



Land Use Capability Zone Map

2008

Prepared by State of New Jersey Highlands Water Protection and Planning Council in Support of the Highlands Regional Master Plan

**Technical
Report**

HIGHLANDS REGIONAL MASTER PLAN

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EXECUTIVE SUMMARY

The Regional Master Plan addresses components necessary to protect the natural, scenic and other Highlands resources, including but not limited to, forests, wetlands, stream corridors, steep slopes, and critical habitat for flora and fauna. The Land Use Capability Zone Map was developed pursuant to N.J.A.C. 7:38-1.1(a) whereby the Highlands Council includes in its Regional Master Plan a land use capability map and a comprehensive statement of policies for planning and managing the development and use of land.

The Land Use Capability Zone Map is one of a series of capability maps and identifies the Highlands Region in three distinct Zones, within which are four Sub-Zones.

- Protection Zone
- Wildlife Management Sub-Zone
- Conservation Zone
 - Conservation Environmentally Constrained Sub-Zone
- Existing Community Zone
 - Existing Community Environmentally Constrained Sub-Zone
 - Lake Community Sub-Zone

Zone designation will provide all levels of government (federal, State, county, and municipal) and the public with an indication of capacity and where special consideration is required to protect regionally significant resources.

INTRODUCTION

The following provides an introduction and overview of the development process, data input information, and the use of the Land use ANalysis Decision Support (LANDS) model for the Highlands Region. The LANDS model provides for a comprehensive evaluation of both resource constraints and development opportunity at a regional scale. It addresses the potential for conflict between natural resource protection and economic growth by identifying environmental constraints and capacity limitations of land and infrastructure, and identifying those areas within the Highlands Region that can best support appropriate and varying levels of economic and development activity.

The LANDS model is necessary to address the requirements of the Highlands Water Protection and Planning Act (Highlands Act) and provides regional guidance for the implementation of the goals, policies, and objectives in the Regional Master Plan. The Highlands Council developed the LANDS model recognizing the range and nature of land throughout the Highlands Region in order to create overlay zones that best represent the requirements of the Highlands Act and the goals, policies, and objectives of the Regional Master Plan.

The LANDS model has the ability to represent indicators, capacity, and constraints at a scale of 2,500 square feet (50 ft. x 50 ft.). While it is cartographically impractical to show this level of detail at a regional scale, the finer scale capability of the model will be very useful to the Council, local officials and the public during the Plan Conformance period when identifying environmental constraints and capacity limitations of land and infrastructure. During Plan Conformance, additional information will be available to identify and refine those areas within the Highlands Region that can best support appropriate and varying levels of economic and development activity.

The Council has established three primary overlay zones using the LANDS model. These zones are the Protection Zone, the Conservation Zone, and the Existing Community Zone. These overlay zones distinguish between resource constrained lands, where development will be limited (Protection Zone), and those lands characterized by existing patterns of human development where, dependent on municipal planning, land or capacity constraints, additional growth may or may not be appropriate (Existing Community Zone). The Conservation Zone identifies those areas with a high concentration of agricultural lands and associated woodlands and environmental features, where

development potential may exist to the extent it is not limited by available infrastructure to support development (e.g. water availability, the existence of concentrated environmental resources that are easily impaired by development, or the protection of important agricultural resources).

In addition to these three primary overlay zones, the Council has identified four sub-zones within the Protection, Conservation, and Existing Community Zones which are described below. These constrained areas recognize regionally significant sensitive environmental features where development is subject to stringent limitations on the extension or creation of water and wastewater services; however, they do not incorporate all environmental constraints and other factors that may be considered during local development review and Highlands Project Review.

OVERLAY ZONE DESIGNATION

Overlay zones serve to establish an area that addresses distinguishing circumstances or landscape features, and is superimposed over existing municipal zoning. Overlay zones do not replace existing municipal zoning, but rather build upon base zoning by establishing additional standards and criteria, and are intended to provide a means to address issues of special public interest (e.g. watershed management area, open space preservation, historic preservation, urban enterprise zone) that the underlying base zoning may not otherwise take into consideration.

In the Highlands Region, overlay zones will provide all levels of government (Federal, State, county, and municipal) and the public with an indication of areas where special consideration is required to protect regionally significant resources. Overlay zones also indicate where and how development initiatives may occur based on the ability of areas to accommodate growth. The LANDS model was designed by the Highlands Council to develop the following overlay zones each with their own purpose, application, and minimum standards as generally discussed below and these will collectively be referred to as overlay designations.

The **Protection Zone (PZ)** consists of high resource value lands that are important to maintaining water quality, water quantity, and sensitive ecological resources and processes. Land acquisition is a priority in the Protection Zone and development activities will be extremely limited; any development will be subject to stringent limitations on consumptive and depletive water use, degradation of water quality, and impacts to environmentally sensitive lands. The LANDS model uses a 75 acre minimum mapping threshold for the delineation of the Protection Zone.

The **Wildlife Management Sub-Zone (WM)** consists of all National Wildlife Refuges managed by the United States Fish and Wildlife Service and Wildlife Management Areas administered by the NJDEP Division of Fish & Wildlife's Bureau of Land Management, within the Highlands Region. These areas are part of a network of lands and waters for conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and their habitats and permit compatible wildlife-dependent recreational uses, such as hunting, fishing, wildlife observation and photography, and environmental education and interpretation. There is no minimum mapping threshold for the delineation of the Wildlife Management Sub-Zone.

The **Conservation Zone (CZ)** consists of areas with significant agricultural lands and interspersed with associated woodlands and environmental features that should be preserved when possible. Non-agricultural development activities will be limited in area and intensity due to infrastructure constraints and resource protection goals. The LANDS model uses a 75 acre minimum mapping threshold for the delineation of the Conservation Zone.

The **Conservation Zone – Environmentally Constrained Sub-Zone (CZ-EC)** consists of significant environmental features within the Conservation Zone that should be preserved and protected from non-agricultural development. Development activities will be constrained through restrictions on the extension or creation of water supply and wastewater services. The LANDS

model uses a 10 acre minimum mapping threshold for the delineation of the Conservation Zone – Environmentally Constrained Sub-Zone.

The **Existing Community Zone (ECZ)** consists of areas with regionally significant concentrated development signifying existing communities. These areas tend to have limited environmental constraints due to previous development patterns and may have existing infrastructure that can support development and redevelopment provided that such development is compatible with the protection and character of the Highlands environment, at levels that are appropriate to maintain the character of established communities. The LANDS model used a 75 acre minimum mapping threshold for the delineation of the Existing Community Zone.

The **Existing Community Zone – Environmentally Constrained Sub-Zone (ECZ-EC)** consists of significant environmental features within the Existing Community Zone that should be protected from further fragmentation. They serve as regional habitat “stepping stones” to larger contiguous critical habitat and forested areas. As such, they are not appropriate for significant development and are best served by land preservation and protection. Development is constrained through restrictions on the extension or creation of water supply and wastewater services. The LANDS model used a 2 acre minimum mapping threshold for the delineation of the Existing Community Zone – Environmentally Constrained Sub-Zone.

The **Lake Community Sub-Zone (LCZ)** consists of patterns of community development around lakes that are within the Existing Community Zone and within 1,000 feet of lakes. The LANDS model focuses on lakes 10 acres or greater and delineates this zone as consisting of an area of up to 1,000 feet (depending on the protection focus) from the lake shoreline in order to protect water quality, resource features, shoreline development recreation, scenic quality and community character. A future management area is planned, encompassing the full lake watershed, for protection of the lake water quality. This zone has unique policies to prevent degradation of water quality and watershed pollution, harm to lake ecosystems, and promote natural aesthetic values within the Existing Community Zone. The LANDS model used a 2 acre minimum mapping threshold for the delineation of the Lake Community Sub-Zone.

