3.3 Surface Water Resources

3.3.1 Existing Conditions

Ramapo Creek

The Ramapo Creek is the main surface water resource on the Hidden Creek site (Figure 3.3-1). This stream is part of the headwater system for the Ramapo River, which is located approximately three miles to the southeast. The Ramapo Creek is composed of two first order, headwater streams that merge approximately 200 feet upgradient of the site. The first of these streams originates approximately two miles south of the site, near a small pond feature off of Pine Tree Road. The second stream is a drainage from the Monroe Ponds near the center of the Village of Monroe. A third headwater stream, whose headwaters are in a small wetland system along Route 17 to the north of the site, joins Ramapo Creek near the northwestern corner of the property.

The portion of Ramapo Creek that traverses the subject site is classified as a class B stream (Title 6, Part 860, New York State Environmental Conservation Law). A class B designation indicates that this stream is suitable for primary and secondary contact recreation and for fish propagation and survival.

The Ramapo Creek through the site is primarily composed of pools varying from one-half to one-and-a-half feet deep and a few areas of slow flowing runs. The slope of the stream bed is generally low gradient (<2 percent). A majority of the stream bed (approximately 70 percent) is composed of fine silt, sand, and small pebbles. The remaining 30 percent is made up of small rock and cobble sized material. The predominance of the smaller sediment particles may be due to the slow velocity, as slow currents allow for the settling of suspended material.

The banks of this stream show significant signs of erosion and undercutting, most likely due to high peak discharges caused by the gradual increase in impervious surfaces in the immediate watershed. Such erosion has resulted in the noticeable entrenchment of the active stream channel. The bankfull height, or distance from the typical water surface to the top of the bank, is two to four feet along the Hidden Creek portion of this stream.

The riparian area along the north bank of Ramapo Creek on site has a moderately high cover of second growth tree species. The streamside area along the southern side of Ramapo Creek however, has a far lower tree cover due to the installation and continued maintenance of a sewer line. Most of the southern riparian area is vegetated by upland field and herbaceous wetland communities.

According to the Federal Emergency Management Agency (FEMA) maps for the Village of Monroe, a small portion of the Hidden Creek site is designated by FEMA as a 100 year floodplain. The location of the site's floodplain area is also depicted in Figure 3.3-1. In general, the floodplain occupies a narrow strip of elevated terrace along most of the existing stream channel.

The DEC Region 3 Division of Fish, Wildlife, and Marine Resources was contacted in October, 2002 regarding the availability of fish survey data for this section of Ramapo

Creek. According to the DEC, no fish surveys have been conducted on the Ramapo Creek or any other headwater tributary of the Ramapo River. Given the lack of existing information on the fishery resources of this stream, the habitat features and geographic location of Ramapo Creek were used to predict the fish community that might potentially inhabit this stream. This list has been submitted to NYSDEC for their review of the DEIS. A discussion of the potential fishery resource of the Ramapo Creek is provided in Section 3.4, Terrestrial and Aquatic Ecology.

Existing Drainage Patterns and Runoff

Two separate drainage basins currently occupy the Hidden Creek site. The location of each of these existing drainage basins is shown on Figure 3.3-2. The smallest drainage basin, identified as Basin 1, is located in the far southern corner of the Hidden Creek site and comprises an area of approximately four acres. Runoff from Basin 1 drains in a southwesterly direction toward a low point in the middle of Forshee Street. This drainage basin consists of approximately 25 percent wooded lands, 55 percent lawn areas, and 20 percent impervious surfaces.

The larger drainage basin, identified as Basin 2 in Figure 3.3-2, collects runoff from a 31.2 acre area including most of the Hidden Creek site. Runoff from this area travels in a northwesterly to northeasterly direction (depending on location) as overland flow before ultimately discharging directly into Ramapo Creek. Ramapo Creek conveys this runoff in a northeasterly then easterly direction, eventually exiting the site through a culvert under Freeland Street. Basin 2 consists of approximately 73 percent wooded areas and 17 percent grasses areas, with the remaining balance consisting of brush and impervious surfaces.

