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Kingwood Township
Hunterdon County, NJ

Land Use Plan Element
Kingwood Township Master Plan

October 2012

Prepared by the Kingwood Township Planning Board

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The original of this report was signed and sealed in accordance with N.J.A.C. 13:41-1.3

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Introduction

Kingwood Township is located on the west side of Hunterdon County along the Delaware River. The Township is historically an agricultural community and the land was initially settled around the turn of the 17th century. Kingwood Township was established in 1746 when it was separated from Bethlehem Township. Its present boundaries were established when Franklin Township was separated from the northwest portion of the Township in 1845 and when Frenchtown Borough was established in 1876.[1] Kingwood Township is 35.6 square miles in area with a current population of approximately 3,845 people[2].

Kingwood Township's terrain is characterized by an expansive plateau of farmland, rolling hills of farms and forests, meandering streams, winding, narrow rural roads and rock outcroppings along the Delaware River. This serene landscape lies several miles west of the County's suburbanizing communities to the west in Hunterdon County.

Since the Planning Board's last comprehensive revision of the Master Plan in 1973, the Township's land use patterns and landscape have remained much the same, with residential growth and significant reductions in active farmland being the primary changes in the Township. In this Land Use Plan, the Planning Board seeks to update land use policies that seek to retain and protect the Township's rural landscape, productive agricultural base, wealth of natural resources, and historic identity. Land Use policies are aimed at quality of life preservation and enhancement for today's residents and future generations to come. This Land Use Plan establishes policies for a new focused opportunity for limited, sensible development to accommodate population growth integrated with commercial and employment opportunities on the easterly side of the Township along Route 12, the main thoroughfare, which transects the Township from east to west.

Kingwood Township has approximately 8 miles of Delaware River frontage along its westerly boundary. In 2000, 67 miles of the Lower Delaware received the federal Wild & Scenic River designation. The Lower Delaware Management Plan (http://www.nps.gov/nero/rivers/lowerdelmgmtplan.htm), prepared by the National Park Service (NPS), identifies Treasure Island and Kingwood Township Bluffs as meeting the "outstandingly remarkable resource criteria" with critical habitat designations in the river corridor.

As tributaries to the D&R Canal, the Lockatong and Wickecheoke Creek watersheds have received extensive ongoing study. The Lockatong and Wickecheoke Creek Watersheds Restoration and Protection Plan (http://www.raritanbasin.org/lockwick.html) was developed in June of 2009 by the NJ Water Supply Authority, the goal of which ". . . to is to focus efforts for the restoration and protection of the watersheds toward natural conditions, to the extent feasible, for protection of the water supply, threatened and

[1] Goals and objectives April 2007
[2] April 1, 2010 Census

endangered species, aquatic ecology, natural aesthetics, and to support the primary goal of the Lower Delaware Wild and Scenic Rivers Protection Plan:

> "Maintain existing water quality in the Delaware River and its tributaries from measurably degrading, and improve it where practical."

The Township Committee recognized the importance of these waterways and the significance of local use policies and practices on surface water quality and the more expansive goal of protecting critical habitat, aquatic ecology, natural aesthetics and reinforcement of the Township's rural character and entered into a Memorandum of Understanding as a partner with the NPS on The Lower Delaware Wild and Scenic Rivers Protection Plan. As such, this Land Use Plan endorses and promotes the strategies and programs of The Lower Delaware Management Plan and The Lockatong and Wickecheoke Creek Watersheds Restoration and Protection Plan.

The M.L.U.L. authorizes the Land Use Plan Element to the Master Plan at Section 28.b. which provides for:

> (2) A land use plan element (a) taking into account and stating its relationship to the statement provided for in paragraph (1) hereof, and other master plan elements provided for in paragraphs (3) through (14) hereof and natural conditions, including, but not necessarily limited to, topography, soil conditions, water supply, drainage, flood plain areas, marshes, and woodlands; (b) showing the existing and proposed location, extent and intensity of development of land to be used in the future for varying types of residential, commercial, industrial, agricultural, recreational, educational and other public and private purposes or combination of purposes; and stating the relationship thereof to the existing and any proposed zone plan and zoning ordinance; and (c) showing the existing and proposed location of any airports and the boundaries of any airport safety zones delineated pursuant to the "Air Safety and Zoning Act of 1983," P.L.1983, c.260 (C.6:1-80 et seq.); and (d) including a statement of the standards of population density and development intensity recommended for the municipality;

This Land Use Plan Element includes a Statement of Goals and Objectives, which are the underlying principles of the Master Plan that establish land use policy and zoning. These Master Plan principles are authorized in the Municipal Land Use Law (M.L.I.L.), which grants municipalities the power to zone in New Jersey. The policies and recommendations in this Land Use Plan are informed by the Planning Board's past planning efforts, which identify an orientation of natural resource and agricultural protection, preservation of rural character and limited sensible growth as fundamental underpinnings for planning in the Township. This Land Use Plan updates local land use policies aimed at this planning orientation.

Since the last comprehensive update to the Master Plan in 1973, an amendment to the Land Use Plan was adopted in 1993 for Route 12 and Barbertown. Periodic Reexamination Reports were adopted in 1986, 1988, 1992, 1998 and 2004 as required by

statute Section 89 of the M.L.U.L.). The Planning Board's Periodic Reexamination Reports addressed the statutory requirement for a periodic review of the master plan, but the desire for an updated Master Plan became apparent several years ago.

Since the 2004 Periodic Reexamination Report, the Planning Board prepared and adopted a variety of Master Plan documents, including:

1. An updated Statement of Goals and Objectives in April 2007;
2. A Conservation Plan Element in October 2008;
3. Housing Plan Elements in 2005 and December 2008 in response to changes in affordable housing regulations;
4. A Farmland Preservation Plan Element in December of 2009; and
5. An Open Space and Recreation Plan Element in May of 2011.
6. The most recent Periodic Reexamination Report in December of 2011.

This Land Use Plan Element of the Master Plan addresses the principal recommendation in the 2011 Periodic Reexamination Report to prepare an updated Land Use Plan.

The 2011 Periodic Reexamination Report of the Master Plan also included the following recommendations:

1. Organize one statement of goals and objectives for Master Plan element.
2. Prepare a policy statement, as required in Section 28.d. of the M.L.U.L., indicating the relationship of the proposed development of the municipality, as developed in the master plan to (1) the master plans of contiguous municipalities, (2) the master plan of the county in which the municipality is located, (3) the State Development and Redevelopment Plan . . . and (4) the district solid waste management plan . . . of the county in which the municipality is located.
3. Prepare a Recycling Plan Element.
4. Update the Circulation and Community Facilities Plan elements of the Master Plan.
5. Prepare a Utility Services Plan Element to assess wastewater treatment capacities for centralized sewer facilities in connection with the proposed Eastern Gateway Village Center Overlay District.
6. Prepare and adopt a Historic Preservation Plan Element in accordance with the M.L.U.L. requirements.

The 2011 Periodic Reexamination Report recognized a number of changes in regulations and law, regional and State planning initiatives, and local assumptions that form the basis for the master plan and zoning. Most noteworthy among these and other changes are:

1. The State Development and Redevelopment Plan (SDRP) Cross Acceptance III; - the State has changed course and chosen to abandon the SDRP and replace it with the "State Strategic Plan."

2. Transfer of Development Rights legislation, which enables municipalities to establish a program of land use management that transfers development potential from "a sending area" to a "receiving area" where development may be intensified;
3. The Highlands Water Protection and Planning Act of 2004 and subsequent adoption of the Highlands Regional Master Plan (RMP). Together the Act and RMP dramatically limit growth within the Highlands Region, which lies just to the north of Kingwood Township, including Alexandria Township, Holland Township and Franklin Township.
4. Demographics/growth – increased pace of development within the Township and a shift of development opportunities within the region as a result of new State regulations, including
    a. The designation of C-1 streams in Kingwood Township with required 300' setbacks from these water courses,
    b. State stormwater management regulations,
    c. Uncertainty regarding affordable housing requirements (challenges soon to be decided in the Supreme Court); and
    d. The 2010 Census.

The 2011 Periodic Reexamination concluded that these and other factors should be addressed in an update to the Land Use Plan Element of the Master Plan.

Purposes of Zoning

The municipal power to zone is authorized in the M.L.U.L., which identifies the purposes of zoning at Section 2. Purpose of the Act, as follows:

a. To encourage municipal action to guide the appropriate use or development of all lands in this State, in a manner, which will promote the public health, safety, morals, and general welfare
b. To secure safety from fire, flood, panic and other natural and manmade disasters;
c. To provide adequate light, air and open space;
d. To ensure that the development of individual municipalities does not conflict with the development and general welfare of neighboring municipalities, the county and the State as a whole;
e. To promote the establishment of appropriate population densities and concentrations that will contribute to the well being of persons, neighborhoods, communities and regions and preservation of the environment;
f. To encourage the appropriate and efficient expenditure of public funds by the coordination of public development with land use policies;
g. To provide sufficient space in appropriate locations for a variety of agricultural, residential, recreational, commercial and industrial uses and open space, both public and private, according to their respective environmental requirements in order to meet the needs of all New Jersey citizens;

h. To encourage the location and design of transportation routes, which will promote the free, flow of traffic while discouraging location of such facilities and routes, which result in congestion or blight;
i. To promote a desirable visual environment through creative development techniques and good civic design and arrangements;
j. To promote the conservation of historic sites and districts, open space, energy resources and valuable natural resources in the State and to prevent urban sprawl and degradation of the environment through improper use of land;
k. To encourage planned unit developments, which incorporate the best features of design and relate the type, design and layout of residential, commercial, industrial and recreational development of the particular site;
l. To encourage senior citizen community housing construction;
m. To encourage coordination of the various public and private procedures and activities shaping land development with a view of lessening the cost of such development and to the more efficient use of land;
n. To promote utilization of renewable energy sources; and
o. To promote the maximum practicable recovery and recycling of recyclable materials from municipal solid waste through the use of planning practices designed to incorporate the State Recycling Plan goals and to complement municipal recycling programs.

Statement of Goals and Objectives

These Purposes of the Act at Section 2 of the M.L.U.L. combine with detailed local goals and objectives to guide the development of the Master Plan. The M.L.U.L. authorizes the Master Plan Statement of Goals and Objectives in Section 28.b. (1), As follows:

> (1) A statement of objectives, principles, assumptions, policies and standards upon which the constituent proposals for the physical, economic and social development of the municipality are based;

Through the statement of objectives, principles, assumptions, policies and standards, the Planning Board articulates the vision for the future development of the municipality. This vision builds upon what has come before, incorporates these conditions, and expresses what the Township wants to be in the future. The Master Plan statement of goals and objectives guides the Planning Board's development of policies, strategies and standards for each element of the master plan.

The following list is Kingwood Township's statement of Master Plan goals and objectives[3]:

Land Use and Management

[3] Statement of Goals and Objectives, Kingwood Township Planning Board, April 2007 (with updates).

- To establish conservative land use policies to preserve Kingwood Township's rural, historic and agricultural character, and to protect the Township's natural resources.
- To offer flexibility in development techniques which recognize new approaches and technologies responsive to evolving demographic and economic needs, and the Township's natural resource and environmental protection objectives.
- To establish and maintain land use policies that permit controlled development at suitable locations and appropriate intensities, patterns and arrangements by discouraging the extension of growth-inducing infrastructure into rural areas.
- To establish development densities and intensities at levels consistent with the Township's agricultural goals, the natural terrain, the estimated supply of groundwater resources and the ability of the soil to sustain on-lot sewage disposal systems while maintaining ground water quality.
- To develop low-density design options for development to maintain rural character, minimize new road construction and maintenance, minimize stormwater detriments, maximize ground water recharge, and minimize the threat of septic contamination to the ground water.
- To minimize conflicts between non-agricultural and agricultural uses by providing flexible development techniques for single-family, low-density housing, with options for preserving large portions of the property.
- To encourage commercial development that services the needs of this rural, agricultural community.
- To promote cooperation with neighboring municipalities in the region, particularly Frenchtown Borough and the Townships of Alexandria, Franklin and Delaware, to advance consistent development and open space goals, policies and plans.
- To promote the goals and objectives of Kingwood Township through the incorporation of local policies and strategies that respond to the basic premises, intent and purposes of the State Development and Redevelopment Plan and the Hunterdon County Master Plan.

Community Design

- To provide for a proactive approach to physical design and community planning so that adjacent land uses function compatibly and harmoniously in terms of scale and location.
- To maintain the rural character of Kingwood Township using design options such as minimizing impervious cover, protecting open space, and encouraging agricultural uses.
- To enhance the rural character of the Township by maintaining Kingwood's narrow, winding roads and including areas influenced by the rugged terrain.

Natural Resources

- (REFERENCED IN THE INTRODUCTION ABOVE)To protect sensitive environmental resources from destruction or degradation, including but not limited to steep slopes, ridgelines, trout streams, wetlands, stream corridors, potable water supplies, watersheds, aquifers, rivers, viewsheds, forests and other

vegetation, soils, habitats of threatened and endangered species and unique natural systems.

- To relate the intensity of development, in areas relying on groundwater supplies and on-site sewage disposal, to conservative estimates of available water resources and the ability of the soil and ground water to sustain on-lot disposal systems without degrading or impairing the water quality.
- To develop criteria for flexible zoning such as lot size averaging and large lots to protect and minimize encroachment of critical areas.
- To identify steep slopes and establish steep slope criteria in order to protect severe topographic areas, such as areas along Route 29 and along the corridors of streams, where larger lots are expected to be maintained as a result of rock conditions and steep slopes.
- To deter development on steep slopes, wherever they occur in order to protect existing natural systems and to prevent soil erosion and degradation of surface water quality.
- To ensure long-term ground water quality and quantity through low density residential zoning.
- To identify and manage stream corridor buffer areas by maintaining undisturbed vegetation and to maintain and improve water quality, wildlife corridors and opportunities for passive and active recreation.

Housing

- To provide for a variety of housing types which respond to the needs of households of varying size, age, and income, persons with disabilities and emerging demographic characteristics.
- To promote and support the development and redevelopment of affordable housing intended to address the Township's fair share of the region's lower income housing, particularly in areas that may be served by public transportation which connect to areas of employment.

Agriculture

- To encourage the preservation of agriculture through proactive planning where there are suitable conditions for the continued operation and maintenance of agricultural uses.
- To recognize agriculture as a significant economic industry in the community and to encourage economic opportunities in this industry.
- To preserve large contiguous tracts of land to assure that agriculture remains a viable, permanent land use.
- To encourage compatibility between agricultural operations and neighboring non-agricultural development through the state Right-To-Farm Act and through regulating density, pattern and arrangement of non-agricultural housing.
- To develop a relationship between the agricultural and non-agricultural community by encouraging designated areas for horseback riding, passive recreational trails, and other trails prohibiting motorized vehicle use
- To manage the pattern and arrangement of permitted development so that productive and potentially productive agricultural areas and agricultural soils

remain consolidated into large contiguous masses of land, uninterrupted by non-agricultural land uses.

Circulation

- To develop design criteria for development along arterial and collector streets so as to avoid strip residential frontage development and an uncontrolled number of driveway access points.
- To utilize low-impact design strategies, including minimized pavement widths and minimal curbing; and to maintain the Township's road network of narrow rural roads that establishes and reinforces Kingwood's rural character.
- To encourage stormwater controls through pervious paving, innovative roadside-drainage stabilization, and minimization/elimination of curbing (or curb cuts).
- To discourage and prevent changes to the rural road network that may serve to accommodate increased traffic volumes along the Township's rural lanes
- To program limited development in rural areas so that traffic will not exceed the capacity of the existing rural road network to provide safe, efficient and convenient traffic movements during peak traffic periods.
- To recognize that roadways are public lands that deserve aesthetic design consideration as well as efficient movement of vehicles, and to carefully plan the gateway entrances to the Township because they represent a visitor's first impression of the Township.
- To minimize the impacts of transportation systems on the environment, including air and noise pollution.
- To identify road standards which merit special consideration for rural areas.
- To encourage transportation funding for maintenance of existing system, rather than encouraging new systems in rural areas.