REGIONAL INDICATORS

In order to develop the overlay designations in the LANDS model, the Highlands Council used the results of both the Resource Assessment and the Smart Growth Component. The Resource Assessment was used to identify lands within the Highlands Region with significant natural and ecological resources. Indicators were used to measure the regional significance of a particular resource, such as prime ground water recharge, watershed condition, open waters and riparian areas, forests, critical habitat, and steep slopes. Areas with significant agricultural lands and important farmland soils were also evaluated. A determination was made as to their quality and regional significance to the Highlands Region.

The Smart Growth Component was used to identify the nature and extent of developed lands that have limited and dispersed environmental and agricultural resources. Areas were identified based upon existing patterns of development with particular emphasis on areas that are currently served by existing water and wastewater infrastructure.

Twenty-one (21) indicators were used to characterize the Highlands Region and to assign the most appropriate overlay designations (see the table Criteria/Indicators Used in the LANDS model). Indicators can be categorized into three types: (1) feature based indicators, (2) intensity indicators, and (3) Integrity-based indicators.

Feature based indicators capture the location and extent of geographic objects. Preserved farms are an example of a feature based data layer. Many feature based data layers utilized extractions from existing data sets, including but not limited to those compiled by the U.S Census, the NJDEP draft 2002 Land Use Land Cover, or Natural Resources Conservation Service Soil Survey Geographic

digital soils coverage.

Intensity indicators were developed using a Highlands mapping approach that calculated the magnitude to which an area in question included a particular feature. Rather than spatially delineating the location of an actual feature or features, these intensity indicators capture the area in which a critical mass of features or combination of features exists. The actual process includes several steps, including: rasterizing input feature based data at a 50 ft. x 50 ft. grid cell size; identifying the critical mass of input features; and yielding a magnitude per unit area, as calculated using a 250 ft. circular search radius. An example of an intensity indicator is the Forest Resource Area, which reflects that portion of the Highlands Region that contains the critical mass of high ecological value forest areas that exhibit the least fragmentation.

Integrity-based indicators measure the relative degree of quality of a particular resource. The Riparian Corridor Condition – High is an example of an integrity-based indicator. A Riparian Area integrity value class was assigned to the riparian corridor for each subwatershed based on a cumulative assessment of five indicators (including impervious cover, natural vegetation, water/wetland species, agricultural, and road crossings). The Riparian Corridor Condition – High is an integrity-based data layer that represents areas that exhibit predominantly natural vegetation including high quality habitat for water/wetland dependent species, and a generally low incidence of impervious area, agricultural uses, and/or road crossings.

LANDS INDICATORS

The following table describes the indicators that were used to inform the development of the overlay designations using the LANDS model.

INDICATORS USED IN THE LANDS MODEL

Zone	Criteria	Indicator	Indicator Tier	
Protection	Forest Integrity	Total Forest Area w/in Forest Resource Area	Primary	
		Core Forest > 250 Acres	Secondary	
		Total Forest	Secondary	
	Riparian Corridor	Riparian Corridor Condition - High	Primary	
	Recharge	Prime Ground Water Recharge	Primary	
	Critical Habitat	Critical Habitat - Landscape Rank 3-5 Plus Landscape 2 within Highlands Rank 2-3	Vernal Pools + 1000 feet	Primary
			Significant Natural Areas	Primary
			Preserved Lands	Secondary
			Lakes >10 Acres	Secondary
Conservation	Agriculture	Contiguous Farms >250 acres	Primary	
		Agriculture Land Use > 10 acres	Secondary	
		Agriculture Land Use Land Cover	Secondary	
Existing Community	Development Intensity	Core Developed Lands	Primary	
		Moderate Developed Lands	Primary	
		Suburban Fringe Lands	Primary	
		Rural Developed Lands	Secondary	
		Developed Land Use Land Cover	Secondary	
		Land Use Land Cover Anderson Code 1140	Secondary	
	Utilities	Existing Area Served (Potable Water) + 100 feet	Existing Area Served (Highlands Domestic Sewerage Facilities) + 100 feet	Primary
				Primary
Transportation	Transportation Score >= 3	Primary		

The following section fully describes the indicators that were used to inform the development of the overlay designations using the LANDS model.

PROTECTION INDICATORS	
1.	<p>Total Forest Area w/in Forest Resource Area</p> <p>The Total Forest Area within the Forest Resource Area is a feature based data layer and is defined as the presence of Total Forest Area within the Forest Resource Area. The Total Forest Area is a feature based data layer that was extracted from the NJDEP 2002 draft Land Use Land Cover data. Total Forest is defined as all upland and wetland forest and scrub/shrub categories (excluding old field). NJDOT roads, buffered by 10 feet, were removed from the file. (Ecosystem Management Technical Report, July 2008). The Forest Resource Area data layer is an intensity indicator that includes high ecological integrity forest areas including those forested areas that express one or more of the forest integrity indicators (Ecosystem Management Technical Report, July 2008).</p>
2.	<p>Core Forest > 250 Acres</p> <p>Forest Core > 250 refers to the area of a forest patch that is greater than 300 feet from an altered edge, based on the Total Forest Area. The Forest Core Area >250 is a feature based data layer that includes those areas consisting of 250 acres or greater of core forest. (Ecosystem Management Technical Report, July 2008).</p>
3.	<p>Total Forest Area</p> <p>The Total Forest Area is a feature based data layer that was extracted from the NJDEP 2002 draft Land Use Land Cover data. Forest is defined as all upland and wetland forest and scrub/shrub categories (excluding old field). NJDOT roads, buffered by 10 feet, were removed from the file. (Ecosystem Management Technical Report, July 2008)</p>
4.	<p>Riparian Corridor Condition - High</p> <p>Riparian Corridor Condition – High is an integrity-based indicator. A Riparian Area integrity value class was assigned to the riparian corridor for each subwatershed based on the cumulative assessment of 5 indicators (including impervious cover, natural vegetation, water/wetland species, agricultural, and road crossings). The Riparian Corridor Condition represents areas that exhibit predominantly natural vegetation including high quality habitat for water/wetland dependent species, and a generally low incidence of impervious area, agricultural uses, and/or road crossings. (Ecosystem Management Technical Report, July 2008)</p>
5.	<p>Prime Ground Water Recharge</p> <p>The land area that contributes the highest recharge areas that contributes 40% of ground water recharge by volume, under drought conditions. (Water Resource Technical Report, July 2008)</p>

