3 SOIL RESOURCES AND STEEP SLOPES

Soils are classified based on soil morphology and characteristics developed during soil formation. The criteria used to classify soils are designed to guide choices in land use and soil management. The State of New Hampshire soils have been generalized into landscape areas based on distinct soil patterns, topography, and drainage, and named after the major soils making up that landscape. Grantham is primarily part of the Monadnock-Marlow-Herman soil landscape that makes up most of the eastern portion of Sullivan County. Along the Plainfield town boundary, and following along the ridgeline to Sargent Hill, lies the Monadnock-Lyman-Rock Outcrop soil landscape. Colton-Adams-Rumney soils follow along the Bog Brook Wetland Complex. (Shook, 1983). See the Soil Survey of Sullivan County for the General Soil Map. The following soil descriptions are adapted from Shook (1983).

Monadnock-Marlow-Herman soils occur on hills and ridges, characterized by the abundance of small streams and surface stones. South and east facing slopes are typically steeper and rock outcrops are common along the ridges and steeper slopes. This soil supports predominantly mixed forest, dotted with rolling hillsides cleared of surface stones for hay crops and pasture. Steep slopes, dry soils, stoniness, and erosion are major limitations of these soils.

Monadnock-Lyman-Rock Outcrop soils occur primarily on higher elevations where outcrops and surface boulders are prominent on the landscape. The primary vegetation is coniferous forest. Steep slopes, depth to bedrock, large surface boulders, and erosion are limitations of this landscape.

Colton-Adams-Rumney soils were formed in glacial outwash deposits by clay, silt, sand, and other materials deposited by running water. They are long and narrow and occur on terraces, kames, and plains that run roughly parallel to major streams. These soils are predominantly wooded but suitable for hay crops and pasture. Ground-water pollution from septic systems is a hazard in Adams and Colton soils while flooding is a limitation of the Rumney soils.

The soils data depicted for this study are from county-wide soil surveys produced by the USDA Natural Resources Conservation Service (NRCS) at a scale of 1:20,000 or 1:24,000. The smallest soil area that can be shown on the county-wide soil surveys is three to five acres in size. Therefore, maps produced with this data are intended for general land use planning purposes only; they do not display sufficient precision to be used for site-specific applications.

3.1 AGRICULTURAL SOILS

The Sullivan County Soil Survey shows that there are relatively few prime agricultural soils (406 acres) or soils of statewide importance (255 acres) in Grantham. Where these soils do exist, they are scattered in the south-central part of town and along the I-89 and Route 10 corridors (Figure 3-1, Appendix A). Many of these areas are also developed. Grantham should consider limiting non-agricultural uses on prime agricultural soils and soils of statewide importance to direct development away from these resources and encourage viable farming operations by retaining larger tracts of land.

Farmland of local importance (4,366 acres) is more widespread throughout the town making up 25% of the total land area. Farmland soils are defined below. Refer to the Soil Survey of Sullivan County for the average yields per acre that can be expected of principal crops (corn silage, alfalfa hay, grass-legume hay, grass hay, grass-clover, and pasture) for all soil types under a high level of management.

Prime farmland, as defined by NRCS, "is land with the best characteristics suited to food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained yield of crops when it is treated and managed using acceptable faming methods. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment. Prime farmland may now be in crops, pasture, woodland, or other land, but not urban or built-up land or water areas. It must be used for producing food or fiber or be available for these uses" (Shook, 1983).

Soils of statewide importance are lands that are not prime or unique but are considered important for the production of food, feed, fiber, forage, and oilseed crops. The criteria for soils of statewide importance are:

- slopes of less than 15 percent
- not stony, very stony or bouldery
- not somewhat poorly, poorly or very poorly drained
- includes soil complexes comprised of less than 30 percent shallow soils and rock outcrop and slopes do not exceed 8 percent
- not excessively drained soils developed in stratified glacial drift, generally having low available water holding capacity

(NRCS, 1983)

Farmland of local importance is farmland that is not prime, unique, or of statewide importance, but has local significance for the production of food, feed, fiber and forage. The County Conservation District Board uses the following criteria to identify these soils: 1) Soils that are poorly drained, have artificial drainage established and are being farmed; and 2) Specific soil map units identified from the NRCS county soils survey legend, as determined by the Conservation District Board (NRCS, 1983).