Existing runoff from the project site has been calculated for the 2-year, 10-year, 25-year and 100-year storm events using the Hydrocad's TR-20 Method. The TR-20 model was used for the generation of hydrographs for each of the calculated storm events, and for the routing and sizing of the detention basins. TR-20 is the basis for the USDA Soil Conservation Service TR-55 model, which is a simplified version of TR-20. As stated in the Soil Conservation Service Manual for TR-55, "this method (TR-55) approximates the TR-20 model, a more detailed Hydrograph procedure. TR-20 is to be used if the watershed is very complex, or a higher degree of accuracy is required... The TR-55 model should not be used to perform final design if an error in storage of 25 percent cannot be tolerated. " Because of the additional parameters and routings available in the TR-20 model, it is possible for the project engineers to develop modeling which is more site specific and potentially more accurate.

Table 3.3-1 describes the existing peak flows at the evaluated design points. The design point for Drainage Basin 1 is the Freeland Street culvert through which Ramapo Creek exits the site. The Design point for Basin 2 is a culvert beneath the low point of Forshee Street.

Table 3.3-1
Existing Peak Flows at Onsite and Offsite Design Points, Hidden Creek (cubic feet per second)

Drainage	Storm Event (Year)					
	1	**2**	**10**	**25**	**50**	**100**
Basin 1	2.67 cfs	3.86 cfs	8.23 cfs	10.53 cfs	11.69 cfs	14.03 cfs
Basin 2	18.23 cfs	27.00 cfs	59.91 cfs	77.46 cfs	86.37 cfs	104.46 cfs

Source: Pietrzak and Pfau Engineering & Surveying 2002

Existing Pollutant Loading

Based on the current land use and the existing physical conditions at the project site, the project engineers have estimated the existing annual pollutant loading rate for the Hidden Creek site. These loading rates are summarized in Table 3.3-2 below. The Simple Method, as described in the New York State Department of Environmental Conservation Stormwater Management Design Manual, was utilized in the calculation of these potential pollutant values.

Table 3.3-2
Existing Pollutant Loading Estimates, Hidden Creek

	Basin 1	**Basin 2**
Total Nitrogen (lbs./yr)	16.36	50.85
Total Phosphorus (lbs./yr)	2.13	6.61
Total Suspended Solids (lbs./yr)	445.9	1,385.57
E. coli (billion colonies)	5,593.15	17,380.14

Source: Pietrzak and Pfau Engineering & Surveying, 2002

3.3.2 Potential Impacts

Drainage and Runoff Impacts

Upon completion of the Hidden Creek project, approximately 8.63 acres of this 29.3 acre site would become impervious. These impervious surfaces are associated with the proposed buildings, parking areas, and road network. This change in the perviousness of the site will result in increases in both the rate and volume of runoff generated by this site. If not properly mitigated, this increased runoff could cause erosion of the stream channel and flooding to downstream areas. Prolonged and substantial alterations to the volume of runoff can change the hydrology of associated wetlands and floodplain areas.

Regrading for the creation of building sites and roads will also result in changes to the drainage patterns of the site. In particular, existing drainage basin 1 would be reduced in size from four acres to approximately 2.88 acres. To prevent increases in peak runoff toward the homes on Forshee Street, no development has been proposed within basin 1. Flow from this drainage would still travel toward the same design point, a culvert under Forshee Street.

Existing Drainage Basin 2, however, would be divided into three separate drainage basins according to the proposed plan. Two of these drainage basins (proposed basins 2S and 3S) would convey runoff from a 12.6 acre area into two detention ponds. These basins will capture and hold the collected runoff from the road network and buildings and gradually release it at a controlled rate. The drainage outlets from the basins are designed to control the discharged flows to a flow rate equal to or less than in the existing condition.

The third drainage basin, proposed basin 4S, would occupy nearly 20 acres of the site, most of which will remain undisturbed by this proposal. Runoff from this basin would travel in a westerly direction via overland flow. Proposed basins 2S, 3S, and 4S would ultimately discharge into Ramapo Creek, thus they have the same design point as existing Basin 2, namely the culvert under Freeland Street. The proposed drainage basins are shown on Figure 3.3-3.

The anticipated peak flow at the two previously mentioned design points following the construction of the Hidden Creek development was calculated using the TR-20 method. Table 3.3-3 compares existing flows with the predicted post development flow rate after detention for the 1-year, 2-year, 10-year, 25-year, 50-year and 100-year design storms.

