4.0 Status of Individual Special Protection Areas

4.1 Clarksburg Master Plan Special Protection Area

The Clarksburg Area Master Plan, adopted in June of 1994, approved the creation of the first SPA. Based on the environmental analysis for the Clarksburg Master Plan, and guidance provided from the Maryland Department of the Environment and Maryland Department of Natural Resources, portions of Little Seneca Creek, Ten Mile Creek, Wildcat Branch, and Cabin Branch were included in the SPA (Figure 2) in order "to assure that identified sensitive environmental resources were protected to the greatest extent possible from development activities" (Approved and Adopted Clarksburg Master Plan, June 1994, page 206). "Achieving this rather delicate and imprecise balance was recognized to be a difficult goal but one which must be achieved if Clarksburg's outstanding environmental setting is to be preserved" (Approved and Adopted Clarksburg Master Plan, June 1994, page 18).

The Little Seneca portion of the SPA encompasses approximately 6100 acres of land. These headwaters of Little Seneca Creek are designated by the state of Maryland as a Use IV-P stream (i.e. protection of put-and-take trout and public water supply). Table 3 below lists the State standards for Use IV-P streams.

The Ten Mile Creek subwatershed is approximately 3600 acres of land. The SPA includes all land in the subwatershed east of the Ten Mile Creek mainstem and north of West Old Baltimore Road. Ten Mile Creek is designated by the state of Maryland as a Use I-P stream (i.e. protection of water contact recreation, aquatic life and drinking water supply). Table 3 below lists the State standards for Use I-P streams. Historically, Ten Mile Creek was one of the last streams in Montgomery County to support Brook Trout.

Only two small portions of the Cabin Branch subwatershed are included in the SPA. These areas were identified by the Clarksburg Area Master Plan as being outside projected 100' wide stream buffers and having a higher potential for groundwater contamination than the surrounding areas.

The inclusion of a small portion of the Wildcat Branch subwatershed is due to the potential for adverse impacts to the stream from anticipated development along Brink Road and the construction of Mid-County Highway. The Wildcat Branch portion of the SPA consists of any tributaries in the Clarksburg planning area that receive stormwater runoff from the Brink Road area and the future Mid-County Highway extension. The Wildcat Branch is designated by the state of Maryland as a Use Class III stream (protection of naturally reproducing trout populations). State standards for all freshwater use classes are listed in Table 3.

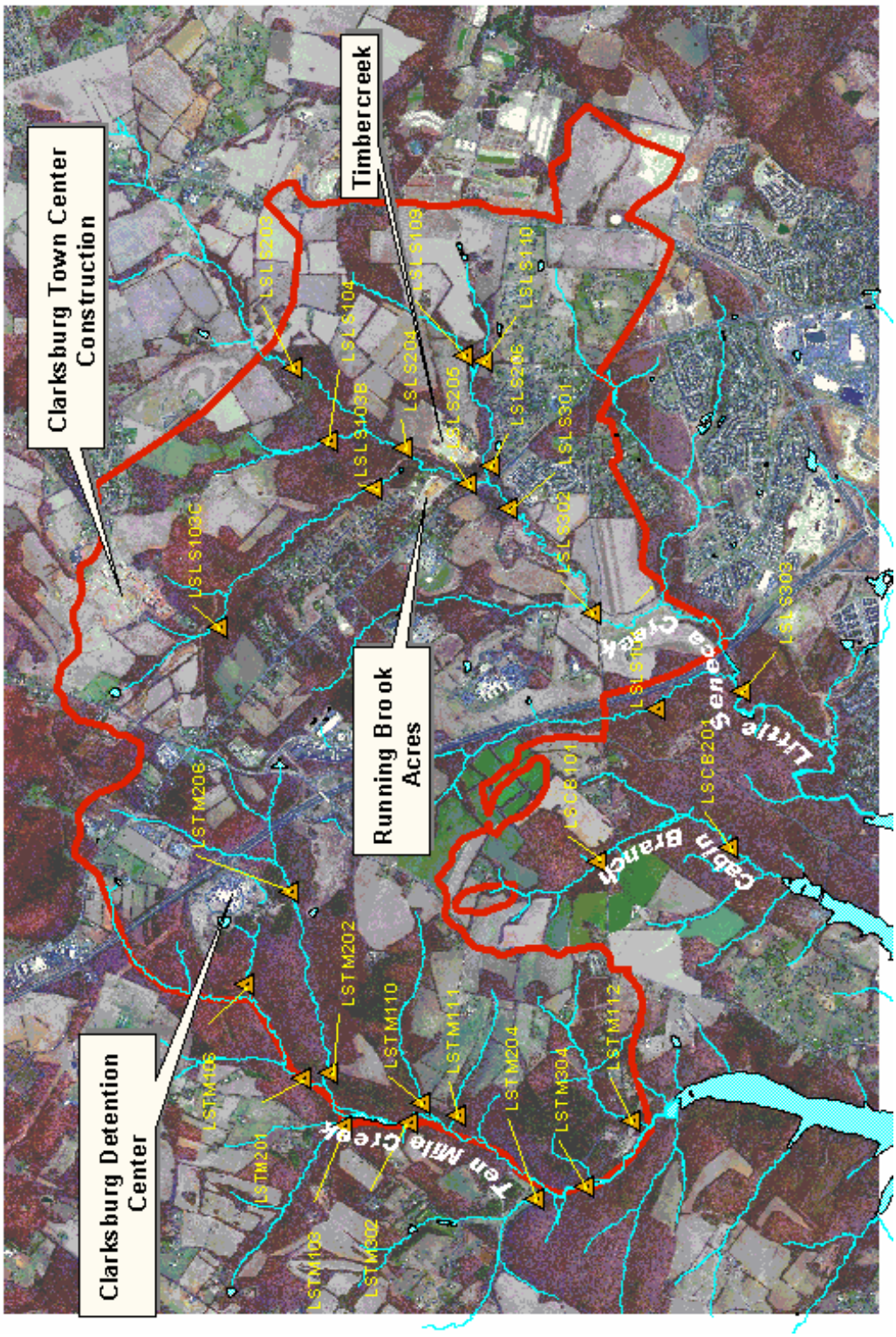

Figure 2 Clarksburg SPA Delineated in Red

Table 3 Maryland Water Quality Standards For Freshwater Use Classes (COMAR 1993 parts 26.08.02.01– 03)

Parameter	Class I-P	Class III	Class IV-P
Maximum Total Fecal Coliforms (log mean per 100 mL)	200	200	200
Minimum Dissolved Oxygen (mg/L)	5	5	5
Minimum Daily Average Dissolved Oxygen (mg/L)	N/A	6	N/A
Maximum Temperature (Degrees Fahrenheit)	90° or ambient (whichever is greater)	68° or ambient (whichever is greater)	75° or ambient (whichever is greater)
pH	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5
Maximum Turbidity (NTU)	150	150	150
Maxumum Monthly Average Turbidity (NTU)	50	50	50
Total Residual Chlorine	N/A	No Chlorine Permissible	N/A

4.1.1 Extension of Water and Sewer Service and Increased Density of Development

The 1994 Clarksburg Master Plan recommends the majority of the Clarksburg SPA for public water and sewer service. The Clarksburg area is starting the initial expansion of public water and sewer service recommended in the master plan, primarily in the Town Center District located between Clarksburg and Stringtown Roads northeast of Route 355. The County Council in 2001 approved an amendment to the Water and Sewer Plan which grants approval for public water and sewer service throughout much of the Development Stages 2 and 3 areas (Future Sewer Service Areas A1 and A) east of I-270; the accompanying map (Figure 3) reflects these approvals.

