Watershed

Acreages presented here are based on surface water features selected from the New Hampshire Hydrography Dataset (see metadata for a listing of the FCODES used) and may differ from previously reported totals.

WATERSHED CODE	01060003
WATERSHED NAME	Salmon Falls-Piscataqua Rivers
SUBWATERSHED CODE	010600030805
SUBWATERSHED NAME	Great Brook-Exeter River
SUBWATERSHED ACREAGE	12362.8
SURFACE WATER ACREAGE	550.9
PERENNIAL/INTERMITTENT STREAMS AND SHORELINE LENGTH (FEET)	335385.6
PERENNIAL/INTERMITTENT STREAMS AND SHORELINE BUFFER AT 50FT	702.5
PERENNIAL/INTERMITTENT STREAMS AND SHORELINE BUFFER AT 100FT	1378.9
PERENNIAL/INTERMITTENT STREAMS AND SHORELINE BUFFER AT 150FT	2023.1
PERENNIAL/INTERMITTENT STREAMS AND SHORELINE BUFFER AT 200FT	2643.1
PERENNIAL/INTERMITTENT STREAMS AND SHORELINE BUFFER AT 250FT	3245.8
PERENNIAL/INTERMITTENT STREAMS AND SHORELINE BUFFER AT 300FT	3832.8
PERENNIAL STREAMS AND SHORELINE LENGTH (FEET)	306099.8
PERENNIAL STREAMS AND SHORELINE BUFFER AT 50FT	436.3
PERENNIAL STREAMS AND SHORELINE BUFFER AT 100FT	867.4
PERENNIAL STREAMS AND SHORELINE BUFFER AT 150FT	1289
PERENNIAL STREAMS AND SHORELINE BUFFER AT 200FT	1709.6
PERENNIAL STREAMS AND SHORELINE BUFFER AT 250FT	2131.9
PERENNIAL STREAMS AND SHORELINE BUFFER AT 300FT	2556.3

Results and Discussion

Table 2 presents the town-level acreage summaries for each buffer increment (50' to 300') based on perennial/intermittent streams and shorelines. The table also reports the length of the input shoreline features, and the area of the input polygons (lakes, ponds, etc.) Note that data are presented for the entirety of any town that extends into the Coastal Basin. For these 48 towns, the perennial/intermittent and shoreline buffers cover an area of almost 32,000 acres (50' buffers) up to approximately 180,000 acres (300' buffers). At the individual town level, buffers range from less than 69 acres (50' buffers in the town of New Castle) to over 8,000 acres (300' buffers in the town of Alton).

Table 3 presents comparable data for buffers based on perennial streams only and shorelines. These buffers cover areas ranging from 69 acres (again, the 50' buffers in the town of New Castle) to almost 6,200 acres (300' buffers in the town of Barrington). Collectively, the 300' buffers cover over 127,000 acres within the 48 towns wholly or partially in the Coastal Basin.

Table 4 presents the summary data for perennial/intermittent stream and shoreline buffers at the subwatershed (HUC-12) level. Note that because this table (as well as Table 5) summarizes within the Piscataqua/Coastal Basin only, the mapped area is less than that used as the basis for Tables 2 and 3. The Upper Cocheco River (06030601) and the Middle Lamprey River (06030703) have the greatest land acreage within the 300' buffers, with 6,887 and 6,722 acres respectively. In total, these large buffers cover over 133,000 acres in the Coastal Basin.

The results for perennial streams and shoreline buffers are presented in Table 5. With the elimination of intermittent streams in the calculation, the Bellamy River (06030903) with 4,903 acres and the Middle Lamprey River (06030703) with 4,432 acres have the largest areas within the 300' buffers. The total acreage in the Coastal Basin within the 300' buffers drops to just over 96,000 acres.

These tables provide the viewer with a basis by which he or she may evaluate the impact that varying input features (e.g. perennial and intermittent streams vs. perennial streams only) and/or varying buffer sizes impose on the surrounding landscape. For example, the overall buffer area for perennial streams and water bodies within the Coastal Basin increases significantly, from 16,846 acres to 96,064 acres, when the buffer distance changes from 50' to 300'. These figures are further amplified when intermittent streams are included, as the buffered area increases from 23,853 to 133,109 acres. Recognizing the impacts associated with these changes in buffer delineations may provide an important foundation to policy makers when they consider alternate courses of action.