Table 3.3-3
Comparison of Pre- and Post Development Peak Flows at Design Points

Drainage Design Point		Storm Event (Year)					
		1	2	10	25	50	100
Basin 1	pre-development	2.67 cfs	3.86 cfs	8.23 cfs	10.53 cfs	11.69 cfs	14.03 cfs
	post-development	2.40 cfs	3.43 cfs	7.18 cfs	9.14 cfs	10.13 cfs	12.12 cfs
Basin 2	pre-development	18.23 cfs	27.00 cfs	59.91 cfs	77.46 cfs	86.37 cfs	104.46 cfs
	post-development	14.15 cfs	19.87 cfs	59.74 cfs	77.45 cfs	85.55 cfs	104.18 cfs

Source: Pietrzak and Pfau Engineering & Surveying

As Table 3.3-3 suggests, the post-development peak flow rates would be approximately the same or slightly lower than those predicted under existing conditions. This decrease in flow at the design points is due to the number of stormwater control features proposed for the project. These stormwater control features include two detention ponds that would promote the infiltration and gradual release of stormwater runoff. A description of the proposed stormwater management plan is given in Section 3.3.3, and fully described in Appendix C.

Based on the engineer's evaluation of drainage impacts, the project will not result in an increase in runoff rates for any of the design storms evaluated if the proposed mitigation measures as described are utilized. As the project has a net zero increase in the peak rate of runoff for all storm events simulated, no increase is stormwater runoff is projected as a result of this project.

Water Quality Impacts

Due to the increase in impervious surfaces and the change from undeveloped to residential use, the proposed Hidden Creek project has the potential to adversely impact the quality of stormwater runoff from the property. Pollutants introduced from automobiles, fertilizer use, pet waste, herbicide and pesticide application and atmospheric deposition may increase following the change in cover type and reduction in natural vegetation, as well as the conversion of land from undeveloped to clustered residential.

The project engineer utilized the Simple Method as described in DEC publications to estimate the potential pollutant loading rate upon completion of the Hidden Creek development. These post-development values are compared with those calculated for existing conditions in Table 3.3-4.

Table 3.3-4
Pre vs. Post Development Pollutant Loadings
for On-site and Off-site Design Points, Hidden Creek

	Basin 1		**Basin 2,3,4**	
Parameter	Pre	Post	Pre	Post*
Total Nitrogen (lbs./yr)	16.36	13.67	50.85	200.1
Total Phosphorus (lbs/yr)	2.13	1.78	6.61	26.01
Total suspended solids (lbs./yr)	445.9	372.5	1,385.6	5,452.9
E. coli (billion colonies)	5,593	4,672	17,380	68,399

* The post-development values for the Basin 2,3,4 design point is a compilation of the values for the three proposed drainage basins that would drain into Ramapo Creek, namely Proposed basin 2S, 3S, and 4S. These three basins all have the same design point, the culvert under Freeland Street.
Source: Pietrzak and Pfau Engineering & Surveying

As Table 3.3-4 indicates, Basin 1's post-development loading rates for all tested pollutants would be lower than the pollutant loading under existing conditions. This decrease is mainly due to the reduction in Basin 1's drainage area (from 3.98 to 2.84 acres) as a result of this project. A smaller drainage area diminishes the amount of pollutant encountered by surface runoff, assuming land use and cover remain the same.

Following construction, the estimated annual loading of nutrients and sediment is expected to increase from the portion of the site that discharges into Ramapo Creek. According to Table 3.3-4, post-development values for Proposed Basins 2S, 3S, and 4S could be upwards of four times higher than existing loading rates. Without proper stormwater management and use of erosion control best management practices, site development can result in impacts to downstream receiving waters.

If left uncontrolled, sediment loading during and after project construction could result in the siltation of downstream portions of Ramapo Creek. Siltation could have a number of impacts on the various functions of this stream system, including diminishing drinking water quality and recreation potential. Another major potential impact would be to the various organisms inhabiting the Ramapo Creek. Increased sediment load could damage fish spawning habitat, directly injure fish, or eliminate habitat for macroinvertebrates that fish feed on. The potential impacts of siltation on Ramapo Creek's fishery resource is evaluated further in section 3.4, Terrestrial and Aquatic Ecology.