Economic Development

- To encourage appropriate commercial uses for Kingwood Township such as local convenience commercial services in the villages and a few highway-related uses along Route 12 with low floor area ratios.
- To encourage any new commercial activity to serve the rural, agricultural nature of the community.

Historic and Cultural Resources

- To recognize and protect historical resources within the Lower Delaware Wild and Scenic River Management Area as recommended in the Lower Delaware Management Plan.
- To safeguard the heritage of the Township by preserving those resources that have historic, archaeological, scenic, social, cultural, economic and architectural significance based on national, state and local importance and criteria.
- To discourage encroachment on historic structures and sites by uses and buildings that is incompatible or detracts in design.

Community Facilities and Utilities

- To plan for the expansion of necessary public services, such as utilities, community facilities and recreation, at a reasonable cost in response to the proposals in the land use plan element.
- To establish a system whereby necessary capital improvements can be programmed and planned in advance, and land can be reserved to meet the future needs for community facilities and open space.

Recreation and Open Space

- To promote the provision of appropriate and balanced public open space and recreational facilities through public action and the development review process.
- To prepare and maintain recreation and open space master plans to establish and enhance recreational lands and public open space; to establish linkages of public spaces through the use of greenways, greenbelts, waterways, paths and bikeways; and, to establish as the highest priority for public acquisition, areas of critical recreational, scenic or environmental value.

The challenge is to address these far-reaching objectives in a manner that provides the greatest good for the most people, and to determine the best uses in the most appropriate locations to serve the general welfare of the people, while respecting the rights of property owners to achieve a reasonable beneficial use of their land.

Existing Zoning

The Township's existing zoning is shown on Figure 1. The Township's existing zoning has remained unchanged for an extended period of time. Zoning in the Township is primarily Agriculture/Residential, the AR-2 District, which seeks to provide limited opportunities for residential development while maintaining the Township's rural character, but most important to retain active farmland and farmland capability. Zoning to permit economic development uses are primarily oriented along State Route 12. A Village residential and commercial node is identified at the intersection of Route 12 and Kingwood Road (CR 519) and a special zoning designation for the Byram Colony is also designated on existing zoning.

The Planning Board's 2011 Periodic Reexamination Report noted that "Despite robust growth and economic prosperity in the region, Kingwood Township's nonresidential zoning districts that are situated primarily along Route 12, contain an ample supply of available land and include generous development standards. Those lands, however, failed to attract substantial development or a variety of nonresidential uses permitted in local zoning. Permitted uses include businesses, laboratories and research facilities, light manufacturing and assembly uses, professional offices, and a wide range of retail uses and commercial services. As a result, there was no appreciable improvement toward addressing the imbalance in residential vs. nonresidential land use in the community, no meaningful employment generation, little improvement in the local availability of goods and services and little in the way of a tax ratable offset for residential taxpayers." Route 12 Zoning has remained in place for at least two decades. Economic development, protection of community character and scenic corridors and expanded housing choice

were identified in the Periodic Reexamination as planning priorities and changes were recommended to zoning and the Land Use Plan to address these priorities.

Land Use Plan

This Land Use Plan Element is designed to implement the foregoing goals, objectives, principles and assumptions in a manner which respects and responds to the capabilities and limitations of the natural conditions - groundwater quantity and quality, surface water resources, agricultural use opportunities, soils, steep slopes, woodlands, wetlands and flood prone areas. The Plan generally depicts the proposed location, extent and intensity of development of land to be used in the future for varying types of residential, commercial and industrial purposes, as shown on the Land Use Plan Map (Figure 1b). Land use planning proposals become effective change agents when implemented through the Land Use Management Ordinance.

The Land Use Plan Element is the fundamental unit of the Master Plan, with the broadest scope and most far-reaching consequences. It represents a municipality's basic statement about the future disposition of land and the physical form of the community. Informed by the other plan elements, which play supporting roles, the Land Use Plan has the greatest influence on the Township's future, as they shape local zoning.

This Land Use Plan maintains the policy orientation of prior Master Plans, but refines this orientation to better address evolving conditions and concerns. The Plan establishes a comprehensive set of goals and objectives and suggests new planning initiatives to achieve the Township's objectives. The recommendations of the 2011 Reexamination Report are reflected in this Land Use Plan.

In general, zoning districts have not been reduced, however. Certain districts will be impacted by recommended overlay zone designations as a means to better reflect the intended uses in that area of the Township and local scenic corridor protection objectives. The overlay zoning approach is essentially two-fold and includes:

(1) A Route 12 Scenic Corridor overlay zone extending from east to west along the entire length of Route 12 to protect and enhance the visual character of the highway when development occurs (shown on "Figure 2, Amendment to Zoning Map, Route 12 Scenic Corridor Overlay (SCO) Zone"); and
(2) An Eastern Gateway Village Center Overlay zone, which will permit increased density and diversified land uses at the easterly limit of the Township centered at the intersection of Barbertown-Point Breeze Road and Route 12 (see Figure 3, Amendment to Zoning Map, Eastern Gateway Village Center Overlay (EGVCO) Zone").

This overlay zoning strategy promotes an important goal of this Land Use Plan, which is to maintain the rural character of the Township as perceived from Route 12 and to avoid and prevent conventional highway strip development patterns along the Route 12 corridor. The strategies proposed within the scenic corridor overlay area include

increasing lot area requirements and introducing overlay zoning standards to establish visual enhancements along the highway and protect the existing scenic attributes of the rural landscape that predominates along the corridor, particularly west of Baptistown.

Three sub-districts identified for the Eastern Gateway Village Center Overlay (EGVCO) area centered at the Barbertown-Point Breeze Road & Route 12 intersection, which include (1) a commercial/artisan sub-district; (2) a mixed-use core sub-district; and (3) professional office/residential sub district. Each sub-district provides for a variety of housing choice and nonresidential uses, including: multifamily units above ground-level retail (mixed-use), townhomes, with or without co-housing units, multifamily residential buildings, live-work dwelling units, artisan loft buildings and planned unit developments. These uses are designed to respond to changing demographics and evolving workplace requirements for career choices that respond to changing economic conditions. The intention is to maximize economic utility of Route 12 lands in this location by providing for a land use pattern that responds to current economic and housing demands.

There is a general desire to retain the rural road system in the Township. Road widening within the EGVCO overlay zone will be permitted where necessary to improve sight distances and accommodate increased development densities where it is permitted. A comprehensive circulation system among new and emerging developments is planned by requiring street extensions to adjoining tracts, using cul-de-sacs sparingly and targeting economic development to areas of concentrated development in and adjacent to the Eastern Gateway Village Center Overlay.

This policy approach responds to the goal of providing for beneficial economic growth in a manner that prevents sprawl development patterns. This focused growth strategy also serves to maintain the Township's rural character as perceived from the Route 12 corridor. By focusing growth to a limited area of the municipality and discouraging sprawl, this policy advances the goal of protecting groundwater and surface water quality, and better accomplishes the goals of rural conservation, environmental protection, agricultural retention and protection of the scenic attributes of Kingwood Township.

Long term planning objectives to preserve and protect areas of the community in conjunction with focused growth nodes, such as the EGVCO, through the use of "Transfer of Development Rights" or "TDR."

> "Transfer of Development Rights (TDR) is a land use tool that allows a community to use market forces to encourage the transfer of development potential from areas that the community wants to preserve (called sending zones) to areas that are more appropriate to accommodate increased growth (called receiving zones). Landowners in the sending zones receive compensation for restricting development on their property. As a market-based system, payment for this lost development potential comes from purchasers who buy credits representing the lost development potential in the sending zones. The credits then entitle the purchaser to build in a receiving zone at a density greater than that permitted in the underlying zoning.

> TDR has become an increasingly important tool in the preservation of lands with sensitive resources, whether those resources are environmental, agricultural, or historical. In New Jersey, TDR programs have been established to preserve large contiguous parcels of farmland to maintain agricultural viability, such as the programs in Chesterfield and Lumberton Townships in Burlington County, while in the New Jersey Pinelands TDR is used to preserve tracts of ecologically important lands to maintain ecosystem health and high water quality[4].

For Kingwood Township, a municipal TDR Program could serve to compensate landowners that are interested in retaining the productivity of their farmland (i.e. lands situated within a sending zone) by allowing the transfer of development rights from farmland to areas such as the EGVCO (i.e. a receiving zone). A municipal TDR program is authorized in the M.L.U.L. at Section 140, which identifies the mandatory requirements to establish the program, which are summarized from the law as follows:

40:55D-140. Actions prior to adoption, amendment. Prior to the adoption or amendment of any development transfer ordinance, a municipality shall:

> a. Adopt a development transfer plan element of its master plan pursuant to Sections 28 and 141 of the M.L.U.L;
>
> b. Adopt a capital improvement program pursuant to Section 29 of the M.L.U.L. for the receiving zone, which includes the location and cost of all infrastructure and a method of cost sharing if any portion of the cost is to be assessed against developers pursuant to Section 42 of the law;
> c. Adopt a utility service plan element of the master plan pursuant to Section 28 of the M.L.U.L. that specifically addresses providing necessary utility services within any designated receiving zone within a specified time period so that no development seeking to utilize development potential transfer is unreasonably delayed because utility services are not available;
> d. Prepare a real estate market analysis pursuant to Section 148 of the M.L.U.L., which examines the relationship between the development rights anticipated to be generated in the sending zones and the capacity of designated receiving zones to accommodate the necessary development; and
> e. Either receive approval of: (1) its initial petition for endorsement of its master plan by the State Planning Commission or as part of a county or regional plan, provided that the petition included the development transfer ordinance and supporting documentation, or (2) the development transfer ordinance and supporting documentation as an amendment to a previously approved petition for master plan endorsement by the State Planning Commission.

[4] NJ Highlands Council, Regional Master Plan explanation of TDR.

The M.L.U.L requirements to establish a municipal TDR program are quite extensive. However, the benefits to the community should be evaluated to determine whether TDR is an appropriate land use tool for Kingwood Township.

Route 12 Scenic Corridor Overlay (SCO) Zone

The 2011 Reexamination Report recommended the Scenic Corridor Overlay (SCO) for preserving and enhancing undeveloped rural lands situated along the Route 12 Corridor in such a manner that the area will maintain and reinforce Kingwood Township's rural character and existing scenic views and vistas within and along the Corridor. At the same time there is a desire to provide for reasonable land use opportunities for lands situated there. In maintaining the prevailing rural character of the Route 12 Corridor the Township sees the establishment of design standards as an aid to guide future development in such a manner that will serve to achieve this land use-planning objective, and simultaneously provide new opportunities for development in a coordinated fashion within the Route 12 Corridor (See Figure 2, Amendment to Zoning Map, Route 12 Scenic Corridor Overlay (SCO) Zone).

Existing nonresidential land use zoning within the Route 12 Corridor has been established in the Township's zoning ordinances for decades, which has sought to attract a robust variety of industrial, business, and commercial development, but it has instead attracted limited piecemeal and uncoordinated land use changes, sporadic development and strip highway commercial development. If existing zoning provisions that have served to encourage sprawl and piecemeal and strip highway commercial development along the highway in an uncoordinated fashion continue to remain in place it is recognized that the likely outcome will result in development that is contrary to the protection of the scenic rural character and the scenic views and vistas that predominate through the Route 12 Corridor.

The purpose of the Scenic Corridor Overlay Zone (SCO) is to revise the zoning to be more in conformance with the development opportunities that realistically exist in the subject area, to preserve the rural character and rare scenic beauty in and along Route 12 and to promote design compatibility for the development, redevelopment, and changes in land use along the Route 12 corridor. Design standards are identified to preserve existing viewsheds, especially the open vistas in the section of the Corridor west of Baptistown, and to prevent adding strip highway commercial sprawl development along the corridor. The planning objective is to replace linear highway commercial development standards that permit development close to the Highway with no scenic design controls with standards that provide realistic opportunities for development while preserving the corridor's existing scenic beauty and rural character. Within the SCO District certain uses will be prohibited such as, mechanical contractors, furniture and appliance stores, department stores and supermarkets, mini warehousing, theaters and bowling alleys and automobile dealerships (new and used). A provision protecting existing uses made nonconforming as a result of this ordinance amendment is called for to allow changes to site plans in accordance with pre-ordinance amendment development standards.

Within the portion of the SCO District *east* of Baptistown (intersection of Route 12 and County Route 519) development will maintain a minimum setback of 200 feet from Route 12. In order to preserve the scenic vistas and distant views along the Route 12 corridor between Baptistown and Frenchtown, buildings within the SCO District *west* of Baptistown (intersection of Route 12 and County Route 519) shall comply with an enhanced requirement for setback from Route 12. The enhanced setback will require principal buildings, accessory building and off-street parking areas shall be located at least a distance of at least one half of the average lot depth, or 100', whichever is greater. A majority of the parcels along this stretch of the State Highway include lot depths exceeding several hundred feet, which at one-half of the average lot depth permits the placement of development farther back on the lots, which will thereby serve to maintain existing distant scenic views.

Finally, building design standards will be implemented for all development to address fire and emergency access, establish visual screens, architectural standards, parking, loading and signage controls.

The SCO District covers approximately 1, 644 acres and the overlay covers parts of six existing zoning Districts. The largest impact is on the AR-2 District of approximately 581 acres. Next and closely behind is the Business Park District of 503 aces and the Highway Commercial District involving 391 acres. The Village Commercial District involves 107 acres with the Professional Office/Residential having 54 acres affected and the VC-1 District involving 8 acres.

Eastern Gateway Village Center Overlay

Following the recommendation of the 2011 Reexamination Report this Land Use Plan also desires to further the public interest by establishing mixed use smart growth land development options. The location of this overlay designation is supported by appropriate existing and planned infrastructure to (1) accommodate the future population growth of the Township, (2) accommodate reasonable opportunities for affordable housing development, and (3) attract beneficial growth and tax ratable development. The Planning Board has identified lands situated generally along Route 12 in the vicinity of the intersection of Barbertown-Point Breeze Road and Pittstown Road (County Route 615) as the most advantageous location in Kingwood Township for smart growth, mixed use high-density development opportunities. Factors consider in selecting this location include (1) proximity to Flemington and regional development located to the east, (2) County Route 615 access to the regional interstate highway system located to the north, (3) an undeveloped land reserve capable of supporting smart growth, mixed use high-density development, and (4) lands that currently possess centralized wastewater treatment facilities that may be capable of expansion to support smart growth, mixed use high-density development.

The existing nonresidential and industrial zoning within this general area of Route 12 has been established in the Township's zoning ordinances for decades and has failed to

produce significant high-value tax ratable, employment-generating land uses as zoned. It is in the public interest generally for the citizenry of the State and more specifically in the interest of the citizenry of Kingwood Township to provide smart growth, mixed use high-density development opportunities that promote a diversity in the type and price of housing, and commercial development that will serve a broad range of the population and helps to satisfy employment needs of the community in a location convenient to the citizens of Kingwood Township.

The Planning Board has identified this general area with an ample supply of undeveloped land and existing centralized wastewater treatment facilities that may be capable of expansion to accommodate the municipality's affordable housing obligations as evidenced in the Township Housing Plan Element and Fair Share Plan now pending substantive certification by the State. The purpose of the Eastern Gateway Village Center Overlay District (EGVCO) is to establish a framework for planned development with a diversity of uses that enables a transition from conventional strip highway commercial zoning along the Route 12 Corridor to a "Center-based" zoning approach.

The regulations governing the District will allow for the design of sub districts. The Mixed Use Core Sub district will permit all uses in the Village Commercial (VC-1) Zone, except that supermarkets are also permitted, multifamily units above ground-level retail (Mixed-Use), townhomes, with or without co-housing units, multifamily residential buildings, with or without co-housing units, on sites served by a centralized wastewater collection system and Planned Unit Development, inclusive of all uses permitted above, on tracts of 10 acres or greater served by an existing or future centralized wastewater collection system. (Figure 3)

The other sub districts are commercial & artisan sub district and professional office/residential sub district. In the commercial & artisan sub district all uses permitted Business Park (BP) District except for warehousing, manufacturing and lumberyards. Live-work dwelling units artisan loft buildings will be permitted and Planned Unit Development, inclusive of all uses permitted in 1-3 above, on tracts of 10 acres or greater served by a centralized wastewater collection system are allowed. In the professional office/residential sub district all uses permitted in the Professional Office/Residential (PO/R) Zone and also townhomes on sites served by an existing or future centralized wastewater collection system, multifamily residential buildings on sites served by a centralized wastewater collection system and Planned Unit Development, inclusive of all uses permitted in 1-3 above, on tracts of 10 acres or greater served by an existing or future centralized wastewater collection system.