Table 2. Town-level buffer acreage summary based on perennial/intermittent streams and shorelines

Town Name	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial/Intermittent Streams and Shorelines Buffers (acres)					
	Perennial/ Intermittent Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
Alton	835841.4	12602.1	1396.3	2772.0	4128.6	5466.4	6784.4	8082.5
Barrington	750320.4	1398.7	1327.8	2635.0	3920.0	5184.7	6432.9	7665.1
Brentwood	279492.6	122.4	489.8	966.6	1430.9	1888.7	2340.6	2787.1
Brookfield	224939.0	287.3	455.6	902.7	1341.9	1774.0	2197.3	2614.2
Candia	404770.9	217.0	808.8	1618.1	2425.5	3228.6	4022.4	4803.0
Chester	365230.1	99.9	764.2	1534.8	2310.1	3086.7	3864.5	4643.1
Danville	155200.9	130.7	317.4	633.3	947.9	1258.9	1565.4	1867.6
Deerfield	648786.3	763.8	1340.2	2683.2	4021.6	5354.4	6678.5	7987.1
Derry	515406.6	545.6	1035.3	2080.3	3129.8	4180.3	5226.1	6264.4
Dover	452149.0	1549.8	677.9	1346.3	2003.2	2652.9	3293.5	3924.5
Durham	434998.2	1599.8	673.8	1334.4	1986.6	2634.7	3275.0	3909.3
East Kingston	164524.4	62.8	339.6	673.0	998.7	1320.0	1636.2	1945.1
Epping	465621.7	303.3	798.4	1578.7	2342.4	3091.5	3825.6	4538.9
Exeter	387588.3	226.4	682.5	1343.0	1978.2	2594.4	3195.2	3783.7
Farmington	496033.4	421.8	951.6	1903.8	2847.4	3777.2	4691.6	5584.8
Fremont	257364.9	107.6	488.7	967.8	1439.5	1905.2	2361.8	2812.0
Greenland	203552.1	1801.4	350.2	695.3	1035.1	1368.7	1697.8	2020.5
Hampstead	223699.3	470.8	413.1	829.2	1244.9	1655.1	2060.1	2457.5
Hampton	553371.9	785.8	894.4	1629.6	2184.5	2618.6	2988.5	3322.1
Hampton Falls	384899.8	358.4	668.7	1239.7	1707.1	2095.0	2446.0	2779.6
Kensington	192382.1	32.1	394.6	783.3	1164.2	1536.1	1899.6	2253.3
Kingston	332357.7	956.5	570.9	1137.2	1694.3	2243.2	2782.9	3310.9
Lee	301322.3	241.1	527.1	1057.8	1593.8	2132.2	2673.3	3215.3
Madbury	204075.7	399.8	350.3	692.8	1030.4	1364.6	1696.6	2024.7
Middleton	228101.0	284.0	467.9	931.0	1388.8	1841.3	2282.9	2714.5
Milton	447336.4	847.3	790.2	1556.5	2310.9	3056.0	3788.9	4507.1
New Castle	58421.4	841.4	68.9	129.3	184.3	233.8	276.8	314.8
New Durham	572061.0	1707.9	1073.4	2131.7	3177.1	4205.1	5213.5	6200.3
Newfields	103129.2	105.2	198.0	392.2	585.0	777.6	970.6	1163.4
Newington	148858.0	2700.4	208.1	405.8	598.1	786.9	971.7	1152.8
Newmarket	211379.4	1046.2	374.4	739.7	1097.2	1449.9	1797.9	2143.6
North Hampton	262582.1	61.3	526.3	1045.5	1557.0	2053.6	2532.9	2995.7
Northwood	461208.0	1382.7	834.6	1666.1	2494.4	3315.9	4128.2	4927.3
Nottingham	650750.5	1117.2	1212.8	2402.9	3579.2	4744.3	5892.6	7024.8
Pittsfield	338649.5	364.6	610.2	1219.6	1826.9	2431.1	3028.6	3620.3
Portsmouth	251139.4	761.5	405.9	806.5	1200.4	1583.4	1958.1	2325.2

Table 2. Town-level buffer acreage summary based on perennial/intermittent streams and shorelines (cont.)

