



CHARACTERIZATION AND ASSESSMENT OF THE HEATHCOTE BROOK WATERSHED

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Cover Photo: SBMWA bacteria sampling Site HCB7 where Heathcote Brook crosses Mapleton Road in South Brunswick Township

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EXECUTIVE SUMMARY

The results of this characterization and assessment represent an opportunity to properly plan the landscape of the Heathcote Brook Watershed in an environmentally responsible way and to work proactively to protect water quality. Overall, waterways are experiencing moderate degradation due to sedimentation in Heathcote Brook and stormwater is impacting the health of waterways. Sedimentation is partly due to the makeup of the underlying soils and geology. While this condition is natural, many other factors are amplifying this problem. Population increases in the Heathcote Brook Watershed, and associated land use changes, are adding to the amount of impervious surfaces, which augment the frequency and intensity of stormwater, flooding, and erosion.

PLANNING FUTURE GROWTH

Finding: Populations in the Heathcote Brook Watershed townships, like the rest of New Jersey, are on the rise. The population went from 82,785 residents in 1990 to 108,852 in 2000, increasing by 31.5%. From 1986 to 2002 developed lands increased from 1440.6 acres to 2033.6 acres, a gain of over 41%. Developed areas are on the increase at the expense of the remaining forest, wetlands, and agricultural areas in the watershed. (See Landscape and Land Use sections for more information.)

Recommendations:

- If not already completed, buildout analyses for each municipality should be conducted. This will allow for predictions of future growth and where current policies could lead. Regulations could be evaluated to determine if they are protective enough for preserving environmental quality.
- One way to balance the population growth with increased development is to plan for and maintain areas as town centers. These areas can be planned as mixed-use developments (projects that integrate different land uses, such as restaurants, residences, offices, and parks) or low impact developments (ecologically friendly site development and stormwater management that aims to mitigate impacts to air, water, and land) for maximum benefit.
- Heathcote Brook Watershed contains many critical habitats for a variety of threatened and endangered species. Critical habitats cover 65.3% (3,718 acres) of the Heathcote Brook Watershed. Many of these critical areas are adjacent to existing developments, putting them under development pressure. The municipalities that make up the watershed should review and reconsider their zoning to coincide with these environmentally important areas, restricting development and fragmentation of these habitats. Also, open space preservation can use critical habitat data as a tool to plan where efforts can be focused.
- When evaluating rezoning and alternative planned developments, accurate scientific information on the carrying capacity of available water supplies, sewer systems, and other infrastructure needs to be considered, in addition to the goals and objectives of the municipality's Master Plan. It is highly recommended that those municipalities not currently in SBMWA's Municipal Assessment Program consider participating. Within the Heathcote Brook Watershed, Franklin Township has completed the Municipal Assessment process, while SBMWA hopes to begin work with South Brunswick and Plainsboro Townships in the near future. Through this

program, SBMWA works individually with each municipality to review the current Master Plan and ordinances, compare these documents to the goals and objectives of each decision-making committee, and provide recommendations of next steps to take to bring these goals and documents into harmony. SBMWA then follows up with the municipality to implement those recommendations deemed the highest priority by that municipality. SBMWA encourages a continued partnership with Franklin Township to implement key recommendations.

- The extensive sewer service areas that cover the Heathcote Brook Watershed increase the potential for development to occur, if it hasn't occurred already. Figure 13 shows the portions of South Brunswick that have already been sewerred. This Township could prioritize the next phase of sewer line installation in those areas that are not suitable for septic and preserve the lands in acceptable septic areas. This would concentrate development in non-septic areas. Maintaining current septic areas as such would also reduce potential for development and could help preserve critical habitats. Likewise, Plainsboro Township needs to preserve lands in their designated sewer service area, reducing development pressure. Preservation can occur via conservation easements, open space acquisitions, and environmentally sensitive zoning. Franklin Township should refrain from sewerred to reduce development pressure and preserve the Township's critical habitats within the Heathcote Brook Watershed.
- Increasing impervious cover and the resultant decrease in the amount of forest, wetlands, and agricultural areas is occurring in the Heathcote Brook Watershed as development continues. As a result, water quality is being affected and will continue to be a concern. One way to protect water quality is by decreasing the rate of conversion of forest, wetlands, and agricultural lands through participation in the New Jersey Farmland Preservation and Green Acres Programs, as well as by working with regional land conservation groups to preserve key tracts of land. Adopting and enforcing stream corridor ordinances and protecting riparian areas through conservation easements would also benefit the Watershed.
- Riparian corridors are being increasingly encroached upon for development in the Heathcote Brook Watershed. These areas are particularly sensitive to land use changes, as they are the natural buffers that protect the stream itself from a variety of pollutant sources. Placing of new construction in the Heathcote Brook Watershed needs to be sensitive to, or avoid altogether, the riparian corridors in order to maintain ecological integrity.

Applicable BMPS and Mitigation Approaches:

- To determine which resources are available in each municipality, South Brunswick and Plainsboro should each conduct a Natural Resources Inventory or an Environmental Resources Inventory (ERI), if not already completed. Such an inventory would document the location and extent of environmentally important and sensitive areas that should be taken into account when determining where development or increased impervious surfaces are to be placed. Franklin Township has already taken steps to complete an ERI by mid-2008 by working with Amy S. Greene

Environmental Consultants. The report will include information on soils, land use, aquifers, water recharge, water quality, air quality, threatened and endangered species, and known contaminated sites.