The development standards established for the EGVO are dependent upon the expansion of existing or development of future wastewater treatment systems authorized under a Water Quality Management Plan through Hunterdon County and the NJDEP.

The EGVCO covers three existing zoning districts. The following table provides the distribution of the impact of the three sub districts.

	AR-2	BP	PO/R	
Commercial/Artisan	0.03	129.23	0.00	129.25
Mixed Use Core	0.39	97.80	0.45	98.65
PUD	0.07	136.29	29.64	166.0
Totals	0.49	363.32	30.09	393.90

The EGVCO establishes area and yard requirements for each of the residential and non-residential uses. It also establishes Planned Unit Development (PUD) standards addressing architectural requirements, solar orientation, LEEDS certification and plazas and green space provisions.

AR-2 Agricultural and Single-Family Residential District

The AR-2 District has long been established in recognition of the rural and agricultural characteristics of the District and the combination of soil types, geology and topography that occur throughout the Township. Relatively large residential lots are required in this District in response to a range of carrying capacity considerations. Carrying capacity considerations include (1) severe limitations of the land to adequately drain and filter septic effluent; (2) the lack of centralized public water distribution and sewage collection systems to support development; (3) a narrow rural road system with traffic volume & capacity limitations; (4) developed as with limited capacity , weight-restricted bridges which limit traffic volume; (5) the desire to retain and preserve agriculture as an industry and farmland as a natural resource; and (6) natural resource area protection including forests and stream corridors. The AR District is the largest zoning district in the Township, for which this Plan recommends a maximum density of one dwelling unit per ten (10) acres of land.

At the recommendation of the Planning Board, the Township Committee adopted an ordinance that defines constrained lands and establishes a Maximum Tract Yield Calculation formula, which requires reductions in permitted development yield based upon the amount of constrained land contained on a given tract of land. Constrained land includes floodplains, wetlands; wetlands transition area as determined by NJDEP, stream channels, stream corridors and areas of slope 25% or greater. Minimum open lands requirements are established to retain active farmland and protect natural resource areas.

The AR-2 District is the largest in the Township and includes 21,268.96 acres or 93% of the area of the Township. The District encompasses all environmental characteristics of the Township in varying degrees.

Groundwater availability and wastewater disposal are significant limitations to development that vary throughout the AR-2 District in the Township based upon soil classifications. This plan calls for no public water supply or centralized wastewater collection in the AR-2 District. The Township's Environmental Resource Inventory (ERI) cites the 1974 USDA Soil Survey with respect to the Neshaminy, Mount Lucas,

and Legore soils, and states "Ground water is limited and barely adequate for residential wells." The ERI states that most soils in Kingwood have limitations from at least one of the following factors: poor drainage, high water table, shallow bedrock or steep slopes.[5] Well yield is a concern relative to the carrying capacity of lands in the AR-2 to support new development. This concern particularly arises with respect to the potential for new wells to negatively impact the yield of existing residential wells, many of which are low-yielding wells today. A comprehensive well ordinance has been enacted, which requires a demonstration that new wells can be developed without negative impact to off site wells. Nevertheless, groundwater yield remains a priority local concern.

These limitations, along with the Township's reliance on individual wells and septic systems raise concerns related to nitrate dilution and related limiting factors, such as hydric soils, depth to bedrock and depth to seasonal high water, which are planning considerations addressed in this Land Use Plan. Nitrate dilution is a widely used planning indicator to assess carrying capacity for residential development because excessive levels of nitrate in the soil and groundwater can pose both human and ecological risks. Nitrate dilution capacities of soils are assessed through modeling to identify acceptable levels of development that can be supported.

Nitrate Dilution

Nitrate dilution capacities were assessed for the Township's soils through the use of a nitrate-dilution model to estimate the average building lot area needed to effectively dilute nitrogen discharges from conventional septic systems to acceptable levels. The model was developed by the New Jersey Geological Survey and is utilized by the NJDEP to assess carrying capacity for areas served by individual subsurface sewage disposal systems and determines allowable minimum lot sizes. DEP's Water Quality Management Planning Rule requires municipalities to determine allowable densities and minimum lot sizes as part of Water Qualify Management Plan development. Nitrate dilution estimates are generated based upon the soil type identified as one of the inputs to the model. Under the Rule, DEP's allowable residential and development densities are based upon the 2-mg. /l. -nitrate density. The model includes an assumption that the number of persons per household is 3 persons per dwelling unit. For each soil type, NJDEP estimates the average annual recharge rate. No estimate appears to be included for the average depth to bedrock (i.e. depth of soil) and in Kingwood Township, soil depths are typically in the range of zero to 5'. The model is therefore subject to a number of variables.

Nitrate dilution modeling as a planning tool is widely accepted. However, individual municipalities have conducted independent hydrogeological investigations to more closely examine local conditions than the DEP model may permit utilizing the standard assumptions and inputs available in the DEP model. The concern is that NJDEP modeling may not be representative of local conditions and indicated development

[5] Page 33 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

densities from the model may be insufficient to adequately protect groundwater supplies, protect ecosystems and sustain safe drinking groundwater yields over the long term.

The Highlands Water Protection and Planning Council, which is charged with protecting regional water quality and supplies, utilized the DEP Nitrate Dilution model to identify permitted densities throughout the Highlands Region. However, the Highlands Council varied the population input in the DEP model that is used statewide to add a conservative measure to their calculations for development density in the Highlands Region, which lies immediately to the north of the Township.

As a result of the concern that local conditions may not be adequately represented in the DEP model, the Planning Board examined development densities as would be indicated utilizing the Highlands inputs for the Township's soils to consider the added conservative measure that Highlands identified for the model. Varying the population input from three persons to four persons per household, the model indicated a range of recommended densities of 6.7 acres per dwelling to 8.5 acres per dwelling (see more detailed discussion in Appendix – Nitrate Dilution appended to this Plan) for Kingwood Township's soils. Of note are the typically shallow soil depths to bedrock (discussed below), that are not apparently accounted for in either the DEP standard Nitrate Dilution Model inputs or those utilized by the Highlands Council, which may indicate why the Highlands Model inputs were varied for a conservative measure in the estimates for 'safe' development densities in the Highlands Region.

In 1995, Kingwood Township obtained a groundwater study from hydrologist Dr. Robert M. Hordon, which focused on the Lockatong argillite formation and baked shale units. The report estimated groundwater and aquifer recharge capacities, analyzed well yields in these formations and provided an assessment of lot size requirements in relation to a variety of nitrate dilution targets. The nitrate dilution target of 10 mg/l, the NJDEP safe drinking water standard, was applied in the modeling to demonstrate that the Township's minimum lot size requirement at that time was inadequate to protect groundwater from exceeding the safe drinking water standard. Since then, the NJDEP has instituted a nitrate dilution planning target of *2 mg/l* as the guideline for assessing lot area requirements. When applied to the Pizor, Nieswand & Hordon nitrate dilution modeling methodology identified in the Hordon study, the 2 mg/l planning target appears to yield a lot size requirement of 10.25 acres per dwelling unit for the Lockatong argillite formation and the baked shale units, which together account for approximately 65% (64.7%) of the area of Kingwood Township.

Depth to Bedrock

The soil map unit (classification) is also used to characterize the typical depth to bedrock for each soil type. Depth to bedrock is a limiting factor in assessing the suitability of land for building, roads, foundations and septic systems. The range in the Township found for soils in the Township is 0 to 60 inches. Only three (3) soil types (Birdsboro, Bowmansville and Pope) accounting for approximately 550 acres in the Township have with no restrictions regarding bedrock. These are areas near the Delaware River; the

islands in the river, and a small area located on Barbertown-Point Breeze Road have depths greater than 60 inches. Figure 5 shows the distinctions within the Township.

In some cases, a fragipan layer is encountered with or without the presence of shallow bedrock. A fragipan is a subsoil layer, typically high in clay, which is a higher density than the soil above it. A fragipan layer becomes cemented and very hard when dry, and brittle when moist. The layer is low in organic matter and slowly or very slowly permeable to water and also restricts root growth (Soil Science Society of America, 2008). When present in Kingwood, the fragipan layer varies in depth between 15 and 36 inches in depth.[6] This is also identified on Figure 5.

In crop production agricultural areas, a "plowpan" is encountered, similar in permeability characteristics to a fragipan (slow permeability). A plowpan is a compacted layer formed in the soil directly below the plowed layer.

Groundwater Recharge

With a total dependence on groundwater for most of the Township, groundwater and aquifer recharge is a major issue. The concern about groundwater recharge and the protection of drinking water resulted in a 1988 amendment to the Water Quality Planning Act. N.J.S.A. 58:11A, 12-16 required the NJDEP to within two years of the effective date of the Act to prepare and publish a methodology that will allow the user to define, rank and map aquifer recharge areas. In conjunction with this methodology, the NJDEP was to prepare and publish model land use regulations or best management practices designed to encourage ecologically sound development in aquifer recharge areas and restrict activities known to cause groundwater contamination. NJDEP is required to prepare and publish a map of the aquifer recharge areas in the State, using, to the greatest extent possible, the revised State geologic map (scale 1:100,000), and any local and regional mapping efforts already completed or underway which the department shall verify. Periodically thereafter, the DEP is required to update mapping.

The NJ Geological Survey developed a methodology, which estimates ground water recharge and is useful for evaluating the relative effect of present and future land uses on recharge areas. For this method, recharge was calculated based on data for precipitation, soil, land use/ land-cover, surface runoff, and evapotranspiration. This method was then applied to GIS coverage with a number of assumptions made for the calculations and model inputs.

There are recognized limits to the accuracy of the method:

1. The calculated ground water recharge includes any water entering the ground while lesser amounts actually enter the aquifer;
2. It assumes that all water, which migrates below the root zone recharges the aquifer, which it does not;

[6] Page 35 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

3. It addresses only natural ground water recharge, and does not include artificial recharge, withdrawals or natural discharge;
4. Wetlands and water bodies were eliminated from the analysis, because the direction of flow between ground water and surface water is site-specific and also varies seasonally, and this level of detail was beyond the scope of the study. These areas were assumed to provide no recharge or discharge; and
5. Regional data for stream base flows used for modeling may not be representative of local streams[7]

An additional limitation of the data is that NJGS estimates long-term average annual recharge, which does not represent the reduced recharge during critical summertime conditions[8].

Keeping these limitations in mind, the estimated groundwater recharge rate is from 1 to 16 inches per year in Kingwood (excluding surface water, wetlands and hydric soils), for estimated average annual subsurface recharge (Figure 6). This represents 2 to 34% of precipitation.

For comparison, in 1966, the State Geologist estimated recharge to be 10 to 15% of precipitation for areas similar to Kingwood Township (Kasabach, 1966), while a typical figure for recharge in the sandy coastal areas of New Jersey is approximately 50% of rainfall[9].

As stated in the assumptions, only a portion of water entering the ground actually recharges the aquifer, but the NJGS Report did not attempt to quantify this amount. According to Lewis-Brown (1995), of the US Geological Survey, "…only about 6% of the recharge at land surface reaches depths greater than 75 feet below land surface." In contrast, Robert Canace, of the NJGS, suggested that 20% of the estimated recharge should be used for planning purposes, representing the portion of recharge actually available for use during drought conditions.[10] Using the 6% estimate, Kingwood may have usable recharge of 0.06 to 0.96 inch. If it is assumed that 20% of ground recharge is aquifer recharge, then only 0.2 to 3.2 inches are added to ground water per year.

While it is unknown at this time which figure is closer to actual conditions in Kingwood, the general principle is this: Recharge is limited. Therefore, if withdrawals of ground

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[7] Lewis-Brown, Jean C. and Eric Jacobsen. 1995. Hydrogeology and Ground-water flow, Fractured Mesozoic Structural-Basin Rocks, Stony Brook, Beden Brook, and Jacobs Creek Drainage Basins, West-Central New Jersey. US Geological Survey Water-Resources Investigations Report 94-4147. West Trenton, New Jersey

[8] Page 55 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

[9] Page 56 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

[10] Canace, Robert. 1995. New Jersey Geological Survey, Department of Environmental Protection, Division of Science and Research. Critique of the Franklin Township ground water resources

water were greater than the recharge amounts, the aquifer would experience a continuous net reduction in the available water supply.[11]

Another approach to evaluate groundwater is its impact on septic disposal. Using a study entitled "Evaluation Of Groundwater Resources of Delaware Township, Hunterdon County," prepared by M2 Associates, Inc. in February 2004 this question was partially addressed.

Recharge areas for nitrate dilution are dependent on dependable yields of groundwater in the bedrock formation. Recharge areas should provide a sufficient amount of precipitation to infiltrate into an aquifer system to ensure that water is available for both human consumption and to sustain the ecosystem. Based on the application of the Trela-Douglas Model in Delaware Township, lot sizes were estimated for the infiltration of nitrates into the Stockton and Passaic formations and the Lockatong and diabase formations that extend into Kingwood Township (Figure 7)[12].

For the Stockton and Passaic formations the study applied a higher nitrate dilution standard of the recharge (5.6 mg/l) area. The study estimated that a recharge area of 4.1 acres per dwelling unit is needed to adequately dilute nitrates to the identified standard. For the Lockatong and diabase formations the study estimated that a recharge area of 13.1 acres per dwelling unit is necessary to ensure adequate nitration dilution. If the resulting recharge acreage is multiplied by 2.8 (5.6 mg/l ÷ 2 mg/l) to represent the 2 mg/l target, the resulting recharge acreage required appears to result in recharge area requirements of 11.5 (11.48) acres for the Stockton and Passaic formations and36.7 (36.68) acres for the Lockatong formation. Together, these two formations account for approximately 65% of the area of Kingwood Township.

Groundwater Yield

According to the Township's Environmental Resource Inventory (Kingwood Township Environmental Commission, by Deborah Kratzer, 2009), the Township's bedrock geology is characterized as follows:

- Lockatong Formation – 29%,
- Lockatong Red Bed Formation – 6%
- Passaic Formation – 49%
- Passaic Formation Gray bed – 14%
- Stockton Formation - .06%

[11] Page 57 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

[12] Page 48-51 Evaluation Of Groundwater Resources of Delaware Township, Hunterdon County M2 Associates, Inc. February 2004

In the groundwater studies prepared for Delaware Township (2004) and West Amwell Township, the author, Matthew Mulhall of M2 Associates, provides the following explanation of water storage and transmission:

> Since groundwater in bedrock aquifer systems is stored and transmitted along fractures, joints, and bedding planes, the availability of water is dependent on the separation between fractures, the degree to which these fractures are interconnected, and weathering of the materials between fracture planes. In some rocks, fractures are separated by a few inches of competent, unweathered, and impermeable bedrock. In other rocks, the distance between fracture openings may be several feet. In some areas such as near major regional faults, fractures form highly connected networks and therefore, more water can be stored and transmitted. In areas where a single or few fractures are available, there is little storage or transmission capability.

In his 2003 West Amwell Groundwater Resources report, Mullhall provides the following explanation of wells drilled in the Passaic and Stockton Formations and the Lockatong Formation.

> In the Passaic and Stockton Formations, wells are usually drilled to deeper depths because of the potential to encounter additional water-bearing fractures and therefore, to increase the yield. In the Lockatong Formation and diabase, since increased yields are unlikely, wells are usually drilled to greater depths in order to store water. The well borehole serves as a subsurface storage tank. Most 6-inch diameter residential wells can store nearly 1.5 gallons per foot and this additional volume of water in storage may be necessary to meet the needs of the residence or business relying on the well.