3.2 IMPORTANT FOREST SOILS

Productive forest soils are based on data developed by NRCS to give the best indication of relative productivity for timber production, management practicability, and limitations. Clearly, nearly the entire State of New Hampshire is covered in productive forest soils so the categories included in this report and on Figure 3-2 (Appendix A) are those without major limiting factors for management. The following descriptions are verbatim from the Data Dictionary (NRCS, 2002). See the Soil Survey of Sullivan County NH for greater detail on management limitations and preferred tree species for each soil type.

1A This group consists of the deeper, loamy textured, moderately well, and well-drained soils. Generally, these soils are more fertile and have the most favorable soil moisture relationships. The successional trends on these soils are toward stands of shade tolerant hardwoods, i.e., beech and sugar maple. Successional stands frequently contain a variety of hardwoods such as beech, sugar maple, red maple, white birch, yellow birch, aspen, white ash, and northern red oak in varying combinations with [softwoods such as] red and white spruce, balsam fir, hemlock, and occasionally white pine. Hardwood competition is severe on these soils. Softwood regeneration is usually dependent upon persistent hardwood control efforts.

1B The soils in this group are generally sandy or loamy over sandy textures and slightly less fertile than those in group IA. These soils are moderately well and well drained. Soil moisture is adequate for good tree growth, but may not be quite as abundant as in group IA soils. Soils in this group have successional trends toward a climax of tolerant hardwoods, predominantly beech. Successional stands, especially those which are heavily cutover, are commonly composed of a variety of hardwood species such as red maple, aspen, paper birch, yellow birch, sugar maple, and beech, in combinations with red spruce, balsam fir, and hemlock. Hardwood competition is moderate to severe on these soils. Successful softwood regeneration is dependent upon hardwood control.

1C The soils in this group are outwash sands and gravels. Soil drainage is somewhat excessively to excessively drained and moderately well drained. Soil moisture is adequate for good softwood growth, but is limited for hardwoods. Successional trends on these coarse textured, somewhat droughty and less fertile soils are toward stands of shade tolerant softwoods, i.e., red spruce and hemlock. Balsam fir is a persistent component in many stands, but is shorter lived than red spruce and hemlock. White pine, red maple, aspen, and paper birch are common in early and mid-successional stands. Hardwood competition is moderate to slight on these soils. Due to less hardwood competition, these soils are ideally suited for softwood production. With modest levels of management, white pine can be maintained and reproduced on these soils. Because these soils are highly responsive to softwood production, especially white pine, they are ideally suited for forest management.

3.3 HYDRIC SOILS

The digital Sullivan County Soil Survey maps 1,668 acres of hydric soils in Grantham (Figure 3-3, Appendix A). Hydric soils form where saturation, flooding, or ponding occur long enough during the growing season to develop anaerobic conditions in their upper layers. In New Hampshire, the presence of hydric soils along with hydrophytic vegetation and hydrology are necessary to delineate a wetland. Mapped hydric soils do not completely correspond to the NWI (Figure 2-2, Appendix A and Section 2.2.3) maps. Through the interpretation of aerial photos, it is commonly found that the actual number of wetlands is greater than NWI data but less than hydric soils data depict (Van de Poll, 2005). Hence, it is important to remember that hydric soils data should be used for planning purposes only.

3.4 WILDLIFE HABITAT POTENTIAL OF SOILS

The wildlife habitat potential of soils is a broad category, included in soil survey manuals with game species in mind. Today, biologists recognize the importance of focusing conservation efforts on entire ecosystems rather than focusing on a single species or just game species (Foss, 2009). It is more important to apply agricultural soil values, important forest soil values, and hydric soil values when evaluating soils. Wildlife habitat potential of soils is included for informational purposes and was not included in the co-occurrence analysis discussed in Section 5.4.3.