- To minimize the impacts of development, each Township could conduct a study of the existing public transportation system to encourage its use and suggest changes that may make it more usable.
- The LEED (Leadership in Energy and Environmental Design) Program for existing and new development should be encouraged by the Townships for any proposed development or redevelopment. LEED emphasizes state of the art strategies for sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. For more information on the LEED Program, visit the website (<http://www.usgbc.org/>) of the U.S. Green Building Council, which developed the Program.
- Before a property can be developed, the owner is required by federal and state law to determine whether wetlands are present. The owner submits a Letter of Interpretation (LOI) Application to NJDEP, which includes wetland delineation maps, soil data, and plant and wildlife reports. A copy of these LOI applications is kept at the municipal hall. It is very important for the Township to review these LOI Applications and have elected or appointed officials walk the site in question to confirm that their understanding of the wetland area agrees with the property owner's delineation. If the Township notices a discrepancy, they can request that NJDEP come to the site and verify or modify the wetland delineation. Once an LOI has been approved by NJDEP, it is very difficult to amend it. When NJDEP approves the LOI Application, this officially determines the wetland classification and its boundaries and buffer size. In turn, this can affect where and how large of a footprint the development can have.
- NJDEP also encourages public comment on the wetland permit applications. Townships should be aware of any pending permits, review them, and provide comments to be able to protect their natural resources and have more control over development.
- Townships can also provide input to NJDEP on wetland mitigation decisions, which require compensation for freshwater wetland disturbances by requiring the developers to provide the creation of at least two acres of wetland for each acre disturbed.

Applicable Model Ordinances:

- The adoption or enforcement of an Impervious Cover Limitation Ordinance applicable to new developments could significantly slow the effects of development and protect high groundwater recharge areas. Princeton and East Amwell Townships have adopted variations on this ordinance, with Princeton limiting impervious cover to an acceptable flat percentage, while East Amwell's stronger ordinance for the Sourlands region imposes a sliding scale percentage depending on the size of the lot involved. An existing ordinance that encompasses both of these variations is in effect in New Castle County, Delaware. This ordinance caps the acceptable impervious surfaces at 20% while imposing a sliding scale

impervious cover reduction for any redevelopment depending on the lot size. New Castle County's overlay ordinance for water resource protection areas is found within Article 10 (Environmental Standards) or Section 40.10.380 and can be found at <http://www.co.newcastle.de.us/CZO/nccportal.asp>.

- Consider creating an ordinance to require the installation of pervious pavement for redevelopment projects. This would serve to actually reduce the impacts of impervious cover. One approach is to mandate the use of pervious pavement for driveways, walkways, and other paved areas such as parking lots. Bethany Beach in Delaware has such an ordinance, which can be found at <http://www.townofbethanybeach.com/documents/500/PourSurfOrd.pdf>. A second approach is to make the requirement part of a "Low-Impact Development" (LID) Ordinance that incorporates LID techniques into a land development ordinance. The Town of Warsaw, Virginia enacted such a mandatory LID Ordinance, which can be viewed at <http://www.riverfriends.org/LinkClick.aspx?fileticket=VlaUwo%2fvYtQ%3d&tabid=86&mid=425>. Although this ordinance does not specifically refer to pervious pavement, that is one of the potential methods for maintaining the pre-development volume of runoff. An incentive-based rather than mandatory approach used by some communities, such as the City of Fitchburg, Wisconsin, is to charge stormwater utility fees to private property owners based on the amount of impervious area on a site. These fees pay for the City's stormwater management program. Property owners can apply for credit on their stormwater bill for properly functioning on-site stormwater management BMPs, beyond what is required by City Ordinance. One such BMP includes pervious pavement. Fitchburg's Stormwater Utility Credit and Rebate application form can be viewed at <http://www.city.fitchburg.wi.us/files/2550961.pdf>.
- The adoption or enforcement of a stream corridor ordinance will prevent further development in this key area while preserving the riparian corridor. South Brunswick Township has passed a stream corridor ordinance and Franklin Township has protective language included in its land use ordinance. To give added protection, Franklin Township should consider establishing a separate stream corridor ordinance. SBMWA's model stream corridor ordinance is included in Appendix H. Some townships in New Jersey are also incorporating critical areas into their stream corridor ordinances, making them much stronger. Each Township should consider including such language in their ordinances and Plainsboro should consider adopting a stream corridor ordinance for their Township.

Finding: Impervious cover prevents the movement of water into the soil. The Heathcote Brook Watershed has an average impervious cover of 12.9%, however many areas are rated at 26% and above (Figure 19). An impervious coverage between 10 and 25% results in the loss of sensitive elements from the stream system while those areas with an impervious cover greater than 25%

experience a shift to poor stream conditions that includes diminished aquatic diversity, water quality, and habitat function. The municipalities also need to be aware that much of the underlying soils in the Heathcote Brook Watershed are moderately to highly erodible and also have slow to very slow infiltration rates, which result in high to very high surface runoff in this region. Water quality impacts due to the erodible nature of the soils in this region have been noted. (See Land Use and Water Quality sections for more information.)

Recommendation:

- Increasing impervious cover will only exacerbate water quality problems by increasing the frequency and intensity of storm flows and flooding, while also increasing the NPS pollution contributions. Municipalities need to incorporate innovative ways to plan developments including low impact development, re-zoning (changing zoning classifications to permit development that is less dense or restrictive), mixed-use development (projects that integrate different land uses, such as restaurants, residences, offices, and parks), conservation design (placing a development on the least environmentally restrictive portion of a property, incorporating water recycling, energy efficiency, and sustainably produced materials into building design), and town-center designation (centralized growth areas through incentives and allows for developing at higher densities). For example, Franklin Township has already zoned many areas in the Heathcote Brook Watershed with a large lot size (requiring three or five acre lots) to encourage less dense development. These methods enable municipalities to accommodate the growth occurring throughout the watershed while significantly reducing the harm from such development. Redeveloping existing urban land uses will also help to maintain or reduce current amounts of impervious cover in those areas.