In Kingwood Township, the Passaic Formation accounts for approximately 63% of the area of the Township occupying the westerly side of the Township extending from the northeast to south west. The Passaic Formations adjoin the Lockatong Formation, which predominates on the southeast side of the Township, which extends from the northeast to southeast and accounts for approximately 35% of the area of the Township.

At the time of the Land Use Plan update the NJ Water Supply Authority is conducting stormwater quality and quantity monitoring within the Lockatong and Wickecheoke watersheds. Upon availability, final results may be utilized in further evaluation of aquifer recharge estimate and nitrate dilution requirements within Kingwood Township.

Depth to Seasonal High Water

Depth to seasonal high water is a limiting factor for septic system development (Figure 8). The seasonal high water table is the distance between the ground surface and the top of the water surface in the saturated part of an aquifer. A seasonal high water table of less than one foot severely constrains development, while between 1 and 3 feet can provide

obstacles to development.[13] Shallow depths to the water table severely limit the location of buildings and septic systems and are associated with wetlands, but on the other hand these same areas often support more diverse vegetation and wildlife communities. Thus, their protection benefits the environment by both preserving areas of high resource value, and by avoiding areas where problems can occur. Figure 8 identifies six categories of soil phases, plus variables and water. The generally shallow 0-1' category identifies poorly drained soils with water tables at the surface; somewhat poorly drained soils; soils with moderate to moderately slow permeability; and, includes hydric soils associated with wetlands, flood hazard areas and floodplains, depressions, drainage ways and the lower part of slopes. This category generally presents severe limitations for development. The category of generally moderate, 2-6' below the surface, is generally found where impervious layers impede drainage and along various stream terraces. Depending on which end of the spectrum they fall, these soils can be very constraining or relatively unconstrained. The significance of this factor in the Township is associated in the southern portion of the Township adjacent to several Category One streams.

Soil hydrologic group classifications for soils in the Township are shown to be a limiting factor to septic disposal based upon infiltration rates. Most soils in the Township are classified as possessing a slow infiltration rate rating. Figure 9 shows the infiltration ratings that correspond to the definitions of the hydrologic soil groups listed in the table below.

Class	Definition
A	High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels
B	Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils that have moderately course textures
B/D	Drained/undrained hydrology class of soils that can be drained and are classified. Moderate to very slow infiltration rates.
C	Slow infiltration rates. Soils with layers impeding downward movement of water, or soils that have moderately fine or fine textures
C/D	Drained/undrained hydrology class of soils that can be drained and classified. Slow to very slow infiltration rates
D	Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer
Source: NRCS Soil Survey Geographic (SSURGO) Database	

Figure 9 shows that the southerly portion of the Township is rated with very slow infiltration rates.

[13] Page 35 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

Each of the soils also has a septic suitability factor, which may affect the functioning of a septic system. The NRCS SSURGO database provides septic suitability limitations for each soil type. The septic suitability interpretations shown on Figure 10 are based on N.J.A.C. 7:9A Standards for Individual Subsurface Sewage Disposal Systems, Subchapter 10. The factors for disposal fields, which may affect the functioning of the system and therefore limit septic suitability, are listed below:

- Excessively coarse substratum (which allows effluent to percolate to ground water too rapidly);
- Presence of water (including depth to high water table, flooding, and hydric soils);
- Depth to restrictive layer (bedrock or restrictive substratum); and
- Steep grades over 25%.

The Standards for Individual Subsurface Sewage Disposal Systems (N.J.A.C 7:9A) prohibit septic system development in soils that are subject to flooding; in locations with the combination of slope greater than 10%; and less than 50 feet upslope of any bedrock outcrop where signs of ground water seepage can be detected (NJDEP, 1999).

In Kingwood Township, soil suitability for septic disposal fields is very limited, based on the variety of factors discussed above. Portions of some soil classifications have areas where regulations would not permit septic system disposal field construction due to flooding, hydric soils, or steep slopes. Other areas have no technical limitations. Bedrock outcrop areas were not rated. These general suitability guidelines would need to be used in combination with on-site testing, the SSURGO interpretation report "Sewage Disposal (NJ)," and N.J.A.C.7: 9A subchapter 10 to determine what types of disposal field installations would be appropriate in any given situation. In soils with more than one limiting factor, a disposal field must be a type approved as an acceptable option for each of the soil suitability classes, which apply (NJDEP, 1999).

The Township's existing minimum lot size requirement in zoning should be reevaluated based upon the data presented above. The Trela-Douglas model applied conservatively to Kingwood Township's soils appears to indicates that the Township's existing 7-acre minimum lot size is not be sufficient for a variety of the soil classifications identified in the Township. A variety of factors discussed in this Plan indicate that septic disposal field limitations exist, which include: (1) depth to bedrock; (2) groundwater recharge; (3) aquifer recharge and groundwater availability (4) depth to seasonal high water table; and (5) soil hydrologic group infiltration rates.

Policy Considerations

As a matter of policy, the Planning Board prepared and adopted the Kingwood Township Conservation Plan Element in 2008. The Conservation Plan includes a number of recommendations that should be considered in the Land Use Plan. One recommendation

specifically calls for reduced land use density as an objective to further the goals of the Conservation Plan, as follows:

- Establish and maintain reduced land use densities and intensities, which respect the capacity of the environment to sustain development, while at the same time maintain the vitality and viability of critical habitat areas and the natural resource conservation and environmental protection objectives of this plan.

Agricultural Protection Zoning

In 2009, the Planning Board adopted the Kingwood Township Farmland Preservation Plan (FPP). The FPP serves as the vehicle for the Township to qualify for State Agriculture Development Committee (SADC) Planning Incentive Grant (PIG) Funding for farmland preservation. The FPP identifies a comprehensive set of strategies to retain and preserve farmland and farming as an industry. This Land Use Plan identifies an additional policy orientation that supports and builds upon the Planning Board's 2009 FPP and establishes the policy of Agricultural Protection Zoning (APZ), which is explained in this section.

One of the most meaningful and productive means to retain viable agriculture in Kingwood Township is the preservation of prime and farmland-capable soils, which have long been recognized as one of the Township's most valuable natural resource assets. Protection of valuable agricultural soils from development has been achieved through the Township's land development regulations and somewhat remote location, relative to the more suburban communities of the region to the east and northeast. The rich agricultural history of the Township that continues today is a testament to the productive capacities of these soils. While soil of this magnitude is not often considered a non-renewable resource, the removal and disturbance of such rich soils forever alter the long-term agricultural base and once removed cannot be replaced. If properly managed, this natural resource will yield benefits to future generations of farmers and consumers. The survival of Kingwood Township's prime and farmland capable soils as a productive natural resource depends on managing the resource properly and preventing the loss of productive soils to development pressures that are expected to continue well into the future.

Approximately 25% of Kingwood Township's land base is characterized as prime and statewide important farmland, according to data provided by the NJDEP entitled Soil Survey Geographic Database (SSURGO), distributed through the Natural Resource Conservation Service (NRCSA). The Township's Statewide Important Soils account for 70% of all soils in the municipality. Despite the fact that there have been a series of suburban developments that have consumed a portion of these natural resources, much of this natural resource base survives intact, and limiting its loss in the future assumes a high priority in this Land Use Plan.

In New Jersey, a parcel cannot qualify for farmland assessment unless it contains at least five (5) acres, and if the dwelling is included on the property, this minimum increases to six (6) acres. However, since some nonproductive lands may not qualify for farm assessment, a six (6) acre minimum will not assure the potential for preferential farmland tax assessment.

The following table identifies the average size of farm assessed lands in Kingwood Township. This table includes all Farm Assessed and Farm Qualified land in the Township accounted for in 507 parcels of land.

Average Farm Size – Kingwood Township (2006)

Acres	Total Acreage	Average	# of parcels
10 or less	735.86	3.81	193
Greater than 10 to 20	1,414.64	14.44	98
Greater than 20 to 40	2,511.19	30.26	83
Greater than 40	10,176.73	76.52	133
TOTAL	**14,838.42**	**29.27**	**507**

Preserved farms			**# of parcels**
10 or less	0	0	0
Greater than 10 to 20	28.32	14.16	2
Greater than 20 to 40	225.59	32.26	7
Greater than 40	1,654.42	82.72	20
TOTAL	**1,908.33**	**65.80**	**29**

Average farm size for non-preserved farms	12,930.09	27.05	193

Source: Hunterdon County Planning Division GIS parcel data - 2006

Kingwood Township's agricultural land use base is characterized by an average farm size of 29.27-acres, based upon 14,838 acres of farm qualified and farm assessed land and 507 parcels of land. Of the Township's total 22,801 acres in area, these 14,838 acres account for 65% of Kingwood Township's 35.6 square miles. Kingwood Township's public investments in preserving farmland have resulted in the preservation of 1,908 acres of farmland, accounting for slightly less than 13% of the Township's farmland. The average parcel size of a farm in Kingwood Township is 27.05 acres in area for non-preserved farms.

The median size of all 507 farm-assessed parcels (3A & 3B) is 15.3 acres in area. When farm assessed parcels less than 5-acres (typical exception area for house) are removed from the analysis, the average farm size is 37.28 acres and the median size farm parcel is 24.18 acres.

NJDEP Land Use Land Cover interpretations provide an aerial perspective of agricultural land use (Figure 13). When overlaid on farm qualified and farm assessed land, the following Land Use / Land Cover characteristics are revealed.

Land Use / Land Cover / Farm Qualified & Farmland Assessed Lands

2007 LULC Cropland Pasture Land	
On Farm Assessed Property	6,121
Total Twp wide	7,109
	86% located on 3A/B properties
2007 LULC Forested	
On Farm Assessed Property	4,699.25
Total Twp wide	7,986.35
	58.8% located on 3A/B properties

6,121 acres of the Township's 7,109 acres characterized as Cropland and Pasture Land is currently under farmland assessment or is farm qualified. 4,699 acres of Kingwood Township's nearly 8,000 acres of forested land is currently under farmland assessment or is farm qualified. 65% of the Township is currently under farmland assessment and exhibiting varying types of agricultural production.

Perhaps the fundamental long-term goal as stewards of Kingwood Township's precious natural resource base is embedded in the concept of sustainability. Sustainable agriculture, sustainable water resources, and a sustainable natural environment are goals that are central to protecting the natural resources and environment with which the Township has been endowed. Ensuring the survival of these resources for future generations is the challenge that the Township faces.

> *Sustainability - Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs (as defined by the Brundtland Commission, 1987);*

Although this definition has become widely publicized, the term sustainability is not limited to one precise definition. Additional definitions for sustainability assist in establishing a framework for planning:

> *The concept of meeting the needs of the present without compromising the ability of future generations to meet their needs. In nature conservation terms, it refers to the use of a natural resource in a way where it can be renewed, such that the environment's natural qualities are maintained. (www.jncc.gov.uk/earthheritage/module/glossy.htm)*

> *The term originally applied to natural resource situations, where the long term was the focus. Today, it applies to many disciplines, including economic development, environment, food production, energy, and lifestyle. Basically, sustainability refers to doing something with the long term in mind, (several*

hundred years is sufficient). Today's decisions are made with a consideration of sustaining our activities into the long term future (ag.arizona.edu/futures/home/glossary.html).

As defined by the US EPA, sustainability refers to the ability of an ecosystem to maintain a defined/desired state of ecological integrity over time. (glei.nrri.umn.edu/default/glossary.htm)

The challenge for Kingwood Township is to effectively establish land use policies that ensure the maintenance and sustainability of the Township's agricultural and natural resource base over the long term. As regional development pressures reemerge from the Great Recession, the Township's land and natural resources will again become the focus of the northeast region's century's old appetite to convert more land to accommodate growth. The pressure to convert land and accommodate growth will undoubtedly reemerge. Lying just beyond the Highlands Region, which is now subject to stringent development controls, Kingwood Township's policy objective is to retain, maintain and sustain its valuable and irreplaceable natural resource and agricultural base.

Conflicts between farm and non-farm uses can frequently result in a loss of farmland or farm uses. Agricultural retention objectives have prompted many localities to adopt large lot zoning strategies to retain agricultural lands for farm use and to discourage non-farm uses in agricultural areas. If the farmland base is not protected in the near term, farming may decline sharply with a critical mass of farmland converted to non-farm uses. Viable agriculture cannot be expected to succeed if new development proceeds according to the currently permitted density. Such zoning permits the entry of large numbers of non-farm residences and the conflicts they inevitably bring.

New Jersey courts have upheld 10-acre agricultural zoning as a reasonable means to retain agriculture and protect the agricultural land base of a community. Bedminster Township in nearby Somerset County and East Amwell Township, Hunterdon County are two examples where agricultural zoning strategies were found to be valid use of municipal zoning powers when zoning validity was challenged. Additionally, environmental protection weighed heavily into the Bedminster decision, which involved lands that were included in the Township's Environmentally Sensitive Planning Area. These court decisions are consistent with appropriate agricultural land use strategies for the protection of agricultural areas identified by the National Agricultural Lands Study (NALS) (Coughlin & Keene, 1981) which found that half of the communities surveyed relied on a large minimum lot as the principal density control in the agricultural zone. Most of these communities were in or adjoining metropolitan areas. Within the communities surveyed by NALS, minimum lot sizes ranged from ten (10) acres to six hundred forty (640) acres.

Kingwood Township's natural resource base includes many of the agricultural and environmentally-sensitive land characteristics of its neighboring Highlands Planning Area municipalities, such as Alexandria and Franklin Townships, which includes a vast area of environmentally sensitive agricultural lands. Similarly, East Amwell Township is

a community in the SDRP-designated Rural Planning Area where the Courts have found that the basis for that Township's 10-acre zoning is a valid and well reasoned land management strategy to protect its agricultural base of relatively large lots, consistent with this SDRP Rural Planning Area designation.

It is noteworthy that the NJ Supreme Court upheld 40-acre zoning in the Pinelands in what is known as the Gardner decision. In Gardner, the Court found that a 40-acre minimum lot size requirement was found to be valid under the policies of the Pinelands Comprehensive Management Plan, a regional land management plan that focuses growth into areas that are appropriate and designated for higher densities, while maintaining open areas for continued viable agriculture and natural resource protection, such as the 40-acre zoning district which was the subject of the court challenge. This is a similar situation to the State Plan policies for Planning Area 4, 4B and Planning Area 5, as found throughout Kingwood Township, which are designated for protection of large contiguous environmentally sensitive and agriculturally productive areas, and where zoning is an effective technique to achieving these and groundwater resource protection goals. Courts have also upheld Highlands Preservation Area zoning, which includes among its purposes the retention of agricultural land and includes a minimum lot size requirement for agricultural land of 25-acres and a minimum lot size requirement of 88 acres per dwelling for forested land (minimum lot sizes in the Planning Area range from approximately 10 to 25 acres for farmland and forested land, respectively).

In 1997, The American Farmland Trust (AFT) examined a range of approaches to retaining farmland, and recommended "**Agricultural Protection Zoning**" (APZ) as a zoning technique used **to support and protect farming by stabilizing the agricultural land base**. The AFT is a nationwide nonprofit organization dedicated to protecting agricultural resources, founded by a group of concerned farmers in 1980. AFT's mission is to stop the loss of productive farmland and to promote farming practices that lead to a healthy environment. AFT defines APZ as ordinances that allow no more than one house for every 20 acres, support agricultural land uses and significantly restrict non-farm land uses.

As described by AFT, APZ is a zoning technique used to support and protect farming by stabilizing the agricultural land base. APZ designates areas where farming is the desired land use, generally on the basis of soil quality as well as a variety of location factors. Other land uses are discouraged. APZ ordinances vary in what activities are permitted in agricultural zones. The most restrictive regulations prohibit any uses that might be incompatible with commercial farming. The density of residential development is limited by APZ. Maximum densities range from one dwelling per 20 acres in the eastern United States to one residence per 640 acres in the West.