<p>6. Critical Habitat - Landscape Rank 3-5 Plus Landscape 2 within Highlands Rank 2-3</p>	<p>The Landscape Project values patches of land for wildlife species based on occurrence data and land use type. A landscape rank is assigned to each patch based on species valued for that patch. All Habitat (Landscape Rank 3 - 5), is a feature based data layer that includes habitat with Landscape Ranks 3 through 5 for the following: 1. Federally Listed (Rank 5) – a species listed by USFWS as threatened or endangered; 2. State Endangered (Rank 4) - a species listed on the official endangered wildlife list that the NJDEP promulgates pursuant to the Endangered and Nongame Species of Wildlife Conservation Act of 1973 (ENSCA); 3.State Threatened (Rank 3) - a species designated as “threatened” on the list of nongame wildlife species that the NJDEP promulgates pursuant to ENSCA. (Ecosystem Management Technical Report, July 2008)</p> <p>NJDEP-ENSP assigned a Highlands Conservation Rank index to each species occurrence based upon how critical the Highlands Region is to the continued existence of the species within the state. The Highlands Conservation Rank feature based data layer utilized in LANDS refers to the following: Critically Significant (Rank 3) – if habitats in the Highlands Region were lost, that species would not exist in the state; Significant (Rank 2) – Highlands Region habitats play a significant role for that species’ existence in the state. (Ecosystem Management Technical Report, July 2008)</p>
<p>7. Vernal Pools + 1000 feet</p>	<p>A vernal pool is a confined ephemeral wetland depression that provides important breeding areas for amphibians. The Vernal Pools +1000 feet feature based data layer includes 2005 NJDEP confirmed vernal pool data buffered by 1,000 feet. (Ecosystem Management Technical Report, July 2008)</p>
<p>8. Significant Natural Areas</p>	<p>The Significant Natural Area feature based data layer contains sites or areas that constitute outstanding examples of a particular habitat type or geologic formation, or habitat that supports populations of rare or endangered plant species in the Highland Region. The data layer utilized Natural Heritage Priority data and was spatially reviewed for the 95 sites. “Active Use” lands (per the Highlands Land Classification Data Layer Relationship table) and roadway right of ways were removed from this data layer. (Ecosystem Management Technical Report, July 2008)</p>
<p>9. Preserved Lands</p>	<p>Preserved Lands feature based data layer is based on data collected from the following sources:</p> <ul style="list-style-type: none"> • NJDEP Green Acres Program and State-Held Conservation Easements; • State Owned, Protected Open Space and Recreation Areas; Preserved farms that have "final approval" from the SADC; National Park Service Water Resources Division; • USFWS National Wildlife Refuge System; • NJDEP Wildlife Management Areas; • New Jersey Conservation Foundation; • The Nature Conservancy; County Open Space; • Watershed Lands.

CONSERVATION INDICATORS

<p>1. Contiguous Farms > 250 acres</p>	<p>The Contiguous Farms >250 data layer is an intensity indicator that represents areas of contiguous farming landscapes. The layer is based upon the following factors: parcels with 10% or greater agricultural uses and 1%+ important farmland soils (unique, local, statewide importance, and prime soils) and preserved farms. Features were buffered by 50 feet to reduce fragmentation and only those areas with 250 or greater contiguous areas were selected. Once the Agricultural Resource Area was established (an intensity indicator that reflects areas in the Region with a prevalence of active farms) those parcels that are outside of the Agricultural Resource Area were deleted. (Sustainable Agriculture Technical Report, July 2008)</p>
<p>2. Agriculture Land Use > 10 acres</p>	<p>The Agricultural Land Uses >10 acres is an intensity indicator that represents the extent of lands that are currently in agricultural use within the Agricultural Resource Area based upon NJDEP 2002 Land Use Land Cover data, with 10 acres as a minimum threshold. Agricultural lands are used primarily for the production of food and fiber and some of the structures associated with this production. Categories include cropland and pastureland, orchards, vineyards, nurseries and horticultural areas, confined feeding operations, and other agriculture. Parcels were identified 10% or more of the parcel was classified as agricultural per Land Use Land Cover. (Sustainable Agriculture Technical Report, July 2008)</p>
<p>3. Agriculture Land Use Land Cover</p>	<p>Agriculture Land Use Land Cover is a feature based indicator and is based on the following 2002 NJDEP Land Use Land Cover codes 2100, 2200, 2300, 2400, 2140, and 2150.</p>

EXISTING COMMUNITY INDICATORS	
1.	<p>Core Developed Lands</p> <p>The Core Developed Land is an intensity indicator that is based on the following factors: (1) Areas with an impervious surface of at least 30 percent (as indicated by NJDEP draft Land Use and Cover data) and at least 5 contiguous acres; (2) Existing Areas Served with wastewater, buffered by 10 feet; (3) Population densities of greater than 8 people per acre occurring for at least 10 contiguous acres; (4) Non-residential “waste generating” land uses of at least 5 contiguous acres served by on-site wastewater disposal units.; and (5) “Waste generating” land uses, greater than 50 contiguous acres, but excluding rural residential lands. A spatial analysis was performed in order to identify those areas in the Region that contain a critical mass of core developed features in areas of greater than 75 acres of greater. (Regional Land Use Conditions and Smart Design Guideline Technical Report, July 2008)</p>
2.	<p>Moderate Developed Lands</p> <p>The Moderate Developed Land is an intensity indicator that includes and extends beyond Core Developed Lands, with the addition of “Active Use” lands, excluding rural residential land (NJDEP Land Use Land Cover code 1140). Actively used lands are listed in the Highlands Land Classification Data Layer Relationship. A spatial analysis was performed in order to identify those areas in the Region that contain a critical mass of moderately developed features of 75 contiguous acres or greater. (Regional Land Use Conditions and Smart Design Technical Report, July 2008)</p>
3.	<p>Suburban Fringe Lands</p> <p>The Suburban Fringe Land is an intensity indicator that includes and extends beyond Moderate Developed Lands with the addition of “Active Use” lands, including rural residential land (NJDEP Land Use Land Cover code 1140). Only those areas that adjoin or are next to a Moderate Developed Lands and exhibited 75 contiguous acres or greater of suburban fringe developed areas were retained in the data layer. Those non-contiguous areas are moved to the Rural Developed Lands layer. (Regional Land Use Conditions and Smart Design Technical Report, July 2008)</p>
4.	<p>Rural Developed Lands</p> <p>Rural Developed Land is an intensity indicator and is comprised of areas classified as Suburban Fringe Lands, which are isolated and non-contiguous with more intensely developed areas.</p>
5.	<p>Developed Land Use Land Cover</p> <p>The Developed Land Use Land Cover feature based indicator is based on the following NJDEP Land Use Land Cover codes: 1110, 1120, 1130, 1140, 1150, 1200, 1300, 1500, 1600, 7300, 1211, 1400, 1410, 1419, 1440, 1810, 1462, 1463, 1499, 1710, 1800 and 1804.</p>
6.	<p>Land Use Land Cover 1140</p> <p>The Land Use Land Cover feature based indicator is based on NJDEP 2002 Land Use Land Cover and represents single unit residential neighborhoods with areas between 1 acre and up to and including 2 acre lots. Also included are estates or modern subdivisions with large lot sizes providing a density less than or equal to 1 dwelling unit per acre.</p>
7.	<p>Existing Area Served (Potable)</p> <p>The Utility Analysis delineated areas served with existing water service based upon “public community water supply systems” (PCWS), which may be owned and operated by governmental entities</p>