Applicable BMPs and Mitigation Approaches:

- Disconnect downspouts from stormwater systems at all municipal properties and encourage businesses and residents to do the same. Downspouts should be directed either into a vegetated bed or a rain barrel. Among other things, water from a rain barrel can be used to water nearby vegetated beds, rinse garden tools or muddy boots, or wash the car.
- Install vegetated filters next to roads and sidewalks, enabling the stormwater to enter as sheet flow. This will remove suspended sediments and other pollutants from the stormwater runoff as well as encourage infiltration and the reduction in stormwater volumes entering waterbodies or stormwater systems. (See the NJ Stormwater Best Management Practices Manual, NJDEP, 2004b.)

Applicable Model Ordinances:

- The adoption or enforcement of an Impervious Cover Limitation Ordinance applicable to new developments could significantly slow the effects of development. Princeton and East Amwell Townships have adopted variations on this ordinance with Princeton limiting impervious cover to an acceptable flat percentage while East Amwell's stronger ordinance for the Sourlands region imposes a sliding scale percentage depending on the size lot involved. For more information, see the

references to these model ordinances in the model ordinance section on pages 77-78.

- Consider creating an ordinance to require the installation of pervious pavement for redevelopment projects. This would serve to actually reduce the impacts of impervious cover. For more information, see the references to model pervious pavement ordinances in the model ordinance section on page 78.

PROTECTING & MAINTAINING GROUNDWATER RESOURCES

Finding: There are 13 known contaminated sites (KCSs) in this 9.15 square mile watershed. Twelve of the sites are found within South Brunswick Township alone, one of which is a Superfund Site. (See Known Contaminated Sites section for more information on each KCS and how they affect groundwater.)

Recommendation:

- The large number of KCSs in the Heathcote Brook Watershed warrants that the potentially responsible parties and NJDEP remediate any contamination present, particularly at the Superfund site.
- Until remediation is complete, all parties should monitor, as required, to ensure that contamination is contained and that the potential water supply it feeds and the surrounding areas are protected from potential contamination.

Applicable BMPs and Mitigation Approaches:

- Potentially responsible parties should work with NJDEP to ensure that the appropriate actions are taken to fully remediate the contamination.
- For certain types of contamination, stormwater could be conveyed off site through a vegetated swale to prevent infiltration into the ground where it could contribute to the further spread of contamination.

Applicable Model Ordinances:

- Townships can adopt an ordinance requiring that site plan approval be conditioned upon an applicant providing the completion of a Phase I Environmental Site Assessment Report when a KCS is sold. If the report recommends a Phase II Environmental Site Assessment Report, the report must be done at the request of the purchaser if it has not already been completed. Franklin Township in Gloucester County has amended their site plan approval process to incorporate this change.
- Townships should keep a list of KCSs attached to property record cards to ensure that if a property is sold at a tax sale, the status is made known to the purchaser.

Finding: Much of the Heathcote Brook Watershed (44.8%) contains areas with high groundwater recharge. Between 1986 and 1995 Heathcote Brook lost 10.2% of its groundwater recharge capability due to continued development in high groundwater recharge areas. Groundwater recharge areas need to be protected by ordinances or preserved by their respective municipalities to restrict development in these areas. The municipalities within

the Watershed should use high groundwater recharge areas, in addition to critical habitat data, when setting priorities for additional open space preservation. Reduced development in the high groundwater recharge areas will aid in ensuring that plentiful supplies of water are available for the future and that streams will continue to flow. (See Water Supply section for more information.)

Recommendations:

- Since some of the high groundwater recharge areas are located in agricultural areas in Franklin, Plainsboro, and South Brunswick Townships, these municipalities need to encourage regulations on the use of chemicals (especially ecologically harmful chemicals like pesticides) in the agricultural areas above groundwater recharge zones to prevent possible contamination (Figure 17). If this is not possible, farms need to review and evaluate the many options available to reduce their pesticide use in such areas. For example, participation in the New Jersey Conservation Reserve Enhancement Program (CREP) helps farmers reduce impairment from agricultural water runoff sources in an effort to improve water quality along both impaired and unimpaired New Jersey streams through best management practices (BMPs).
- Municipalities could institute an educational campaign directed at all property owners on the effects of pesticide use on surface and groundwater. Property owners could be encouraged to minimize pesticide use and to join SBMWA's River-Friendly Program for one-on-one guidance as to how to reduce pesticide use or find less toxic alternatives. SBMWA works individually with each property owner to assess current land stewardship practices and provide recommended actions for improvement. The River-Friendly Program focuses on water quality, water quantity, wildlife and habitat enhancement, and education components, all geared towards reducing NPS pollution.
- Municipalities should limit increases in impervious surfaces in the Watershed in order to prevent costly mitigation efforts to restore recharge areas in the future. (See Planning Future Growth, above.)
- Municipalities should prioritize land in high recharge areas for preservation and protection. As an example, identifying lands located above high recharge areas that are also riparian areas and critical habitats for threatened and endangered species (Figure 18) could be one way to target land for preservation. Since listing specific properties in this report could affect their purchase price, SBMWA has chosen not to do so here.