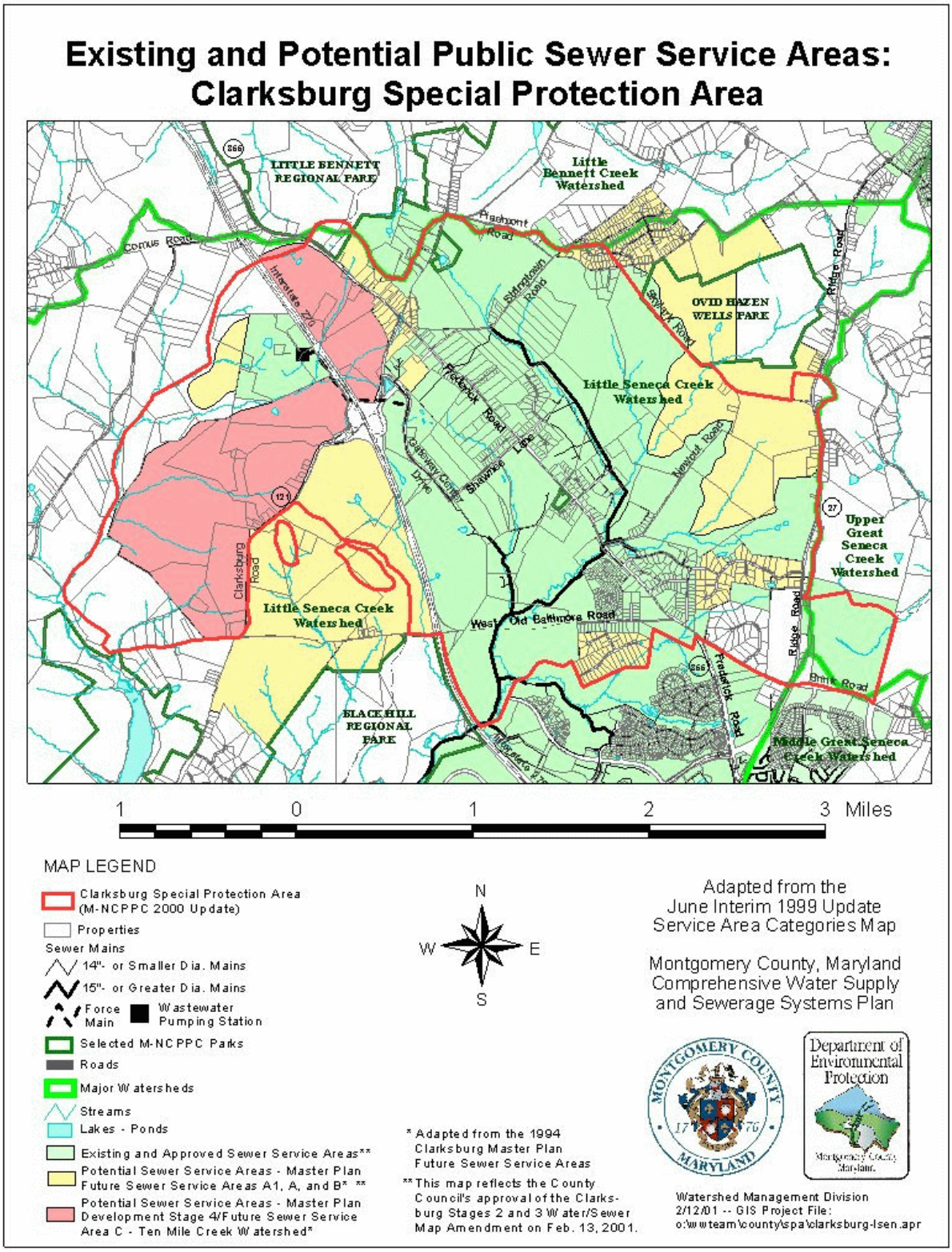

Figure 3 Clarksburg SPA Sewer Service Areas

Only one major area of Development Stage 3 remains as a potential sewer service area - that is the entire area west of I-270, primarily in the Cabin Branch subwatershed (Future Sewer Service Area C, as shown on the accompanying map). Public sewer approval of this area will require inclusion in the WSSC capital improvements program (CIP) budget of the capital sewerage system projects (trunk mains, pumping stations, and force mains) needed to provide sewer service.

Another potential sewer service area within the SPA is Development Stage 4 (Future Sewer Service Area C) in the Ten Mile Creek subwatershed (shown in red on the map). Master plan staging triggers link development needing pubic water and sewer service in Stage 4 in part to the results of water quality monitoring for the earlier development stages. These requirements reflect the concern in the Clarksburg Master Plan for, "... the environmentally fragile nature of the streams in this area ..." The master plan requires DEP to conduct baseline monitoring in the Little Seneca Creek and Ten Mile Creek watersheds for at least three years. Baseline assessment in these watersheds began in 1994. The master plan also requires ongoing monitoring by DEP as development proceeds in the Newcut Road and Town Center (Stage 3) neighborhoods to evaluate the water quality best management practices (BMPs) for that development. DEP is to provide its evaluation of these BMPs in the Annual Report on the Water Quality Review Process which follows immediately after the release of 2,000 building permits in the Newcut Road and Town Center neighborhoods. This allows for significant development to get under way east of I-270 to reinforce the Clarksburg town concept. More than 2000 dwelling units will be included in this total because DPS issues a single permit for all the multifamily structures on a property even though individual building permits are required for each single family home and townhouse. For the purposes of tallying 2000 building permits, an apartment complex and a single family home each count as a single building permit. As of August 2003, MNCPPC indicates that 424 permits have been issued in the Town Center Area. When the remaining 1576 permits will be issued depends on the state of the economy and the demand for housing in the Clarksburg area. DEP staff estimate that it could be four to eight years before 2000 permits have been issued.

The County Council will then assess the results of DEP's evaluation, along with considering capital infrastructure needs for the Stage 4 area and voluntary water quality protection measures taken by local property owners. Following the assessment, the approved and adopted Clarksburg Master Plan (June 1994), stipulates that the County Council can choose from among the following actions:

- Proceed with Stage 4 development by granting Water and Sewer Plan amendments allowing public water and sewer service.

- Proceed with Stage 4 development, as above, but with additional measures, such as more stringent water quality requirements and further development staging, to protect the watershed.

- Defer action on development in Stage 4, pending further study or consideration, by deferring the Water and Sewer Plan amendments needed for public water and sewer

service

- Consider other land use options for the watershed, which may or may not require public water and sewer service.

4.1.2 Status of Development in the Clarksburg Master Plan SPA as of June, 2003

The Clarksburg SPA has experienced the most development activity of the three SPAs by far. This area has undergone numerous changes in the last year, with several large sites under construction. Some of the more notable sites under construction include Clarksburg Town Center Phase I and II (269 acres), Greenway Village Phase I and II (164 acres, 210 acres pending approval), Martens Property Phase I (52 acres, 51 acres pending approval), Highlands of Clarksburg (56 acres) and Rocky Hill Middle School (25 acres). Several additional developments are nearing the end of the development review process and will likely be under construction before the end of this year. The largest and most notable of these is Clarksburg Village which will consist of 730 acres of mixed use development and the associated infrastructure. Additionally, there are several other significant sites (Linthicum East 126 acres, Gateway Commons 56 acres and Cabin Branch 535 acres-243 acres in the SPA) that are currently in varying phases of the development review process and are aggressively pursuing development plan approvals.

As can be seen by the sheer number of acres of proposed development listed above (about 2000 acres), which include only the larger development sites, there will be a significant increase in density and impervious area in the watershed. This, along with the potential sedimentation impacts associated with construction, will greatly challenge the ability to sustain existing stream conditions in this watershed. Adding to this challenge are master plan and planning decisions to increase densities by requiring several sites, including Clarksburg Village, Martens Property and Gateway Commons, to absorb Transferred Development Rights (TDRs) into the subdivisions. These density increases in Clarksburg address important county goals to increase available housing and protect agricultural resources. However, these will also add impervious are and reduce available area for buffers and redundant stormwater management facilities.

Table 4 lists development projects which are active in the Clarksburg SPA. The table covers the time period from 1995 to June 2003. Table 4 is intended to provide the reader with a general idea of the locations, types, intensity, and stage of review or development of land development projects. As shown in the table, construction is currently underway on several projects and nearing completion on several others in the watershed. Baseline and construction (temporary) BMP monitoring is currently being performed on several sites as noted in section 4.1.3. As these sites are finalized, monitoring of the permanent stormwater management BMPs will begin.

Table 4 Clarksburg SPA Development Projects (1995 to June 2003)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
All Souls Catholic Cemetery – Germantown	Wildcat Branch	166 acres - RDT	Phase I under construction. Plans for Phase approved.
Catawba Manor	Clarksburg, Little Seneca Subwatershed	10.9 acres (4.5 in SPA) RMX-2,R-200	Site under construction
Cellular Phone Antenna Site Ferguson Farm	Clarksburg, Little Seneca Creek Subwatershed	0.6 acres - RDT Communication tower and access drive	Exempt from water quality plan requirements. Stormwater management provided. Construction complete
Clark Meadow, Phase I	Clarksburg, Little Seneca Subwatershed	37 acres, R-200	Subdivision plan approved before SPA designation. Construction complete. As-built approved.
Clark Meadow, Phase II	Clarksburg, Little Seneca Subwatershed.	1.0 acres, R-200.	Site under construction.
Clarksburg Detention Facility (Seneca Correctional Facility)	Clarksburg, Ten Mile Creek Subwatershed	34 acres	Construction complete.
Clarksburg Bus and Maintenance Depot	Clarksburg, Little Seneca Creek	9.28 acres	Water quality inventory approved. Sediment control permit pending.
Highlands of Clarksburg (Clarksburg Gateway)	Clarksburg, Little Seneca Creek	56.4 acres, RMX-2 and R-200	Final water quality plan approved. Under construction.