APZ ordinances establish procedures for delineating agricultural zones and defining the land unit to which regulations apply. They specify allowable residential densities and permitted uses, and sometimes include site design and review guidelines. Some local ordinances also contain right-to-farm provisions and authorize commercial agricultural activities, such as farm stands, that enhance farm profitability. Occasionally, farmers in

an agricultural protection zone are required to prepare conservation or farm management plans.

The definition of APZ varies with jurisdiction and by region of the country. A minimum lot size of 20 acres, combined with other restrictions, may be sufficient to reduce development pressures in areas where land is very expensive and farming operations are relatively intensive. Several county APZ ordinances in Maryland permit a maximum density of one unit per 20 acres. In areas where land is less expensive and extensive farming operations such as ranches predominate, much lower densities may be required to prevent fragmentation of the land base. In Wyoming and Colorado, counties are not permitted to control subdivision of lots that are larger than 35 acres. The 35-acre provision has led to the creation of hundreds of 35-acre "ranchettes" in both states, fragmenting ranches into parcels that are too small for successful commercial ranching.

Many towns and counties have agricultural/residential zoning that allows construction of houses on lots of one to five acres. Although these zoning ordinances permit farming, their function is more to limit the pace and density of development than to protect commercial agriculture. In fact, such ordinances often hasten the decline of agriculture by allowing residences to consume far more land than necessary. AFT defines APZ as ordinances that allow no more than one house for every 20 acres, support agricultural land uses and significantly restrict non-farm land uses. Kingwood's rich, fertile and productive farmland is worthy of such protection. The amendment to the Agricultural Residential (AR) District designation identified for Kingwood Township in this plan is not intended to slow the pace of development, but rather maintain large contiguous areas of farmland for continued agricultural use, protect existing critical habitat and groundwater resource for the survival of these resources into the long-term future.

The courts first validated zoning as a legitimate exercise of police power in the 1920s, giving local governments broad authority to regulate local land use. Rural counties in California, Pennsylvania and Washington began using zoning to protect agricultural land from development during the mid-1970s. In 1981, the National Agricultural Lands Study reported 270 counties with agricultural zoning. In 1995, an informal AFT survey found nearly 700 jurisdictions in 24 states with some form of APZ.

APZ helps reserve the most productive soils for agriculture. It stabilizes the agricultural land base by keeping large tracts of land relatively free of non-farm development, thus reducing conflicts between farmers and their non-farming neighbors. Communities also use APZ to conserve a "critical mass" of agricultural land, enough to keep individual farms from becoming isolated islands in a sea of residential neighborhoods. APZ also helps promote orderly growth by preventing sprawl into rural areas, and benefits farmers and non-farmers alike by protecting scenic landscapes and maintaining open space. Kingwood's remaining agricultural landscape may well be an appropriate candidate area for the application of Agricultural Protection Zoning.

APZ can also limit land speculation, which drives up the fair market value of farm and ranch land. By restricting the development potential of large properties, APZ is intended

to keep land affordable to farmers. A strong ordinance can demonstrate to farmers that the town or county sees agriculture as a long-term, economically viable activity, instead of an interim land use. APZ also helps promote orderly growth by preventing sprawl into rural areas, and benefits farmers and non-farmers alike by protecting scenic landscapes and maintaining open space, and in Kingwood Township, protecting groundwater as a critical resource.

In Kingwood Township, there has been significant public investment in preserving farmland and open space. Steady growth in preserved farmland demonstrates the public interest in preserving farmland, which will be best served through APZ strategies that reinforce these public expenditures and protect the Township's agricultural base. Zoning strategies should be implemented that effectively assure the protection and sustainability of limited resources, build upon ongoing public investments and enhance quality of life.

BENEFITS

- APZ is an inexpensive way to protect large areas of agricultural land.
- By separating farms from non-agricultural land uses, APZ reduces the likelihood of conflicts between farmers and non-farming neighbors.
- APZ helps prevent suburban sprawl and reduces infrastructure costs.
- Compared to purchase of conservation easement and transfer of development rights programs, APZ can be implemented relatively quickly.
- APZ is easy to explain to the public because most landowners are familiar with zoning.
- APZ is flexible. If economic conditions change, the zoning can be modified as necessary.

Source: American Farmland Trust, *Saving American Farmland: What Works* (Northampton, Mass., 1997).

Examples cited by the AFT, which include defining APZ in the east as permitting one residential dwelling per 20 acres of land, include the example of Maryland. In Maryland, County government controls zoning as opposed to local municipal governments with the power to zone in New Jersey. While the policy of 20-acre APZ may be sustainable in the courts in New Jersey, a local policy orientation and definition of APZ is appropriate for Kingwood Township. With an existing average agricultural lot size lot of approximately 29 acres today, including many smaller farms, this Plan establishes the policy to promote the retention of farmland and to sustain agriculture. Nearly 2,150 acres of the Township's 14,838 acres of farmland is situated on farms less than 20-acres in area. The Township's existing natural resource constraints ordinance requires substantial open space and agriculture set-asides (50%) as part of any major subdivision. In combination with a refinement of the Township's open lands requirements in favor of retaining greater areas of farmland and open lands, a reduction in permitted density from the existing 7-acres to 10-acres will better serve the objectives of securing long-term sustainability of the Township's agricultural base.

This Land Use Plan calls for the reduction in permitted density in the AR-2 District to one (1) dwelling unit per ten (10) acres of land. In combination with mandatory open lands controls for subdivision of parcels exceeding 40-acres in area, the 10-acre density adjustment will serve to protect the Township's agricultural base and retain long-term opportunities for sustained agricultural land use. This recommendation is supported by the Land Use Plan policy to establish Agricultural Protection Zoning effectively responds to the policy orientation to protect farming and the rural character of the Township and is consistent with carrying capacity limitations identified in this Land Use Plan.

This Land Use Plan recommends modifications to the Township's minor subdivision options, as follows:

1. Increase the minimum frontage requirement to 300'.
2. Require combined driveway access whenever possible in all minor subdivisions and identify combined driveway access for future lot creation.
3. Require recorded shared driveway access and maintenance agreements among landowners.
4. Require identification of a primary and reserve septic system on each lot created.
5. Extend the time interval required for resubdivision of any lots created or remainder lots from one year to five years.

Proposed Historically Significant Settlements & Nodes

This Land Use Plan calls for the zoning classification of "Historically Significant Nodes," which acknowledge the value, charm and integrity of the Township's historic crossroad settlements, such as Baptistown and Barbertown. This classification could also include other crossroad locations within the Township, or farmsteads, houses of worship, cemeteries, "nodes" or collections of potentially historic buildings that may be designated by private party nomination. The purpose of this designation is to establish zoning standards in the ordinance that would require buffering, setbacks, or other forms of visual mitigation when development is proposed on lands adjacent to the Township's historically significant settlements and structures.

The purpose of this designation is not to impose historic district development standards on the maintenance of potentially historically significant buildings in these areas of the Township. Rather, the purpose is to ensure that change does not detract from these areas or impose unwanted development impacts. An example would be to establish minimum setback distances buffering standards in the zoning and site plan ordinance for new development when it is proposed adjacent to a designated historically significant settlement or node. Another example might be to establish standards to ensure that redevelopment or expansion of existing development adjacent to a historically significant settlement or node is required to establish appropriate buffering and screening to protect from modern visual, noise, or traffic impacts.

VR-1 Village Residential District

The purpose of the VR-1 Village Residential District is to provide for and protect the character of the existing Village of Baptistown. Zoning provisions set forth in the ordinance are designed to recognize that the village is essentially developed on parcels of one (1) acre. The VR-1 Village Residential District consists of 33.88 acres (0.15% of the Township). All or portions of the district appear to be appropriate for designation as a Historically Significant Settlement.

VR-2 Village Residential District

The purpose of the VR-2 Village Residential District is to provide for and protect the character of the existing Village of Barbertown while recognizing the existing nonresidential uses located within its boundaries. The minimum lot size for the district is 87,120 square feet and consists of 18.88 acres. All or portions of the existing district appear appropriate for designation as a Historically Significant Settlement.

VC-1 & VC-2 Village Commercial Districts

The purpose of these two districts is to provide the opportunity to develop appropriate commercial services of a convenience nature and to provide for the development of commercial goods and services in and around the Village of Baptistown[14]. The VC-1 District permits development on lots of 43,560 square feet and the VC-2 permits development on 87,120 square feet. These districts combined involve 143.67 acres.

Portions of the VC-1 district appear to be appropriate for designation as a Historically Significant Settlement.

Highway Commercial District

The purpose of the Highway Commercial District is to provide for the development of various highway-oriented commercial uses outside the village areas and along Route 12, which have a market generally wider than the immediate Kingwood community[15]. This land use plan calls for the establishment of the Route 12 Scenic Corridor Overlay Zoning designation, which requires enhanced setbacks west of Baptistown that are equal to one half of the average lot depth, but not less than 100' from Route 12 and conformity to the AR-2 Zone minimum lot size. This increases the existing four (4) acre minimum lot size to seven (7) acres. The District is comprised of 392.58 acres along the State highway corridor. The zoning standards for the district will be altered by the requirements of the proposed SCO zoning designation recommended in the 2011 Periodic Reexamination Report and this Land Use Plan.

BP Business Park District

[14] §132-33A
[15] §132-34A

This zoning district is located in the vicinity of Route 12, which is partially developed with a variety of business and industrial uses. The intent of this district is to further promote the industrial and commercial businesses in Kingwood, which are sensitive to the particular environmental conditions of the area. This is the second largest district in the Township involving 868.79 acres. Development requires 5-acre parcel as a minimum lot size requirement.

As noted in the discussion about the Eastern Gateway Village Center Overlay District (EGVCO) this district has failed to achieve its original expectations. Instead of amending the provisions of the district, this Land Use Plan calls for the elimination of the BP District. This Land Use Plan recognizes existing development within the BP District and recommends a grandfather ordinance provision to allow existing uses conforming to zoning as of the date of adoption of the recommended zoning change to be grandfathered so as not to impose a nonconforming use burden on property owners when site plan amendments may be proposed.

PO/R Professional Office Residential District

The purpose of this zone is to provide a mixed-use area under specific conditions to promote a suitable transition area between existing commercial/industrial uses and residential uses. This zoning also recognizes the changing character to certain areas caused by increased and increasing intensity of use with regard to Route 12 traffic. Low-intensity retail service facilities characterized by low traffic generation are also permitted[16]. The PO/R District consists of 85.06 acres and requires 2-acre lots at a minimum for development. A portion of the PO/R District is to be rezoned to the proposed Eastern Gateway Village Center Overlay District (EGVCO) that is recommended in the 2011 Periodic Reexamination Report, which is also designated in this Land Use Plan.

FP Floodplain District[17]

The flood hazard areas of the Township are subject to periodic inundation which results in loss of life and property; health and safety hazards; disruption of commerce and governmental services; extraordinary public expenditures for flood protection and relief; and impairment of the tax base, all of which adversely affect the public health, safety and general welfare.

These flood losses are caused by the cumulative effect of obstructions in areas of special flood hazard which increase flood heights and velocities and, when inadequately anchored, cause damage in other areas. Uses that are inadequately flood-proofed, elevated or otherwise protected from flood damage also contribute to the flood loss.

It is the purpose of this article to promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

[16] §132-32A
[17] §132-37A&B

1. Protect human life and health;
2. Minimize expenditure of public money for costly flood control projects;
3. Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
4. Minimize prolonged business interruptions;
5. Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard;
6. Help maintain a stable tax base by providing for the second use and development of areas of special flood hazard so as to minimize future flood blight areas;
7. Ensure that potential buyers are notified that property is in an area of special flood hazard; and
8. Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

BC Byram Colony Zone

The purpose of the BC Byram Colony District is to provide for and protect the character of the existing Byram Colony area. The provisions set forth in the zoning ordinance recognize that the colony is essentially fully developed. The BC Zone is the second smallest zoning district in the Township and is comprised of 24.39 acres.

Rural Historic Roads and Scenic Corridors

This Land Use Plan calls for the identification and protection of the Township's rural historic roads and scenic corridors. This classification is developed in recognition of Rural Historic Scenic Corridors – The Township developed this classification to acknowledge that certain roadways in the Township are important for their contribution to the rural character of the Township. The Township's local roads convey varying volumes of traffic, but are noted for protection in the Master Plan because of their historic configuration, varying roadway width and scenic roadside and corridor elements that contribute to the rural character of the Township, such as stone-walls, roadside hedges, mature trees, forests and open scenic vistas.

Rural Historic Scenic Roads have varying right of way widths often due to historic and older homes and structures and environmental features such as steep slopes and mature trees located very close to the right of way. These roads have changed little from their historic origins, generally follow the existing terrain, and have characteristics that do not meet modern standards. The intent of the rural historic road designation is to maintain rural character and preserve this component of Kingwood Township's rural tradition. Generally, the desirable traveled way width of these roads is not less than 20 feet, with no curbs while keeping in mind the historic character of the road. There are also frequently severe constraints on road widths within the historical districts given the setback of the existing buildings from these roads.

Rural Historic Scenic Roads assume special importance under this plan. In order to retain the visual character of the rural portions of the Township, road improvements should not be initiated to open rural lands for development. Limiting access points, such as roadways and driveways will serve to maintain the free flow of traffic while also maintaining scenic roadside resources and views.

The treatment of roadside features is an important element in preserving and maintaining rural historic character. Special practices and treatments are to be required. These include replanting wherever natural vegetation is removed, the use of common driveways and limited access for new streets to limit driveway cuts, and discouraging or prohibiting the removal of vegetation and existing roadside features and the alteration of grades. In order to preserve rural historic roads and character, historic features along the roads such as stone rows, hedgerows, stone retaining walls and fences, should not be disturbed. Where required, sidewalks should be separate from the roadway and meander where necessary to avoid features to be preserved. The use of alternative natural construction materials should be required to maintain the rural scenic character of these corridors.

Land Use and Natural Resource Background Information

Land Use by Property Class and Land Use/Land Cover

Figure 11 is a map of the Township identifying, land use by property tax class. Land use by property tax class indicates the type of use on a property according to the property tax records of the Township's tax assessor. Coupling tax assessment records with a tax parcel map through the use of Geographic Information Systems (GIS), the map depicts various land use and ownership categories to create a picture of land use patterns. However, a land use classification system by tax class assigns a single use to the lot, and thus tends to obscure more detailed information concerning woodlands, wetlands and other open lands on a lot.

On a Township-wide basis the land use by property class (according to the year 2011 tax list[18]), is as follows:

Property Class	Acres	**Percent**
Vacant	968	4.4
Residential	4,390	20.1
Farm	14,834	67.8
Commercial	153	0.7
Industrial	115	0.5

[18] New Jersey Association of County Tax Boards

Public	795	3.6
Quasi-Public	629	2.9

According to these data, the predominant property class in the Township is farmland, slightly exceeding 2/3 of the Township's land area. Residential land uses occupy 20 percent of the land area. Lands assessed as vacant account for 4.4% of the Township, followed by public (3.6%) and quasi-public (2.9%), which combined account for 6.5 percent of the Township. The public land category involves a diverse assortment of ownership, including State, County lands, municipal lands and school property. The quasi-public category comprises cemeteries and graveyards, churches and other charitable property, including such ownership as the Hunterdon County Land Trust, Boys Scouts of America, Fire Department and Rescue Squad. Industrial and commercial lands account for just 1.2% of the Township's land area.

Another view of land use is provided by the NJDEP Land Use/Land Cover classifications. . This data was derived from 1986[19], 1995 and 2007 Digital Ortho Quarter-Quads, flown for the entire State. The Land Use/Land Cover data shows land use that actually exists on the ground. Property Class information may show an entire property farm assessed, while Land Use/Land Cover data may reveal that only a portion of property actually farmed. For example, a parcel entirely farm assessed may only devote a portion of the parcel to farm-qualified agricultural activity. The table below identifies the Land Use/Land Cover designations for three decades. Figure 12 depicts Land Use/Land Cover data for 1995. Figure 13 depicts Land Use/Land Cover data for 2007. Changes in Land Use/Land Cover are provided in the table below.