Town Name	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial/Intermittent Streams and Shorelines Buffers (acres)					
	Perennial/ Intermittent Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
Raymond	462460.5	504.5	843.7	1682.9	2514.8	3335.3	4145.3	4941.2
Rochester	833105.0	665.7	1349.2	2648.8	3913.8	5147.6	6354.5	7542.3
Rollinsford	133388.2	161.5	245.6	477.6	700.4	915.1	1125.0	1331.0
Rye	311155.4	408.4	524.4	1034.1	1513.7	1966.7	2394.2	2794.3
Sandown	238906.3	343.3	471.1	938.2	1399.3	1852.7	2298.5	2736.4
Seabrook	397582.2	494.9	681.2	1222.9	1625.4	1941.3	2215.3	2466.3
Somersworth	156747.8	179.4	269.4	534.9	797.6	1058.0	1317.1	1573.7
South Hampton	189312.7	102.5	352.5	680.0	985.9	1275.7	1553.2	1820.9
Strafford	684550.3	1627.4	1220.5	2417.0	3598.7	4763.5	5912.0	7047.1
Stratham	220346.7	244.8	421.8	837.8	1252.4	1666.6	2080.2	2487.9
Wakefield	633444.0	6712.5	1084.3	2095.4	3053.6	3977.0	4870.0	5735.4
Wolfeboro	719311.4	539.2	1027.9	2025.3	2996.6	3944.5	4873.2	5787.0
TOTAL	**17,947,855.4**	**48,688.7**	**31,979.5**	**63,059.6**	**93,258.1**	**122,735.0**	**151,617.0**	**179,949.6**

Table 3. Town-level buffer acreage summary based on perennial streams and shorelines.

Town Name	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial Streams and Shorelines Buffers (acres)					
	Perennial Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
Alton	610338.2	12602.1	882.5	1753.4	2616.4	3473.8	4327.7	5179.1
Barrington	633944.4	1398.7	1063.8	2112.7	3145.3	4164.8	5174.5	6175.6
Brentwood	159862.6	122.4	224.6	455.1	691.8	936.6	1191.5	1457.2
Brookfield	119179.2	287.3	215.0	427.6	639.0	850.1	1060.3	1270.4
Candia	252757.8	217.0	463.4	934.7	1411.8	1895.4	2385.6	2878.2
Chester	211004.3	99.9	414.8	847.0	1295.2	1757.1	2231.5	2719.1
Danville	90327.2	130.7	168.8	338.1	507.5	675.2	841.4	1005.8
Deerfield	392998.9	763.8	756.4	1524.2	2298.7	3080.0	3866.3	4653.4
Derry	365238.1	545.6	695.0	1411.2	2145.7	2898.2	3666.7	4447.9
Dover	452149.0	1549.8	677.9	1346.3	2003.2	2652.9	3293.5	3924.5
Durham	434998.2	1599.8	673.8	1334.4	1986.6	2634.7	3275.0	3909.3
East Kingston	97237.3	62.8	188.5	378.3	569.2	765.6	967.7	1173.0
Epping	312745.1	303.3	456.3	912.7	1369.4	1826.3	2282.8	2734.9
Exeter	314744.2	226.4	522.7	1039.2	1545.3	2047.0	2545.7	3043.5
Farmington	289729.9	421.8	484.1	983.5	1494.0	2011.4	2533.3	3059.1
Fremont	148142.6	107.6	242.9	485.6	731.6	982.8	1234.7	1488.1
Greenland	203552.1	1801.4	350.2	695.3	1035.1	1368.7	1697.8	2020.5
Hampstead	113754.6	470.8	164.0	337.5	519.5	709.4	906.9	1111.6
Hampton	511697.3	785.8	804.5	1461.2	1949.4	2329.7	2655.0	2951.5
Hampton Falls	328530.5	358.4	546.2	1007.2	1376.6	1677.8	1952.7	2222.0
Kensington	113635.4	32.1	223.3	459.8	705.8	959.2	1217.0	1477.5
Kingston	241931.4	956.5	368.6	741.9	1115.3	1490.8	1867.3	2242.5
Lee	255434.2	241.1	425.1	859.9	1306.6	1761.8	2225.4	2696.0
Madbury	204075.7	399.8	350.3	692.8	1030.4	1364.6	1696.6	2024.7
Middleton	135811.8	284.0	257.9	515.0	772.9	1031.7	1290.5	1549.5
Milton	327469.7	847.3	520.7	1030.1	1540.9	2055.6	2573.0	3090.9
New Castle	58421.4	841.4	68.9	129.3	184.3	233.8	276.8	314.8
New Durham	310985.4	1707.9	480.5	960.5	1443.2	1930.6	2422.9	2917.3
Newfields	97086.4	105.2	184.2	364.7	543.9	722.9	902.5	1082.1
Newington	148858.0	2700.4	208.1	405.8	598.1	786.9	971.7	1152.8
Newmarket	202699.0	1046.2	354.8	701.3	1041.4	1377.5	1709.2	2038.3
North Hampton	148785.3	61.3	277.2	571.6	879.6	1196.6	1517.9	1842.8
Northwood	319606.1	1382.7	514.5	1035.6	1564.3	2100.9	2641.8	3181.5
Nottingham	497555.2	1117.2	864.4	1712.5	2552.8	3389.2	4218.1	5038.8
Pittsfield	249609.1	364.6	409.5	824.8	1243.4	1664.6	2086.6	2511.0
Portsmouth	251139.4	761.5	405.9	806.5	1200.4	1583.4	1958.1	2325.2