Table 4. (continued)

Clarksburg Heights	Clarksburg, Little Seneca Subwatershed	54 acres, R-200	Subdivision plan approved prior to SPA designation. Construction complete.
Clarksburg Ridge (Funt Property)	Clarksburg, Little Seneca Creek	24 acres, Residential	Under construction.
Clarksburg Town Center -	Clarksburg, Little Seneca Subwatershed	269 acres, RMX-2, RDT	Phases I, IA, IB and II are under construction.
Clarksburg Village (Newcut Village)	Clarksburg, Little Seneca Creek	730 acres, mixed use, TDR receiving area.	Final water quality plan approved.
Egan Property (C.N. Sherwood Property)	Clarksburg, Ten Mile Creek Subwatershed	101.6 acres, R-200, Commercial Picnic / Catering Facility	Phase I under construction. Phase II under review.
Gateway Commons	Clarksburg, Little Seneca Creek	56 acres, R-200 TDR-7	Final water quality plan approved.
Gateway 270 (Phase I)	Clarksburg, Little Seneca Creek	24.5 acres, I-3, 3 lots	Construction complete.
Gateway 270 (Lot 7)	Clarksburg, Little Seneca Creek	4.9 acres, I-3	Construction complete.
Gateway 270 West (Phase II)	Clarksburg, Little Seneca Creek	35.5 acres, I-3, 6 lots	Construction complete.
Greenway Village (DiMaio Property)	Clarksburg, Little Seneca Creek	374 acres, PD (Planned Development)	Final water quality plan submitted for Phases I and II. Under construction.
Greenridge Baptist Church	Clarksburg, Little Seneca Creek	8.2 acres	Pre-application meeting completed. Project on hold.

Table 4. (continued)

Clarksburg Gateway (now part of Highlands of Clarksburg)	Clarksburg, Little Seneca Subwatershed	16 acres, RMX-2 (high density)	Under construction.
Kingsley Wilderness School	Clarksburg, Little Seneca Creek	5.5acres, Montgomery County Site 30	Under construction.
Linthicum Property East (Phase I)	Clarksburg, Little Seneca Creek	126 acres, R-200	Final water quality plan under review.
Martens Property	Clarksburg, Little Seneca Creek	103.1 acres, R-200 TDR-4.	Phase IA and IB under construction. Phase II sed. con. under review.
Nanna Property (Phase I)	Clarksburg, Little Seneca Creek Subwatershed	4 acres, R-200	Construction complete.
Nanna Property (Phase II)	Clarksburg, Little Seneca Creek	12.1acres, R-200C, 24 lots proposed	Under construction.
Parkside	Clarksburg, Little Seneca Creek	10.9 acres, R-200 RMX-2	Detailed sediment control plans approved.
Rocky Hill Middle School (New)	Clarksburg, Little Seneca Creek	23+ acres, School	Under construction.
Running Brook Acres	Clarksburg, Little Seneca Creek	11.7 acres, R-200, 24 lots proposed (cluster)	Construction nearing completion.

4.1.3 Summary of BMP Monitoring in the Clarksburg SPA

Table 5 lists thirteen projects in the Clarksburg SPA performing BMP monitoring during 2002. The Linthicum (East) development project has not begun construction as of August of 2003. Data obtained from the site provides a baseline of pre-construction conditions which will be compared to during-construction and post-construction period results.

Table 5 BMP Monitoring Required in the Clarksburg SPA

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Clarksburg Detention Center / *Chester Engineers* ***(construction completed 4/03)***	**3 groundwater wells** *Ammonia, Total Phosphorus, Total Nitrogen, Specific Conductance, Nitrate, pH, Ortho-Phosphorus* **1 rainfall logger** - *along with the flow logger* **1 flow logger (SWM pond discharge rate***)* **1 continuous temperature logger** **stormwater monitoring** **2 water quality stations to monitor sediment traps (inflow and outflow)**	**pre-development monitoring:** 6 months **during-construction monitoring:** until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years during construction monitoring is to include 6 storm events	**groundwater data:** 11/97 - 6/03 **rainfall data:** 1/98 -9/02 **flow data:** 1/98 - 9/02 **temperature data:** 1/98 - 9/02 6 storm events received
Clarksburg Town Center / *Biohabitats* ***(construction began 9/99)***	**1 continuous flow logger** **1 rainfall logger -** along with flow logger **3 continuous temperature logging stations** **4 surface water quality stations:** *VOC, Oil and Grease, Herbicides & Pesticides, NO2, NO3, TN, TP, TSS, Metals, pH, DO, Conductivity*	**pre-development monitoring:** 1 year **during-construction monitoring**: until all infrastructure is installed, site stabilized and 50% of lots developed **post-construction monitoring**: 5 years	**flow and rainfall data:** 4/97 - 3/98, 10/00 - 12/02 **temperature data:** 6/97 - 9/97, 9/00, 6//01 - 10/01, 6/02 – 10/02 **surface water quality:** 5/97, 6/97, 11/02, 4/03
Gateway 270 / *Rodgers Associates* ***construction complete***	**4 continuous temperature loggers**	Three summers following permit approval	**Temperature data:** 7/99-9/99, 6/00-9/00, 6/01-9/01

Table 5. (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Gateway 270 West / *Rodgers Associates* (c***onstruction complete)***	**water quality monitoring at stormwater pond:** Cadmium, Copper, Lead, Zinc, Kjeldahl Nitrogen, Nitrate Nitrogen, Ammonia Nitrogen, and Ortho-Phosphate	**pre-development monitoring:** 3 storm samples **during-construction monitoring**: none required **post-construction monitoring**: 3 storms per year for three years	**water quality data:** 7/10/00, 7/18/00, 7/31/00, 7/9/02, 12/20/02
Running Brook Acres ***(construction began during fall of 2001)***	**Embeddedness** **stormwater monitoring of 1 sediment trap** (TSS inflow and outflow) **Chemical and nutrient monitoring of linked BMP**	**pre-development monitoring:** 3 months **during-construction monitoring:** until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Embeddedness:** 9/01-3/03 **TSS Sampling:** 3/26/02, 7/7/02, 10/11/02, 2/4/03
Greenway Village at Clarksburg (previously known as DiMaio Property) / *ESA* *(Construction began during summer of 2003)*	**7 Groundwater wells** **3 Discrete flows** **1 Continuous flow logger** **3 Cross sections** **3 Embeddedness stations** **1 Temperature logger** **Stormwater monitoring of 1 sediment trap** (TSS inflow and outflow) **Water Quality – Storm Sampling Western trib.** (NO2, NO3, TKN, Ortho-P, total P, Cu, Cd, Pb, Zn, TSS)	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 5 years	**Cross-sections:** 12/01 **Groundwater Wells:** 11/01 – 11/02 **Discrete Flows:** 2/02 – 11/02 **Stream Flow:** 12/01 – 5/02 **Embeddedness:** 12/01 – 11/02 **Stream Temperature:** 6/02 – 10/02 **Water Quality:** 10/11/02, 10/30/02

Table 5. (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Highlands at Clarksburg / *Macris, Hendricks and Glascock* *(construction began in summer of 2002)*	**2 Temperature loggers** **Stormwater TSS at sediment pond** **Photos of outfall** **Embeddedness** **Water chemistry at one linked BMP - required for post-construction period only** **5 groundwater Wells**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring**: 3 years, 5 years for wells	**Temperatures**: 6/01-9-01 **Wells**: 11/00-11/01
Timbercreek (previously known as Nanna property) / GTA ***(construction began10/01)***	**2 Temperature loggers** **2 Groundwater wells**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Temperatures**: 6/01-9/01, 6/02 – 9/02 **Wells:** 4/01 – 12/02
All Souls Cemetery / *Macris, Hendricks and Glascock* ***(construction began during fall of 2001)***	**1 Temperature logger** **2 stream channel cross sections**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Temperature:** 6/01 – 9/01, 6/02 – 9/02 **Cross Sections:** 5/01, 7/02, 1/03

Table 5 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Martens Property / *GTA* *(construction began 3/03)*	**4 Groundwater wells** **2 Temperature loggers** **TSS sampling in sediment control facility – 4 samples per year** **Water quality sampling to evaluate pollutant removal efficiency of one SWM facility - required for post-construction period only**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Temperature:** 6/00 – 9/00, 6/02 – 9/02 **Wells:** 3/02 – 12/02
Linthicum Property (East) AKA Summerfield Crossing/ *Rodgers Consulting, Inc.* (construction has not begun)	**5 Groundwater wells** **5 Temperature loggers** **1 Discrete flow station** (discharge measurements taken at time of well readings) **2 Embeddedness monitoring stations** **2 Nutrient sampling stations in Little Seneca Cr.**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Wells:** 12/3/02, 3/11/03 **Temperature:** pre-construction data to be collected during summer of 2003 **Discrete Flow:** 12/3/02, 3/11/03 **Embeddedness:** 12/3/02, 3/11/03 **Nutrient sampling:** 3/25/03, 5/7/03, 5/13/03

Table 5 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	**REQUIRED BMP MONITORING**	**REQUIRED TIME FRAME FOR BMP MONITORING**	**DATA SUBMITTED TO DATE**
Catawba Manor McCarthy and Associates (Construction began 4/03)	**1 Groundwater well** **1 Temperature logger and BOD at sand filter**	**pre-development monitoring:** 1 year – well only **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management **post-construction monitoring:** 1 year	Groundwater well installed during 2002 **No data submitted**
Clarksburg Ridge Rogers and Associates (Construction began during summer of 2002)	**TSS**	**during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management	**No data submitted**

Clarksburg Detention Center (during-construction)

Clarksburg Detention Center is located on the west side of I-270 just north of the Rt. 121 interchange. Construction began in September of 1998 and was completed in March of 2003. The sediment control ponds were converted to stormwater management facilities in April of 2003. Prior to construction of the Detention Center the property was used for sewage sludge disposal. Much of the sludge was removed from the area that was to be disturbed during the beginning phase of construction.

