



Mr. Morris Deputy, Town Manager  
Town of Middletown  
19 W. Green St.  
Middletown, DE 19709

November 9, 2007

Re: Proposed Middletown Water Resource Protection Area (WRPA) Ordinance

Dear Mr. Deputy:

Enclosed is a report that provides a technical basis for a water resource protection area ordinance for Middletown. The purpose of the WRPA ordinance is to protect the quality and quantity of the wells and recharge areas that provide drinking water for the town. Since the population of Middletown exceeds 2,000, the Town is required to adopt a WRPA ordinance by the end of 2007 according to the Delaware Source Water Protection Law of 2001.

The goal of the ordinance is to guide new development at full build out with a threshold of 20 percent impervious cover within the recharge WRPA boundaries. Scientific literature indicates a 20 percent impervious cover threshold protects the quality and quantity of water that recharges the aquifers. The ordinance is designed for compatibility with the town's comprehensive plan, which focuses dense development in and near the downtown area and distributes less dense growth in the outlying green belt areas.

We calculated 3 scenarios with our GIS land use mapping for the recharge area within the Town boundaries:

**Scenario 1:** Under existing (2006) land use conditions, impervious cover within the recharge WRPA within the town boundaries is 21 percent, just above the desired water quality/quantity threshold.

**Scenario 2:** At full build out with future annexations without a source water ordinance, impervious cover within the recharge WRPA within the town boundaries projects to 41 percent, too high to protect aquifer recharge areas.

**Scenario 3:** We recommend a WRPA ordinance that sets impervious cover thresholds for proposed single family residential (20%), multifamily residential (20%), nonresidential commercial/office/industrial/institutional (30%), and transportation (30%). These impervious cover thresholds ensure that overall impervious within the recharge WRPA will be no higher than 31% at full build out. We recommend reducing residential street width to 24 feet to reduce transportation imperviousness by 30% as compared to 32 feet wide streets.

We advocate consideration of the draft ordinance which protects the 300 feet wellhead radius around the town's production wells. The ordinance also prohibits new hazardous materials such as gasoline tanks in the recharge WRPAs. By utilizing zoning in the comprehensive plan, the ordinance allows higher impervious cover in commercial and office nonresidential areas and less in low density residential areas. This accomplishes the goal not to exceed 20 percent impervious town-wide in the recharge areas based on full build-out with annexations in place.

Sincerely;

Gerald J. Klauffman PE, Director  
UD IPA - Water Resources Agency

Cc: Timothy DeSchepper, Middletown Town Planner  
John Barndt, DNREC Division of Water Resources

Troy Mix, UD IPA  
Andrew Homsey, UP IPA WRA

**Proposed Water Resource Protection Area (WRPA) Ordinance for the Town of Middletown  
November 9, 2007**

**Goal/Purpose of Ordinance**

The goal of the ordinance is to plan new development in Middletown at full build out so new development does not exceed a threshold of 20% impervious cover within the recharge WRPA within the town boundaries. The ordinance is designed to be compatible with the town's comprehensive plan, which focuses more dense development in/near the downtown area and distributes less dense growth in the outlying green belt areas.

We advocate consideration of the enclosed draft ordinance, which protects the 300 feet wellhead radius around the town's production wells. The ordinance would also prohibit new hazardous materials such as gasoline tanks in the WRPAs. By utilizing the zoning in the comprehensive plan, we recommend a WRPA ordinance that sets impervious cover thresholds for proposed single family residential (20%), multifamily residential (20%), nonresidential commercial/office/industrial/institutional (30%), and transportation (30%). To accomplish this we also recommend reducing residential street widths to 24 feet curb to curb to reduce transportation impervious cover by 30% when compared to 32 feet wide streets. This is would accomplish the goal not to exceed 20% impervious cover for new developments in the recharge areas based on full build-out with planned annexations in place.

The percent impervious cover threshold was set based on water budget models that indicate the volume of recharge diminishes rapidly once the impervious cover exceeds 10% to 20% of a particular parcel. A hydrologic study in the Gwynns Falls watershed near Baltimore reaffirmed the existence of a threshold by concluding that the runoff ratio changes dramatically when the impervious cover exceeds the threshold of 20% (Brun and Band, 2000). Impervious cover is defined as the amount or percentage of pavement and roof area in a particular watershed, WRPA, or development site.

**Methods**

We used Arc View GIS mapping to compute the percent impervious cover for existing and future land use scenarios within the Recharge Water Resource Protection Area within the boundaries of the Town of Middletown according to the following steps.

Step 1. Delineate existing (2006) land use data from aerial photographs and load into Arc View (Figure 1).

Step 2. Overlay recharge WRPA and existing Middletown municipal boundaries on to land use map (Figure 2).

Step 3. Compute area of each land use (acres) for existing (2006) and future (with annexation) conditions for each of the following land uses within the recharge WRPA (Table 1):

- Low Density Residential, 1/3 to 2 acre lots (LDR)
- Medium/High Density Residential, less than 1/3 acre lots, multifamily and attached housing (MDR)
- Office (OFC)
- Commercial (COM)
- Industrial (IND)
- Transportation/Utility (TRU)
- Institutional (INS)
- Public Open Space (POS)
- Wooded (WOD)
- Agriculture (AGR)
- Water/Wetlands (WAW)
- Barren/Vacant (BAR)

Step 4. Compute overall impervious cover within the recharge WRPA for existing and future conditions by inputting land use into a model using the following formula:

$$\%IMP = [(LDR \text{ Area})(LDR \text{ Imp}) + (MDR \text{ Area})(MDR \text{ Imp}) + (OFC \text{ Area})(OFC \text{ Imp}) + (COM \text{ Area})(COM \text{ Imp}) + (IND \text{ Area})(IND \text{ Imp}) + (TRU \text{ Area})(TRU \text{ Imp}) + (INS \text{ Area})(INS \text{ Imp}) + (POS \text{ Area})(POS \text{ Imp}) + (WOD \text{ Area})(WOD \text{ Imp}) + (AGR \text{ Area})(AGR \text{ Imp}) + (WAW \text{ Area})(WAW \text{ Imp}) + (BAR \text{ area})(BAR \text{ Imp})] / \text{Area of WRPA}$$

where:

%IMP = Composite impervious cover within the recharge water resource protection area

LDR Area, etc. = Area of each land use within the water resource protection area (ac)

- LDR Imp = 30%
- MDR Imp = 50%
- OFC Imp = 60%
- COM Imp = 80%
- IND Imp = 70%
- TRU Imp = 60 %
- INS Imp = 50%
- POS Imp = 0%
- WOD Imp = 0%
- AGR Imp = 0%
- WAW Imp = 0%
- VAC Imp = 0%

Area of WRPA = Total area within recharge water resource protection area (ac).