	Water) + 100 feet	or investor-owned utilities. The Water EAS + 100 is a feature based data layer and was buffered by 100 feet to reduce fragmentation due to roads. (Utility Capacity Technical Report, July 2008)
8.	Existing Area Served (Highlands Domestic Sewerage Facilities) + 100 feet	Community infrastructure, wastewater in particular, is based upon the identification of Highlands Domestic Sewerage Facilities, which include publicly-owned and investor-owned domestic wastewater treatment facilities, and provides wastewater treatment to municipalities. The Utility Analysis delineated existing areas served with sewers. The Sewer EAS + 100 is a feature based data layer and was buffered by 100 feet to reduce fragmentation due to roads. (Utility Capacity Technical Report, July 2008)
9.	Transportation Score >= 3	<p>The Transportation Score >= 3 is an intensity indicator and identifies multimodal opportunities throughout the regional transportation system and is based on the cumulative value of 3 or more points from the following factors:</p> <p>Transportation corridors - Includes developed lands within 1/4 mile of significant US routes, state routes, and specified county routes;</p> <p>Interchanges and intersections - Includes developed lands within 1/2 mile of buffered roadway interchanges and intersections;</p> <p>Train station "inner core" - Includes developed and undeveloped lands within 1/2 mile "inner core" buffer of train stations in or within 1/2 mile of the Highlands Region;</p> <p>Train station "outer core" - Includes developed and undeveloped lands within a 1 mile "outer core" buffer of train stations in or within 1 mile of the Highlands Region;</p> <p>Park & rides - Includes all developed lands within a 1/2 mile buffer from all park and ride locations in or within 1/2 mile of the Highlands Region;</p> <p>Bus routes - Includes all NJ Transit and major private bus carriers in the Highlands Region, which operate daily basis on any of the US, State or County routes used in the analysis.</p>
10.	Lakes >10 Acres	The Lakes > 10 Acres feature based data layer is based on NJDEP 2002 Land Use Land Cover Codes 5200, 5300 and 5420 with 10 acres as a minimum threshold.

RATIONALE FOR INDICATORS

Several basic principles were used for the selection of indicators for the LANDS overlay designations:

- Select indicators for the resource, land use and development features that are most directly and richly descriptive of the distinctive character of various Highlands Region landscapes;
- Select the minimum number of indicators that describe the maximum area of the Highlands Region;
- Minimize redundancy of indicators; and
- Select indicators that can be used in a presence/absence method.

Thirteen primary indicators were selected based on these principles (see above Table Indicators used in the LANDS Model). Six are associated with critical environmental features typical of the least developed areas of the Highlands Region, and therefore best help to delineate the Protection Zone.

They relate to the most concentrated forested areas, the highest quality riparian areas, prime ground water recharge areas, habitat for threatened and endangered wildlife species, habitat for species that rely exclusively on the specialized feature of vernal pools, and regionally unique ecological communities. Many other potential indicators were considered, but were not used due to complete or extensive redundancy, weakness of association with Highlands natural resource values, minimal acreage of the resource, or data quality limitations. The six selected indicators focus on the most critical resources in their most critical areas, and respond directly to goals, policies and objectives or requirements of the Highlands Act regarding the preservation of Highlands resources.

Six primary indicators are associated with intensively developed areas, and therefore best help to delineate the Existing Community Zone. They relate contiguous areas of existing development (at core, moderate and suburban landscapes), existing areas served for public water supply and wastewater utilities, and high intensity transportation areas. These indicators respond directly to goals, policies, and objectives or requirements of the Highlands Act regarding development, redevelopment, and economic sustainability. As with the Protection Zone indicators, other candidate indicators were rejected due to redundancy, minimal acreage, or data quality limitations. Finally, the most concentrated agricultural landscapes were used as an indicator to help delineate the Conservation Zone. This indicator responds directly to the Highlands Act objectives regarding the maintenance of agricultural lands for agriculture.

The method used in the LANDS model did not weigh the indicators at any point. The lands delineated by these indicators were aggregated separately into each of the three primary zones, and only then were the three resulting areas compared to determine where potential conflicts existed. Rules were then developed to determine which overlay designation should apply in the case of each significant conflict; these rules are described below. In some cases, secondary indicators (see above Table Indicators used in the LANDS Model) were used to either resolve a conflict or to assign to an overlay designation to those areas not addressed by the primary indicators. In each case, the secondary indicators were selected because of their relationship to the primary indicator (i.e., addressing a similar resource but not at the same density or intensity as the primary indicator).

It should be noted that the assignment of a land area to an overlay designation according to this method does not directly result in a land use capacity for new development. In each zone, there will be lands that have no capacity for development (e.g., preserved lands, fully developed lands), limited capacity (e.g., environmentally constrained lands), or significant capacity.

TESTING FOR INDICATORS

The rationale for the use of the above mentioned indicators were independently validated by the use of Artificial Neural Network (ANN) Modeling in order to identify the zone specific indicators most important for differentiating the presence or absence within the Protection, Conservation and Existing Community zones across the Highlands Region. The ANN utilized the 51 indicators in the November 2006 Highlands Draft Regional Master Plan to determine which variables were important for differentiating the presence or absence within a particular zone. For the Protection, Conservation and Existing Community zones, the ANN models helped validate that the indicators in the table Indicators used in the LANDS Model were highly characteristic of their corresponding zone.

LAND USE ANALYSIS DECISION SUPPORT SYSTEM (LANDS)

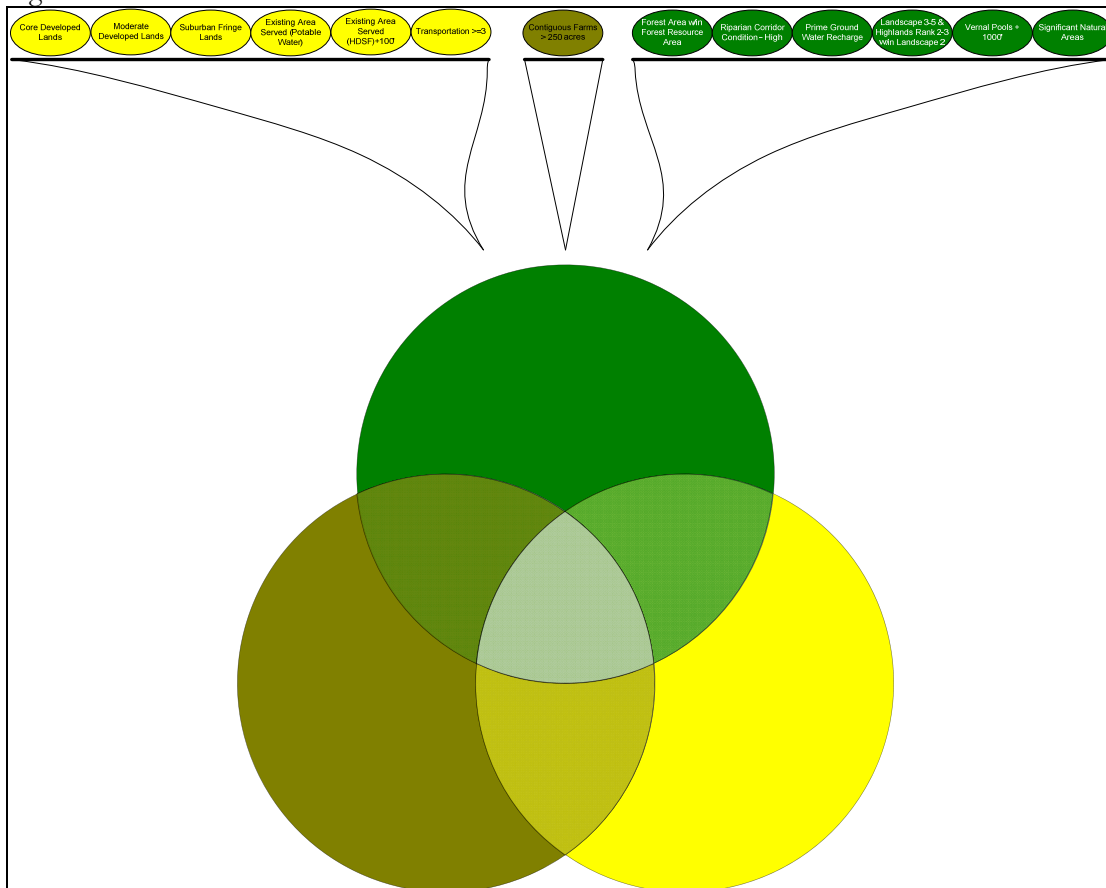
The LANDS model used a series of resource indicators and a set of rules, according to which an overlay designation was assigned throughout the Highlands Region. The LANDS model can be best described by six basic steps.