BMP monitoring began in November of 1997 and includes three groundwater wells which are monitored for water level and nutrients (Figure 4). The purpose of groundwater monitoring is to determine 1) whether the groundwater table lowers in response to impervious surface added to the site and 2) whether groundwater nutrient levels go down in response to removal of sewage sludge.

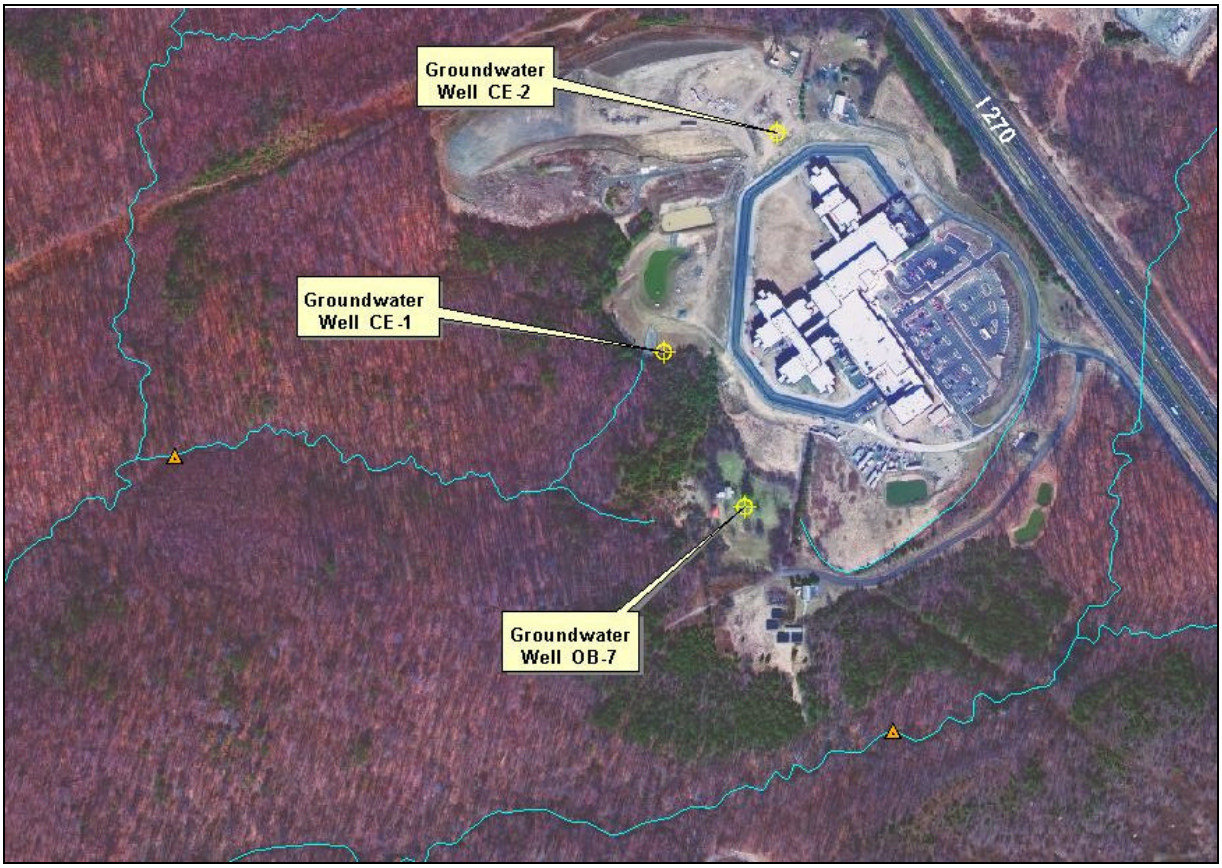

Figure 4 Clarksburg Detention Center photo taken 12/02

Results of the groundwater level monitoring presented in Figure 5 show the typical seasonal fluctuations where groundwater levels are higher in the spring and lower in the fall. Water levels reached their lowest point in August of 1999 and December of 2002 following droughts of record. Interestingly, water level in well CE-1 has continued to drop during the first part of 2003 despite large amounts of precipitation. Water level in the other two wells has come up sharply since 12/10/02. The location of well CE-1 near the primary stormwater management facility makes this result unexpected. Now that the post-construction period has begun and the sediment trap forebay has been converted to a sand filter, more water should infiltrate into the ground and bring the water level up in well CE-1.

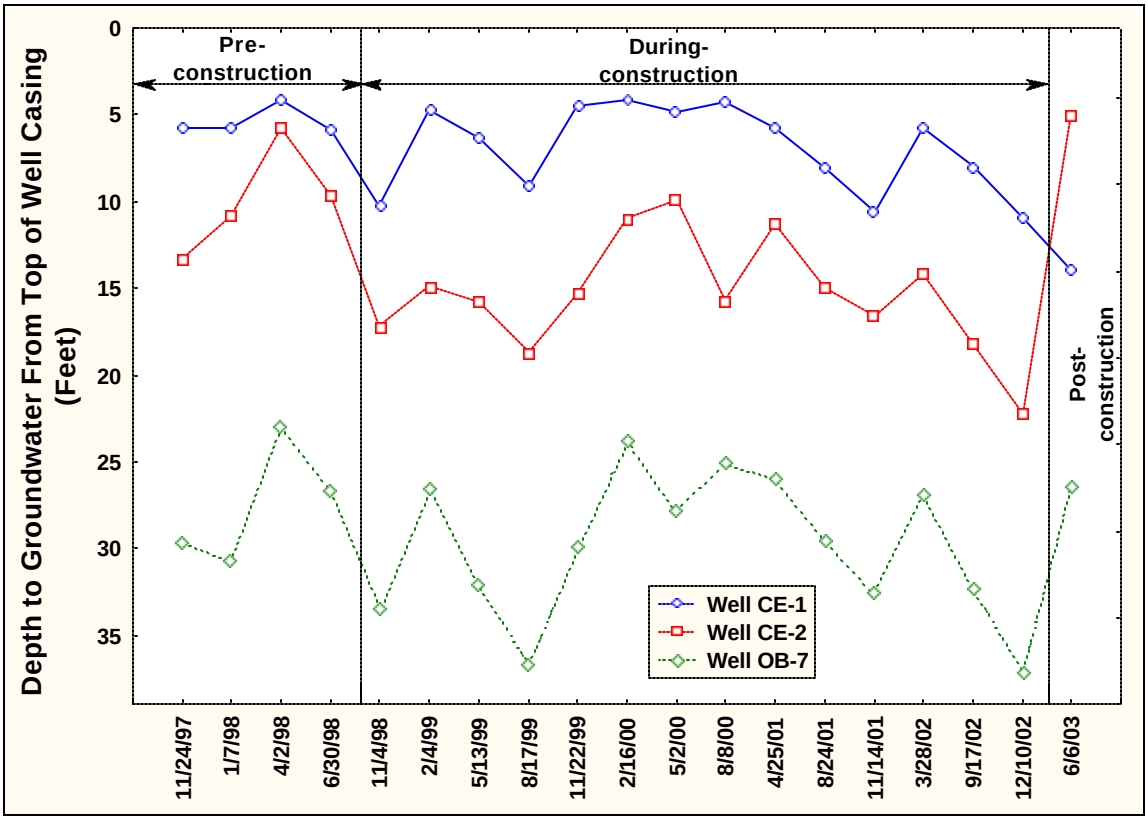

Figure 5 Groundwater Levels From Clarksburg Detention Center

Concentration of total phosphorus (TP) and nitrate in samples obtained from the three wells are presented in Figure 6 and Figure 7. TP concentration from all three wells has remained low except for samples obtained on 4/2/98 and 8/17/99. The sharp increase detected on 4/2/98 occurred prior to any land disturbance which makes it very difficult to explain. The increase on 8/17/99 was detected at the two wells within the construction disturbance area (CE-1 and CE-2), while concentrations remained relatively low at well OB-7 located outside the disturbance area. Land disturbance and removal of buried sewage sludge may have caused a sudden short term spike in concentration at wells CE-1 and CE-2. Since 8/17/99 TP concentrations have remained relatively low. Concentrations did increase slightly at all three wells on 9/17/02.