Applicable BMPs and Mitigation Approaches:

- To ensure that groundwater and aquifers maintain adequate water supply, municipalities can require the use of stormwater BMPs, such as infiltration ponds and basins in new developments. These ponds are lined with permeable soils and materials that allow water to be slowly released back into the ground. Other stormwater BMPs that address infiltration include bioretention basins, pervious pavement (see above), vegetated swales, and vegetated filters to capture discharge as sheet flow (NJDEP, 2004b). BMPs such as these should be implemented at each new development or

redevelopment project. However, each site is unique. For information on the use of BMPs under the New Jersey stormwater management rules, see SBMWA's document, *New Jersey's Nonstructural Stormwater Strategies Point System-A Primer*, available at <http://www.thewatershed.org/info/2007NSPSPprimer.pdf>

- In order to minimize the use of pesticides and reduce the harmful effects on people and the environment, New Jersey requires Integrated Pest Management (IPM) to be used in each public, private, and charter school. IPM does not prohibit the use of pesticides, but advocates using the most effective, least-risk option. Pesticides are only used as the last resort under IPM. To further strengthen this policy and protect a widening area of people and the environment, Franklin, Plainsboro, and South Brunswick Townships could join 53 other Boroughs, Townships, and Cities by enacting a resolution requiring IPM to be used in parks and on other municipal properties. In addition to parks, municipal right-of-ways such as roadsides, drainage ditches, swales, or bridge culverts could be included in the municipal IPM program. An example of a model IPM resolution drafted by New Jersey Environmental Federation can be found at: <http://cleanwateraction.org/njef/pfzresolution.pdf>. A resolution such as this could be used to push for enactment of an IPM ordinance, which results in a much stronger policy.

Applicable Model Ordinances:

- Each municipality should adopt or enforce an Impervious Cover Limitation Ordinance for new developments and consider creating an ordinance requiring pervious pavement installation for all redevelopments. (See model ordinance section in the impervious cover finding, above, for more details.)
- To limit the likelihood of inadvertent exposure to pesticides and the resulting health risks, there are numerous configurations of ordinances enacted in New Jersey relating to advance notification of applications. For example, Old Bridge Township in Middlesex County adopted an ordinance requiring notification via a newspaper ad whenever pesticides will be applied on a community-wide or area-wide basis. Similar ordinances have been enacted in the townships of West Milford (Passaic County), Vernon (Sussex County), and Hanover (Morris County), and in the boroughs of Bernardsville, Cresskill, and Tenafly. New York State has taken the notification laws to an even stricter level. The state authorizes local county laws that require commercial applicators to provide written notice to all occupants within 150 feet of the application site, as well as requiring residents applying pesticides on their own private property to post lawn signs if the application covers more than 100 square feet. Information on New York's Neighbor Notification Law, including the text for the law and the NY Department of Environmental Conservation implementing regulations, as well as a list of New York counties that have opted into the law can be found at: <http://www.dec.state.ny.us/website/dshm/pesticide/neighbor.htm>. A citizens' guide to the New York State pesticide notification laws can be found at: <http://www.oag.state.ny.us/>

environment/pesticide_guide.html. Notification laws could also require all applicators to provide information on the amount and type of pesticide applied within the municipality. Each of the municipalities within the Heathcote Brook Watershed should consider enacting some version of the pesticide application notification ordinance.

- To protect critical areas, an ordinance could be passed that would prohibit pesticide use in specific zones such as forests or stream corridors. Many towns in Maine have enacted variations on this theme. For a listing of the different types of municipal pesticide ordinances and the Maine Townships that have adopted them, see http://www.maine.gov/agriculture/pesticides/pdf/municipal_list.pdf. An example of an ordinance adopted by Wells, Maine, which includes language restricting pesticide applications within the special Branch Brook Aquifer Protection District is found within the Land Use Ordinance at http://www.e-codes.generalcode.com/codebook_frameset.asp?ep=fs&t=ws&cb=1006_A. The section of the code that applies is 145-31.G.2. To get there, open the table of contents and click on the “+” sign in front of “Part II – General Ordinances”, “Chapter 145: Land Use”, and “Article V”. Then click on 145-31.
- To prohibit fertilizer applications in certain circumstances that would directly affect water quality, such as during a runoff event, municipalities could adopt the NJDEP’s Fertilizer Application Model Ordinance. This model ordinance can be found at <http://www.state.nj.us/dep/watershedmgt/DOCS/TMDL/Fertilizer%20Application%20Model%20Ordinance.pdf>. The model ordinance could also be modified to create a new ordinance prohibiting pesticide applications under similar circumstances.
- Several counties and townships have executed variations on IPM policies restricting the application of pesticides to very limited circumstances, sometimes referred to as Pesticide-Free Zones (PFZs). For example, Burlington County has established an IPM plan for the county parks that only permits the use of two types of chemical pesticides. Some Townships in New Jersey, including Brick, Chatham, Wall, Irvington, and Ocean City have passed resolutions creating PFZs. NJ Environmental Federation has created a model IPM resolution that includes the designation of PFZs on certain public properties. Clifton, Pine Beach, and Hazlet have all adopted resolutions based on this model. This model resolution can be found at: <http://cleanwateraction.org/njef/pfzresolution.pdf>.

PROTECTING WATER QUALITY

Finding: The nature of Piedmont geology has a large influence on the water resources and environmental quality of the Heathcote Brook Watershed. Sandstones, siltstones, and shales typify the Piedmont Physiographic Province. (See Geology section for more information.)

Recommendation:

- The Magothy Formation is part of the high yielding Potomac-Raritan-Magothy Aquifer system. Since this aquifer is susceptible to groundwater

contamination because of its widespread exposure and high sand content, its outcrop area should be considered when prioritizing areas for protection. This factor could be included with high groundwater recharge areas, riparian areas, and critical habitats when setting priorities for additional open space preservation (see recommendation in Maintaining Groundwater Resources, above). The Magothy Formation and its related aquifer should be considered when making municipal decisions about approving proposed development locations and how strict to be about the related stormwater management practices.