- I. Population of the Model
- II. Zone Development
- III. Conflict Resolution
 - a. Protection Zone / Conservation Zone
 - b. Existing Community Zone / Conservation Zone
 - c. Protection Zone / Existing Community Zone
 - d. Existing Community Zone / Protection Zone / Conservation Zone
 - e. Unclassified Determination
- IV. Absorption Process
- V. Quality Assurance
- VI. Lake Community & Wildlife Management Sub-Zones

POPULATION OF THE MODEL

The LANDS model begins with the input of both primary and secondary indicators. All indicators are listed in the table Indicators Used in the LANDS Model and are followed by the rationale and testing of these indicators. Primary indicators result in the development of zones only where no conflict is present. A combination of secondary indicators and/or rules is utilized to resolve conflict amongst primary indicators. This is further explained in the Conflict Resolution section. Figure 1 illustrates this step.

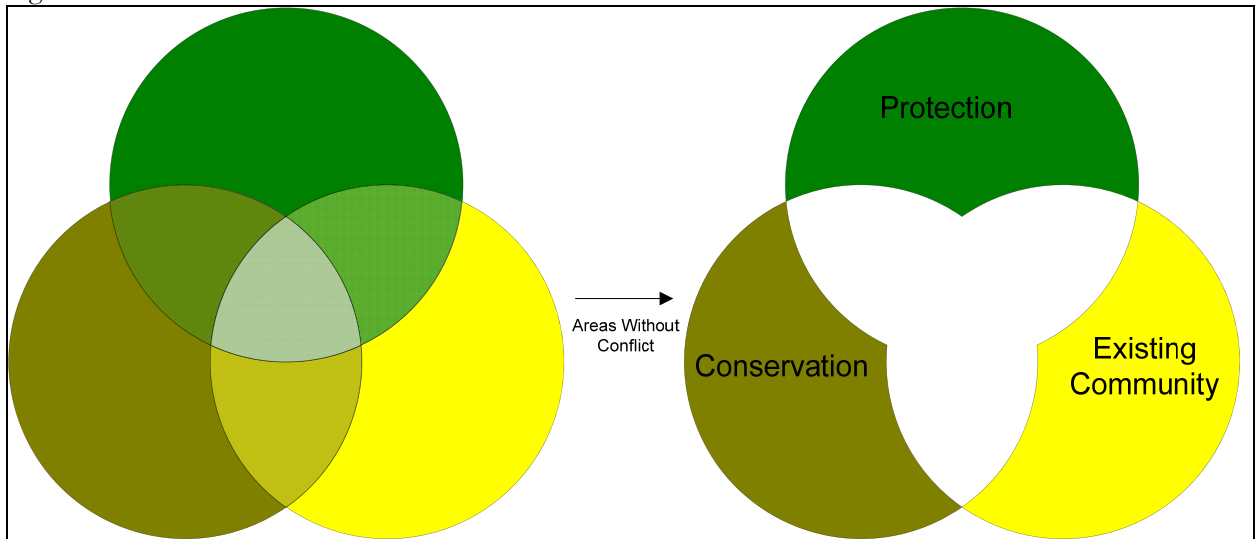
Figure 1



ZONE DEVELOPMENT

Primary indicators are attributed with their presence or absence. Where no conflict exists amongst primary indicators, the overlay designations were delineated. LANDS resulted in a majority of the Highlands Region represented in any one of the three primary zones with no conflict between the indicators. These areas form the foundation of the zone designations and are built upon throughout the following steps. Figure 2 illustrates the result of Zone Development.

Figure 2



CONFLICT RESOLUTION

Conflict resolution is rectified in five steps.

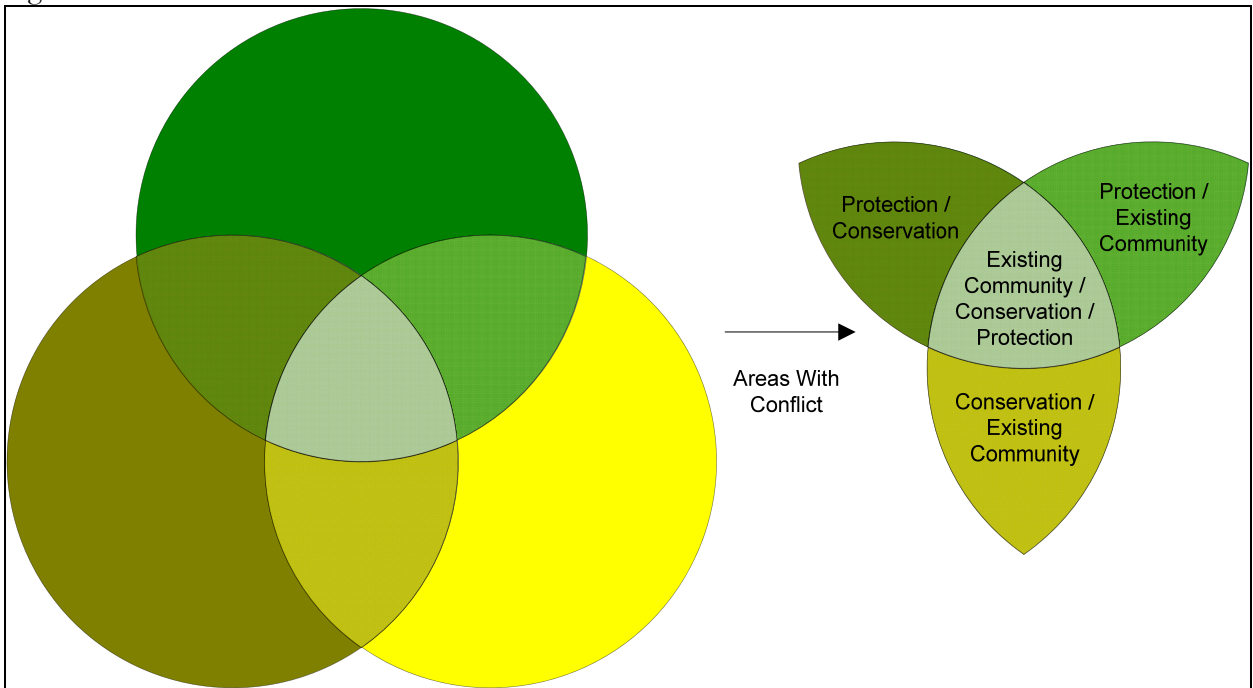
- a. Protection Zone/ Conservation Zone
- b. Existing Community Zone / Conservation Zone
- c. Protection Zone / Existing Community Zone
- d. Existing Community Zone / Protection Zone / Conservation Zone
- e. Unclassified Determination

Conflict among the overlay zones is an expected and natural outcome of the LANDS model for two primary reasons. Conflict is the recognition that in, or proximate to, any given overlay zone, features exist which are different. For example, there exist regionally significant forested ridgelines within otherwise altered lands. Conflict areas also exist due in part to the limitation of the spatial base layers that were used. These base layers were developed from a range of scales and various mapping protocols. For example, the NJDEP Land Use Land Cover dataset was developed with a one acre minimum mapping unit and is an interpretation of existing land uses through the use of aerial orthophotography, whereas the Highlands parcels do not have a minimum mapping unit and is an interpretation of locally adopted tax maps.