When planning for wildlife habitat, an understanding of the soils may facilitate proper management techniques. Vegetation and surface water availability are affected by soils which, in turn, impact food, water, and cover for wildlife. Figure 3-4 (Appendix A) illustrates soils with good to fair wildlife habitat potential for openland, woodland, and wetland species. Habitat for openland wildlife includes cropland, pastures, meadows, and shrubby areas producing grain and seed crops, grasses, and other herbaceous plants. Wildlife attracted to these areas may include grassland birds, snakes, and red fox. Habitat for woodland wildlife includes both hardwood and softwood forests. Wildlife includes turkey, white-tailed deer, moose, ruffed grouse, and bear. Habitat for wetland wildlife includes shrub/scrub swamps, bogs or other wetlands that may attract waterfowl, beaver and mink. In Figure 3-4 (Appendix A), soils with suitable habitat ratings indicate areas where the habitat type is easily established, improved or maintained with little to moderate management for satisfactory results. (Shook, 1983) See the Soil Survey of Sullivan County, NH for greater detail on the potential of habitat elements, such as hardwood or softwood trees, shrubs, and wetland plants, for each soil type.

3.5 STEEP SLOPES AND RIDGELINES

As noted in the 2005 Master Plan, hillsides and ridgelines are a prominent landscape feature in Grantham, helping to define the town's rural character and small town identity. Steep slopes, 15% or greater, cover approximately 33% of the land area in Grantham; 11% of those slopes are greater than 25% (Figure 3-5, Appendix A). Steep slopes provide recreational opportunities, aesthetic value, and wildlife habitat.

Historically, ridgelines, with their shallow soils, were natural constraints to development. Today, as evidenced by the Town of Newbury, NH for example, they are highly sought after by developers for the scenic vistas. Construction along ridgelines and prominent hillsides, that once buffered and contributed to the rural character of communities, alters the viewshed and potentially changes the nature of the community. Hillside and ridgeline development increase erosion potential and contribute to increased runoff. The challenges of maintaining transportation infrastructure, utilities, and providing emergency services for ridgeline developments can lead to increased expenses for the town (Bonomo et. al., 2005).

For the Conservation Commission, when assessing threats to open space, it is also important to note where steep slopes do *not* exist. South-central Grantham, between Corbin Park and Grantham Village is largely undeveloped. It also has fewer steep slope development constraints and, according to the Build Out in the 2005 Master Plan, the highest potential for building development in the entire town.

Maintaining hillsides and ridgelines as popular destinations for hiking and other outdoor activities is also important. However, careful management of recreation is needed in these sensitive areas to avoid impacts to soils and vegetation (see Section 7.5).

Steep slopes greater than 25% are often associated with talus slopes or ledges (Van de Poll, 2005) which provide shelter and denning habitat for species such as porcupine and bobcat. In winter especially, south facing slopes provide thermal relief and foraging habitat for bobcat and deer. Undeveloped hillsides also offer natural ecosystem services such as storm-water management and erosion control, limiting pollution runoff into surface waters.

The zoning ordinance in Grantham currently prohibits the inclusion of steep slopes 20% or greater in determining lot sizes. There are no ridgeline protections in place. Consideration should be given to enacting steep slope and ridgeline protections. The REPP handbook includes model ordinances for these in its *Land Use Planning Techniques: A Handbook for Sustainable Development* which may be found at http://des.nh.gov/organization/divisions/water/wmb/repp/innovative_land_use.htm.

3.6 SUMMARY OF RECOMMENDATIONS

- Establish an Agricultural District in the zoning ordinance recognizing prime farmland and farmland of statewide importance as most appropriate for food and hay crops or pasture. The Agricultural District would reserve agricultural soils for agricultural uses, limit non-agricultural uses, direct development away from prime agricultural soils, and encourage viable farming operations by retaining larger tracts of land.
- Enact a hydric soils protection ordinance limiting development on hydric soils. Hydric soils may be included in any wetland protection provisions.
- Enact steep slopes and ridgeline protection ordinances to preserve the landscape from overdevelopment and to protect the rural character of Grantham.