As shown on Table 3.3-4, it is estimated that approximately 5,452.9 pounds per year of Total Suspended Solids (TSS) or sediment could potentially be generated in the Ramapo Creek drainage basin upon completion of the Hidden Creek project. Such a loading rate could have a significant adverse impact on the downstream portions of Ramapo Creek. However, a number of runoff and sediment control features are proposed for the Hidden Creek project that would maximize the removal of suspended particles from runoff entering Ramapo Creek. In fact, these sediment control features would decrease the post development sediment loading to below that of existing conditions (see Mitigation Measures below).

The proposed increase in human activity within Hidden Creek's drainage basins is likely to increase the availability, and thus runoff concentration, of various other pollutants. The amount of total nitrogen and total phosphorous generated in the site's Ramapo Creek drainage basins are expected to increase above existing levels upon completion of the project. A potential impact of increased phosphorous in freshwater aquatic ecosystems is eutrophication, which can result in the prolific growth of algae and plants in downstream areas. Such nutrient enrichment may have a number of adverse impacts on the fish and invertebrate species of downstream areas. Phosphorous, which is the primary element of concern in freshwater systems, tends to attach to sediment particles, and can be controlled if measures utilized for sediment removal as described are developed and maintained. These impacts are also discussed further in Section 3.4, Terrestrial and Aquatic Ecology.

Other pollutants that may be generated from the Hidden Creek site also have the potential to negatively impact the Ramapo Creek and its associated water bodies. These pollutants include simple elements like chloride, metals like lead, copper, zinc and aluminum, and organic chemicals such as petroleum and antifreeze.

Chloride may be generated from the site as a result of winter time salt usage on the proposed road network. When dissolved in water, high concentrations of chloride may act as an oxidizing agent, and result in impacts to fish and other aquatic organisms. Because this element is not effectively filtered from either surface or groundwater flow, slight to moderate impacts from chloride are anticipated from this project. Careful use of road salt is necessary to minimize this potential impact.

The homeowners' association will provide guidelines to the road plowing and salting contractor as to the amount of salt to be used and when application of salt will be necessary. These guidelines will be based on State and County DOT guidelines and available research on salt use in close proximity to aquatic systems. Except for storm events where icing is a serious problem, snow removal and road clearing will be accomplished with plowing only. In larger storm events where salt application may be necessary, greater dilution of salt by melting snow and treatment through the retention ponds will help mitigate this potential impact.

When deposited into aquatic systems, metals have the potential to impact fish and invertebrates. Chronic exposure to metals may negatively affect an organism's fitness or even reproductive success. Metals, however, are typically associated with industrial rather than residential uses. As such, impacts related to metal pollution are not anticipated from this project. Metals also tend to be removed during settling of suspended sediments, as described below.

Various organic chemicals from automobiles and other machinery may be generated from the proposed parking areas and road network at the Hidden Creek site. Petroleum compounds and antifreeze are two such pollutants that can contaminate drinking water supplies and kill exposed aquatic organisms. Due to the proposed parking and roadway areas, stormwater runoff from the site may contain low concentrations of these compounds after completion of the project. In recent years, higher State standards for automobile inspections has reduced the number of cars most likely to leak petroleum compounds or antifreeze. Impacts to downstream areas are expected to be slight on a long-term basis.

Limited use of herbicides and pesticides may occur on the Hidden Creek site in order to maintain landscape plantings and lawn areas. By their very design, these chemicals have the potential to negatively affect aquatic organisms in Ramapo Creek and downstream water bodies. Such impacts can be lethal if exposure is frequent or the concentration is above an organism's tolerance. Again, however, use of these chemicals is expected to be quite limited. Furthermore, the application of herbicides and pesticides will be made by New York State certified applicators according to the manufacturer's recommendations and all State and federal applicable laws governing such activity, unlike applications from single family homeowners, who may apply such materials with no license or oversight, manufacturer's recommendations include a broad range variables, including wind conditions, proximity to surface water, soil permeability and depth to groundwater, etc. These measures should decrease the likelihood of herbicides and pesticides reaching Ramapo Creek. The likely materials to be used at a project of this type would be a general purpose weed killer commercially sold as "Round-up" and a broad spectrum pesticide such as carbaryl. Such materials, when applied in accordance with applicable standards, have not been found to cause environmental harm (other than targeted species).