For example, the impervious cover of a 1000-acre recharge area, with 200 acres single family residential, 100 acres commercial, 300 acres wooded, and 400 acres agriculture would be computed as:

$$\%IMP = [(200 \text{ ac})(30\%) + (100 \text{ ac})(80\%) + (300 \text{ ac})(0\%) + (400 \text{ ac})(0\%)] / 1000 \text{ ac}$$

$$\%IMP \text{ Recharge area} = [6,000 + 8,000 + 0 + 0] / 1000 = 14.0 \%$$

One should note that this methodology employs estimates of characteristic imperviousness and land uses can vary depending on the density of use of each individual parcel. Therefore the level of precision is thought to be precise to the nearest integer and certainly to the range of the nearest even 5 percent. The above calculation of 14.5% is precise to the nearest whole number and certainly precise within the range of 10 to 15%.

## Results

Table 1 summarizes the results of the analysis. Under Scenario 1, currently there are 4528 acres (7.1 sq mi.) of land within the Recharge WRPA within the boundaries of Middletown plus the area planned for annexation. Approximately 1799 acres of the land is developed within the WRPA leaving 2729 acres in agriculture, wooded, wetland, and barren land. The existing (2006) overall impervious cover within the Middletown portion of the WRPA is 21%, just above the 20% threshold beneficial to protect the aquifer..

**Table 1**  
Existing/Future Land Use and Impervious Cover within Recharge Water Resource Protection Area (WRPA)  
Town of Middletown, Delaware  
November 8, 2007

	<b>Scenario 1</b>	<b>Scenario 1</b>	<b>Scenario 2</b>	<b>Scenario 2</b>	<b>Scenario 3</b>	<b>Scenario 3</b>
	<b>Existing 2006</b>	<b>Existing 2006</b>	<b>Future w/ Annexation Comp Plan</b>	<b>Future w/ Annexation Comp Plan</b>	<b>Future w/ Annexation Comp Plan w/WRPA</b>	<b>Future w/ Annexation Comp Plan w/WRPA</b>
<b>Land Uses</b>	<b>% Imperv.</b>	<b>Acres</b>	<b>% Imperv</b>	<b>Acres</b>	<b>% Imperv</b>	<b>Acres</b>
Low Density Residential	30	351	30	845	20	845
Medium/High Residential	50	613	50	613	20	591
Office	60	21	60	186	30	186
Commercial	80	209	80	663	30	663
Industrial	70	56	70	243	30	243
Transportation/Utilities	60	428	60	428	30	414
Institutional	50	121	50	491	30	491
Public/Private Open Space	0	640	0	712	0	749
Wooded	0	19	0	21	0	21
Agriculture	0	1528	0	103	0	103
Water/Wetlands	0	215	0	215	0	212
Barren/Vacant	0	326	0	7	0	7
Total Acres		4528		4528		4528
Total Impervious Area		948		1875		1400
% Impervious		21%		41%		31%

Under Scenario 2, at future full build out conditions with the comprehensive plan annexations in effect without a WRPA ordinance, there will be a total of 3469 acres of developed land, an increase of 1670 developed acres. The amount of open land remaining within the WRPA in Middletown will be 1059 acres. At full buildout, the overall impervious cover within the recharge WRPA is estimated to grow to 41%, far exceeding the 20% threshold.

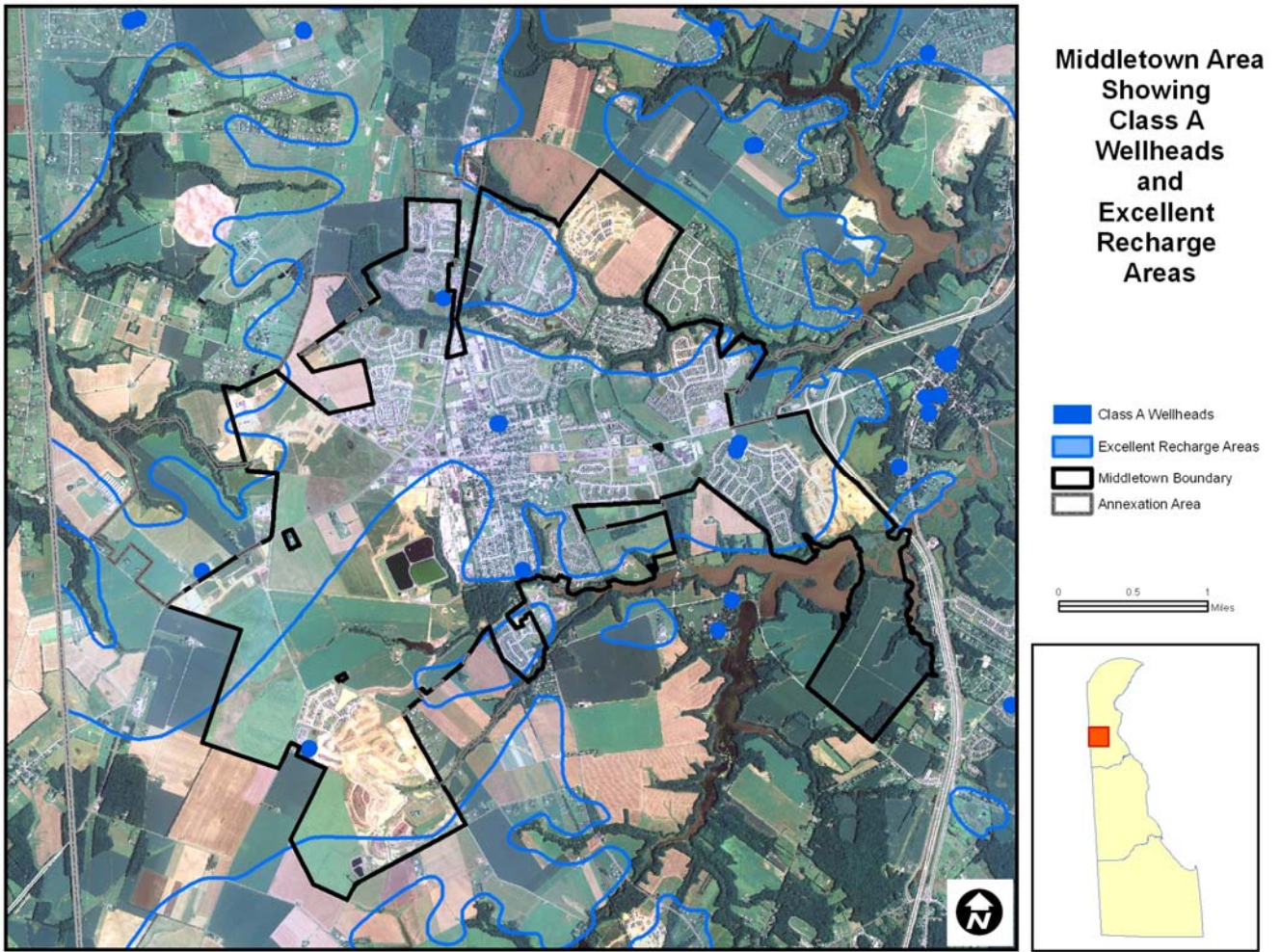
Scenario 3 incorporates the recommended WRPA ordinance at full buildout with comp plan annexations in effect. Under this plan, future residential land uses are developed by right with a maximum impervious cover threshold of 20 percent and nonresidential developments are capped at 30 percent impervious. At full build out with the recommended WRPA ordinance in effect, the overall impervious cover within the recharge WRPA is projected to be 31%, a substantial reduction compared to 41% without the ordinance. If applicants wish to exceed the impervious cover thresholds but not exceed 50% impervious, the ordinance provides options for rooftop recharge and other low impact development techniques that would offset the loss in recharge due to new development. Table 2 summarizes recommended impervious cover thresholds for developed land uses in recharge and wellhead WRPAs in Middletown.