Applicable BMPs and Mitigation Approaches:

- South Brunswick and Franklin Townships could strengthen their stormwater management plans for areas where the Magothy Formation outcrops (see Figures 8 and 9). To protect this susceptible aquifer recharge area, these municipalities can require extensive use of stormwater BMPs for both new developments and redevelopments. Examples of stormwater BMPs that address infiltration include infiltration ponds and basins, bioretention basins, pervious pavement (see above), vegetated swales, and vegetated filters to capture discharge as sheet flow (NJDEP, 2004b).

Applicable Model Ordinances:

- The bedrock formations more resistant to erosion, such as the Lockatong and Jurassic Diabase, tend to form ridges. Protecting the associated steep slopes will reduce the potential for erosion from development activities, stormwater outfall flows, road and driveway cuts and crossings, and tree removal. This has been done by Montgomery Township in their Land Development Ordinance (Section 16-3, 16-6.4, and 16-5.6) and Critical Areas Ordinance and West Amwell in their Stream Corridor Ordinance. For information on how to get access to these ordinances, see Appendix H.
- Townships within the Heathcote Brook Watershed should enact a strong Stream Corridor Ordinance or strengthen their existing ordinance to protect water quality. SBMWA's model stream corridor ordinance is included in Appendix H.

Finding: Much of the Heathcote Brook Watershed is classified as having hydrologic soil group C, covering 3,001.4 acres out of a total of 5,854.7 acres (51.3%) in the entire watershed. Hydrologic soil group C represents soils with a slow infiltration rate, and is representative of the moderately consolidated soils seen in the Piedmont Physiographic Province. The second most common hydrologic soil group in the Heathcote Brook Watershed is group B, covering 28% of the watershed and representing moderate infiltration rates. Runoff from these soil groups will be moderate to rapid due to these moderately fine-to coarse-textured soils' moderate to slow infiltration rates.

Most of the Heathcote Brook Watershed is also assessed as having high K-factors, or high soil erodibility. These areas have the greatest potential for

benefit from soil conservation practices and the greatest likelihood for harm from construction and development.

Based upon the visual assessment data and observations during the biological assessments, the most likely stressor affecting the macroinvertebrate communities in Heathcote Brook is heightened sedimentation. The basis for this heightened sedimentation may be due to the soil composition and moderate to high erodibility of the Heathcote Brook Watershed itself, which is exacerbated by the high amount of developed lands in the watershed. The nature of the Piedmont soils in the Heathcote Brook Watershed is an important factor impacting water quality of Heathcote Brook, especially macroinvertebrate communities and their habitats. (See Water Quality and Soils sections for more information.)

Recommendation:

- Because municipalities rely on their local Soil Conservation Districts (SCDs) to enforce the soil erosion and sediment control regulations, SCDs need to be aware of the characteristics of a site's underlying soils when they review and enforce plans to control and manage soils during construction activities.
- Due to the somewhat consolidated nature of the stones and soils in the Piedmont Physiographic Province, infiltration rates for water entering the ground are moderate to slow. This has the potential to produce a high amount of runoff from storm events. This stormwater runoff needs to be controlled or managed by the municipalities so that it does not degrade water quality or increase the potential for flooding and erosion.
- Maintenance of soil integrity in areas with highly erodible soils can be done by encouraging environmentally friendly construction, properly implementing soil and erosion control BMPs, encouraging forested areas, and increasing or creating riparian buffer zones. Streambank stabilization and planting projects should be encouraged wherever streambanks are actively eroding along Heathcote Brook or its tributaries. Prior to implementation, a thorough scientific assessment should be done to ensure the appropriate location of restorations and appropriate methods used. Farms located within these areas could greatly benefit by working with NJ CREP implementing soil conservation practices.
- Heathcote Brook, Carters Brook, and an unnamed tributary have been identified as candidates for C1 designation. Acceptance by the NJDEP of the nomination of these streams as C1 waterways will aid in protecting the riparian corridors and maintaining the vegetated cover that stabilizes the soils. C1-designated waterways are afforded a higher level of protection from development while minimizing impacts from stormwater runoff; providing floodwater storage, erosion control, and groundwater recharge; and maintaining biological habitats and diversity. South Brunswick and Franklin Townships should actively support these nominations in order to move along the NJDEP acceptance process. The NJDEP Bureau of Water Quality Standards and Assessment is responsible for overseeing the Surface Water Quality Standards, which include stream designations such

as C1. The Bureau can be reached at (609) 777-1753 and more information is available at <http://www.state.nj.us/dep/wms/bwqsa/>.

- The headwaters of Heathcote Brook are located in South Brunswick Township. Residents, businesses, and South Brunswick municipal officials need to be particularly aware of their roles in impacting and improving water quality in this Watershed. The prevention and minimization of NPS pollution is important everywhere along streams, but particularly in the headwaters. Property owners along streams should consider participating in SBMWA's River-Friendly Certification Program to reduce their contribution to NPS pollution. SBMWA works individually with each property owner to assess current land stewardship practices and provides recommended actions for improvement. The program focuses on water quality, water quantity, wildlife and habitat enhancement, and education components, all geared towards reducing NPS pollution in different ways.

Applicable BMPs and Mitigation Approaches:

There are many stormwater best management practices that could be implemented in the Heathcote Brook Watershed to reduce the sediment contribution from stormwater runoff. Such BMPs could also reduce the frequency of flooding, erosion potential, and other pollutant loads. For a detailed listing of potential BMPs, refer to the New Jersey Stormwater Best Management Practices Manual (NJDEP, 2004b).