Nitrate concentrations did not follow patterns observed with TP. On dates when TP concentration was high nitrate was relatively low. Nitrate concentrations in Well OB-7 have been consistently higher then either of the other two wells with values well above the drinking water standard of 10.0 mg/l (Figure 7). Presumably, the sewage sludge, which was not removed

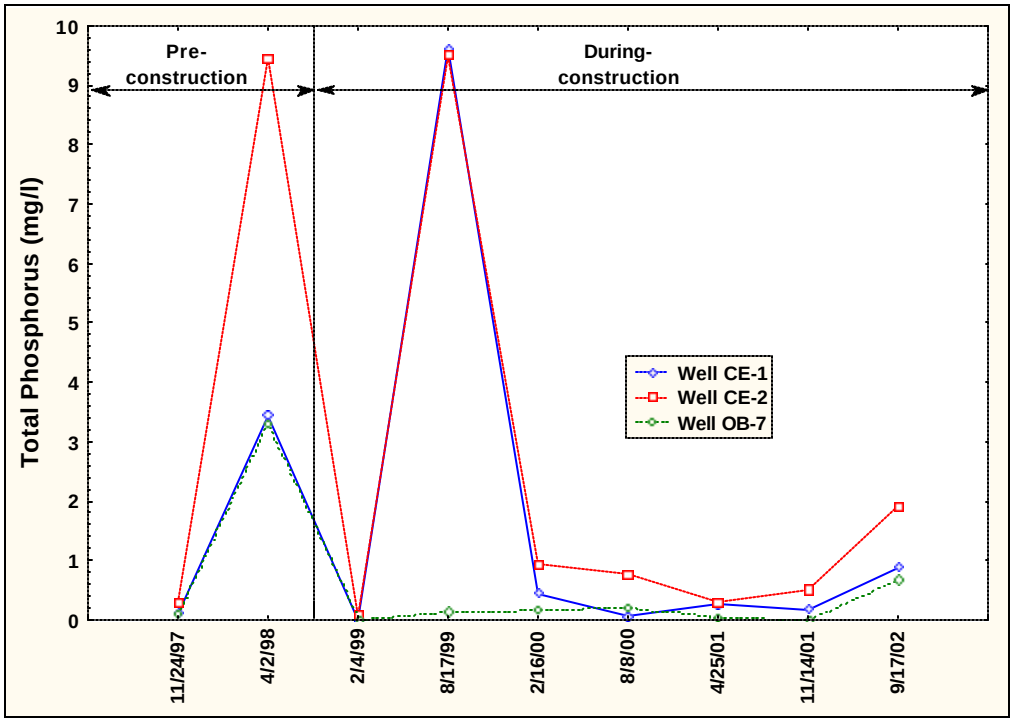

Figure 6 Total Phosphorus Concentration in Groundwater Samples From the Clarksburg Detention Center

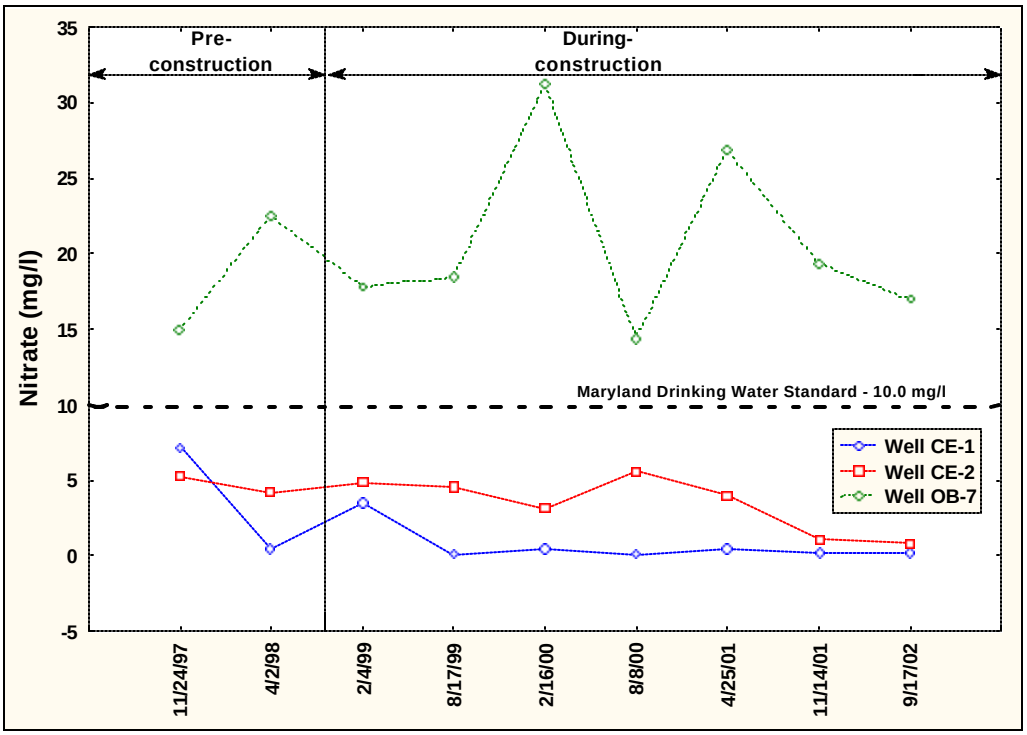

Figure 7 Nitrate Concentration in Groundwater Samples From the Clarksburg Detention Center

from the area immediately surrounding well OB-7, is the cause of high nitrate concentration in this well. Nitrate concentrations in the other two wells (CE-1 and CE-2) have gone down during the period of study to date. Well CE-1 has gone from 7.2 mg/l on 11/24/97 to 0.18 mg/l on 9/17/02. Well CE-2 has gone from 5.25 mg/l on 11/24/97 to 0.83 mg/l on 9/17/02. The decrease in nitrate concentrations in these two wells is likely due to removal of sewage sludge from the site.

DEP has received rainfall and flow data from the Clarksburg Detention Center but it needs further analysis before it can presented here. Temperature data from the site only reflects water temperatures when the pond is flowing. At other times the instrument is recording air temperatures. Therefore, the temperature data cannot be analyzed without reliable flow data. Temperature data will be presented along with the flow data from the project when available.

Clarksburg Town Center (during-construction)[1]

One year of pre-construction data was collected on this project between March of 1997 and March of 1998. Water quantity monitoring resumed during the fall of 2000 as construction on the site began. Water quality sampling resumed in 2001. A monitoring report was submitted to DPS and DEP in February of 2003 summarizing data collected over a 27 month period of during-construction conditions. The following sections are excerpts from this report.

During the course of 2002 (second year of construction) the stream still exhibits typical behavior of a headwater stream, similar to pre-construction conditions. Lowest average monthly flows during the second year of during-construction monitoring were recorded in the summer and the highest monthly average flows were recorded during the late autumn and winter into the spring. This is very similar to the pre-construction conditions where the lowest average monthly flows were recorded during the summer months and the highest monthly average flows were recorded during the winter months. The summer of 1997, during the pre-construction monitoring, was extremely dry and hot. During that summer, both of the tributaries became dry several times. This is very similar to the conditions during this year of construction. Although 2002 rainfall data at the site does not show abnormally low precipitation totals during these months, there was a record drought and the tributaries were dry part of the time. During the first year of during-construction monitoring, lowest average flows were recorded during the spring because February through the middle of May were dry. Highest average flows were recorded during the late-autumn and winter months, similar to this year's monitoring and pre-construction conditions.

There was a noticeable increase in discharge averages during the second monitoring year from

1 This section consists of excerpts from the January 2002 Clarksburg Town Center During-Construction Water Quality and Quantity Monitoring Report, prepared by Biohabitats Inc. and Versar Inc.

November 2001 to November 2002 as compared to the first monitoring year from October 2000 to October 2001. In the first year of 'during construction' monitoring, there was a slight increase in discharge as compared to pre-construction conditions. The rainfall totals did not change dramatically during the monitoring periods; therefore rainfall does not account for the discharge increase in the second year of during construction monitoring. The increase may be due to soil compaction during construction which reduces the ability of soils to absorb water.