Table 3. Town-level buffer acreage summary based on perennial streams and shorelines (cont.)

Town Name	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial Streams and Shorelines Buffers (acres)					
	Perennial Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
Raymond	351306.4	504.5	590.9	1182.5	1771.7	2356.4	2937.5	3514.2
Rochester	607633.5	665.7	848.4	1684.7	2523.1	3367.8	4220.9	5087.4
Rollinsford	133388.2	161.5	245.6	477.6	700.4	915.1	1125.0	1331.0
Rye	283744.4	408.4	464.2	919.0	1349.8	1760.7	2152.5	2524.0
Sandown	117448.2	343.3	196.9	398.8	604.3	812.1	1021.5	1232.5
Seabrook	373187.7	494.9	627.2	1118.1	1473.2	1746.4	1981.7	2199.1
Somersworth	138420.2	179.4	228.9	458.3	688.5	919.0	1150.4	1381.2
South Hampton	125753.0	102.5	213.5	416.4	611.5	805.0	999.1	1194.9
Strafford	495504.0	1627.4	796.5	1589.6	2388.9	3193.9	4001.2	4811.1
Stratham	192941.5	244.8	363.1	732.6	1108.9	1492.8	1883.4	2274.6
Wakefield	519238.0	6712.5	808.2	1553.0	2254.6	2931.5	3591.4	4236.1
Wolfeboro	383139.8	539.2	768.5	1512.4	2236.5	2943.9	3639.6	4325.2
TOTAL	**13,327,739.9**	**48,688.7**	**22,061.2**	**43,640.3**	**64,766.0**	**85,632.2**	**106,370.2**	**127,021.7**

Table 4. HUC12-level buffer acreage summary based on perennial/intermittent streams and shorelines