**Table 2**  
 Maximum Impervious Cover Criteria in the Water Resource Protection Area (WRPA) Overlay Zoning District  
 Town of Middletown, Delaware  
 November 8, 2007

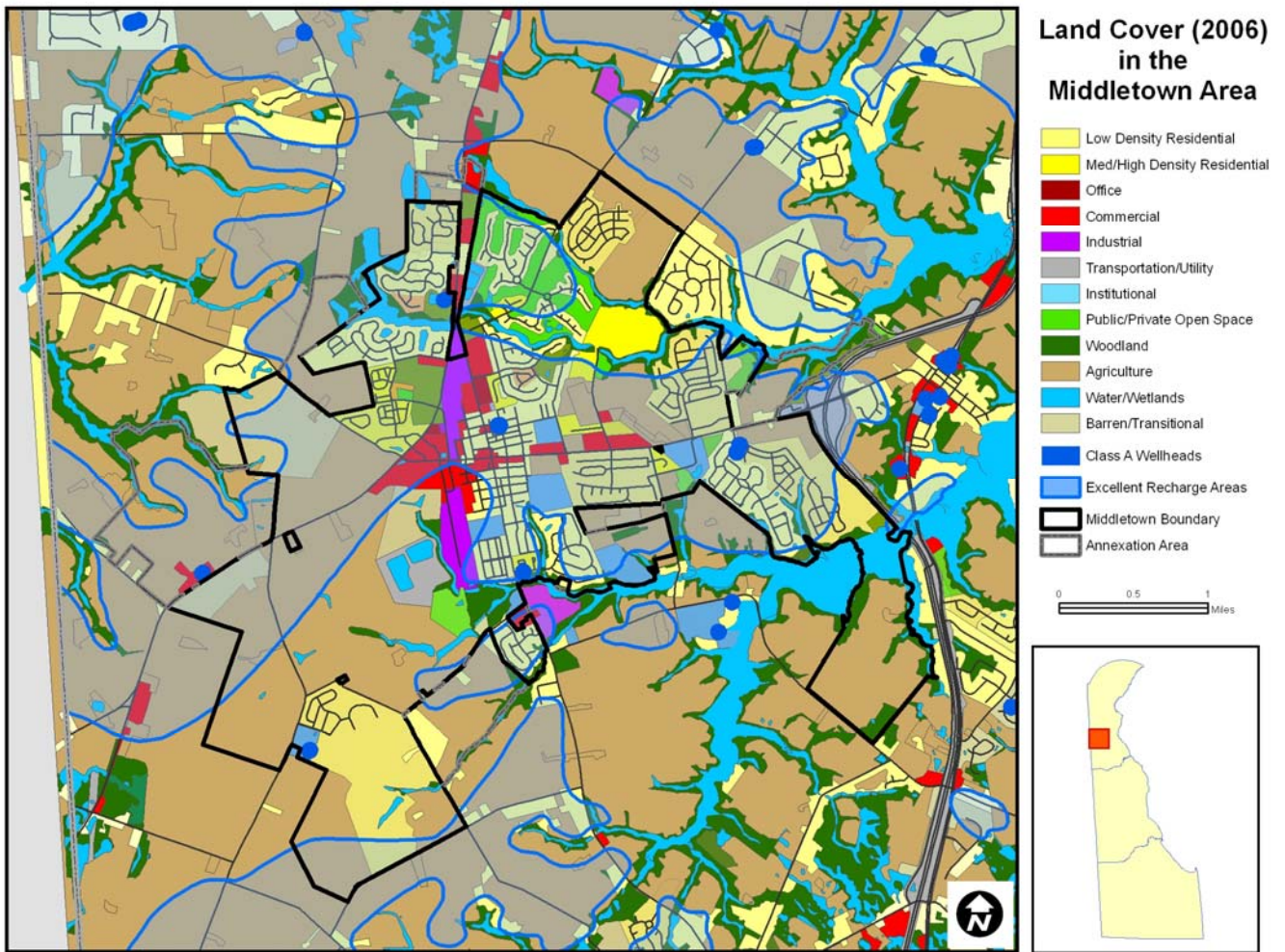
<u>Land Use</u>	<u>Recharge WRPA</u>	<u>Wellhead WRPA (300 feet radius)</u>
Single Family Residential	20%	0%
Multifamily Residential Townhouse/ Apartment	20%	0%
Office Commercial/ Industrial/ Institutional	30%	0%

New nonresidential developments may exceed 30 percent impervious but not exceed 50 percent provided a water budget is submitted recommending recharge facilities to infiltrate rooftop runoff in the same annual volume as for predevelopment conditions

Enclosed is a draft water resource protection area ordinance consideration by the Town of Middletown.