Monitoring of stream water chemistry is also being done for the Clarksburg Town Center project. Versar field staff monitored baseflow conditions and one storm event during the past year, on November 21, 2002 and April 25, 2003, respectively. The sampling points for baseflow monitoring were the same as the previous "during construction" monitoring performed last year. The sampling points for the storm event were more centrally located (i.e., downstream for the tributaries nearer the confluence and upstream for the confluence nearer to the tributaries). The sites were identified as follows: Site 1 is located below the confluence of the three tributaries and just north of Stringtown Rd.; Site 2 is on the western tributary; Site 3 is on the northern tributary; Site 4 is on the eastern tributary.

Baseflow monitoring consisted of instream water quality measurements (temperature, pH, dissolved oxygen, specific conductance) and grab sampling of water for chemical analysis (carried out by Martel, Inc. of Towson, MD). Monitoring was carried out according to NPDES guidelines (e.g., no rainfall for 24 hours prior to monitoring) and samples were collected and transported according to EPA guidelines. Results of baseflow monitoring are presented in Table 6.

Baseflow water quality measurements were comparable to those recorded in 2001. Dissolved oxygen measurements were between 10 and 11 mg/L in all tributaries. Observed pH values were near neutral as in 2001. Specific conductance measurements were mixed in comparison to 2001.

Total phosphorus concentrations were between 0.05 and 0.10 mg/L, similar to concentrations found in 2001. Nitrate concentrations were identical or slightly lower than in 2001. Other nutrient concentrations were unchanged or non-detectible.

The only metal pollutant that showed a substantial change between 2001 and 2002 collections was copper, which decreased in all tributaries to near non-detectible levels (detection limit = 0.01 mg/L). Zinc, which was just above detection limits in 2001, decreased also to non-detectible or near non-detectible levels.

Total suspended solids were also reduced from 2001 by 43% (confluence) to 77% (east tributary). Total petroleum hydrocarbons were slightly above detection limits in 2001, but were not detectible in 2002 (detection limit for both years = 2 mg/L). Hardness showed slight increases in all tributaries while alkalinity showed a mixture of increases and decreases. Volatile organic compounds, pesticides, and herbicides continued to show no detectible concentrations

Table 6 Water Quality Results From November 21, 2002 – Baseflow Sampling

Parameters	Site 1 (confluence)	Site 2 (west trib.)	Site 3 (north trib.)	Site 4 (east trib.)	units
Instream Water Quality Measurements					
Water Temperature	9.41	9.13	7.97	10.6	C
pH	7.0	7.0	7.1	7.0	
Dissolved Oxygen	10.3	10.4	10.6	10.1	(mg/L)
Specific Conductance	0.187	0.253	0.176	0.172	(ms/cm)
Chemical Parameters					
Alkalinity	26	10	26	30	(mg/L)
BOD (5-day)	<2	<2	<2	<2	(mg/L)
Hardness	66	60	58	76	(mg/L)
Nitrate	2.2	3.0	1.9	2.4	(mg/L)
Nitrite	<0.02	<0.02	<0.02	<0.02	(mg/L)
Total Kjeldahl Nitrogen	<0.5	<0.5	<0.5	<0.5	(mg/L)
Total Phosphorus	0.06	0.07	0.06	0.09	(mg/L)
Ortho-phosphorus	<0.01	<0.01	<0.01	<0.01	(mg/L)
Total Suspended Solids	4	4	3	3	(mg/L)
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005	(mg/L)
Zinc	0.01	0.01	<0.01	<0.01	(mg/L)
Lead	<0.002	<0.002	<0.002	<0.002	(mg/L)
Copper	0.002	0.002	0.006	0.002	(mg/L)
Chromium	<0.005	<0.005	<0.005	<0.005	(mg/L)
Nickel	<0.02	<0.02	<0.02	<0.02	(mg/L)
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	(mg/L)
TPH	<2	<2	<2	<2	(mg/L)
VOCs	ND[1]	ND	ND	ND	(µg/L)
Herbicides	ND	ND	ND	ND	(µg/L)
Pesticides/PCBs	ND	ND	ND	ND	(µg/L)

Results from storm sampling are presented in Table 7. The storm event produced 0.71" of rain, as recorded by Montgomery County's Tuckerman Lane rain gauge. Overall water chemistry results for the storm event were comparable to the baseflow, although the following differences are noted: total suspended solids levels were from 3 to 11 times higher during the storm event, storm nitrate and hardness levels were slightly higher in all streams, copper levels decreased slightly on average, and zinc levels increased slightly on average. Water quality parameters for the storm event were mixed in comparison to the baseflow: specific conductivity was higher, dissolved oxygen was lower, and pH was lower in all streams. Note: a calibration problem detected later in the dissolved oxygen probe may have contributed to the lower dissolved oxygen levels found in the streams during the storm event.

The pH of stormflow in the tributaries dropped below neutral as was the case in 2001. The pH levels measured at the confluence and in the west tributary were slightly more acidic than Code of Maryland Regulations limits for Use I waters (protection of aquatic life; Code of Maryland Regulations). The specific conductance measured for the storm event in 2003 was higher for 3 of the 4 streams. The west tributary showed a slight decrease from 2001, but was still the highest measured of the 4 in both years. Dissolved oxygen measurements were much lower than 2001 probably due to the dissolved oxygen probe calibration problem described above.

Zinc levels in 2003 were just above detection limits but were not detected in 2001. Nickel was detected in one tributary in 2001 but was absent in 2003. Copper was detected in the west tributary in 2001, but was present in the confluence and north tributary in 2003.

Total suspended solids levels were approximately 3 to 11 times higher during the 2003 stormflow than in 2001. Hardness increased for all streams, ranging from 8% to 95% higher than in 2001. Nitrate results for the later storm were slightly lower on average while total phosphorus results were slightly higher on average. Orthophosphorus was below detection limits in 2003, but was detected in 2001.

Overall, the results show continued fairly good water quality. Because of very low levels or trace amounts of some pollutants, the increases and decreases noted between years are probably random and not indicative of any trend toward or away from degraded water quality. Some metals were slightly above detection limits, but fell below criteria for impaired Use I waters.
The increase in TSS during 2003 storm sampling is likely related to the increase of acreage under construction.

Table 7 Water Quality Results From April 25, 2003 - Storm Event Monitoring

Parameters	Site 1 (confluence)	Site 2 (west trib.)	Site 3 (north trib.)	Site 4 (east trib.)	Units
Instream Water Quality Measurements					
Water Temperature	13.0	12.9	13.1	12.5	C
pH	5.7	6.2	6.5	6.5	
Dissolved Oxygen	4.7[1]	5.2[1]	5.6[1]	5.4[1]	(mg/L)
Specific Conductivity	0.264	0.369	0.219	0.247	(ms/cm)
Chemical Parameters					
Alkalinity	24	14	32	28	(mg/L)
BOD (5-day)	<1	<1	<1	<1	(mg/L)
Hardness	70	70	68	86	(mg/L)
Nitrate	2.8	3.9	2.4	3.1	(mg/L)
Nitrite	<0.02	<0.02	<0.02	<0.02	(mg/L)
Total Kjeldahl Nitrogen	<0.5	<0.5	<0.5	<0.5	(mg/L)
Total Phosphorus	0.05	0.05	0.06	0.07	(mg/L)
Ortho-phosphorus	<0.01	<0.01	<0.01	<0.01	(mg/L)
Total Suspended Solids	12	11	15	33	(mg/L)
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005	(mg/L)
Zinc	0.01	0.02	0.01	0.01	(mg/L)
Lead	<0.002	<0.002	<0.002	<0.002	(mg/L)
Copper	0.006	<0.002	0.002	<0.002	(mg/L)
Chromium	<0.005	<0.005	<0.005	<0.005	(mg/L)
Nickel	<0.02	<0.02	<0.02	<0.02	(mg/L)
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	(mg/L)
TPH	<2	<2	<2	<2	(mg/L)
VOCs	ND[2]	ND	ND	ND	(µg/L)
Herbicides	ND	ND	ND	ND	(µg/L)
Pesticides/PCBs	ND	ND	ND	ND	(µg/L)

Notes:
1. Calibration problem suspected.
2. ND = below detection limits.