The homeowners' association will also enforce a 100 foot "no-spray" buffer along the Ramapo Creek. Because the landscape plan utilizes mostly native vegetation, insect problems and thus the need for pesticides and herbicides are expected to be minimal.

Due to the sensitive nature of the site's surface water resources, the applicant has proposed a series of stormwater and pollution control measures for the Hidden Creek development. These various measures were designed to prevent potential impacts to on-site and downstream water resources by allowing for the extended detention and treatment of runoff. Such treatment would remove the required amount of sediments, nutrients and other chemicals to allow for the discharge into Ramapo Creek. A summary of the plan is provided in Section 3.3.3, Proposed Mitigation, below.

<u>Stream Corridor Impacts</u>

According to the current site plan, all trees north of Ramapo Creek and those within a 75 to 150 foot wide buffer zone along the southern side of the stream would not be disturbed during the construction of the Hidden Creek development. As such, impacts associated with the loss of stream side vegetation, particularly thermal degradation, are not anticipated as a result of this project.

The removal of stream side vegetation can result in a variety of impacts to a stream ecosystem and the organisms that inhabit it. One of the most significant impacts is thermal degradation. Shading by a riparian forest canopy helps regulate a stream's water temperature and minimize temperature extremes. The loss of this canopy can therefore promote higher maximum temperatures in summer and lower minimum temperatures in winter. Some fish species like trout can only tolerate a specific temperature range. Increases in water temperature may result in the loss of these particular fish species if they inhabit a given stream reach. Higher water temperatures may also have several indirect effects on fish species, including lower dissolved oxygen content of the water and ammonia toxicity. Again, these impacts are not projected to occur.

Floodplain Impacts

As discussed above, narrow bands along the elevated upland areas off Ramapo Creek are designated as 100 year floodplain according to FEMA. Level floodplains along streams and rivers allow for the dispersion of floodwater over a larger area. This dispersion decreases the both the quantity and velocity of flow experienced at downstream areas. Vegetation within the floodplain also acts to slow floodwater velocity. Building within the floodplain can result is greater flooding at downstream areas due to the loss in retentiveness of the impacted floodplain.

As seen in Figure 3.3-4, the proposed project will not cause any disturbance within the site's 100 year floodplain. As such, impacts relating to the loss of floodplain area are not anticipated as a result of this project.

3.3.3 Proposed Mitigation

Required Permits

The proposed action will result in the alteration of approximately 17.3 acres of land. Since the area of site disturbance exceeds one acre, stormwater management plans must be in compliance with the SPDES General Permit for Storm Water Discharges from Construction Activities. This permit is administered by the NYS DEC. As the Village of Monroe is a designated MS-4 (municipal separate storm sewer system), final approval of the stormwater pollution prevention plan will be required from the Village.

Sediment and Pollution Control

Construction Phase

The greatest potential impact associated with this project during the construction phase would be from erosion and sedimentation. An Erosion Control plan is provided in the set of submitted site plans in the rear of the DEIS. The written portion of the Soil Erosion Control Plan is provided as part of the Stormwater Pollution Prevention Plan in Appendix C.

The primary aim of this plan is to reduce soil erosion from areas exposed during construction and prevent silt from reaching the on-site wetlands and areas downstream. All soil erosion and sedimentation control practices have been designed according to the New York State Department of Environmental Conservation Stormwater Management.

The main objectives of the Soil Erosion and Sediment Control Plan are the following:

- control erosion at its source with temporary control structures,
- minimize the amount of sediment-laden runoff from areas of disturbance, and control the runoff prior to discharge to off-site areas.
- deconcentrate and distribute stormwater runoff through natural vegetation or structural means before discharge to critical zones such as streams or wetlands.

Prior to the commencement of any phase of this project that would result in the disturbance of soils, erosion and sediment control measures would be established in accordance with the specifications attached to final construction drawings. The installation of these control features would begin with the most down stream device and progress up gradient in order to minimize the migration of sediment off site.