**Figure 1.** Aerial photograph (2006) in the vicinity of the Town of Middletown, Delaware



**Figure 2.** Land Use/Land Cover (2006) in the vicinity of the Town of Middletown, Delaware

**MIDDLETOWN WATER RESOURCE PROTECTION AREA ORDINANCE  
ARTICLE ??**

(DRAFT November 8, 2007)

**Section 1100 Intent .**

The intent of this ordinance is to protect the quality and quantity of ground and surface water in wellhead and recharge resource protection areas during new development in the Town of Middletown. This ordinance is designed to meet the requirements of the 2001 Delaware Source Water Protection law.

**Section 1101 Definitions.**

This section defines words, terms, and phrases found in this article.

**Applicant.** A person, firm or government agency who executes the necessary forms to obtain approval or a permit for any zoning, subdivision, land development, building, land disturbance, or other activity regulated by the Code.

**Aquifer.** A body of rock (crystalline, sand or gravel) that contains sufficient saturated permeable material to conduct groundwater springs or to yield economically significant quantities of groundwater to wells.

**Best Management Practices.** That combination of conservation measures, structures, vegetation or management practices, that reduces or avoids adverse impacts of development on adjoining site's land, water, or waterways and waterbodies.

**Detention/Retention Basin.** A natural or man-made structure designed as a temporary holding basin for water. Water may be detained to minimize flooding downstream, or retained to increase aquifer recharge.

**Drainage Areas.** The delineated areas that currently contribute or are proposed to contribute runoff to a specific location or point.

**Drainage Facility.** Any system of artificially constructed drains, including open channels and separate stormwater sewers, used to convey storm, surface, or groundwater, either continuously or intermittently, to natural water courses.

**Environmental Report.** Any study, report or application required by this Code, such as floodplains, water resource protection areas and wetlands.

**Flood Fringe.** Those portions of the floodplain, outside the floodway, subject to inundation by the one hundred (100) year recurrence interval flood and generally associated with standing or slowly moving water, rather than rapidly flowing water. Flood fringe is determined by detailed study data and profiles found in the FEMA Flood Insurance Study.

**Floodplain.** A relatively flat or low-lying land area adjoining a river, stream, or watercourse which is subject to periodic partial or complete inundation. Specifically, those areas identified by the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM) as being subject to periodic inundation by a one hundred (100) year storm, including the floodway, flood fringe and areas for which no base flood elevations area available as depicted in the FEMA Flood Insurance Rate Maps (community no. 10585) dated April 17, 1996 or as later amended.

**Flood Protection Elevation.** A point two (2) feet above the water surface elevation of the one hundred (100) year flood.

**Floodway.** The portion of the floodplain district required to carry and discharge the waters of the one hundred (100) year flood without increasing the water surface elevation at any point more than one (1) foot above existing conditions as demonstrated in a flood insurance study.

**Forest.** An area covered by a canopy of woody plants (trees) that qualifies as mature and/or young. It may also be a woodland, woodlot, grove, or stand of trees meeting the specifications of the forest type.

**Forest, Mature.** An area or stand of trees whose total combined canopy covers an area of one (1) acre or more composed of canopies of trees having a DBH of at least eighteen (18) inches or greater covering at least seventy-five (75) percent of that



area. Also, any stand or grove consisting of eight (8) or more individual trees having a DBH of at least eighteen (18) inches whose combined canopies cover at least fifty (50) percent of the area encompassed by the grove.

**Forest, Young.** An area or stand of trees whose total combined canopy covers an extra of one (1) acre or more, with canopy trees having a DBH of six (6) inches and covering at least sixty (60) percent of the area. However, no trees kept or grown for commercial purposes shall be considered a young forest.

**Grading.** The excavating, filling (including hydraulic fill) or stockpiling of earth materials, or any combination thereof, including the land in its excavated or filled condition.

**Groundwater.** A portion of the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

**Hydric Soils.** Soils which in their natural, undrained state are wet frequently enough at or near the surface to periodically produce anaerobic conditions, thereby influencing plant species composition and/or growth.

**Infiltration.** The passage or movement of water through the soil profile.

**Landscape Plan.** A plan associated with a subdivision, land development or parking facility plan indicating the placement of trees, shrubs, growth cover and affiliated structures and improvements, including specifications, species, quantities and installation as prepared by a Delaware registered landscape Architect.

**Landscaping.** The design and installation of plant material such as lawns, groundcover, trees, bushes, etc.

**Mitigation.** Any action taken to lessen the specified undesirable impacts of a proposed land use or land disturbance activity, including those which would adversely affect the health or longevity of a natural feature, pose a visual intrusion or conflict, or otherwise be deemed incompatible with surrounding properties.

**National Geodetic Vertical Datum (NGVD).** Elevations referenced to mean sea level datum of the 1929 or 1988 U.S. Geological Survey.

**Non-delineated floodplain.** An area subject to a 100-year flood, adjacent to a watercourse that is identified by a blue line on the current United States Geological Survey (USGS) topographic maps of the County or in the detailed maps of the N.C.C. Soil Survey for which FEMA has delineated a floodplain.

**Public Water Supply Well.** A well from which the water is used to serve a community water system by section 22.146 (Public Water Systems) in the Delaware state Regulations Governing Public Drinking water Systems.

**Recharge Areas.** The recharge water resource protection areas are designated as having the best potential for groundwater recharge. They were delineated using methodology described in a report prepared by the Delaware Geological Survey entitled "Delineation of Ground-Water Recharge Resources Protection Areas in the Coastal Plain of New Castle County, Delaware," dated January 1993 ("recharge resource area").