HUC-12 Code and Name[1]	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial/Intermittent Streams and Shoreline Buffers (acres)					
	Perennial/ Intermittent Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
0401-Upper Branch River - Lovell Lake	345,964.4	233.1	627.9	1,235.2	1,825.3	2,401.6	2,962.6	3,510.5
0402-Junes Brook - Branch River	230,875.4	1,310.2	641.4	1,263.0	1,874.9	2,478.3	3,069.5	3,647.3
0403-Headwaters - Great East Lake	175,720.5	652.0	401.6	789.0	1,166.5	1,534.3	1,891.7	2,238.6
0404-Milton Pond	382,669.6	368.4	289.5	564.1	834.1	1,100.1	1,360.9	1,615.1
0405-Middle Salmon Falls River	86,853.5	276.3	631.4	1,237.8	1,826.2	2,400.9	2,967.4	3,527.2
0406-Lower Salmon Falls River	569,674.6	515.8	123.2	243.5	363.0	481.1	597.2	711.5
0601-Upper Cocheco River	155,525.7	368.3	1,175.1	2,347.7	3,512.0	4,662.2	5,788.0	6,887.3
0602-Axe Handle Brook	416,376.4	268.0	294.5	587.6	878.9	1,170.1	1,461.5	1,751.7
0603-Middle Cocheco River	215,915.1	1,239.6	679.4	1,342.2	1,989.4	2,615.7	3,225.2	3,820.3
0604-Bow Lake	347,926.6	272.1	341.3	664.4	977.1	1,282.5	1,582.4	1,880.8
0605-Nippo Brook - Isinglass River	239,246.2	351.3	672.1	1,338.7	1,998.8	2,649.6	3,289.4	3,917.3
0606-Long Pond	430,596.2	512.3	426.5	851.8	1,276.7	1,700.3	2,119.3	2,534.2
0607-Lower Isinglass River	397,433.5	421.5	672.8	1,332.6	1,979.4	2,613.0	3,233.1	3,842.3
0608-Lower Cocheco River	467,017.2	211.8	665.6	1,318.6	1,959.3	2,589.5	3,212.0	3,823.4
0701-Headwaters - Lamprey River	233,589.2	139.1	947.6	1,891.9	2,828.7	3,757.8	4,678.6	5,581.7
0702-North Branch River	654,506.0	617.5	454.5	911.3	1,368.3	1,823.4	2,273.9	2,714.0
0703-Middle Lamprey River	306,743.9	913.7	1,152.3	2,294.9	3,425.0	4,540.2	5,640.8	6,721.6
0704-Pawtuckaway Pond	338,626.6	253.2	498.2	984.0	1,461.8	1,931.4	2,391.3	2,842.3
0705-Bean River	171,385.6	62.7	690.2	1,379.4	2,068.2	2,755.0	3,435.1	4,105.3
0706-North River	234,467.7	361.5	362.0	723.5	1,083.5	1,441.3	1,796.7	2,149.4
0707-Little River	312,544.3	103.3	453.0	898.8	1,338.7	1,776.4	2,211.0	2,641.6
0708-Piscassic River	385,246.4	448.3	634.7	1,257.6	1,872.3	2,483.5	3,089.5	3,691.4
0709-Lower Lamprey River	229,915.9	97.3	574.4	1,136.3	1,689.3	2,234.0	2,773.4	3,308.4
0801-Watson Brook	488,782.0	222.1	475.1	949.0	1,420.3	1,888.0	2,351.0	2,808.6

Table 4. HUC12-level buffer acreage summary based on perennial/intermittent streams and shorelines (cont.)

HUC-12 Code and Name[1]	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial/Intermittent Streams and Shoreline Buffers (acres)					
	Perennial/ Intermittent Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
0802-Towle Brook - Lily Pond	355,776.8	170.1	1,018.4	2,039.5	3,060.0	4,073.6	5,078.6	6,073.9
0803-Spruce Swamp - Little River	222,497.1	36.0	620.9	1,225.7	1,817.7	2,400.3	2,972.6	3,535.8
0804-Little River	393,778.5	165.4	466.1	926.2	1,379.1	1,826.7	2,269.6	2,707.5
0805-Great Brook - Exeter River	335,385.6	550.9	702.5	1,378.9	2,023.1	2,643.1	3,245.8	3,832.8
0806-Squamscott River	290,788.3	99.2	608.4	1,205.8	1,798.9	2,389.2	2,973.9	3,549.7
0901-Winnicut River	432,234.3	560.6	570.4	1,131.8	1,684.6	2,227.1	2,761.1	3,285.0
0902-Oyster River	540,996.0	1,278.4	802.3	1,600.5	2,397.3	3,192.9	3,983.2	4,767.9
0903-Bellamy River	391,336.5	5,999.5	931.0	1,836.8	2,722.0	3,593.1	4,454.5	5,307.3
0904-Great Bay	315,404.2	2,315.3	593.0	1,179.4	1,764.1	2,346.8	2,924.4	3,494.7
1001-Portsmouth Harbor	325,798.8	326.1	438.5	856.4	1,256.0	1,633.1	1,991.5	2,336.4
1002-Berrys Brook - Rye Harbor	519,182.5	270.5	622.8	1,231.2	1,808.0	2,357.6	2,881.8	3,378.3
1003-Taylor River - Hampton River	967,479.3	1,233.0	930.2	1,777.1	2,533.2	3,228.1	3,888.9	4,526.2
1004-Hampton Harbor	171,655.5	26.3	1,664.8	3,012.4	4,022.7	4,797.6	5,452.3	6,041.9
TOTAL	**13,079,916.1**	**23,250.7**	**23,853.8**	**46,944.6**	**69,284.3**	**91,019.4**	**112,279.5**	**133,109.0**