The most expansive land use types in Kingwood Township are forest and agriculture, which accounts for approximately 70 percent of the Township. However, there has been a continual decrease in agricultural land over that time. A comparison of land use by property tax to the land use/land cover data shows that approximately 53 percent of land classified as agricultural by tax class is agricultural by land use type.

The "Urban" Land Use/Land Cover designation includes land uses that range from individual rural residential units to commercial and industrial uses. The "Urban" designation is developed land in one fashion or another, and includes power lines, roads and athletic fields. Urban land covers accounts for approximately 12 percent of the Township and accounts for the largest change in acreage between 1986 and 2007 with an increase of 907 acres.

While property classification is annually updated, DEP's Land Use/Land Cover is only periodically updated due to the expense of creating the information on a statewide basis. There have been periods in the last several decades when Land Use/Land Cover data was not generated by the State because of budget constraints. For example the work was conducted by the State in 2002, but not in 1991-92 because of budget constraints.

	1986	**1995**	**2007**	

[19] 1986 Land Use/Land Cover was prepared by the Office of State Planning in the Department of Treasury based on the system used by NJDEP in 1995 and 2007.

Land Use	Acres	%	Acres	%	Acres	%	Change 1986-2007
Agriculture	9,031	39.6%	8,366	36.7%	7,839	34.4%	-13.2%
Barren Land	7	0.0%	13	0.1%	63	0.3%	837.6%
Forest	7,770	34.1%	7,935	34.8%	8,135	35.7%	4.7%
Urban	1,750	7.7%	2,294	10.1%	2,657	11.7%	51.9%
Water	392	1.7%	402	1.8%	456	2.0%	16.1%
Wetlands	3,852	16.9%	3,792	16.6%	3,652	16.0%	-5.2%
	22,802	100.0%	22,802	100.0%	22,802	100.0%	

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Barren Land includes sites under construction at the time of the aerial photography. Wetlands account for approximately 16 percent of the Township's land area. Water represents approximately 2 percent. The distribution of wetlands is discussed below in the Wetlands section, while the category of water includes the Delaware River and ponds.

The Township has seen changes in land use and the concomitant effects. Among the salient points are the following:

- During the period 1995-2004 over 195 building permits issued for new residential development, and approximately 223 new housing units were created.
- The Township added 63 residents since the last Census in 2000.

Land Use/Land Cover data highlight changes that have occurred in the Township over approximately 20 years. These changes include the conversion of approximately 1,000 acres of farmland to residential use, which supports the conservative approach to land use management recommended in this Land Use Plan.

Geology and Hydrogeologic Zones

The bedrock geologic formations in Kingwood Township were all formed during the Mesozoic Era (Triassic and Jurassic periods), and belong to a geologic group called the "Late Triassic Newark Group". There are six bedrock classifications in Kingwood Township depicted on the map entitled Bedrock Geology - Kingwood Township (Figure 7).[20]

The Stockton Formation consists of sandstone, mudstone, silty mudstone, argillaceous siltstone, and shale occupying only 13 acres in the Township at the very southerly point in the Township along the Delaware River. Studies conducted from wells in the formation have shown yields ranging from 1.5 to 70 gallons per minute (gpm) with a median yield of 18 gpm.[21] Data for 271 domestic wells studied by USGS indicate that the Stockton Formation is one of the higher yielding aquifer systems.

[20] 2008 Kingwood Township Environmental Resources Inventory.

[21] Kasabach, Haig F. 1966 Geology and Ground Water Resources of Hunterdon County, Special Report No. 24 Bur. Of Geology and Topography, Div. of Resource Development, Dept. of Conservation and Economic Development.

The Lockatong Formation and the Red Bed Lockatong Formation were deposited on top of the Stockton Formation. The Lockatong is comprised of dolomitic or silty argillite, mudstone, sandstone, siltstone, and minor silty limestone occupying 6,616 acre while the latter is dolomitic or silty argillite, mudstone, sandstone, siltstone, and minor silty limestone, occasionally red occupying 1,401 acres. Data from 348 domestic wells studied by USGS indicate a median yield of 7 gpm.[22]

The Passaic Formation was deposited in the upper Triassic and lower Jurassic period and is distinguished by its red-brown, brownish-purple, and grayish-red shale and siltstones. A subset of the Passaic Formations is the Passaic Formation Gray Bed, where gray like deposits were found throughout the Passaic Formation and thus is gray bed is considered a subset of the Passaic formation. Together they occupy 63% of the Township (14,455 acres). The same report for Hunterdon County conducted by Kasabach showed that 528 domestic wells demonstrated a median yield of 15 gpm.

The Jurassic Diabase is the youngest formation and is found in the southern part of the Township. The Diabase formations are identified by their diabase, medium- to coarse-grained. Work conducted on studying domestic wells (97) within the formation showed a median yield of 5.0 gpm with the yield declining with the depth of the wells.[23]

Kingwood Township relies exclusively on ground water. Kingwood Township, like most of the Piedmont Physiographic Province, is underlain by dense, almost impermeable, bedrock that yields water mostly from secondary porosity[24] and permeability provided by fractures. Therefore, the distribution and orientation of these fractures controls the rates and directions of ground water flow.

The Stockton, Lockatong, Passaic and diabase formations that are characterized by several layers of extensively fractured rocks (water-bearing units) that are typically 1 to 10 feet thick interbedded with layers of sparsely fractured rocks (confining units) that typically are 30 to 100 feet thick. The argillite rocks of the Lockatong formation and diabase rocks are among the poorest (lowest yielding) aquifers in New Jersey due to the scarcity of fractures.

Topography and Steep Slopes

Elevations in the Township range from a low of 90' above sea level along the Delaware River in the southwest to a high of 560' above sea level (Figure 14). Approximately three-quarters of the land is within the 3 to 12 percent slope range, with steep slopes (15 percent or greater) occurring along stream corridors Steep slopes require special management approaches to reduce runoff and erosion, and to maintain water quantity and quality.

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[22] Page 16, Evaluation of Groundwater Resources of Delaware Township, Hunterdon County, New Jersey, Mulhall, Matthew J. PG, February 15, 2004.

[23] Page. 21 Ibid.

[24] *Porosity* is the measure of voids in soil or rock, which are available to hold water (like holes in a sponge). *Primary porosity* is due to spaces between the soil or rock particles or within porous rock particles. *Secondary porosity (process of sediment consolidating into rock formation)* is found in fractures in bedrock. Aquifers with primary porosity store far more water than those with only secondary porosity.

In 2011 the Township adopted Ordinance No. 16-04, which amended its Steep Slope Conservation chapter. The purpose of the chapter is to regulate the intensity of use in areas of steeply sloping terrain in order to limit soil loss, erosion, excessive stormwater runoff, the degradation of surface water and to maintain the natural topography and drainage patterns of land. The chapter promotes redevelopment within existing footprint and limits disturbance to 15% of areas with a slope of 15% or more and less than 20% can be developed, graded and/or stripped of vegetation.

Forested Areas

The protection of forested areas in Kingwood is an important piece in maintaining the character of the Township. Woodlands offer habitats to a variety of plant and animal species, maintain climate, reduce erosion, maintain nutrient levels and improve air quality. These areas also offer scenic vistas and natural corridors that identify the character of the region.

Kingwood Township's location, in the Piedmont land formation, gives it a rich diversity of tree species and habitats. There are numerous tree species found in the Township, ranging from conifers to soft and hardwoods. In general the forest cover consists primarily of three forest types: Coniferous, Deciduous, and Mixed Forests. The following table provides a breakdown of what is found in the Township[25].

Land Cover		*Acres*	*%*
FOREST 9302 acres 33.3%	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	781.14	2.80
	DECIDUOUS FOREST (>50% CROWN CLOSURE)	5,453.72	19.53
	CONIFEROUS FOREST (10-50% CROWN CLOSURE)	89.07	0.32
	CONIFEROUS FOREST (>50% CROWN CLOSURE)	581.52	2.08
	PLANTATION	22.30	0.08
	MIXED FOREST (>50% CONIFEROUS W/ 10-50% CROWN CLOSURE)	46.27	0.17
	MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)	258.55	0.93
	MIXED FOREST (>50% DECIDUOUS WITH 10-50% CROWN CLOSURE)	55.55	0.20
	MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)	119.86	0.43
	OLD FIELD (< 25% BRUSH COVERED)	365.86	1.31
	DECIDUOUS BRUSH/SHRUBLAND	236.30	0.85
	CONIFEROUS BRUSH/SHRUBLAND	461.89	1.65
	MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND	829.57	2.97

Freshwater Wetlands

The Freshwater Wetlands Protection Act (FWPA) established the regulatory framework for the identification and protection of freshwater wetlands in New Jersey in 1987. Among the unique values of wetlands are the purification of surface water and

[25] NJDEP Land

groundwater resources; the mitigation of flood and storm damage through the storage and absorption of water during high runoff periods; the retardation of soil erosion; the provision of essential breeding, spawning, nesting, and wintering habitats for the State's fish and wildlife; and, the maintenance of critical base flows to surface waters through the gradual release of stored flood waters and groundwater. The method for identifying and designating wetlands includes three parameters, hydrology, soils and vegetation. The hydrological factor relates to the degree of flooding or soil saturation found through soil borings; the soil factor relates to the presence of hydric soils; and, the vegetation factor relates to the presence of hydrophytes, or plant species adapted to hydric conditions.

One of the requirements of the FWPA was that the N. J. Department of Environmental Protection (NJDEP) provides a comprehensive mapping of wetlands in the State. The attached map (Figure 15) of Freshwater Wetlands is a composite of the quarter-quad maps prepared by the NJDEP to satisfy this mandate. The categories of freshwater wetlands shown on the map include the following[26]:

Land Use		*Acres*	*%*
WETLANDS 3,966 acres 14.2%	WETLAND RIGHTS-OF-WAY	3.58	0.01
	CEMETERY ON WETLAND	1.14	0.00
	MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE	20.17	0.07
	MANAGED WETLAND IN BUILT-UP MAINTAINED REC AREA	16.43	0.06
	AGRICULTURAL WETLANDS (MODIFIED)	1,182.14	4.23
	FORMER AGRICULTURAL WETLAND (BECOMING SHRUBBY, NOT	90.82	0.33
	FRESHWATER TIDAL MARSHES	1.71	0.01
	DECIDUOUS WOODED WETLANDS	2,213.28	7.93
	CONIFEROUS WOODED WETLANDS	10.07	0.04
	DECIDUOUS SCRUB/SHRUB WETLANDS	159.13	0.57
	CONIFEROUS SCRUB/SHRUB WETLANDS	37.20	0.13
	MIXED SCRUB/SHRUB WETLANDS (DECIDUOUS DOM.)	102.25	0.37
	MIXED SCRUB/SHRUB WETLANDS (CONIFEROUS DOM.)	67.63	0.24
	HERBACEOUS WETLANDS	19.64	0.07
	MIXED WOODED WETLANDS (DECIDUOUS DOM.)	14.48	0.05
	MIXED WOODED WETLANDS (CONIFEROUS DOM.)	9.29	0.03
	DISTURBED WETLANDS (MODIFIED)	16.58	0.06

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Although the NJDEP mapping of wetlands and the soils' map of hydric soils can provide guidance as to the location of wetlands, only a field investigation can substantiate the presence or absence of wetlands and the associated buffers.

In regard to buffers the Township has adopted a chapter on riparian zones. The purpose of the chapter is to provide for land use regulation to protect the streams, lakes, and other surface water bodies of the Township and to comply with N.J.A.C. 7:15-5.25(g) 3, which

[26] NJDEP Land Use/Land Cover 2007

requires municipalities to adopt an ordinance that prevents new disturbance for projects or activities in riparian zones. Compliance with the riparian zone requirements does not constitute compliance with the riparian zone or buffer requirements imposed by the State. Although variances can be granted and exceptions are specifically identified in the chapter the requirements for riparian zone are

1. 300 feet wide along both sides of any Category One water (C1 water), and all upstream tributaries situated within the same HUC 14 watershed.
2. 150 feet wide along both sides of the following waters not designated as C1 waters:
    a. Any trout production water and all upstream waters (including tributaries);
    b. Any trout maintenance water and all upstream waters (including tributaries) within one linear mile as measured along the length of the regulated water;
    c. Any segment of a water flowing through an area that contains documented habitat for a threatened or endangered species of plant or animal, which is critically dependent on the surface water body for survival, and all upstream waters (including tributaries) within one linear mile as measured along the length of the regulated water; and
    d. Any segment of a water body flowing through an area that contains acid-producing soils.
3. For all other surface water bodies, a riparian zone of 50 feet wide is to be maintained along both sides of the water.

If a discernible bank is not present along a surface water body, the portion of the riparian zone outside the surface water body is measured landward as follows:

    a. Along a linear fluvial or tidal water, such as a stream, the riparian zone is measured landward of the feature's center line
    b. Along a nonlinear fluvial water, such as a lake or pond, the riparian zone is measured landward of the normal water surface limit
    c. Along a nonlinear tidal water, such as a bay or inlet, the riparian zone is measured landward of the mean high water line; and
    d. Along an amorphously shaped feature such as a wetland complex, through which water flows but which lacks a discernible channel, the riparian zone is measured landward of the feature's center line.

As noted, exceptions are permitted if permitted under the Stormwater Management rules (N.J.A.C. 7:8), the Flood Hazard Area Control Act Rules (N.J.A.C. 7:13) and subject to review and approval by the New Jersey Department of Environmental Protection to the extent required by those rules. The following disturbances for projects or activities in the riparian zone are allowed:

    a. Redevelopment within the limits of existing impervious surfaces;
    b. Linear development with no feasible alternative route;
    c. Disturbance that is in accordance with a stream corridor restoration or stream bank stabilization plan or project approved by the New Jersey Department of Environmental Protection;

d. Disturbance necessary to provide for public pedestrian access or water-dependent recreation that meets the requirements of the Freshwater Wetlands Protection Act Rules, N.J.A.C. 7:7A, the Flood Hazard Area Control Act Rules, N.J.A.C. 7:13, or the Coastal Zone Management rules, N.J.A.C. 7:7E; or
e. Disturbance with no feasible alternative required for the remediation of hazardous substances performed with New Jersey Department of Environmental Protection or federal oversight pursuant to the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11 et seq. or the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. § 9601 et seq.

Surface Water Quality Standards (SWQS)

The rules in chapter N.J.A.C. 7:9B set forth designated uses, use classifications, and water quality criteria for the State's waters based upon the uses, and the NJDEP's policies concerning these uses, classifications and criteria, which are necessary to protect the State's waters. The SWQS operate in conformance with the Federal Water Pollution Control Act (33 U.S.C. 1313(c)), commonly known as the Clean Water Act (CWA), and the Federal Water Quality Standards Regulation at 40 CFR 131.

Surface water classifications are names assigned by the NJDEP to group waters according to designated uses (designated uses include potable water, propagation of fish and wildlife, recreation, agricultural and industrial supplies, and navigation) and water quality criteria. The criteria are numerical targets for constituent concentrations (such as toxic pollutants) or narratives that describe in-stream conditions to be attained, maintained or avoided, so that the specified uses are protected for the different use classifications. Figure 16 illustrates the stream categories within Kingwood. In Figure 16, "category" is shown, which is a compendium of all surface water classification designations for a given water body. Category describes a stream's surface water classification in terms of its general surface water class; its antidegradation status and its trout water status.

Several NJDEP programs use the SWQS, including the New Jersey Pollutant Discharge Elimination System program, Site Remediation program, Stream Encroachment, Land Use Regulation Program and Total Maximum Daily Loads (TMDL's). TMDL's represent the assimilative capacity of surface water for a given parameter of concern. The development of TMDL's includes balancing the impacts from point sources, nonpoint sources and natural background levels of a specific pollutant. [27]

Category 1 (C1) Streams[28]

Waterways can be designated Category One because of exceptional ecological significance, exceptional water supply significance, exceptional recreational significance, exceptional shellfish resource, or exceptional fisheries resource. The Category One

[27] Page 72 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

[28] Ibid

designation provides additional protections that help prevent water quality degradation and discourage development where it would impair or destroy natural resources and environmental quality. The antidegradation provisions of the SWQS are triggered when an applicant proposes an activity that has the potential to lower water quality. Previously approved wastewater discharges authorized through the NJPDES program, as well as existing development is not subject to the antidegradation policies unless a new or expanded activity is proposed. Under the February 2004 Stormwater Management rules, 300-foot buffers must be maintained in a natural state adjacent to all Category One waters and upstream tributaries of Category One waters. However, where the buffer is already disturbed, the width may be reduced in the disturbed area, but will not extend less than 150 feet from either bank. The buffer does not affect existing development. The buffer requirement can also be adjusted to reflect local conditions through the approval of a stream corridor protection plan as part of a regional stormwater management plan.