**Reforestation.** Replanting or planting of forest plant materials.

**Riparian Buffer Area (RBA).** Where a parcel of land is adjacent to a perennial, lake, tidal wetland or area draining greater than ten (10) acres forming a transition zone between the aquatic and the terrestrial environments is proposed for development or redevelopment, a RBA shall be designated. The RBA shall include the waterbody and the adjacent area within at least one hundred (100) feet from the top of bank of the waterbody. The RBA shall also include the floodplain or non-tidal wetland plus the adjacent area within a minimum of fifty (50) feet of the resource.

A. **Identification and Calculation.**

1. Streams (perennial, intermittent, mapped, and unmapped) with identifiable banks and beds, lakes, and tidal wetlands or areas which drain greater than ten (10) acres are subject to the regulations of this section.
2. Initial identification of the watercourses/waterbodies shall be made using the U.S. Geological Survey quadrangle maps or more accurate information, as available. Field verification to determine evidence and location of channelized flow is required for a specific determination.

3. The width of existing impervious area such roadways, parking lots, structures, sidewalks, etc. shall not count towards the RBA measurements.

B. **Exceptions.** An RBA shall not be designated along industrial ponds, sewage lagoons, man-made irrigation ditches, stormwater management basins and other artificial features with a similar water quality or storage function.

**Runoff.** That portion of precipitation or snow melt that has not evaporated or infiltrated into the soil, but flows on land surface.

**Slope, Steep.** The term slope is defined as the vertical change in elevation divided by the horizontal distance over which that vertical change occurs. The steep slope area consists of two (2) areas which are delineated and defined as follows:

- A. **Prohibitive slope.** Prohibitive slopes are those of greater than twenty-five (25) percent slope as based on a site survey, where such slope exists in any continuous horizontal increment of fifty (50) feet or more.
- B. **Precautionary slope.** Precautionary slopes are those of fifteen (15) to twenty-five (25) percent slope as based on a site survey, where such slope exists in any continuous horizontal increment of fifty (50) feet or more.

These definitions do not include manmade steep slopes resulting from the implementation of an approved plan.

**Stormwater Management.** The mitigation of the hydrologic impacts of lost natural runoff storage by the use of constructed storage facilities.

- A. For water quantity control, a system of vegetative, structural, and other measures that may control the volume and rate of stormwater runoff which may be caused by land disturbing activities or activities upon the land; and
- B. For water quality control, a system of vegetative, structural, and other measures that control adverse effects on water quality that may be caused by land disturbing activities or activities upon the land.

**Surface Water.** Natural or artificial bodies of water greater than one (1) acre in extent at the normal annual water level, as depicted on U.S.G.S. topographic quadrangles and/or as determined by on-site surveys by a registered surveyor, landscape architect or engineer. Excluded from this definition are retention basins or other stormwater management facilities, farm ponds or other facilities associated with agricultural operations, sewage lagoons and other facilities for which normal maintenance and repair is necessary.

**Top of Bank.** A point above the mean water surface of a watercourse that defines the maximum depth of channel flow in the watercourse. It is either determined visually or computed as an elevation using the peak rate of runoff from a two (2) year storm event.

**Tree, Canopy.** A tree whose leaves would occupy the upper level of a forest in a natural ecological situation. These trees are also called shade trees, and typically reach heights of fifty (50) to one hundred (100) feet at maturity.

**Tree, Understory.** A tree whose leaves would occupy the intermediate level of a forest in a natural ecological situation. They are also found as dominant species in old field succession. These trees are also called ornamental trees.

**Variance.** Relief from the standards of this Section.

**Waterbody.** Any watercourse, tidal wetland or lake defined by a bank or shore in which water can be found.

**Watercourse.** A stream channel (perennial, intermittent, mapped or unmapped) with banks and a bed within which concentrated water flows.

**Water Resource Protection Area.** Water resource protection areas in Middletown are Class A Wellhead and Recharge areas. All such areas are as depicted on the three-map series "Water Resource Protections areas for the City of Newark, City of Wilmington, New Castle County, Delaware," prepared by the University of Delaware Water Resources Agency dated 2001 and revised 2006. The WRPA maps are available at [www.wr.udel.edu](http://www.wr.udel.edu).

**Water table.** The level below the surface at which the ground is saturated by water.

**Wellhead, Class A.** The wellhead water resource protection areas are surface and subsurface areas surrounding public water supply wells or wellfields where the quantity or quality of groundwater moving toward such wells or wellfields may be adversely affected by land use activity. Such activity may result in a reduction of recharge or may lead to introduction of contaminants to groundwater used for public supply ("wellhead"). The Class A wellhead zone shall include the area within a three hundred (300) foot radius circle around all public water supply wells which are classified as community water systems, as defined by section 22.157 (public water systems), in the State of Delaware Regulations Governing Public Drinking Water Systems.

**Wetland.** Those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions; or areas that are defined and delineated in accordance with the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands" dated January 10, 1989, and as may be amended from time to time; or as further defined and delineated by the U.S. Army Corps. Of Engineers, the U.S. Environmental Protection Agency, or the Delaware Department of Natural Resources and Environmental Control.

**Wetland Delineation and Report.** An on-site method or process for identifying wetlands as described in the Corps of Engineers Wetland Delineation Manual, Technical Report: Y-87-1, from 1987 and as amended. The report shall be prepared by a person with professional experience and knowledge in wetlands identification and shall analyze a site for the existence and extent of wetlands.

**Section 1102 Floodplains and Floodways.**

- A. Intent: This section shall detail the requirements, allowable disturbances, and permitted construction practices within all floodplains and floodways within the Town.
- B. Boundary interpretation. Where there appears to be a conflict between a mapped boundary and actual field conditions, a determination of the exact boundary of the area subject to inundation by the base flood shall be made using the one hundred (100) year flood elevation information provided in the flood insurance study for the flood fringe portions of the floodplain and using the best one hundred (100) year floodplain elevation information available for general floodplain areas. For the floodway portion of the floodplain the exact boundaries shall be determined by scaling the distances shown on the floodway map and by utilizing the data in the applicable flood insurance study (FIS) for the area. Where the boundary of the floodplain is disputed, the burden of proof shall be on the applicant.
- C. Floodplain. No structure shall intrude into the 100 – year floodplain except for piers needed to support bridges, erosion control structures, dams for flood control or water supply, and utility crossings. No fill or structures designed for human habitation are permitted in the 100-year floodplain.
- D. Flood Protection Elevation. The finished first floor of all structures adjacent to the floodplain shall be elevated to a point two (2) feet above the water surface elevation of the one hundred (100) year flood.