It should be noted that no one or multiple indicators completely cover the Highlands Region, so cells which are unclassified are addressed later in the LANDS model either by rule, secondary indicator, or a combination of both.

Figure 3 illustrates conflicting zones.

Figure 3

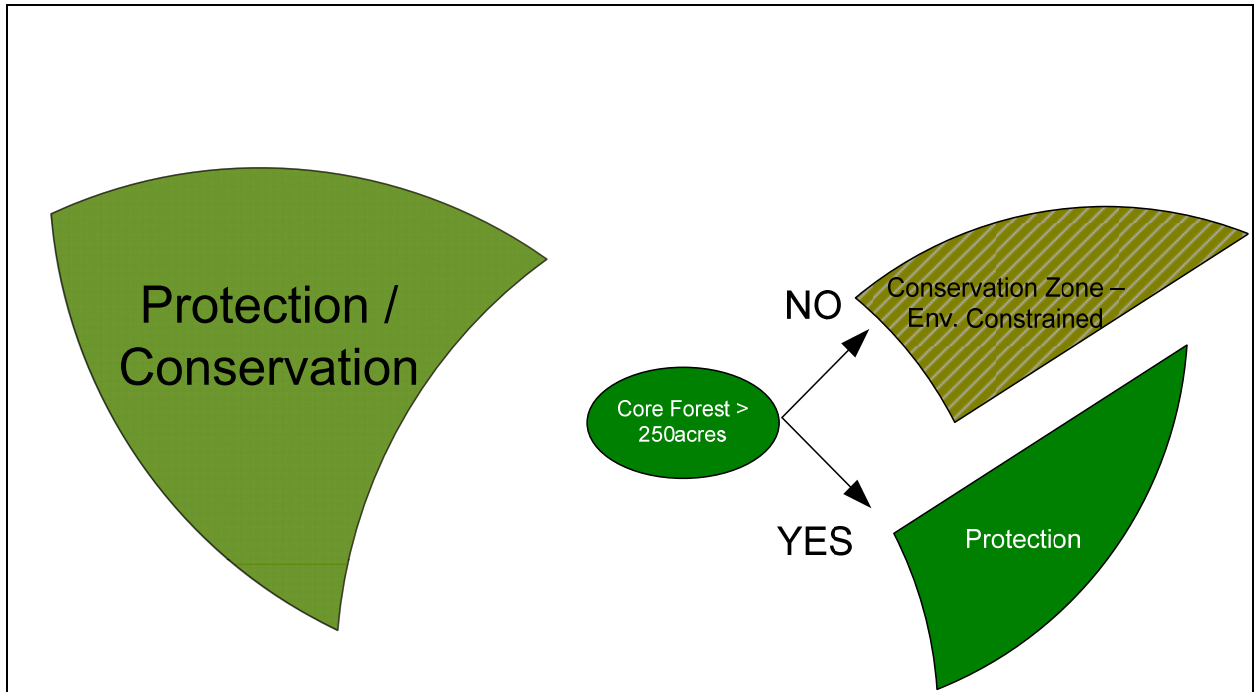


Protection / Conservation Conflict

1. IF a conflict area has both **Conservation/Protection** indicators, THEN conflict area goes to **Conservation Zone - environmentally constrained sub-zone**, UNLESS area contains **Core Forest > 250** indicator; THEN conflict area goes to **Protection Zone**.
 - i. This rule provided priority to agricultural resources, but recognizes that the **Contiguous Farms > 250** indicator includes some high priority forests that should not be in the Conservation Zone.

Figure 4 illustrates this rule.

Figure 4 – Protection / Conservation Conflict Resolution

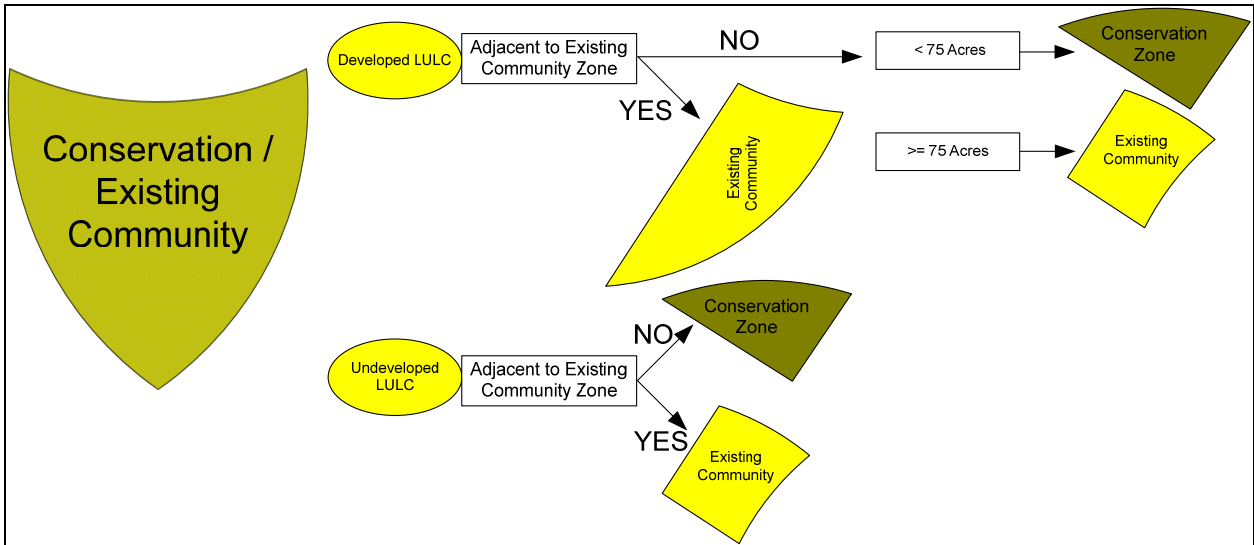


a. Existing Community / Conservation Conflict

1. IF conflict area is LULC Developed AND adjacent to Existing Community Zone, THEN conflict area goes to the Existing Community Zone.
2. IF conflict area is LULC Developed > 75 acres, AND not adjacent to Existing Community Zone, THEN conflict area goes to Existing Community Zone.
3. IF conflict area is LULC Developed < 75 acres, AND not adjacent to Existing Community Zone, THEN conflict area goes to Conservation Zone.
4. IF conflict area is undeveloped AND not adjacent to Existing Community Zone, THEN conflict area goes to Conservation Zone.
5. IF conflict area is undeveloped AND adjacent to Conservation Zone, THEN conflict area goes to Conservation Zone.

Figure 5 illustrates this rule.

