APPENDIX XVII: Land Use/Land Cover Mapping

Introduction

The NH Land Use Mapping Standard describes a classification scheme and mapping protocols for generating land use data from high resolution, remotely sensed data sources. The standard was developed by GRANIT staff at Complex Systems Research Center (CSRC), University of New Hampshire, in consultation with the Office of Energy and Planning (OEP) and the nine Regional Planning Commissions in the state. It was informed by prior land use mapping projects conducted by Planning Commissions and GRANIT staff, as well as a series of discussions hosted by the NH Department of Environmental Services. This broad input yielded a standard which is designed to meet the land use mapping needs of a diverse community of users.

Data

The primary data source for land use data is high-resolution (1 ft.), color, leaf-off, digital orthophotography. The majority of the Lakes Region was flown in 2006. Additional data sources include:

- Locally generated interpretation of land use (Andover Planning Board), 2009.
- National Agricultural Imagery Program (NAIP), 2008.
- NH Department of Transportation road centerlines, 2008.
- NH National Hydrography Dataset (NHHD), 2006.
- US Fish & Wildlife Service National Wetlands Inventory (NWI), 2001.
- USGS town boundaries, 2009.

Land Use Classification

The data will utilize a classification structure that represents an enhancement of the standard USGS Anderson Level II land use coding (USGS Professional Paper 964, 1976). This hierarchical coding structure assigns a Level I (1-digit) code as follows:

1. Urban and built-up land
2. Agricultural land
3. Brush or transitional between open and forest
4. Forest
5. Water
6. Wetlands
7. Barren land

Efforts by OEP in the mid 1990's to coordinate a NH land use mapping standard resulted in the incorporation of Level III (3-digit) and IV (4-digit) codes to the USGS structure, thereby creating a comprehensive, detailed land use categorization. The following illustrates the 4 classification levels for one type of land use:

Level	Code	Category Description
I	1	Urban and built-up land
II	14	Transportation, communication, and utilities
III	144	Road transportation
IV	1441	Limited & controlled highway right-of-way

Digitizing
From our computer screen we zoom in to a 1:2,400 scale and work through the community, screen-digitizing (drawing) boundaries that are visible in the source photography and utilizing the appropriate grouping from the list of 58 categories. Outside of areas served by sewer and where residential boundaries are indistinct, a one-acre square may be used to delineate a residence.

Major categories
LRPC has found that for the purposes of master development, condensing the 58 detailed divisions into 10 – 13 broader categories is usually appropriate and practical. The exact categories depend on the existing uses in the community and the needs of the Master Plan Committee; those that are frequently utilized in the Lakes Region include:

- Residential
- Commercial, Services, and Institutional
- Industrial
- Transportation, Communications, and Utilities
- Mixed Developed Uses
- Outdoor and Other Urban and Built Up Land
- Agricultural
- Brush or Transitional between Open and Forested Land
- Forest Land
- Water
- Wetlands
- Barren or Vacant Land

Land Cover vs. Land Use
Land Cover is what is on the surface of the earth; it may be trees, water, rock, pavement, lawn, etc. *Land Use* describes how the land is being used by humans; this includes residential, commercial, transportation, recreation, and agriculture.

The Role of the Committee
As a Current Land Use map is developed for a community (often but not always, in conjunction with a Master Plan), LRPC works with local members of the community to ensure that the map is an up-to-date representation of what exists on the ground at the time of development.

Typically, LRPC staff will conduct an initial interpretation of the community and bring a Preliminary Map to the Committee for additional input. There are usually three major things that the staff needs to know to complete the Land Use/Land Cover interpretation:

- What changes have occurred since the date of the source photography (usually new developments)?
- Are the *Land Uses* depicted on the map appropriate interpretations of what currently exists?
- Is the legend appropriate for the community and the Committee?

The Committee should provide their feedback by marking up the Preliminary Map showing the location and type of LU/LC. The Committee should return the map by a specified date which will allow for the timely editing and printing of the Final Review Map.

Portions of this were adapted from *NH Land Use Mapping Standard: CTAP Land Use Mapping Project*, GRANIT/Complex Systems Research Center (March, 2007).

Andover LU/LC Adaptations

The Lakes Region Planning Commission worked with the Andover Master Plan Update Committee to provide mapping assistance and some adaptations were made to the process outlined above for two reasons: data availability and the specific needs of the Committee. These changes to the state-wide methodology were made either out of necessity, to reflect the most up-to-date information, or to respond to and reflect the concerns and particular issues that are important to the town.

Data

High-resolution (1 ft.), color, leaf-off, digital orthophotography from 2006 is not available for Andover; the best data available is 1-meter resolution leaf-on color imagery from the National Agricultural Imagery Program (NAIP) from 2008. Although not as detailed, these images are relatively current.

Classification

Prior to LRPC's involvement in the mapping effort, work had already been started by some of the Master Plan Update Committee. Utilizing the NAIP, 2008 imagery GIS layers had been developed for several Land Use categories which had been identified by the Committee as most appropriate for characterizing LU in Andover. The Land Use categories were defined as:

- **Single unit residential:** Only a single residential unit on a lot. Includes the cleared area near the buildings.
- **Residential with farm:** One or more residential units on a lot with farming activity. Does not include lots with only a residence and small vegetable gardens.
- **Residential with home-based business:** One or more residential units on a lot with a home-based business. A home-based business is any business activity that is conducted on the same lot where the business proprietor lives.
- **Farm without residential:** Land actively used for farming that does not have an associated residence on the lot
- **Cleared land – not farmed**
- **Multiple unit residential**
- **Commercial:** Land on which the main use is a business use that sells goods or services to the public.
- **Industrial**

- **Institutional:** Churches, Masonic Hall, Historical Society, and similar uses

This existing data was incorporated into the new LU/LC map and supplanted these LU categories which were listed above:

- Residential
- Commercial, Services, and Institutional
- Industrial
- Transportation, Communications, and Utilities
- Mixed Developed Uses
- Outdoor and Other Urban and Built Up Land
- Agricultural

Roads, Railroads, and Electric Transmission Lines were identified as separate LU categories and Barren or Vacant Land was seen as unnecessary for characterizing Andover.

Process

After receiving the local data layers and corresponding with the Chair of the Master Plan Update Committee, the LRPC staff reviewed the data and edited it, as necessary. LRPC staff also conducted Land Cover interpretation. The results of these edits and interpretations were discussed with the Committee at two successive meetings.

Residential Density

A look at where development currently exists in Andover shows that there have clearly been areas where people have built homes and businesses in close proximity to one another (villages and lakeshores) and other areas where the settlement patterns are less dense. In addition to the Land Use/Land Cover map, the Andover Master Plan Committee wished to see an analysis of the density of residential units in the town of Andover.

Using ArcInfo 9.3 software and the Spatial Analyst Extension, the staff at the Lakes Region Planning Commission was able to graphically represent areas of existing residential density in terms of Acres per Housing Unit.

Each residential polygon on the Land Use/Land Cover map (Single Unit Residential, Multiple Unit Residential, Residence with Home-based Business, and Residential with Farm) was transformed into a point representing the center of the polygon (centroid). Each point was assigned a value of "1", except for Multiple Unit Residential points, which the Committee agreed should receive a value of "2".

The footprint of the town was divided into 0.25-acre cells. Using the Density Tool in Spatial Analyst a simple density calculation was conducted of the points that fell with a 500' radius search circle as it scanned across all cells in the town. In this way, a value was assigned to each 0.25-acre cell that represents the density of housing units near that cell. The Residential Density Map expresses this in terms of Acres per Residential Density Unit.