- The new NJDEP Stormwater Management Rules (N.J.A.C. 7:8) state several requirements for large new developments and redevelopments focusing on minimizing disturbances and impervious surfaces, increasing groundwater recharge, reducing peak flows, and reducing pollutants (such as suspended sediment) carried by stormwater. Key BMPs that increase infiltration and filter out sediments include infiltration basins, bioretention basins, pervious pavement (see above), vegetated swales, and vegetated filters to capture discharge as sheet flow (NJDEP, 2004b). BMPs such as these should be implemented on each new development or redevelopment project. However, each site is unique. For information on the use of BMPs under the New Jersey stormwater management rules, see SBMWA's document, *New Jersey's Nonstructural Stormwater Strategies Point System-A Primer*, available at <http://www.thewatershed.org/info/2007NSPSprimer.pdf>.
- The implementation of stormwater BMP retrofits in areas being redeveloped, or on municipal properties, could result in cleaner water in Heathcote Brook and its tributaries. In this case, existing stormwater management BMPs can be improved to better protect downstream waterbodies. Vegetating existing swales located near Heathcote Brook or its tributaries is one example of a low-cost method that can result in positive changes.
- Agricultural activities (as some of this region is still farmland and many farms are located near streams and in highly erodible areas) need to investigate the use of BMPs to help alleviate sediment loads into area streams. The New Jersey CREP works with farmers to fund and implement such BMPs. For more information about New Jersey CREP,

please visit www.fsa.usda.gov/pas/publications/facts/html/crepnj04.htm. For a comprehensive guide to all the various state and federal grant programs for farmers and other landowners, visit <https://www.njaudubon.org/Conservation/PDF/IncentiveGuide.pdf> for the “Guide to Conservation Incentive Programs For New Jersey Landowners and Farmers”, published by the New Jersey Audubon Society. It includes information on CREP, the Landowner Incentive Program (LIP), Wildlife Habitat Incentives Program (WHIP), Environmental Quality Incentives Program (EQIP), Conservation Reserve Program (CRP), Grassland Reserve Program (GRP), and others.

- Streambank restorations and reforestations are excellent BMPs to increase infiltration of stormwater, filter out pollutants such as sediment and nutrients, stabilize barren soils and streambanks, reduce streambank and sediment erosion, and with time reduce stream temperatures through the creation of shaded areas which results in improved in-stream habitat. Streambank restorations and reforestations should be pursued whenever possible for stream reaches along Heathcote Brook and its tributaries showing signs of erosion and/or minimal vegetation.

Applicable Model Ordinances:

- To help alleviate any heightened sedimentation of waterways within the Heathcote Brook Watershed, municipalities should work with the appropriate Soil Conservation District to ensure that proper measures are taken to contain sediment at construction sites. County Soil Conservation Districts currently approve and oversee Soil Erosion and Sediment Control Plans for sites 0.25 acres in size or more. Best management practices, such as constructing silt fences and covering stockpiles of soil, should be properly installed and maintained for the duration of construction activities. More information on the New Jersey Soil Conservation Districts and their regulations is available at <http://www.state.nj.us/agriculture/divisions/anr/nrc/conservdistricts.html>.
- An ordinance incorporating soil protection will help protect streamside and other vegetation and prevent materials from washing into streams and degrading habitat and water quality post-construction. For example, a stormwater management ordinance (SMO) can address the protection of soils from damage during stormwater runoff. Model SMOs are available from Hunterdon County (<http://www.co.hunterdon.nj.us/pdf/stormwater/HCETModelOrdinanceFINALNov05.pdf>) and from NJDEP (http://www.njstormwater.org/tier_A/pdf/NJ_SWBMP_D.pdf). Stream corridor ordinances also establish protections favorable for soil retention within a riparian buffer. SBMWA is currently updating the model stream corridor ordinance. Please contact SBMWA for guidance; we would be happy to work with any township on this issue. A woodlands protection ordinance protects soil post-construction. Chatham Township has such an ordinance, which can be viewed at: http://www.chathamtownship.org/ORDINANCE_2005-023.pdf. Protecting steep slopes reduces the potential for erosion. This has been done by Montgomery Township in

their Land Development Ordinance and Critical Areas Ordinance and by West Amwell in their Stream Corridor Ordinance (see above).

- A woodlands protection ordinance would help preserve woodlands when land is being developed. The best way to prevent sedimentation in streams is to keep soil anchored on land by the roots of trees, shrubs, and native vegetation. Preserving established woodlands is one of the first lines of defense. Another result of adopting this type of ordinance is to filter out sediments and pollutants from stormwater flow before reaching the waterbody, reducing soil erosion in the streams, and moderating temperature by providing shade and windbreaks. The Hunterdon County Environmental Toolbox contains a model woodlands protection ordinance that can be found at: http://www.co.hunterdon.nj.us/planning/ordinances/toolbox/Environmental_Toolbox-Woodlands.pdf.
- Adoption of an afforestation ordinance would also protect streams from additional sedimentation resulting from development. An afforestation ordinance requires developers to plant trees and shrubs to create a woodlands habitat, regardless of the amount of tree removal from the site. The Hunterdon County Environmental Toolbox (see above) refers to one such ordinance adopted by Washington Township in Mercer County (Ordinance 103-53) which requires that for most zoning districts, a site development plan must “provide a minimum of 20% of the tract area in forest, if less than 60% of the predevelopment site is woodlands and provide a minimum of 40% of site in forest, if greater than 50% of the predevelopment site is in woodlands either through conservation or through afforestation...”