Figure 5 – Existing Community / Conservation Conflict Resolution

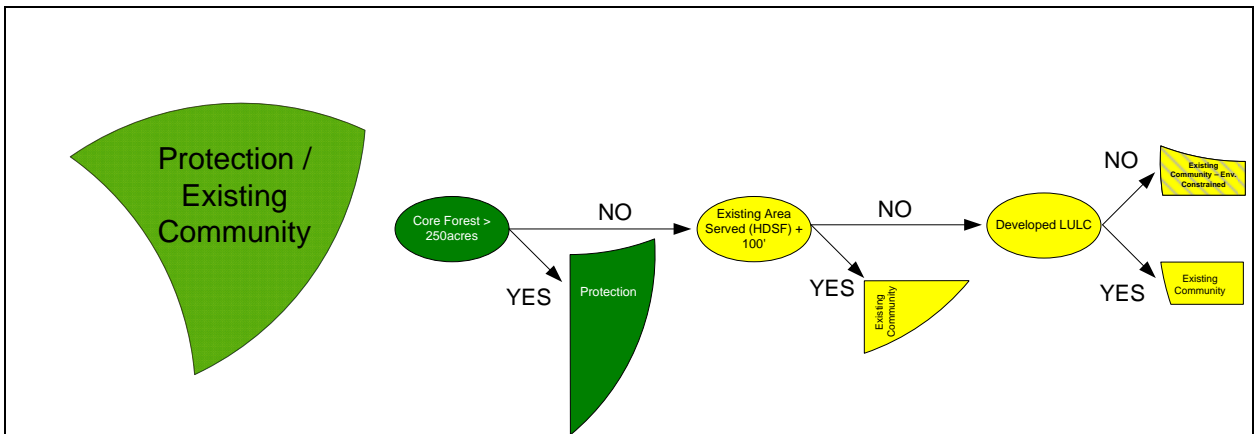


b. Protection / Existing Community Conflict

1. IF a conflict area has Protection/Existing Community indicators AND is within the Core Forest >250 acres indicator, THEN conflict area goes to Protection Zone.
2. IF remaining conflict area has Protection/Existing Community indicators AND is within the EAS + 100 (HDSF) indicator, THEN conflict area goes to Existing Community Zone.
 - i. This rule places developed, sewerded lands in the Existing Community Zone.
3. IF remaining conflict area has Protection/Existing Community indicators AND is LULC Developed, THEN it goes to Existing Community Zone IF it is not LULC Developed, THEN it goes to Existing Community Zone – Environmentally Constrained sub-zone.

Figure 6 illustrates this rule.

Figure 6 – Protection / Existing Community Conflict Resolution

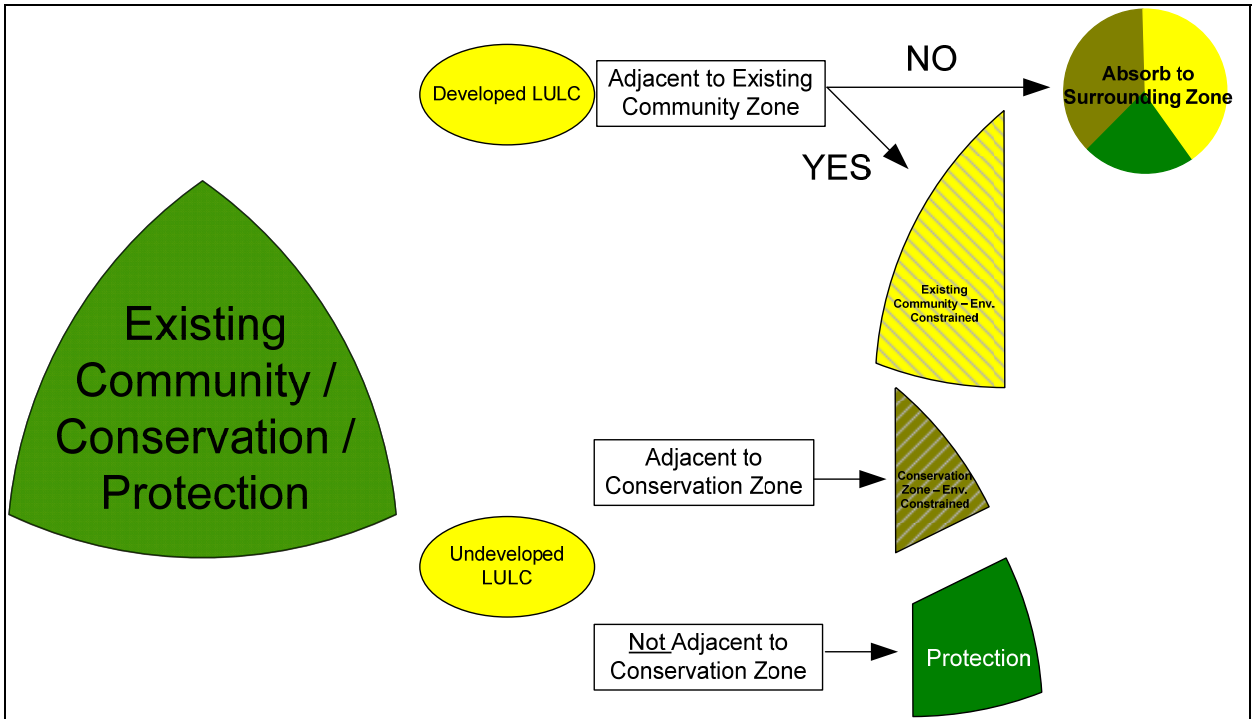


c. Existing Community / Protection / Conservation Conflict

1. IF triple conflict area is LULC Developed AND adjacent to Existing Community Zone, THEN conflict area goes to the Existing Community Zone – Environmentally Constrained sub-zone.
2. IF conflict area is undeveloped AND adjacent to Conservation Zone, THEN conflict area goes to Conservation Zone – Environmentally Constrained sub-zone.
3. IF conflict area is undeveloped AND not adjacent to Conservation Zone, THEN conflict area goes to Protection Zone.

Figure 7 illustrates this rule.

Figure 7 - Existing Community / Protection / Conservation Zone Conflict Resolution



d. Unclassified Areas

Once all the conflict areas have been resolved, the unclassified areas need to be assigned an overlay designation. Examples of areas that may not have been classified include water bodies and roads. The following rules are applied to these areas:

- a. IF unclassified area contains the Total Forest Area THEN area goes to Protection Zone.
- b. IF remaining unclassified area contains Agricultural Area greater than 10 acres within the Agricultural Resource Area (ARA) THEN area goes to Conservation Zone.
- c. IF remaining unclassified area contains Rural Developed Lands THEN area goes to the surrounding zone.
- d. IF remaining unclassified area contains Land Use Land Cover 1140 THEN area goes to the surrounding zone.
- e. IF remaining unclassified area contains Agricultural Land Use Land Cover codes AND is adjacent to Conservation Zone THEN area goes to Conservation Zone.

- f. Remaining unclassified areas are absorbed by their surrounding zone. (See Unclassified Absorption Process below)

ABSORPTION PROCESS

The absorption process associates land areas to the overlay designations contiguous to them. This process was used with the unclassified areas (see Unclassified Areas Step f. above) and the last stage of overlay zone designation (see Overlay Zone Designation Absorption Process below). In the event that an area shares a border with more than one zone, a series of steps are carried out to complete the absorption process.

Unclassified Absorption Process

1. Any polygon less than 1 acre in size is associated to the zone that it shares the majority of its border with.
2. Unclassified areas that share a supermajority (greater than or equal to 70%) with a neighboring zone are associated to that zone.
3. Areas that do not possess a supermajority with any contiguous zone are evaluated for the land-use type that exists within the unclassified area.
 - If the unclassified area contains agricultural land uses and shares a portion of its border with the Conservation Zone (CZ) then it is associated to the CZ.
 - If the unclassified area contains developed land uses and shares a portion of its border with the Existing Community Zone (ECZ) then it is associated to the ECZ.
 - If the unclassified area does not contain agricultural or developed land uses and shares a portion of its border with the Protection Zone (PZ) then it is associated to PZ.
4. Any remaining unclassified areas are then associated to the zone that they share a majority of their border with.