A number of Best Management Practices were chosen to help mitigate against possible erosion impacts during construction. The strategic placement of these features is depicted in the attached Erosion Control Plans. Temporary measures to be used during construction include the following:

- Land that is stripped of vegetation would be left bare for the shortest time possible and seeded with a temporary mix after 14 days to promote the quick establishment of ground cover. Such ground cover would help stabilize the soil and limit erosion. Temporary seeding mix would include ryegrass (or winter rye if seeding from October to November) at an application rate of 30 pounds per acre.
- All slopes would be stabilized with seeding mixtures and mulch to minimize erosion potential. Slopes in excess of four horizontal to one vertical shall be stabilized with jute netting and hydro-seeded. Straw or hay mulch would be added to such steep slope areas at a rate of 2000 pounds per acre and anchored with BioD-Mesh60 netting (RoLANKA International) or approved equivalent.
- Temporary diversion swales would be constructed to either divert clean storm water runoff away from newly graded areas until the establishment of permanent ground cover, or to direct sediment laden runoff into a sediment trapping device (discussed below). These temporary diversion swales would be seeded with a mixture of Kentucky bluegrass, creeping red fescue, and rye grass at an application rate of between 10 and 25 pounds per acre depending upon species.
- Sediment traps would be constructed in key locations down gradient of disturbed areas to collect and filter sediment laden stormwater runoff. These sediment traps would consist of a minimum six inch thick layer of stone riprap over embedded filter fabric. The size of these features would be proportional to the expected volume of runoff.

- Filter fabric silt fencing would be erected around the periphery of all wetland areas to be preserved and the proposed limit of disturbance along the southern bank of Ramapo Creek.

- Under some circumstances, additional rows of silt fencing would be utilized to help slow the overland sheet flow and remove more sediment. These rows would be spaced from 50 to 200 feet apart depending on slope steepness.

- Discharge from sediment traps and diversion swales would be dispersed before reaching silt fencing so that the quantity and velocity of runoff is minimized. This would maximize the ability of the filter fabric to treat the stormwater runoff.

By employing these various erosion control practices in conjunction with one another, the potential adverse impacts associated with the sedimentation of the site's surface water resources during project construction would be minimized to the greatest extent possible.

Post-Construction Phase

As discussed above, there is potential for impacts to the Ramapo Creek due to this project, including increased runoff, siltation, and nutrient enrichment. However, the applicant has incorporated multiple stormwater and pollution control features into the site plan. These various features are designed to reduce or eliminate these potential impacts to the greatest extent practicable while achieving the proposed development. A more detailed description of the proposed stormwater and pollution control features, including the sizing of the basins in conformance with the new NYSDEC Stormwater Design Manual (October 2001), can be found in the Stormwater Pollution Prevention Plan (Appendix C) and on the large scale site plans in the rear of the DEIS (Sheets 5, 7, 8).

A number of Best Management Practices (BMP) were chosen to help mitigate against possible erosion and pollution impacts. These practices were designed in accordance with the New York State Department of Environmental Conservation Stormwater Management Design Manual.

Following construction, erosion and pollution control will be provided by the established vegetation and the permanent stormwater management devices as shown on the attached plans. The principal stormwater and pollution control device would be two detention ponds constructed to capture and treat flows in the north-central portion of the site. These two detention ponds would receive runoff from a 12.26 acre drainage basin composed of most of the development's impervious surfaces. Runoff would be detained in the pools and treated through settling and biological uptake mechanisms. After treatment, stormwater would discharge from the second pond into Ramapo Creek via a single control structure.

Another drainage basin on the proposed Hidden Creek development would also drain into Ramapo Creek upon completion of this project. However, only a small portion of the site's proposed impervious surface area would be located within this 20.08 acre drainage basin. Because of this, the project's engineers have selected the vegetated swale as a suitable method to treat stormwater from this basin. Runoff would drain in a westerly direction via overland flow before discharging directly into Ramapo Creek. The considerable grassed and woodland areas of this drainage basin would act to filter sediment and other contaminants and promote infiltration.