[1]First 8 digits of HUC12 codes (01060003) are omitted to conserve space.

Table 5. HUC12-level buffer acreage summary based on perennial streams and shorelines

HUC-12 Code and Name[1]	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial Streams and Shoreline Buffers (acres)					
	Perennial Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
0401-Upper Branch River - Lovell Lake	243,219.2	233.1	347.1	682.9	1,011.9	1,336.7	1,656.8	1,972.9
0402-Junes Brook - Branch River	160,157.3	1,310.2	408.3	802.4	1,193.5	1,584.3	1,974.5	2,364.0
0403-Headwaters - Great East Lake	143,799.4	652.0	242.2	477.1	708.3	937.0	1,165.1	1,391.0
0404-Milton Pond	287,243.6	368.4	218.1	425.3	631.8	838.1	1,044.1	1,249.1
0405-Middle Salmon Falls River	86,853.5	276.3	418.0	824.9	1,227.6	1,627.9	2,031.1	2,438.3
0406-Lower Salmon Falls River	282,915.3	515.8	123.2	243.5	363.0	481.1	597.2	711.5
0601-Upper Cocheco River	87,111.5	368.3	523.1	1,059.9	1,609.5	2,169.1	2,734.3	3,303.4
0602-Axe Handle Brook	301,951.2	268.0	140.0	284.0	432.3	586.3	745.8	909.0
0603-Middle Cocheco River	160,664.1	1,239.6	421.6	838.5	1,252.7	1,662.1	2,071.8	2,482.9
0604-Bow Lake	266,244.0	272.1	216.5	419.4	617.1	812.4	1,007.1	1,203.2
0605-Nippo Brook - Isinglass River	155,084.3	351.3	490.5	986.9	1,488.2	1,991.5	2,493.8	2,994.3
0606-Long Pond	347,099.4	512.3	237.0	479.5	728.4	982.7	1,239.5	1,499.9
0607-Lower Isinglass River	373,035.1	421.5	487.0	973.9	1,460.5	1,946.6	2,429.6	2,911.2
0608-Lower Cocheco River	282,830.3	211.8	612.4	1,217.5	1,815.3	2,408.0	2,997.8	3,581.1
0701-Headwaters - Lamprey River	152,872.1	139.1	528.0	1,059.9	1,594.5	2,132.8	2,674.7	3,213.9
0702-North Branch River	466,659.4	617.5	269.8	543.2	818.6	1,094.6	1,369.9	1,641.6
0703-Middle Lamprey River	254,567.2	913.7	729.1	1,465.9	2,206.3	2,947.6	3,690.6	4,431.8
0704-Pawtuckaway Pond	233,208.6	253.2	378.5	744.6	1,104.4	1,460.2	1,809.0	2,151.0
0705-Bean River	97,422.9	62.7	451.6	908.5	1,370.4	1,836.9	2,306.6	2,776.3
0706-North River	174,831.6	361.5	195.2	394.9	598.6	806.2	1,017.7	1,231.4
0707-Little River	250,594.4	103.3	317.8	632.2	943.0	1,253.8	1,564.2	1,874.7
0708-Piscassic River	343,714.6	448.3	496.8	990.6	1,484.3	1,982.5	2,481.9	2,983.3
0709-Lower Lamprey River	153,578.4	97.3	481.9	956.8	1,428.1	1,895.0	2,360.8	2,825.6
0801-Watson Brook	261,659.7	222.1	302.1	607.6	915.7	1,225.6	1,535.8	1,846.5

Table 5. HUC12-level buffer acreage summary based on perennial streams and shorelines (cont.)