Overlay Zone Designation Absorption Process

The last step in the absorption process is the assignment of the Land Use Capability Zone Map designation and the absorption of small polygons into the Protection, Conservation and Existing Community Zones. The minimum mapping unit of any of the three zones is 75 acres and the following steps are carried out to complete the absorption process.

1. All classified polygons which are greater than or equal to 75 acres maintain their overlay zone designation.
2. All remaining classified polygons which are less than 75 acres are absorbed to the adjacent zone with which they share the majority of their border.

QUALITY ASSURANCE

Quality assurance checks were performed at this stage and after the Lake Community Zones were assigned. Overlay zone designations were compared with 2002 orthophotography and checked to assess how well the overlay zone designations match with ground conditions. A “heads up” scan was performed on the entire region at a 1:5000 scale by Highlands Council staff who did not participate in the LANDS modeling process. There were two instances where the Highlands Council staff found isolated Existing Community Zones to be counterintuitive to the landscape associated with the Existing Community Zone. Quality assurance demonstrated that these Existing Community Zone polygons consisted, in their entirety, as isolated golf courses and isolated extractive mining. In these instances, these areas were absorbed into whichever adjacent zone borders the polygon for more than 50 percent of the polygon perimeter.

LAKE COMMUNITY & WILDLIFE MANAGEMENT SUB-ZONES

Once the three primary zones and the two sub-zones (Environmentally Constrained Existing Community and Conservation) were delineated, the Lake Management Areas are overlaid for the development of the Lake Community Zone. The Lake Community Zone consists of patterns of community development around lakes within the Existing Community Zone. The LANDS model utilized lakes 10 acres or greater to delineate Lake Management Areas that extend to a maximum of 1,000 feet from the lake shoreline in order to protect water quality, resource features, shoreline development recreation, scenic quality and community character. The delineation of the Lake Community Zone exclusively includes those areas where the Lake Management Area (1,000 foot buffer) coincides with the Existing Community Zone or the Existing Community Environmentally Constrained sub-zone.

Areas managed by the United States Fish and Wildlife Service as part of the National Wildlife Refuge System and areas administered by the NJDEP Division of Fish & Wildlife’s Bureau of Land Management as part of the Wildlife Management Area System were extracted from the Preserved Lands Indicator. These areas are part of a network of lands and waters for conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and their habitats and permit compatible wildlife-dependent recreational uses, such as hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The delineation of the Wildlife Management Sub-Zone exclusively includes these areas with no minimum mapping threshold. These areas superseded the vast majority of the underlying protection zone.

LANDS OUTPUT

In terms of the overall breakdown of the Highlands Region by each of the Land Use Capability Zones (see table below) the Highlands Council found that nearly 75% of the region is either in Protection Zone or one of the Sub-Zones (Existing Community – Environmentally Constrained, Conservation - Environmentally Constrained of Lake Community).

Table 1: Land Use Capability Zone Map – Acres and Percentages by Zone

Land Use Capability Zone Map	Highlands Region	
	Area (acres)	Percent of Land Class
Protection Zone	430,198	50.06%
Wildlife Management Sub-Zone	46,463	5.41%
Conservation Zone	68,806	8.01%
Conservation – Environmentally Constrained Sub-Zone	115,474	13.44%
Existing Community Zone	145,682	16.95%
Existing Community – Environmentally Constrained Sub-Zone	32,098	3.74%
Lake Community Sub-Zone	20,637	2.40%
TOTAL	859,358	100.00%

LANDS COMPARISON WITH LAND USE LAND COVER CHARACTERISTICS

An analysis of the composition of land use within each of the Land Use Capability Zones (see table below) illustrate that the Protection Zone includes most of the forest, water and wetlands. The composition of the Existing Community Zone includes most of the residential, commercial and industrial uses, while the Existing Community – Environmentally Constrained Zones includes mostly forest, water and wetlands demonstrate the existence of natural resources within an otherwise developed landscape. The Conservation Zone includes the vast majority of the agricultural uses within the Highlands Region.

Table 2 Indicators Used in the LANDS Model

Land Classification (2002)	Protection Zone		Conservation Zone		Existing Community Zone	
	Area (acres)	Percent of Land Class	Area (acres)	Percent of Land Class	Area (acres)	Percent of Land Class
Residential	42,126	9.79%	13,331	19.37%	83,487	57.31%
Commercial	1,947	0.45%	827	1.20%	11,884	8.16%
Industrial	687	0.16%	364	0.53%	4,023	2.76%
Other Urban	12,190	2.83%	2,799	4.07%	20,105	13.80%
Agriculture	12,035	2.80%	38,924	56.57%	2,369	1.63%
Forest	285,895	66.46%	7,194	10.46%	10,805	7.42%
Water	21,437	4.98%	816	1.19%	6,070	4.17%
Wetlands	50,310	11.69%	3,825	5.56%	4,138	2.84%
Barren Land	3,571	0.83%	727	1.06%	2,800	1.92%
TOTAL	430,198	-	68,806	-	145,682	-

Table 3 Land Use Capability Zone Map

Land Classification (2002)	Wildlife Management Sub-Zone		Conservation – Environmentally Constrained Sub-Zone		Existing Community – Environmentally Constrained Sub-Zone	
	Area (acres)	Percent of Land Class	Area (acres)	Percent of Land Class	Area (acres)	Percent of Land Class
Residential	275	0.59%	2,650	2.29%	1,130	3.52%
Commercial	37	0.08%	87	0.07%	122	0.38%
Industrial	16	0.03%	59	0.05%	50	0.16%
Other Urban	1,035	2.23%	1,158	1.00%	1,030	3.21%
Agriculture	3,242	6.98%	52,322	45.31%	591	1.84%
Forest	29,649	63.81%	42,484	36.79%	21,947	68.38%
Water	2,046	4.40%	741	0.64%	1,279	3.99%
Wetlands	10,124	21.79%	15,460	13.39%	5,282	16.46%
Barren Land	40	0.09%	514	0.44%	666	2.07%
TOTAL	46,463	-	115,474	-	32,098	-

Table 4: Land Use Capability Zone Map – Acres and Percentages by Zone

Land Classification (2002)	Lake Community Sub-Zone		Highlands Region	
	Area (acres)	Percent of Land Class	Area (acres)	Percent of Land Class
Residential	11,951	57.91%	154,949	18.03%
Commercial	973	4.71%	15,877	1.85%
Industrial	276	1.34%	5,474	0.64%
Other Urban	1,803	8.74%	40,121	4.67%
Agriculture	100	0.49%	109,582	12.75%
Forest	4,024	19.50%	401,999	46.78%
Water	402	1.95%	32,792	3.82%
Wetlands	810	3.92%	89,949	10.47%
Barren Land	297	1.44%	8,615	1.00%
TOTAL	20,637	-	859,358	100.00%

SUPPORTING INFORMATION

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New Jersey Environmental Infrastructure Trust
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New Jersey Pinelands Commission
New Jersey Redevelopment Authority
New Jersey State Agriculture Development Committee
New Jersey Transit
New Jersey Water Supply Authority
North Jersey District Water Supply Commission
North Jersey Transportation Planning Authority
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State Planning Commission
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Eco-Tourism and Recreation	Sustainable Forestry
Education	Transfer of Development Rights
Geographic Information Systems	Transportation
Green Construction	Utility Capacity
Housing	Water Resource Management

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