**Section 1103 Wetlands.**

- A. No fill shall be placed in wetlands except as permitted by wetland mitigation by permit that has been issued by the United States Army Corps of Engineers. Permits from the State may also be required.
- B. It is permissible to construct utility and access crossings within Wetlands where no other recourse is available. The proposed use must be authorized by the Town and meet the requirements of the Town Code, Army Corps of Engineers regulations, and the DNREC. No other forms of construction are permitted in areas designated as Wetlands.
- C. Any work in buffer areas shall meet the requirements of the Town Code, Army Corps of Engineers regulations, and the DNREC.

**Section 1104 Riparian Buffer Areas (RBA).**

- A. Intent: This section shall detail the requirements, allowable disturbances, and permitted construction practices within all Riparian Buffer Areas within the Town.

- B. The water body buffers shall meet the following standards which are intended to preserve and enhance existing vegetation and to re-vegetate disturbed areas. All riparian buffer shall be mapped to delineate the resource. No vegetation shall be removed in the RBA and existing native vegetation shall be preserved to the maximum extent possible. RBA shall extend a minimum of 100 feet past each top of bank for all waterbodies or 50 feet past the floodplain or non-tidal wetland line (which ever is greater). All RBA areas shall be classified as old field, disturbed land, or meadow, and planted in accordance with this Section where native vegetation is not present. The mapping of RBA's shall be supplied with an exploratory plan and at subsequent plan submissions to meet the standards of this Section.
- C. Surface water bodies.
  - 1. No septic systems shall be allowed within an RBA.
  - 2. All developments shall maximize the drainage amount conducted in natural swales rather than storm sewers. A stormwater system's discharge to streams or watercourses shall be by sheet flow through a grassland or discharged from a stormwater management facility having a wetland or aquatic bench.
  - 3. Stormwater runoff from all parking areas shall be directed to a stormwater management facility before it is discharged into an RBA.

**Section 1105. Steep Slope Protection.**

- A. Intent. The intent of this section is to protect hillsides and their related soil and vegetative resources, thereby minimizing adverse environmental effects (refer to Section 1101 for all applicable definitions). Specific objectives include the following:
  - 1. Conservation and protection of precautionary and prohibitive slopes from inappropriate development such as excessive grading, land-form alteration and extensive vegetation removal.
  - 2. Avoidance of potential hazards to life and property and the disruption of ecological balance that may be caused by increased runoff, flooding, soil, erosion and sedimentation, blasting and ripping of rock and landslide and soil failure.
  - 3. Protection of the entire township from uses of land that may result in subsequent expenditures for public works and disaster relief and adversely affect the economic well-being of the township.
  - 4. Encouragement of the use of precautionary and prohibitive slopes for open space and other uses that are compatible with the conservation and protection of natural resources.
- B. Applicability and scope. This regulates the circumstances in which any use may occur on areas of precautionary and prohibitive slopes.
- C. Permitted uses in areas of precautionary and prohibitive slopes. The following uses and no other are permitted in areas of precautionary and prohibitive slopes:
  - 1. Agricultural uses not requiring cultivation or structures.
  - 2. Game preserve, wildlife sanctuary, woodland preserve or similar conservation uses not requiring structures.
  - 3. Passive recreation.
  - 4. Water supply wells with the approval of the Township Engineer and consistent with the DNREC regulations.
  - 5. Other uses within these areas may be permissible upon approval of the Town via a conditional use or variance application.

- D. Prohibited uses in areas of precautionary and prohibitive slopes. The following uses and activities are specifically prohibited and shall not be subject to variance:
1. Structures.
  2. Cut and fill.
  3. Soil, rock or mineral extraction.
  4. Removal of topsoil.
  5. On-site sewage disposal systems.
  6. Roads, driveways and parking lots.
- E. Conditional uses in areas of prohibitive slopes. The Town is authorized to grant conditional uses in the form of variances for the following uses, subject to recommendations of the Township Engineer.
1. Agricultural cultivation and agricultural uses requiring structures.
  2. Conservation uses requiring structures.
  3. Passive recreation uses requiring structures.
  4. Utility easements and rights-of-way.
  5. Accessory structures
  6. Individual driveways accessory to single-family detached dwellings only if the Town determines that no practicable alternative alignments exist.
- F. Conditional uses in areas of precautionary slopes. The Town is authorized to grant conditional uses in the form of variances for the following uses, subject to recommendations of the Town Engineer.
1. district in which the property is located.
  2. Recreation use, whether open to the public or restricted to private membership, such as parks, camps, picnic areas and golf courses, when permitted in the district in which the property is located. Not to be include enclosed structures excepting toilet facilities but permitting small shelters usually found in developed outdoor recreational areas. Any toilet facilities provided shall be connected to central water and sewage systems.
  3. Stormwater management facilities
  4. Roads, driveways and parking lots.
  5. Central sanitary sewer systems.
  6. Accessory uses and structures.
- G. Standards for variances. The Town, in considering a variance, shall consider the following:
1. Degree of modification proposed to the topographic, soil and vegetation resources.
  2. Techniques and extent of mitigation proposed to offset potential adverse environmental effects.
  3. Effects on adjacent and neighboring properties.
- H. Additional standards for variances. An affirmative decision shall not be issued by the Town for a variance unless there is evidence that:

1. Development is being proposed on areas of precautionary or prohibitive slopes only because no other alternative location is practicable.
  2. Earthmoving activities and vegetation removal will be conducted only to the extent necessary to accommodate the proposed uses and structures and in a manner that will not cause excessive surface water runoff, erosion, sedimentation and unstable soil conditions.
  3. Mitigation techniques will be utilized, including but not limited to retaining walls, tree wells, the establishment of ground covers and/or low spreading shrubs and the use of erosion control fabric.
  4. Proposed structures will be of sound engineering design and footings will be designed in response to the site's slope, soil and bedrock characteristics.
- I. Application procedures for variances. An application for a permit shall be filed with the Town who shall make an initial determination on the application. For a use other than those permitted in this section, an application seeking approval for a variance shall be forwarded to the Town, as appropriate, along with required studies or information. The application for a variance shall be accompanied by the following:
1. Plans drawn to a scale of at least one inch equals 50 feet depicting the following:
    - a. Location, dimensions and elevation of the property.
    - b. Existing and proposed uses and development.
    - c. Existing and proposed contours at two-foot intervals.
    - d. Location and boundaries of steep slopes and very steep structures.
    - e. Cross-sections and elevations of the property and proposed structures.
    - f. Existing and proposed land cover characteristics of that portion of the property within the area of precautionary or prohibitive slopes, indicating wooded areas, open areas, ground cover types, any areas with impervious surfaces and subsurface soil types.
  2. Photographs showing existing uses, vegetation and topography of areas of precautionary and prohibitive slopes.
  3. Narrative report describing the slope, soil and vegetation characteristics of that portion of the property within the area of the precautionary or prohibitive slopes. Such report shall also describe:
    - a. Proposed types of structures and methods of construction, types of foundation system (s) to be employed and proposed landscaping, sewage disposal and water supply.
    - b. Sediment and erosion control measures.
    - c. Engineering and conservation techniques intended to alleviate adverse environmental effects that may be created by the proposed use.

**Section 1106**

**Drainageways.**

- A. In addition to the open space protection, the drainageway area protected shall be kept open to provide continuous drainage corridors. Positive surface drainage in these areas shall be preserved. The protected area may be regraded and reshaped to provide for stormwater management and drainage.

- B. The following standards shall govern the design of stormwater management or surface drainage systems in drainageways in conjunction with the Delaware Department of Natural Resources and Environmental Control (DNREC):
  - 1. The drainage shall be designed to slow the time of concentration on the site and retain maximum ground infiltration.
  - 2. Where flows permit, the channels shall be designed as grassed swales, wetlands, or mesic grasslands encouraging sheet flow, except in forests.
  - 3. All permanent pool stormwater management ponds shall be designed to have aquatic benches planted approved plant materials.

**Section 1107 Water Resources Protection Areas (WRPA).**

Water resource protection areas are Class A Wellheads and Recharge Areas. All such areas are as depicted on the three-map series "Water Resource Protections Areas for the City of Newark, City of Wilmington, New Castle County, Delaware," prepared by the University of Delaware Water Resources Agency dated 2001 and revised 2006 ([www.wr.udel.edu](http://www.wr.udel.edu)). These areas shall be protected as required by the following sections to protect the Town's water supply resources from contamination and pollution.

**Section 1108 Wellheads Class A.**

- A. Areas within three hundred (300) feet of the public water supply well shall be one hundred (100) percent open space.
- B. The protection area around the well may be reduced to a one hundred and fifty (150) foot radius provided a hydrogeological report, prepared by a Delaware Registered Geologist and submitted to the satisfaction of the Delaware Geological Survey and the DNREC, is prepared. The report must certify that (1) the minimum 60-day time of-travel from a point to the public water supply well is maintained and (2) the well draws from a confined aquifer.
- C. The natural runoff flowing into wellhead areas shall be allowed and all new stormwater run-off shall be diverted around the wellhead protection areas wherever practical.
- D. The stormwater system's discharge to wellhead WRPA's shall be by sheet through a grassland or discharge from a stormwater management facility having a wetland or aquatic bench. Stormwater runoff from all parking areas shall be directed to a stormwater management facility before it is discharged into a wellhead WRPA.
- E. Within the wellhead area, impervious surfaces shall be limited to the buildings and access associated with the well and distribution and treatment facilities and their maintenance.
- F. The minimum lot area for a proposed public water supply well and related facility drawing from a confined aquifer shall be 1 acre and the minimum lot area for a public well drawing from an unconfined aquifer shall be 2 acres.
- G. This Section does not apply to wellheads constructed prior to December 31, 2007. All existing wellheads constructed prior to this date are considered as being "grandfathered" and the regulations of the section do not apply.

**Section 1109 Recharge Areas.**

Recharge Areas are those areas with high percentages of over 90 percent sand and gravel that have "excellent" potential for recharge as determined through a Stack Unit Mapping Analysis performed originally by the Delaware Geological Survey. All such areas are as depicted on the three-map series "Water Resource Protections Areas for the City of Newark, City of Wilmington, New Castle County, Delaware," prepared by the University of Delaware Water Resources Agency dated 2001 and revised 2006 ([www.wr.udel.edu](http://www.wr.udel.edu)). These areas shall be protected as required by the following sections to protect the Town's water supply resources from contamination and pollution.

- A. Within Multifamily Residential, Office, Commercial, Industrial, Transportation/Utility, Institutional Uses - Development within the recharge area may occur by right provided the gross percent impervious cover of the parcel within the recharge area does not exceed 30%. In situations where the existing impervious cover of a property is over 30% and the applicant desires to re-develop the property, the gross impervious cover shall be equal to or less than the original impervious cover percentage of the original site. In areas zoned as either Office, Commercial, Industrial, or Institutional within Middletown the applicant can exceed 30% impervious cover but not exceed 50% impervious by submitting an environmental study and report certified by a state registered professional geologist or professional engineer with a background in hydrogeology that indicates that additional development would not endanger the public or the environment. The report must contain a pre and post development water budget with plans for a recharge facility to infiltrate rooftop runoff in a annual quantity that is no less than the predevelopment recharge volume
- B. Low Density Residential Uses (1/4 acre per lot or larger) - New development within the environs of Middletown Proper may occur by right provided the gross percent impervious cover of the entire parcel and/or development within the recharge area to be constructed is 20% or less. In areas zoned as low density, single family residential within Middletown the applicant can exceed 20% impervious cover but not exceed 50% impervious by submitting an environmental study and report certified by a state registered professional geologist or professional engineer with a background in hydrogeology that indicates that additional development would not endanger the public or the environment. The report must contain a pre and post development water budget with plans for a recharge facility to infiltrate rooftop runoff in a annual quantity that is no less than the predevelopment recharge volume
- C. No underground or above ground storage tanks containing petroleum products or any hazardous chemicals shall be permitted in a designated recharge area.
- D. For all new construction, all structures shall be required to discharge all roof drains into underground recharge systems or splash onto lawn areas. No roof drains may be connected to the storm sewer system or splash on to pavement.