HUC-12 Code and Name[1]	Input Features		Output Features					
	All Shorelines (feet)	Surface Water (acres)	Perennial Streams and Shoreline Buffers (acres)					
	Perennial Streams and Shorelines	Water Polygons	50'	100'	150'	200'	250'	300'
0802-Towle Brook - Lily Pond	232,403.9	170.1	505.5	1,031.1	1,574.1	2,131.3	2,699.5	3,278.8
0803-Spruce Swamp - Little River	115,147.3	36.0	345.5	689.9	1,036.4	1,388.1	1,743.4	2,103.3
0804-Little River	273,842.0	165.4	226.8	462.4	705.8	957.2	1,217.1	1,483.9
0805-Great Brook - Exeter River	306,099.8	550.9	436.3	867.4	1,289.0	1,709.6	2,131.9	2,556.3
0806-Squamscott River	222,376.7	99.2	545.9	1,093.8	1,646.7	2,205.6	2,766.6	3,325.7
0901-Winnicut River	394,295.0	560.6	422.0	852.5	1,289.9	1,734.5	2,186.0	2,640.2
0902-Oyster River	511,298.8	1,278.4	715.4	1,426.9	2,137.8	2,847.9	3,553.5	4,255.3
0903-Bellamy River	391,336.5	5,999.5	863.0	1,700.9	2,518.4	3,322.5	4,116.7	4,902.5
0904-Great Bay	315,404.2	2,315.3	593.0	1,179.4	1,764.1	2,346.8	2,924.4	3,494.7
1001-Portsmouth Harbor	288,912.2	326.1	438.5	856.4	1,256.0	1,633.1	1,991.5	2,336.4
1002-Berrys Brook - Rye Harbor	407,439.3	270.5	542.3	1,078.3	1,590.6	2,083.6	2,559.4	3,015.6
1003-Taylor River - Hampton River	886,493.3	1,233.0	690.8	1,329.9	1,907.5	2,452.5	2,987.0	3,521.6
1004-Hampton Harbor	105,957.2	26.3	1,485.7	2,666.9	3,523.0	4,158.0	4,684.8	5,161.8
TOTAL	**10,018,322.9**	**23,250.7**	**16,846.5**	**33,255.5**	**49,242.9**	**64,969.9**	**80,561.5**	**96,064.2**

[1]First 8 digits of HUC12 codes (01060003) are omitted to conserve space.

Conclusions

Development of stream/shoreline buffers for the GRANIT Data Mapper utilized existing data layers archived in the GRANIT database to describe areas of land within various buffer widths, ranging from 50' to 300'. The results indicate that aggregated at the HUC-12 level, almost 24,000 acres within the Coastal Basin were covered by 50' buffers when both perennial and intermittent streams as well as shorelines were buffered, with over 133,000 acres covered by 300' buffers. When only perennial streams and shorelines were considered eligible for buffering, the totals declined to just under 17,000 acres (50' buffers) and over 96,000 acres (300' buffers).

The feature data, as well as the tabular acreage summaries, were incorporated in the water resources theme of the GRANIT Data Mapper, thereby making the data viewable within the context of a host of other data sets offered. Of particular importance, users may place the buffers on top of aerial imagery, and observe the land features contained within particular buffers of interest.

The stream buffers hosted in the Data Mapper offer coastal communities the opportunity to visualize buffers based on various input features and on varying widths, and further, to calculate the land acreage associated with each buffer selection. These data may be used to inform discussions among users interested in establishing and/or extending municipal buffer protection measures.

Recommendations

While delivering the buffer data sets through the GRANIT Data Mapper offers a valuable resource to municipal decision-makers, land use boards, and the general public, we are always cognizant that additional and/or updated data sets will enhance the utility of these and other efforts. Accordingly, we recommend that resources be directed at ensuring that current and comprehensive data sets – including aerial imagery, land use, and parcel layers – be developed and maintained, and be hosted on publicly accessible web sites.

Of particular note, we recognize that evaluating the potential impact of any buffers on a local level would be significantly enhanced by the ability to overlay municipal parcel data. We recommend that efforts be specifically directed at compiling, maintaining, hosting, and providing web-based access to digital tax parcel data.