Five streams within Kingwood Township are designated Category 1 by NJDEP. The entire length of Warford Creek is within Kingwood; the majority of Little Nishisakawick and Lockatong Creeks are within Kingwood, while a portion of the Nishisakawick and Wickecheoke Creeks are within Kingwood.

Little Nishisakawick Creek: The NJDEP upgraded from Category Two to Category One antidegradation designation the entire length of the Little Nishisakawick Creek (and unnamed tributaries) based on "exceptional ecological significance. The in-stream habitat quality assessment indicates a slightly less than optimal (sub-optimal) habitat quality. Sightings of the State threatened long-tailed salamander have been reported in the Little Nishisakawick Creek. Little Nishisakawick Creek along with Nishisakawick Creek and Wickecheoke Creek contain the second largest concentration of this amphibian in the State, next to the limestone regions of Warren and Sussex counties. The State threatened long-tailed salamanders are primarily associated with cool, clear forested, rock streams.

Lockatong Creek: The NJDEP upgraded from Category Two to Category One antidegradation designation the entire length of the Lockatong Creek (and named and unnamed tributaries) based on "exceptional ecological significance". The use classifications such as FW2-NT and FW2-TM, applicable to different segments of the Creek remain the same as indicated at N.J.A.C. 7:9B-1.15(d).

Nishisakawick Creek: The NJDEP upgraded from Category Two to Category One antidegradation designation the entire length of the Nishisakawick Creek (and unnamed tributaries) based on "exceptional ecological significance". An assessment of the physical/chemical monitoring data demonstrated that the water quality of the Nishisakawick Creek meets standards except for fecal coliform. The in-stream habitat quality assessment indicates an exceptional (optimal) habitat quality. Nishisakawick Creek has reported State threatened wood turtle sightings, primarily in the upper portions of the drainage area. Sightings of the State threatened long-tailed salamanders have been reported in the Nishisakawick Creek throughout the upper and lower portions of the drainage area.

Wickecheoke Creek: The NJDEP upgraded from Category Two to Category One antidegradation designation the entire length of the Wickecheoke Creek (including Plum Brook and unnamed tributaries) based on "exceptional ecological significance. An

assessment of the physical/chemical monitoring data demonstrated that the water quality of the Wickecheoke Creek meets standards except for temperature, phosphorus, and fecal coliform. Wickecheoke Creek has reported State threatened wood turtle sightings, primarily in the upper portions of the drainage area. Sightings of the State threatened long-tailed salamanders have been reported in the Wickecheoke Creek throughout the upper and lower portions of the drainage.

Agricultural Soils

The current classification system used throughout the State was established by the State Agricultural Development Committee (SADC) in 1990 under the auspices of the Agriculture Retention and Development Act of 1983 This system refines the agricultural capability classifications established by the USDA, NRCS, which had been the norm for 20-30 years, by rating agricultural soils for their specific applicability to New Jersey. While the USDA classification system provided ratings of agricultural soils based on an eight-part system (Agricultural capability classes I-VIII), the classification system developed under the above legislation established a five-part system: prime farmlands, soils of statewide importance, farmland of local importance, unique farmlands, and other. This system is used in the mapped representation of Agricultural Soils.

Prime Farmland Soils include soils that have the best combination of physical and chemical characteristics for economically producing sustained high yields of crops when treated and managed according to acceptable farming methods and is also available for these uses. These soils have the soil quality, growing season, and moisture supply needed; they are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding (USDA NRCS NJ, 2006).

Farmlands of statewide importance include those soils with characteristics that are nearly Prime Farmland. They economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce yields as high as Prime Farmland if conditions are favorable (NRCS NJ, 2006). Kingwood Township has some prime farmland soils. About 25.06% of the Township is in prime agricultural soils with the largest areas being in the northeast corner of the Township. Soils of statewide importance amount to 70.03% of the Township and as noted on Figure 17. A significant area of soils of statewide importance extends along the boundary of the Township with Delaware Township and coinciding with watersheds of the Lockatong ands Wickecheoke Creeks.

In 2009 the Planning Board devised and adopted Farmland Preservation with the Agricultural Advisory Committee. The Plan was prepared not only in pursuant to the requirements of Section 19 of PL75 c.291, but also to further objectives of the Township in preserving its rural character; preserve the presence and facilitate the viability of agriculture; provide flexibility for property owners to preserve their land through the program in a way it suits their needs and desires; and acquire lands or development rights in a manner which is fair to the citizens whose are being acquired.[29]

[29] Comprehensive Farmland Preservation Plan for Kingwood Township (Updated Final Preliminary Draft) December 1, 2009

In the 2009 Plan 17 farms were identified as preserved amounting to 1,296.95 acres. The Plan also targets 34 farms amounting to 2,501.7 acres with 1,463.15 aces in cropland and pasture. Twenty of farms have prime agricultural soils totaling 416.63 acres and 32 farms have soils of statewide importance amounting to 1,069.49 acres. There is one (1) project area.

Potable Water

The Public Community Water Supply (PCWS) Wells are wells that supply potable water to public communities, and serve at least 15 connections used by year-round residents or which serve at least 25 year-round residents. A Well Head Protection Area (WHPA) in New Jersey is a map area calculated around each PCWS well that delineates the horizontal extent of ground water captured by a well pumping at a specific rate over a two-, five-, and twelve-year period of time for unconfined wells (Tier 1, Tier 2 and Tier 3, respectively). WHPA delineations are conducted in response to the Safe Drinking Water Act Amendments of 1986 and 1996 as part of the Source Water Area Protection Program (SWAP). The delineations are the first step in defining the sources of water to a public supply well. Within these areas, potential contamination will be assessed and appropriate monitoring will be undertaken as subsequent phases of the NJDEP SWAP.[30]

There are no PCWS's in Kingwood Township, however, Figure 18 shows four PCWS's in watersheds shared with Kingwood Township. The Well Head Protection Areas for Frenchtown Borough's two public wells extend slightly within Kingwood's boundary.

Where applicable, Monitoring information from these wells could be used in a more detailed analysis of local ground water conditions.

The New Jersey Private Well Testing Act (N.J.S.A. 58:12A-26 et seq.) became effective in September 2002. The PWTA requires mandatory statewide private well testing upon the sale of a house. The well water must be tested for Primary Contaminants[31] (bacteria, Volatile Organic Compounds, arsenic, lead and nitrates) and Secondary Contaminants[32] (pH, iron and manganese). Beginning March 16, 2004, gross alpha particle activity is also required in Hunterdon County. A report summarizing the first year of data generated by the PWTA revealed that, out of 25 wells sampled in Kingwood Township, 6 wells (24%) exceeded a maximum contaminant level for a primary drinking water standard (2 for bacteria, 1 for nitrate, and 3 for arsenic). Statewide, 8% of wells exceeded the primary drinking water standards, while in Hunterdon County the number was 11%. Although the size of the initial dataset may not provide a reliable case, Kingwood's failure rate was the highest for any municipality in Hunterdon, and the 5th highest for the state (excluding municipalities with less than 5 samples)[33] (NJDEP Division of Science,

[30] Page 67 Kingwood Township Environmental Resource Inventory, Kratzer Environmental Services, January 2009

[31] Primary contaminants are contaminants that may a cause potential health risk if consumed on a regular basis above the established maximum contaminant levels (MCLs).

[32] Secondary parameters are regulated by the State for aesthetic or other concerns (taste, odor, staining, scaling of home fixtures) rather than health effects. Whether or not these natural water quality parameters are a problem depends on the amount of the substance present.

[33] 17 municipalities had only 1 to 4 wells tested and had 1 or 2 failures, so the failure percentage was probably higher than it might be if more wells were sampled.

Research and Technology, 2004). The report concluded that: 1.) Certain geologic formations in the Piedmont region contain layers that may leach arsenic into the ground water as it passes through, and 2.) Wells drilled into bedrock aquifers are more susceptible to fecal coliform contamination than wells in the coastal plain. In time, the data from the PWTA can be used to determine water quality trends and assessments of the safety of private well sources.

The New Jersey Geological Survey (NJGS) and the United States Geological Survey (USGS) are involved in ground water monitoring and protection. Ground water monitoring sites within Kingwood and its watersheds are shown on Figure 18 and listed in the following table.

Ground Water Quality Monitoring Sites				
Site Number		Watershed	Site Name	Sampled
NJGS Ambient Ground Water Quality of the New Jersey Part of the Newark Basin				
In Kingwood	22	Lockatong	No names	One sample each 1985 – 1988
	23	Lockatong		
	24	Warford		
	101	Lockatong		
	102	Lockatong		
Outside Kingwood	21	Nishisakawick		
	20	Delaware River		
	100	Wickecheoke		
	103	Wickecheoke		
	119	Lockatong		
	120	Wickecheoke		
	121	Lockatong		
NJGS/USGS Ambient Ground Water Quality Site				
190439		D & R Canal	Bull's Island	
NJGS Hydro Database				
FILNUM 163		Lockatong	Snyder Farm (Rutgers Univ.)	1996
FILNUM 249		Wickecheoke	Shetland Crossing Golf Course	2001
2001. Results of the sampling are reported by the USGS in their yearly series on water resources data of New Jersey. Most recent available: DeLuca, M.J., Hoppe, H.L., Doyle, H.A. and Gray, B.J., 2002, Water resources data New Jersey water year 2001, vol. 3, water-quality data: U.S. Geological Survey water-data report				
New Jersey USGS website (no GIS coverage available)				
190008		Wickecheoke	MAGNESIUM	One sample: 1985
190062		Wickecheoke	MAGNESIUM ELEKTRON	Two samples: 1968 and 1985

190235	Unknown	AGRICULTURAL	One sample: 1988
USGS website http://wwwnj.er.usgs.gov/gw/.			

Wastewater Management

Hunterdon County on May 20, 2008 accepted the role as the Water Quality Management Planning entity from NJDEP. Upon completion the of Wastewater Management Plans for Alexandria, Lambertville, Holland, Delaware, West Amwell and Clinton Township these were included in the County WMP. After conducting a build-out analysis for all municipalities, which included the identification of riparian lands, wetlands, threatened and endangered species, C-1 waterways and malfunctioning septic systems, the County developed a Draft Proposed Wastewater Service Area maps for Hunterdon County municipalities.

It developed maps in coordination with and reviewed by NJDEP, other County officials and municipalities. The maps reflect proposed changes in wastewater service area designations to eliminate conflicts with environmentally sensitive areas and local planning objectives.

The map for Kingwood is Figure 19 and includes three minor facilities and the removal of one location.

Review of Municipal, County and State Plans

The Municipal Land Use Law (MLUL) requires that a municipal Master Plan include a statement concerning the relationship of the Plan to the plans of contiguous municipalities, the master plan of the county in which the municipality is located, the State Development and Redevelopment Plan (SDRP), and the district solid waste management plan of the County (N.J.S.A. 40:55D-28d.). The purpose of this analysis is to ensure that the general welfare of adjoining municipalities, the County and the State as a whole is addressed in the local planning process. Towards this end, this review of other agency plans addresses the plans of adjoining municipalities, Hunterdon County and the State of New Jersey.

Plans of Contiguous Municipalities[34]

Kingwood Township's adjoining municipalities include Frenchtown to the northwest, Alexandria Township to the north, Franklin Township to its northeast and Delaware Township to its south. All are within Hunterdon County.

Alexandria Township

To the north Kingwood abuts Alexandria Township. The 2004 Land Use Plan proposes Agricultural-Residential, possible greenbelt and park adjacent to Kingwood's agricultural residential district.

[34] Conservation Plan 2007

Delaware Township

To the south is Delaware Township. The 2009 Land Use Plan amendment continues to identify the land area abutting Kingwood as agricultural residential (A-2). The amendment did increase the residential zoning from 1 unit per six (6) to 1 unit per seven (7) acres, which is consistent with the Township's A-2 zone of a similar density.

Franklin Township

Franklin Township forms the northeast border of Kingwood. The majority of land uses adjacent to Kingwood are agricultural and residential in a seven (7) acre zoning pattern, which abuts Kingwood's AR-2 zone. Toward the BP District and where Route 12 crosses through a small portion of Franklin is the Township's C-S Commercial Zone South.

Frenchtown

To the northwest corner of Kingwood is the Borough of Frenchtown. The Borough is a mix of residential and commercial development and serves as the postal service for a large portion of the Township. Route 12 enters the Borough through the Township's AR-2 District.

Hunterdon County

The Hunterdon County Planning Board undertook an ambitious growth management planning process in developing and adopting in late 2007 the Hunterdon County Growth Management Plan. This process representing community's desired outcomes for land use, transportation, open space preservation and environmental protection provides guidance to County government while simultaneously providing tools to municipalities to tackle the tough issues they will face in the future.

A key aspect of this planning process was public participation in the formation of a common vision for the County. The Board developed innovative tools so that planning information and concepts were presented to the County as a whole and used to judge public sentiment on key issues.

A Smart Growth Planning Grant from the Office of State Planning in the New Jersey Department of Community Affairs funded the planning process and the eventual County Growth Management Plan. In-kind County support was provided as well. Hunterdon County was awarded $144,000 of the initial $273,000 that requested for its two-year program.

State Development and Redevelopment Plan

Kingwood has participated in the cross-acceptance process and in the adopted State Development and Redevelopment Plan (SDRP) and its State Plan Policy Map (SPPM) Kingwood is divided into three Planning Areas. In the northern portion of the Township it is within the Rural Planning Area (PA 4) and along the southern portion it is in the Rural/Environmentally Sensitive Planning Area (PA4B) because of wetlands, Category 1 streams and other environmental issues. These planning areas comprise much of New Jersey's countryside, where large masses of cultivated or open land surround rural Regional Centers such as Flemington, Towns such as Frenchtown and Villages and Hamlets such as Baptistown and Barbertown. Relatively isolated residential, commercial

and industrial sites are clearly distinguishable from typical suburban development in this Planning Area. The open lands of this Rural Planning Area include farmland of statewide importance, which has the greatest potential for sustaining continued agricultural production in the future along with forested and woodland tracts. These areas along with the Environmentally Sensitive Planning Area – Planning Area 5, serve as the "greensward" for the larger region and are not currently nor are they expected to be urban or suburban in nature in the future.

Small areas along some of the stream corridors are in the Environmentally Sensitive Area (PA5) because of C-1 waters and other environmental factors. These areas are not in active agriculture therefore they are identified in PA5.

Hunterdon County Solid Waste Management Plan

The Hunterdon County Solid Waste Management Plan (SWMP) in affect was adopted in 2007. The municipal responsibilities are outline in the plan with the key responsibility is the adoption of a recycling ordinance.

Kingwood amended its ordinance to comply with the SWMP on June 1, 2010.

Appendices

1. Lockatong and Wickecheoke Creek Watersheds Restoration and Protection Plan
http://www.raritanbasin.org/lockwick.html
http://www.raritanbasin.org/Projects/lockwick/FinalReport/Management%20Plan%2007 1509%20revisions%20113010.pdf

2. **Lower Delaware Management Plan**
http://www.nps.gov/nero/rivers/lowerdelmgmtplan.htm

Appendix – Nitrate Dilution

Nitrate dilution capacities were assessed for the Township's soils through the use of a nitrate-dilution model to estimate the average building lot area needed to effectively dilute nitrogen discharges from conventional septic systems to acceptable levels. The model was developed by the New Jersey Geological Survey and is utilized by the NJDEP to assess carrying capacity for areas served by individual subsurface sewage disposal systems and determines allowable minimum lot sizes. DEP's Water Quality Management Planning Rule requires municipalities to determine allowable densities and minimum lot sizes as part of Water Qualify Management Plan development. Nitrate dilution estimates are generated based upon the soil type identified as one of the inputs to the model. Under the Rule, DEP's allowable residential and development densities are based upon the 2-mg. /l. -nitrate density. The model includes an assumption that the number of persons per household is 3 persons per dwelling unit. For each soil type, NJDEP estimates the average annual recharge rate. No estimate appears to be included for the average depth to bedrock (i.e. depth of soil) and in Kingwood Township, soil depths are typically in the range of zero to 5'. The model is therefore subject to a number of variables.