Gateway 270 project (Post-construction)

This project is a 64.9 acre industrial development zoned I-3. It is bounded by Clarksburg Road to the north, Shawnee Lane to the south and I270 to the west. It consists of ten lots with industrial space, parking and associated infrastructure. Stormwater is redundantly treated by sand filters and wet ponds to provide quantity control for the 2-year storm and quality treatment for the first inch of runoff. A small bioretention cell provides pre-treatment for stormwater on a portion of the site. There are a total of four (4) SWM ponds on site. Water temperature monitoring is done at the outfall from all four ponds, water quality monitoring is done at the outfall from pond 3

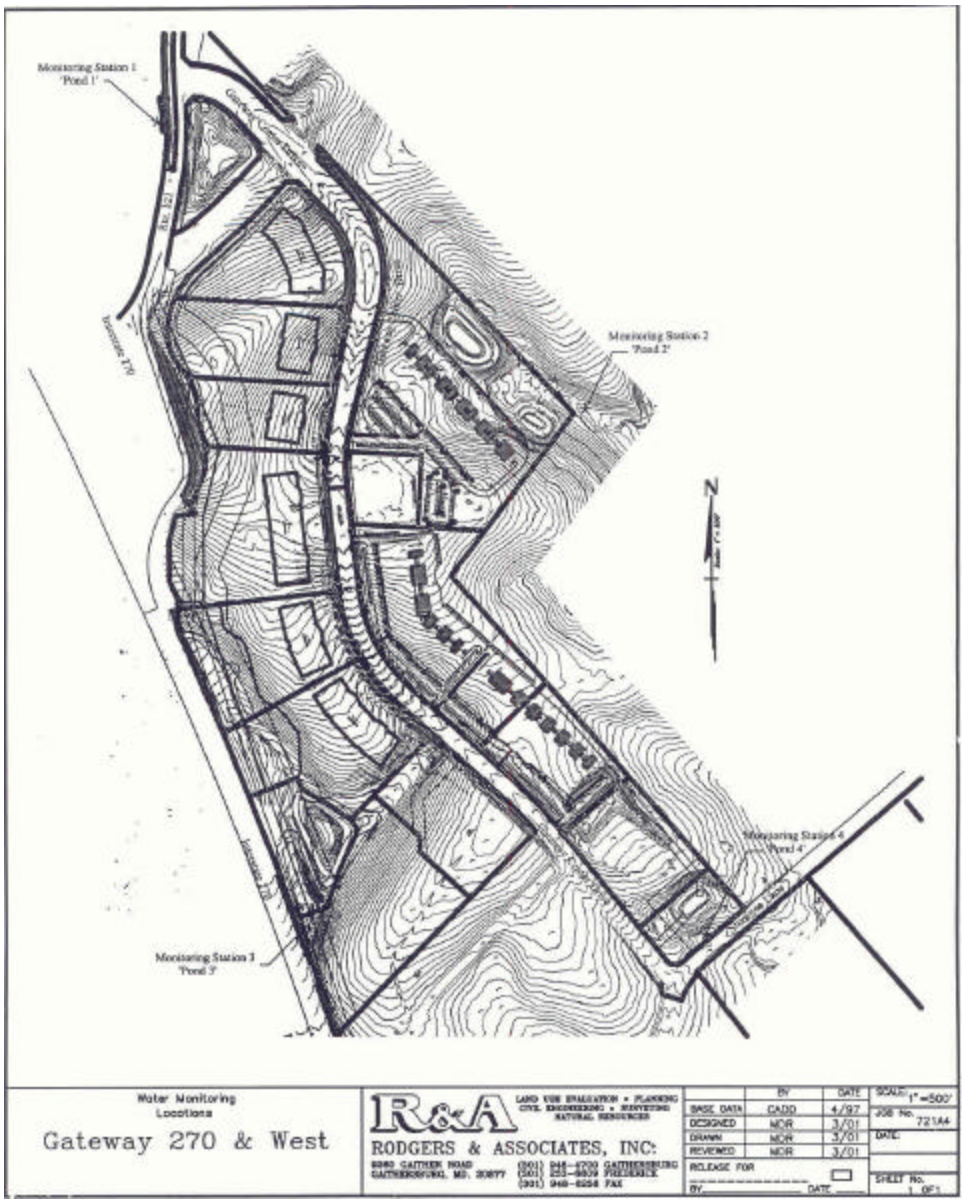

Figure 8 Map of Gateway 270 Business Park

Table 8 contains water quality monitoring results from pond 3. All samples were obtained during storm events. Pond 3 was in place prior to construction. During 2001 a sand filter was installed to treat runoff from new development. The results from 2002 are the first of three years of post-construction monitoring. These results show seven of the nine parameters have remained below detection limits. The detection limit for Kjeldahl nitrogen was lowered during the post-construction monitoring but actual concentration remains below the pre-construction detection limit. Concentration of zinc has increased by two times during post-construction monitoring going from 0.0270 mg/L to 0.0431 mg/L. Although these values are well below the Maryland chronic toxicity criteria of 0.120 mg/l the trend appears to be increasing. Nitrate levels have also increased very slightly but remain very low. Naturally occurring, background levels of nitrate are generally considered to be 1.0 mg/L.

Table 8 Water Quality Data Collected From Pond 3 Outfall

		Cadmium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)	Kjeldahl Nitrogen (mg/L)	Nitrite Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Ortho-Phosphate (mg/L)
7/10/2000	Pre-const.	< 0.0100	< 0.0250	< 0.100	< 0.0200	< 2.0	< 0.050	0.37	< 1.0	< 0.020
7/18/2000		< 0.0100	< 0.0250	< 0.100	< 0.0200	< 2.0	< 0.050	0.15	< 1.0	0.023
7/31/2000		< 0.0100	< 0.0250	< 0.100	< 0.020	< 2.0	< 0.050	0.36	< 1.0	0.035
12/20/2002	Post-Const.	< 0.0100	< 0.0250	< 0.100	0.0270	<1.0	< 0.050	0.45	< 1.0	< 0.020
7/09/2002		< 0.0100	< 0.0250	< 0.100	0.0431	1.6	< 0.050	0.44	< 1.0	< 0.020

Water temperature monitoring was completed during 2002 at all four SWM pond outfalls. Pond 4 was dry throughout the study period. Results from the other three ponds are presented in figures 9, 10 and 11. Outfall from Ponds 1 and 2 remained below the Maryland Use Class IV criteria of 75^0 F or 23.8^0 C throughout the summer of 2002. These results are particularly surprising at pond 1 because this is such a large wet pond and time of retention is long allowing plenty of time for the pond to warm up. There is no baseflow through the pond and therefore no discharge during periods between storms. The riser is designed to release water from the pond surface (ie. no reverse slope discharge). The temperature loggers were placed in a small stream on the west side of Rt. 121 that receives discharge from pond 1. The stream apparently maintained some flow throughout the summer as the logger recorded what appear to be cool stream temperatures. No temperature spikes were observed in response summer storms. A result often observed downstream of wet ponds.

These results indicate that thermal impact from SWM ponds within the Gateway 270 Business Park has been minimal thus far. Temperature of water from these ponds is comparable to water temperature from small first order streams in other parts of the Little Seneca Creek watershed during 2002.