Finding: The visual assessment information, biological data, and bacteria monitoring results show that there are impacts to water quality, mostly stemming from the high amount of developed land in the Heathcote Brook Watershed. The Heathcote Brook is listed in NJDEP’s 2004 Integrated List as impaired due to fecal coliform and as having insufficient data to determine if benthic macroinvertebrate health is attained (NJDEP, 2004a). The Draft 2006 Integrated List of Waters (NJDEP, 2006c) lists Heathcote Brook as impaired for fecal coliform and “Pollutant Unknown”, referring to an impairment of aquatic life. (See Water Quality section for more information.) Since bacteria results were high at all sites, particularly during wet weather, measures should be taken throughout the watershed to reduce bacterial loads to Heathcote Brook and its tributaries.

Recommendations:

- In order to accurately assess the environmental health of Heathcote Brook, long-term trends in water quality need to be determined. Currently, there is insufficient monitoring data (biological or chemical) on the water resources in this region, especially basic water quality information for many of the area’s tributaries, which have an impact on the Heathcote Brook itself. Intensive monitoring at many sites along Heathcote Brook and its tributaries, particularly in the headwaters and along Carters Brook, needs

to occur to determine the stream's health. For example, to determine if bacteria loads from Carters Brook are affecting biological health measured at AMNET site AN0396, biological monitoring is recommended on Carters Brook. The completion of a visual assessment along segment HCB5 (the headwaters of Carters Brook; Figure 24) could also supply some ideas as to sources of bacterial and biological contamination. Future monitoring could be performed by municipal environmental commissions through the State's Environmental Services Program matching grant, as has been done successfully by other towns. More information on the ESP grant can be found at <http://www.state.nj.us/dep/esp/>.

- To determine the source of fecal coliform impairment seen at Site HCB1, additional monitoring is recommended upstream, within, and downstream of the trailer park located just upstream of the sampling site. This would help to determine if the trailer park is the source of significant bacteria or if an unknown upstream source is at fault. Microbial source tracking could also be performed on bacteria samples to confirm or disprove a significant human contribution.
- Site HCB1 is located just downstream of a trailer park that is apparently hooked up to a septic system. If possible, a history of septic maintenance at the trailer park could be helpful in determining the high bacteria levels seen at this site. Likewise a septic system inspection may be warranted.
- Site HCB5 on Carters Brook also showed high fecal coliform counts, possibly due to the aging sewer pipes that closely parallel the tributary. Additional sampling upstream and downstream of this reach could determine the extent of possible infrastructure problems. Microbial source tracking could also be performed on bacteria samples to confirm or disprove a significant human contribution. If results definitely indicate a sewage component, the sewer pipes should be tested for possible leaks and, if found, plans should be made to repair or replace the pipes. The NJ Environmental Infrastructure Trust has a loan program that assists municipalities in correcting or improving both wastewater and stormwater management systems. Their information can be accessed at <http://www.njeit.org/>.
- Since Site HCB5 is in an area where sewer pipes closely parallel the stream, dye analysis could be used to determine if the pipes are actually leaking. If they are, they could be contributing fecal coliform to the stream. Through this analysis, a dye is added to the pipe. If the dye ends up in the stream, the pipe is leaking.
- If not already done, each township could benefit from an inventory of where and what types of current septic systems are in use, locating each system on a map. Figure 13 shows not only septic suitability based on soils in the watershed, but also which areas are designated sewer service areas and which are currently sewered. While the portion of Franklin Township within the Heathcote Brook Watershed appears to be entirely septic, some portions of South Brunswick and Plainsboro Townships within Heathcote Brook Watershed are also using septic systems. By comparing the inventory map to Figure 13, it may become apparent where

inappropriate septic systems have been installed which might be failing. Since much of Franklin Township within the Watershed appears to be unsuitable for septic (Figure 13) and is not designated as a sewer service area, the Township should determine how residents and businesses within that area are handling their wastewater. Franklin Township could apply for NJDEP 604(b) Water Quality Planning Pass-Through Grants, which fund the development of onsite wastewater treatment system (OWTS) management plans. One step of the plan is to inventory the OWTSs within the Township. NJDEP's Division of Watershed Management website on nonpoint source pollution includes information about 604(b) grants and can be found at http://www.state.nj.us/dep/watershedmgt/nps_program.htm.

- For those Townships where septic systems are utilized, it is recommended that septic education programs on the management and maintenance of existing septic systems be conducted for residents and businesses. The septic inventory map would help to target areas that could benefit from such education programs. Even non-failing septic systems can contribute to nutrient pollutant loading, so it is important to manage and maintain all septic systems. SBMWA has a series of septic system informational fact sheets at http://www.thewatershed.org/wm_library.php. NJDEP also has a webpage about onsite wastewater management, which can be found at: http://www.state.nj.us/dep/dwq/sep_site.htm, with links to additional informational documents.
- For those Townships where sewer systems are utilized, it is recommended that a program be developed and implemented to detect and eliminate any illicit connections to the municipal storm drain system, as is required in the New Jersey Phase II Stormwater Regulations. It is also recommended that the existing sewer system pipes be inspected or tested for potential leaks or breaks and that repairs or replacement be done where problems are found.
- Point source dischargers in the Heathcote Brook Watershed need to work within the guidelines of their active permits in order to maintain the health of Heathcote Brook (Figure 6 and Point Source Dischargers Section).
- Areas with agricultural land use (Figure 14) could contribute high bacteria levels if livestock are allowed stream access or if stormwater runs through pastures en route to streams. This stormwater flow could also pick up and carry fertilizers, pesticides, and sediment to the stream. The farms within Heathcote Brook Watershed, particularly those located downstream of Site HCB3 on the mainstem and of Site HCB5 on Carters Brook, should be encouraged to use BMPs to reduce agricultural NPS pollution and improve water quality. Various programs administered by NRCS work with farmers to fund and implement such BMPs. For more information on the various programs, please see the listings included in the Applicable BMP bullet on page 87.
- Since the Heathcote Brook Watershed is already highly developed, the municipalities in this region need to incorporate stormwater management to help reduce the loadings of nonpoint source pollutants into the Brook and to protect areas currently exhibiting low levels of pollutants. Each

municipality was required by the New Jersey Phase II Stormwater Regulations to adopt a stormwater management plan by the spring of 2005 and to adopt a municipal stormwater control ordinance by the spring of 2006. If they haven't done so already, municipalities need to comply with the stormwater management rules by adopting this ordinance.