Nitrate dilution modeling as a planning tool is widely accepted. However, individual municipalities have conducted independent hydrogeological investigations to more closely examine local conditions than the DEP model may permit utilizing the standard assumptions and inputs available in the DEP model. In addition, the Highlands Water Protection and Planning Council, which is charged with protecting regional water quality and supplies, varied the population input in the DEP model that is used statewide to add a conservative measure to their calculations for development density in the Highlands Region, which lies immediately to the north of the Township.

In the Highlands, the model is adjusted with the assumption that there are 4 persons per household. The increase in the number of persons per household as an input to the model adds a conservative measure to the estimated lot size requirement.

In Kingwood Township the 2010 Census identified an average of 2.67 persons per household. However, this is the Census average. Occupancies vary and are routinely higher in modern developments that typically include larger homes of five bedrooms or more. As a planning tool, the more conservative 4 person per household input was used in the model to identify indicated densities for the soils in the Township for this Plan.

Out of the 27 soil classifications in Kingwood Township, the NJDEP nitrate dilution model had the capacity to assess 19 soil types. The eight soil types for which no data could be calculated involved water, shale, a wet variant of another soil type, sand and gravel pits or a combination of two soil types (Neshaminy-Mount Lucas). The modeling results for the Township's 19 soil classifications that were supported in the model utilizing the recommended minimum recharge area for 2mg/l nitrate dilution are listed in the table below.

Soil	Acres/Septic@ 4 Persons/Household	Area in Acres	Acres/Septic@ 3 Persons/Household
Rowland	8.3	297.7	6.3
Riverhead	6.8	48.10	5.1
Reaville	7.9	2,442.01	5.9
Readington	8.1	422.53	6.2
Quakertown	8.5	571.17	6.4
Pope	6.9	339.47	5.2
Penn	7.9	4,649.6	6.0
Neshaminy Variant	8.1		6.2
Neshaminy	6.7	533.68	5.1
Mount Lucas	8.2	239.3	6.2
Lehigh	8.4	14.68	6.3
Legore	7.0	8.16	5.3
Lansdale	7.0	64.12	5.3
Klinesville	6.8	550.52	5.1
Hazleton	6.7	305.9	5.1
Chalfont	7.7	6,190.51	5.8
Bucks	7.0	217.39	5.3
Birdsboro	6.9	182.91	5.3
Abbottstown	7.8	1,567.17	5.9
OTHERS			
Bowmansville	N/A	128.41	N/A
Croton	N/A	2,291.99	N/A
Pits, Sand & Gravel	N/A	9.33	N/A
Reaville variant	N/A	337.26	N/A

Soil	Acres/Septic@ 4 Persons/Household	Area in Acres	Acres/Septic@ 3 Persons/Household
Rubble land	N/A	1,043.76	N/A
Water	N/A	350.62	N/A

Figure 4 shows that approximately three quarters of the Township is comprised of soils where a septic density of 7.0 acres to 7.9 acres is indicated.

By way of context, Kingwood Township lies immediately adjacent to the Highlands Region. While regional development pressure abated significantly since the onset of the Great Recession, Highlands regional land use policies are in place in neighboring communities that call for large minimum lot sizes, which may serve to draw growth pressure to the Township once regional growth reemerges in the future. While it is difficult to predict when the residential development market may recover significantly enough to exert pressure in the region, this is not the first economic cycle in which land development pressures have temporarily abated.

The Highlands Act and regional land use policies focus on protecting regional water supplies that provide water to approximately 8 million residents. Much of the Highlands Region surface water drains to the Delaware River, as do all of the Township's surface water courses. While the Township is fortunate to have avoided inclusion in the Highlands Region when the boundaries were drawn by the State, Kingwood Township's agricultural base, biodiversity, environmentally sensitive lands and water resources contribute to the welfare of the region. The Lockatong and Wickecheoke creeks flow into the Delaware and Raritan Canal that supplies water to water purveyors that serve approximately 1.5 million people in central New Jersey. Both streams, but the Lockatong in particular drain a substantial area of Kingwood Township

There are a variety of variables in the NJDEP Nitrate Dilution Model that was developed by the New Jersey Geological Survey that is utilized to assess carrying capacity or areas served by individual subsurface sewage disposal systems and determine recommended minimum lot sizes.

As mentioned above, the foregoing table identifying recommended minimum lot sizes for Kingwood Township soils is based upon the use of the NJDEP Nitrate Dilution Model. The population density input was varied from the NJDEP standard of 3 persons per household to 4 persons per household. Otherwise, the standard input variables in the NJDEP model were used, including:

1. Population density: 4 persons per household (vs. 3 as the DEP recommended standard)
2. Human NO_3 (Nitrate) loading rate: 10 lbs. per person/per year
3. NO_3 target: 2 parts/million (2 mg/l.)
4. Soil: variable
5. Municipality: Kingwood Township

6. Under average conditions, recharge on the pervious portions of the lot (approx., as determined by GSR-32 methodology), and
7. Net average recharge, (adjusted for impervious coverage).

1. The Population density input of 4 persons per household was utilized for Kingwood Township's soils based upon the Highlands Council's use of this standard versus the NJDEP standard of 3 persons per household. As explained in "Highlands Water Resources Technical Report Volume 1: Watersheds and Water Quality," the Highlands derived this standard as follows:

> ". . . Considering only those New Jersey counties relevant to the Highlands Region, e.g. Bergen, Hunterdon, Morris, Passaic, Somerset, Sussex, and Warren, the average household size is 2.8 people (U.S. Census Bureau, 2005).
>
> None of these counties lie wholly within the Highlands Region, and some contain portions that are highly urbanized while others have large sections of agricultural and rural areas. Relying on county data alone may result in a skewed average household size; however, data for each individual municipality is not available. The municipal and Census Place Data (CDP) data was further analyzed to calculate the distribution of household size, e.g., 1-person, 2-person, up to 7 or more, relative to the total number of households per municipality and CDP. The percent of the residential population living in the households of 4 or more is as high as 40.1% within the municipalities and CDP's examined. The weighted average among total households is 30.6%. In addition, the majority of the households that contain 4 or more people are those that house 4 people. Therefore, a representative occupancy rate of 4 persons per household was used to establish a conservative loading per unit."

Data from the 2010 Census identify higher occupancy rates in Kingwood Township's housing stock than the regional averages cited by the Highlands Council. The percent of resident population living in households of 4 or more is 45% in Kingwood Township, as indicated in the table below:

Kingwood Township, NJ
Total Population
Population by Household Size
Percent of Population by Household Size
Source: US Census Bureau, 2010 Census

	Persons
Total Population	3,845
Average household size	2.66
Average family size	3.04

Subject	Number	Percent of Households	Persons	Percent of Population
HOUSEHOLD SIZE				
Total households	1,446	100.0		
1-person household	262	18.1	262	
2-person household	536	37.1	1,072	
3-person household	260	18.0	780	
		Total:	**2,114**	**55%**
4-person household	269	18.6	1076	
5-person household	84	5.8	420	
6-person household	21	1.5	126	
7-or-more-person household	14	1.0	98	
		Total:	**1720**	**45%**

[1] A household that has at least one member of the household related to the householder by birth, marriage, or adoption is a "Family household." Same-sex couple households are included in the family household's category if there is at least one additional person related to the householder by birth or adoption. Same-sex couple households with no relatives of the householder present are tabulated in nonfamily households. Responses of "same-sex spouse" were edited during processing to "unmarried partner."
[2] "Nonfamily households" consist of people living alone and households which do not have any members related to the householder.

2. The Human NO_3 (Nitrate) loading rate input used by DEP is 10 lbs. per person/per year, which was used in modeling the minimum lot size calculation for Kingwood Township. The Highlands Council identified

> "several reported nitrate loading rates cited by the NJ Geological Survey (Hoffman and Canace, 2004) in their open-file report 'A Recharge-Based Nitrate-Dilution Model for New Jersey,'" identifying a "range from 5.4 to 14.2 pounds per person per year, with an average value of 9.8 pounds per person per year.

Reported Nitrate Loading Rates

Data Source	Reported Parameter	Pounds/Person/Year
Laak, 1980	Total nitrogen	10.4
Ligman and others, 1974	Total nitrogen	14.2
Metcalf & Eddy, Inc., 1991	Total kejdahl nitrogen	9.9
Siegrist and others, 1976	Total nitrogen	5.4
U.S. EPA, 1980	Total kejdahl nitrogen	9.13

> Accordingly, an average nitrate loading rate of 10 pounds/person/year was selected as a representative model input value. Combining this value with the 4 persons per septic, which exceeds the regional average of 2.8 persons per household, provides a conservative factor for total nitrate loading. This, coupled with the fact that any potential denitrification is assumed to be nonexistent, further introduces a conservative factor into the total nitrate mass estimated for a

> representative septic system. This conservative factor helps address any additional nitrate loading sources that may include lawn fertilizers and animal waste. One important mitigating factor to consider of these additional nitrate sources is that, unlike septic system effluent, these sources must first travel downward through the root zone in order to enter ground water. Plant uptake may further decrease nitrate mass during this journey."

NJDEP utilizes the 10 lbs. per person per household standard in the Nitrate Dilution Model, which was used to compute minimum lot sizes for the Township.

3. The NO_3 target: 2 parts/million (2 mg/l.) used by NJDEP was not changed in modeling the minimum lot size calculation for Kingwood Township.

Kingwood Township lies immediately south of the Highlands Planning Area boundary. Kingwood Township's immediate neighbors to the north include Kingwood Township, Holland Township and Franklin Township, portions of which are designated Highlands Planning Area. In these municipalities, the Highlands Council designates "Land Use Capability (LUCZ) Zones." Three primary LUCZ's are identified in the Highlands Plan, which include the Existing Community, Conservation and Protection Zones, a brief summary describing each is provided below.

> "The Existing Community Zone 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 . . ."
>
> The Conservation Zone consists of areas with significant agricultural lands and interspersed with associated woodlands and environmental features that should be preserved when possible.
>
> The Protection Zone consists of high natural resource value lands that are important to maintaining water quality, water quantity and sensitive ecological resources and processes. Land acquisition is a high 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."[35]

Were Kingwood Township situated in the Highlands Region lying immediately to the north of the municipality, the Township's landscape could be best characterized as predominantly Conservation Zone and Protection Zone. Special protections would be afforded these areas under the regional plan. Minor inclusions of Existing Community Zone would also be designated, but only limited areas would carry this designation.

[35] Page 111 – Highlands Regional Master Plan.

For the Conservation Zone and Protection Zone, the Highlands Council has identified nitrate dilution targets less than 2 parts per million for determining minimum lot size requirements (Conservation Zone: 1.87 ppm; Protection Zone: .72 ppm). These targets applied to four representative soil types in the Township would yield the following minimum lot size requirements, as determined using the NJDEP Nitrate Dilution Model, without any adjustment for annual groundwater recharge rate:

Soil	Area of Township (acres)	Acres/Septic 2 ppm - NO_3 target	Acres/Septic 1.87 - NO_3 target	Acres/Septic .72 - NO_3 target
Reaville	2,442.01	7.9	8.4	21.3
Penn	4,649.6	7.9	8.4	21.3
Chalfont	6,190.51	7.7	8.2	20.8
Abbottstown	1,567.17	7.8	8.4	21.2
Croton	2,291.99	N/A	N/A	N/A

The Highlands Council density calculation does not use the NJDEP's standard groundwater recharge rates indicated by the GSR-32 models. "The original GSR-32 models were calibrated to thirty years of climate data measured at 32 climate stations in New Jersey. By using this relatively long historical period, the models captured average climatic conditions for New Jersey,"[2] which the Highlands Council "re-calibrated using climatic data spanning the New Jersey drought of record, the years 1961 through 1966"[36] to introduce an additional conservative factor into the septic system density modeling. Adjustments of a similar nature to the model would yield still higher recommended minimum lot sizes for Kingwood Township.

Kingwood Township commissioned a study in 1995 to evaluate groundwater in the Township. The study is entitled "Ground Water Study of the Argillite Formation in Kingwood Township, Hunterdon County, New Jersey," prepared by Robert M. Hordon, Ph.D., P.JH., dated November 5, 1995. The study analyzed potable well data, identified groundwater recharge estimates and included a discussion of nitrate dilution to assess the then minimum lot size requirement of 2 acres in the AR-2 Zone. The study is appended to this Plan and included the following findings and comments:

1. Lockatong argillite (**Trl**) formation (see Figure 4-attached): 36.6% of the Township is underlain by the Lockatong argillite formation. "This formation has the dubious distinction of ranking among the poorest sources of ground water in the entire state, since the fractures and joints where water may be found are widely spaced, poorly connected and very tight (Kasabach, 1966)."

2. Baked shale (**Trba**) units (see Figure 4-attached): The baked shale units are hydrologically similar to the argillite and are therefore included in the

[36] Highlands Water Resources Technical Report Volume 1: Watersheds and Water Quality

well analysis and discussion. They are estimated to occupy 28.1% of the Township. Together the argillite and baked shale units underlie 64.7% of the Township.

3. Page 19 - "In sum, the various estimates, hydrograph separation techniques and flow-duration curve analyses discussed in this section result in ground water yield estimates ranging from 52,000 to 319,000 gpd/sq mi. The variation in the yield estimates is attributed to the particular methodology employed and the recurrence interval selected.

In regard to the area of nitrate dilution modeling, Dr. Hordon referenced the Trela – Douglas Dilution Model as a means of assessing adequacy of lot sizes. Using the Trela-Douglas model, which requires an estimate for the "infiltration of precipitation" (IP). Dr. Hordon noted that "As previously discussed, the infiltration or recharge estimates for areas underlain by argillite (and baked shale) range from 52,000 to 319,000 gpd/sq mi, respectively. It is suggested that a more reasonable estimate would fall within the 100,000 to 200,000 gpd/sq. mi range. Using his assumption of 200,000 gpd/sq. mi of IP, Dr. Hordon calculated the theoretical diluted value of nitrate-nitrogen at the property line at 10.6 mg/l, and concluded:

> "In conclusion, the 10.6 mg/l nitrogen concentration exceeds the drinking water standard of 10 mg/l. Application of the Trela-Douglas model to Kingwood using a variety of recharge assumptions is shown in Table 2" (see attached). "Note that ground water quality standards are contravened whenever the recharge is too low or the lot sizes too small."

Dr. Hordon also referenced a modified nitrate dilution model by that was developed by Pizor, Nieswand and Hordon (1984). Applied to Kingwood Township, the Hordon study found that:

> "The comparable minimum lot sizes using the same values as before" (in the Trela-Douglas model) "but varying the recharge estimates results in a value of 2.8 and 4.2 acres/DU for recharge values of 150,000 and 100,000 gpd/sq mi, respectively. As expected, both dilution models have similar results given the fact that many of the assumptions are the same. The main conclusion is that 2-acre zoning on the argillite and baked shale areas in Kingwood appears to be too small for the long-term ground water quality protection"

The modified nitrate dilution model used by Dr. Hordon utilized 10 mg/l as the nitrate planning target as follows:

> A = (640 x 0.78 x 40 x 75 x 2.74) / (200,000 x **10**)
>
> A = **2.1 acres/DU**

If the nitrate dilution planning target is adjusted by applying NJDEP's 2 mg/l nitrate dilution target, Dr. Hordon's calculation would appear to result in the following:

A = (640 x 0.78 x 40 x 75 x 2.74) / (200,000 x **2**)

A = **10.258 acres/DU**