Based on the established pollutant removal efficiencies from the proposed Best Management Practices, the actual sediment and pollutant loading rates after treatment were estimated. Table 3.3-5 gives the expected pollutant loading rates for the existing conditions as well as for the post-development untreated and treated scenarios. The DEC Stormwater Design Manual states that it is assumed that if a project meets the water quality volume requirements through the use of BMP's, a project will, by default, meet water quality objectives. This project meets or exceeds these requirements. Since the project will be designed to comply with the DEC's general permit for stormwater, it is reasonable to expect that with such compliance, the predicted reduction in sediment and pollutant loads will provide the required level of water quality for discharge into Ramapo Creek.

Table 3.3-5
Pre vs. Post Development Pollutant Loadings with BMPs

Parameter	Basin 1			Basin 2,3,4		
	Pre	Post	Post w/ BMP	Pre	Post *	Post w/ BMP*
Total Nitrogen (lbs.yr)	16.36	13.67	13.67	50.85	200.1	117.53
Total Phosphorus (lbs./yr)	2.13	1.78	1.78	6.61	26.01	14.08
Total Suspended Solids (lbs./yr)	445.9	372.5	372.5	1,385.6	5,452.9	976.71
E coli (billion colonies)	5,593	4,672	4,672	17,380	68,399	40,516

* The post-development values for the Basin 2,3,4 design point is a compilation of the values for the three proposed drainage basins that would drain into Ramapo Creek, namely Proposed basin 2S, 3S, and 4S. These three basins all have the same design point, the culvert under Freeland Street.
Source: Pietrzak and Pfau Engineering & Surveying

As shown, pollutant loading for all parameters decrease in Basin 1, using the modeling methods recommended by the State. At the combined design point draining Basins 2, 3 and 4, total suspended solids decrease significantly, while nitrogen, phosphorus and coliform are shown to increase, although significantly less following the proposed treatment by the water quality basins. Phosphorus is shown to increase by 7.47 pounds annually.

The pollutant loading calculations as provided indicate an incremental increase to the Ramapo Creek watershed. In terms of the loading quantities, these loadings are within the range (pounds per year) that can be absorbed by natural systems, and the existence of the large wetland associated with the Ramapo Creek and its floodplain downstream of the site is expected to help mitigate these increases. Wetland systems absorb nutrient loadings at a high rate, and it has been shown that these systems can process up to 225 pounds of nitrogen and 45 pounds of phosphorus per surface acre per year without impacting the wetland's nutrient removal function (Nichols, 1983 as reported in Schueler, 1987).

In addition to providing water quality improvements to runoff from the Hidden Creek site, the proposed stormwater control measures have also been designed to provide downstream channel protection during storm events by attenuating the volume and timing of runoff.

The project has been designed to provide for a zero net increase in runoff for the 1, 2, 10, 25, 50 and 100 year design storms. In fact, the proposed design actually allows for a net decrease in runoff during all design storms studied (see Table 3.3-3 above). Such reductions in runoff should significantly reduce the potential erosion and channel entrenchment impacts to Ramapo Creek.

Storm Water Infrastructure Maintenance:

Long term maintenance of all drainage structures, pipes, and treatment devices will be the responsibility of the Village of Monroe.

Long term maintenance shall include the following:

Inspection: The infiltration devices should be inspected periodically for the first few months after construction and on an annual basis thereafter. The drainage infrastructure should also be inspected after major storm events to ensure that the orifices, if any, and inlets remain open. Particular attention should be given to:

- Evidence of clogging
- Erosion of the flow path
- Condition of the embankments
- Condition of the spillways
- Accumulation of sediment at the outlets and sumps
- Erosion of bio-swales or riprap aprons
- Sources of erosion in the contributory drainage, which should be stabilized.

Debris and Litter Control: Removal of debris and litter should be accomplished during mowing operations. Particular attention should be given to removing debris and trash around outlets to prevent clogging.

Erosion Control: Eroding soils in drainage areas should be stabilized immediately with vegetative practices or other erosion control practices. Potential problems are erosion that may occur on the embankment, slopes, and spillways of grassed bio-swales. Also, attention should be given to repositioning protective riprap where appropriate.

Sediment Removal: Sediment should be removed periodically in order to preserve the available storm water treatment capacity of the infiltration devices, and to prevent outlets or filtering mediums from becoming clogged. Also, unless removed, accumulated sediment may become unsightly. While more frequent clean-out may be needed around outlets, a typical clean-out cycle for the entire storm water infrastructure should range from 5 to 10 years.