- Creating or increasing buffer areas along streams serves to filter out pollutants, including bacteria; encourage recharge; and minimize flooding from stormwater flow. Therefore, streambank stabilization and streamside planting projects should be encouraged wherever appropriate. Creating vegetated areas adjacent to impervious areas also helps to increase infiltration and filter out pollutants (vegetated filters).
- Since everyone contributes to NPS pollution, everyone must be involved in its reduction. The only way to successfully and comprehensively tackle the enormous NPS problem is to work one-on-one with individual property owners and help them target the most appropriate ways to reduce their contribution. Education alone does not do the trick. SBMWA's River-Friendly Program is geared towards doing just that: working with individual homeowners, businesses, golf courses, municipalities, and other landowners to help them reduce their contribution to NPS pollution (SBMWA, 2002). The River-Friendly Program simultaneously works on improving water quality management, enhancing wildlife and habitat, and conserving water. Some sample goals could include creating an Integrated Pest Management plan, reducing mowed areas, buffering waterbodies, increasing wildlife and native habitat areas, planting rain gardens, and installing rain barrels. In addition the program has an education component where the participant either holds a forum to educate others and/or attends educational classes themselves. Each Township within the Heathcote Brook Watershed should encourage their residents and businesses to participate, while serving as a role model by enlisting the municipal properties in the River-Friendly Program.

Applicable BMPs and Mitigation Approaches:

There are many stormwater best management practices that could be implemented in the Heathcote Brook Watershed to reduce the bacteria and other pollutant contributions carried by stormwater runoff. Such BMPs could also reduce sediment loads, the frequency of flooding, and erosion potential. For a detailed listing of potential BMPs, refer to the New Jersey Stormwater Best Management Practices Manual (NJDEP, 2004b).

- The new NJDEP Stormwater Management Rules (N.J.A.C. 7:8) state several new requirements for large new developments and redevelopments focusing on minimizing disturbances and impervious surfaces, increasing groundwater recharge, reducing peak flows, and reducing pollutants carried by the stormwater. Key BMPs that increase infiltration and filter out pollutants include infiltration basins, bioretention basins, pervious pavement (see above), vegetated swales, and vegetated filters to capture discharge as sheet flow (NJDEP, 2004b). BMPs such as these should be implemented at each new development or redevelopment project. However, each site is unique. For information on the use of BMPs under

the New Jersey stormwater management rules, see SBMWA's document, *New Jersey's Nonstructural Stormwater Strategies Point System-A Primer*, available at <http://www.thewatershed.org/info/2007NSPSprimer.pdf>

- The implementation of stormwater BMP retrofits in areas being redeveloped or on municipal properties could result in cleaner water in Heathcote Brook and its tributaries. In this case existing stormwater management BMPs can be improved to better protect downstream waterbodies. Vegetating existing swales located near Heathcote Brook or its tributaries is one example of a low-cost method that can result in positive changes.
- Existing stormwater BMPs within areas not planned for redevelopment could also be retrofitted to make them more effective.

Applicable Model Ordinances:

- Stream corridor ordinances, impervious surface ordinances, woodlands protection ordinances, afforestation ordinances, sediment and soil erosion control ordinances, and soil protection ordinances are all beneficial in dealing with NPS pollution (see above for more details).
- NJDEP has also created a Stream Buffer Conservation Zone Model Ordinance. This ordinance deals with the conservation, disturbance, restoration, and management of existing stream buffers for all waterbodies within a municipality. It can be found online at: <http://www.state.nj.us/dep/watershedmgt/DOCS/pdfs/StreamBufferOrdinance.pdf>.
- For those Townships utilizing septic systems, there are several septic related ordinances that could help to improve the health of the watershed. Several townships within the Millstone Watershed have septic ordinances that provide the buyer rights to have the current owner confirm a working septic system prior to purchase. And ANJEC has a model ordinance that mandates inspection upon sale or transfer of property, as well as every three years. This would ensure that failing septic systems are replaced or repaired when property changes hands. A copy of this model ordinance can be obtained from <https://www.anjec.org/html/ord-modelseptic.htm>. Doylestown, Pennsylvania has an ordinance on the books requiring regular inspection, reporting, and pumping of septic systems. Regular pumping would prolong the life of septic systems and regular inspection would catch failing septic systems at an earlier stage to prevent long-term bacterial contributions. A copy of this ordinance (Article III On-Lot Sewage Disposal Systems [Adopted in 2001 by Ordinance Number 299] of Chapter 136 (Sewers) of the Doylestown General Code) can be found at [http://www.e-codes.generalcode.com/codebook_frameset.asp?t=tc&p=1312%2D136%2Ehtm&cn=420&n=\[1\]\[97\]](http://www.e-codes.generalcode.com/codebook_frameset.asp?t=tc&p=1312%2D136%2Ehtm&cn=420&n=[1][97]).