**Section 1110                      Boundary Determination for WRPA.**

- A. All subdivision and land development plans depicting development or land disturbance submitted for Town review shall be evaluated for the existence of water resource protection areas by scaling for distances shown on the water resource protection area map. If existing, the boundaries of the areas shall be delineated on the plan by the applicant's engineer.
- B. When there appears to be a conflict between the mapped boundary and actual site conditions, the applicant may engage the services of a Delaware licensed professional engineer or land surveyor set forth in this section to prepare a report intended to determine more accurately the precise boundary of the water resource protection area, which report shall be submitted to the Town with the detailed findings necessary to indicate the location of the boundary.
- C. The plan showing the boundary conflict should indicate the following:
  - 1. A detailed topographic layout of the subdivision and/or area to be developed prepared by a land surveyor or engineer.
  - 2. For wellhead and recharge boundary determinations, a site-specific geological and hydro-geological analysis shall be performed by a state-registered professional geologist or engineer with a background in hydro-geology and shall be based upon through site investigation and testing; and
  - 3. Evidence derived from a site-specific investigation which may include aquifer testing, test borings, test pits, observation wells, groundwater elevations and topography surveys as appropriate for the type of water resource protection area to clearly demonstrate that the area in question does not meet the definition of a water resource protection area as defined in this section.



- D. The applicant is permitted to make a submission to the Town of Middletown with the advice of the Delaware Geological Survey and the University of Delaware Water Resources Agency, to adjust the boundary or area designation based thereon. Such adjustments shall have the effect of exempting the subject parcel from the use regulations of this section and shall have the effect of amending the limits of the water resource protection area. The applicant will then be required to provide a notification sent by the DGS and UDWRA indicating that they concur with the amended boundary location in order to be exempted from the requirements of this section.

**Section 1111 Uniform Standards and Criteria.**

- A. The following standards and criteria shall be applicable to any limited use, special use or other use requiring an environmental impact assessment permitted pursuant to this Division:
1. Stormwater management facilities shall be designed and constructed in accordance with DNREC "Delaware Sediment and Stormwater Regulations," dated January 23, 1991 or as later revised.
  2. Applicants shall consider the following low impact development techniques to reduce impervious cover in recharge water resource protection areas.
- Narrower residential road cross-sections (24 feet wide) and road shoulders
  - Shorter road lengths
  - Smaller turn-arounds and cul-de-sac radii
  - Permeable paving for spill over parking areas
  - Smaller parking stalls and smaller parking demand ratios
  - Angled one-way parking
  - Clustered subdivisions with open space
  - Smaller front yard setbacks
  - Shared parking and driveways
  - Narrower sidewalks

To provide flexible development options, the amended ordinance should contain stormwater credits that permit the impervious cover to be increased with incorporation of the following techniques:

- Disconnect rooftop runoff to splash onto lawns or infiltrate into the groundwater table.
- Reforest disturbed areas along riparian stream corridors.
- Remove existing impervious surfaces from onsite or from other watersheds.
- Acquire and protect open space offsite through conservation easements.

**Section 1112 Environmental Impact Assessment Report.**

- A. If a proposed use requires an environmental impact assessment report, the applicant shall have such a report certified by a professional engineer, geologist or other certified professional in the applicable environmental discipline. Mitigation cannot be used where the conflict can be avoided or minimized. The report shall contain the following criteria, given in order of preference:
1. Site character. The report shall identify all potential on-site sensitive environmental concerns.
  2. Avoidance. Alternative sites or routes shall be identified that would not damage the resource or result in less resource damage. Reasons shall be provided explaining why using these sites is impossible or infeasible versus that proposed.
  3. Minimization. The applicant shall demonstrate that the plan minimizes the impact of the activity, route, or use on the resource. The applicant shall also demonstrate that the areas impacted shall be lowest quality and result in the least damage to the resource.

4. Mitigation. A mitigation plan shall be submitted indicating mitigation activities. On-site replacement is the most acceptable form of mitigation. However, mitigation can include restoration and enhancement after the use is abandoned. Mitigation by replacement on another site shall be at a ratio of two to one (2:1). Mitigation may also include enhancement; this ratio shall be four to one (4:1). Final Town approval is required for all other forms of mitigation not consistent with this section.

**Section 1113 Forests**

All young and mature forests shall be protected from clearcutting. A plan identifying the location and species of all trees with diameter of 6 inches shall be submitted.

**Section 1114 Reforestation Requirements.**

All open spaces to be reforested shall be planted according to the plant species listed in Table 11-16. The area around each tree shall be mulched. The entire area may be mulched or seeded in a perennial grass mix with a minimum thirty (30) percent indigenous herbaceous forest, or grassland species. Canopy trees shall be selected to provide a diversity of native plants. Plantings shall include a minimum of four (4) species. Where more than one hundred (100) canopy trees are required, a minimum of six (6) species shall be provided; no one species shall have less than five (5) or more than thirty (30) percent of the total trees.

1. Protected resources shall not be disturbed with roadways, parking lots or utility lines. The applicant must demonstrate no possible alternative to crossing the resource exists and the route selected must be the least disruptive.
2. Riparian buffer areas. Stormwater outfall shall be permitted, provided that the discharge velocity from the terminal end of the pipe or the associated energy dissipation practice does not exceed two (2) feet per second (fps) for the two (2) year frequency storm event. In addition, best management practices methods shall be used to convert concentrated flow to uniform, shallow sheet flow, filter sediments, and control erosion.

**REFORESTATION REQUIREMENTS PER ACRE**

<b>No. of Plants</b>	<b>Types of Plants</b>
1	4" caliper canopy
4	3" caliper canopy
10	1- ½" caliper canopy
6	1-½ " caliper or 5-6 ft. understory trees
50	6' whip canopy
30	bare root shrubs or 1 gallon pots

**Section 1115 Roads, Parking Lots and Utilities.**

- A. Protected resources shall not be disturbed with roadways, parking lots or utility lines. The applicant must demonstrate no possible alternate to crossing the resource exists and the route selected must be the least disruptive.
- B. Riparian buffer areas. Stormwater outfall shall be permitted, provided that the discharge velocity from the terminal end of the pipe or the associated energy dissipation practice does not exceed two (2) feet per second (fps) for the two (2) year frequency storm event. In addition, best management practice methods shall be used to convert concentrated flow to uniform, shallow sheet flow, filter sediments, and control erosion.
- C. To reduce impervious cover, residential neighborhood street widths within the recharge water resource protection areas shall not exceed 24 feet curb to curb.