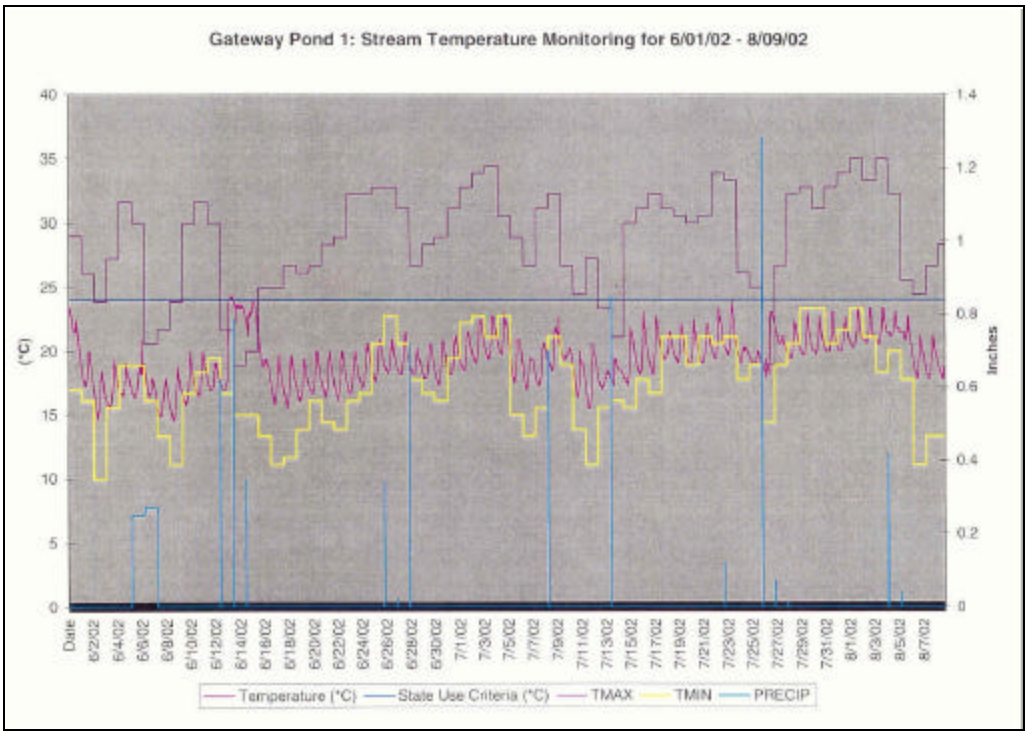

Figure 9 Water Temperature Data Collected At The Outfall Of Pond 1

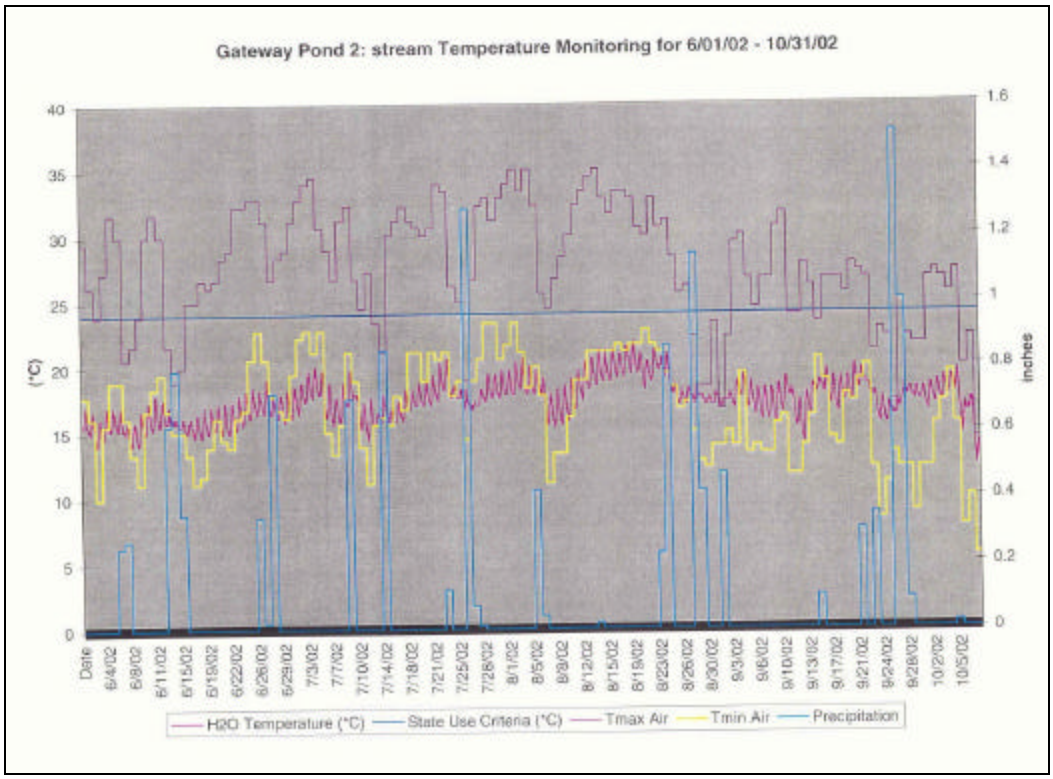

Figure 10 Water Temperature Data Collected At The Outfall From Pond 2

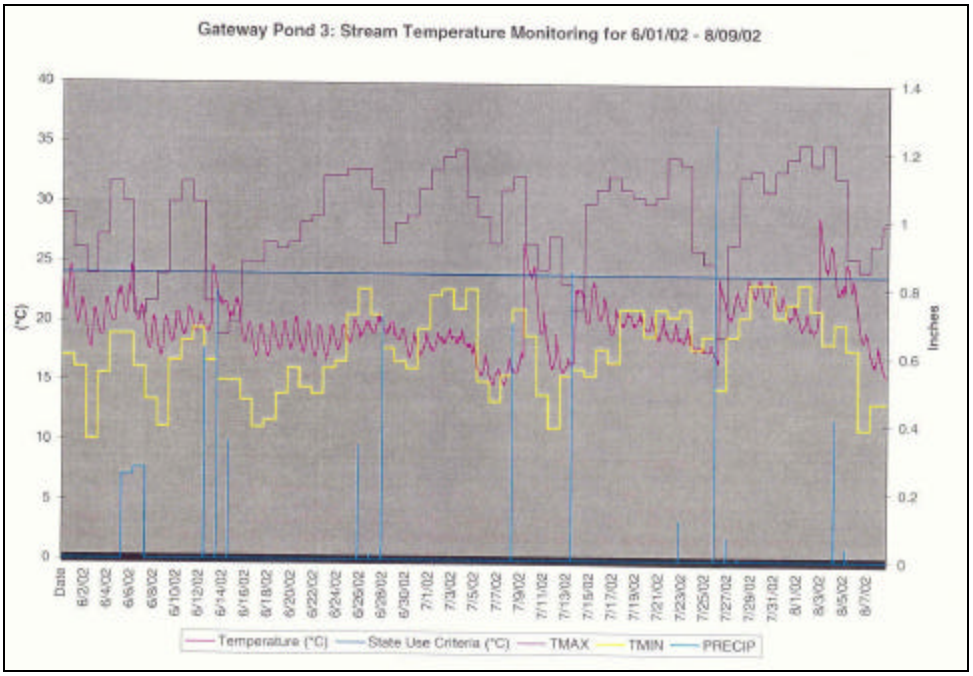

Figure 11 Water Temperature Data Collected At The Outfall From Pond 3

Running Brook Acres (during-construction)

The site (R-200 zoned) consists of 11.75 acres and is located south of Running Brook Road and East of Route 355. Development of the site includes 20 single-family lots and associated infrastructure. Stormwater management for the site includes the following: quantity control provided via a dry pond sized to control the one year storm event with a pre-developed release rate. Quality control to treat the first one-inch of runoff from the impervious area is provided via a treatment train that consists of vegetated conveyance swales which outfall to a forebay/bioretention cell, and then drains to an infiltration cell. Construction on the site began during late fall / early winter of 2001. All BMP monitoring requirements for the site are summarized in Table 5.

Table 9 Running Brook Embeddedness

Embeddedness is assessed at a point in Little Seneca Creek immediately downstream of the sediment control facility. Results of this monitoring, presented in Table 9, show embeddedness went up briefly, early on during- construction, and subsequently has gone down below pre-construction levels. This suggests that construction activity during the beginning phases had some impact on sedimentation in Little Seneca Creek. Subsequently, no impact has been observed.

Date		Embeddedness
09/12/2001	Pre-Constructio	60%
10/10/2001		50%
10/29/2001		50%
11/06/2001		60%
03/26/2002	During-Constructio	75%
06/07/2002		50%
10/11/2002		50%
03/05/2003		30%

Sampling for Total Suspended Solids in the Sediment control facility began in March of 2002. We have received results for four (4) TSS samples that were collected between March 2002 and February 2003. The samples are taken from three locations within the sediment control facility: 1) the forebay, 2) main trap and 3) outfall from main trap. Results are presented in Table 10. It should be noted that these are grab samples, meaning they were taken at one instant in time and may not be representative of a complete storm event.

Table 10 Results of Total Suspended Sediment Sampling At Running Brook Acres

Sample Date	Total Suspended Solids Sampled From three Locations in The Sediment Control Facility			Overall Efficiency	Precipitation From Damascus MD (inches)
	Forebay	Main Trap	Outfall From Main Trap		
03/26/2002	23 mg/L	19 mg/L	18 mg/L	22%	0.54
06/07/2002	58 mg/L	21 mg/L	12 mg/L	79%	0.15 *
10/11/2002	100 mg/L	48 mg/L	104 mg/L	-4%	1.34
02/04/2003	520 mg/L	428 mg/L	226 mg/L	56%	0.27 **

* Rainfall on 6/6/02, ** Rainfall on 2/1/03

On average, sediment removal efficiency between the forebay and outfall from the main trap was 38 percent. Efficiency was highly variable between storm events and appears to have been related to amount of precipitation (Figure 12). Of the storms sampled, the one with the least precipitation had the best efficiency (79%), while the one with the greatest precipitation had the lowest efficiency (-4%). This is most likely due to longer retention time during smaller storms allowing more solids to settle out. In most county development projects, sediment ponds are sized to contain approximately one inch of rainfall on each acre of exposed area. In SPA projects, the ponds are typically twenty-five percent larger and are sized to contain 1.25 inches of rainfall. The Running Brook site was short on space for sediment control and was not required to add the additional storage volume. Had there been opportunity to include this additional storage volume, it potentially would have increased the efficiency of the structure during the storm on 10/11/02 when the water leaving the structure had more suspended solids than the water entering it. This increase in the solids in the water was probably due to resuspension of materials in the sediment trap.

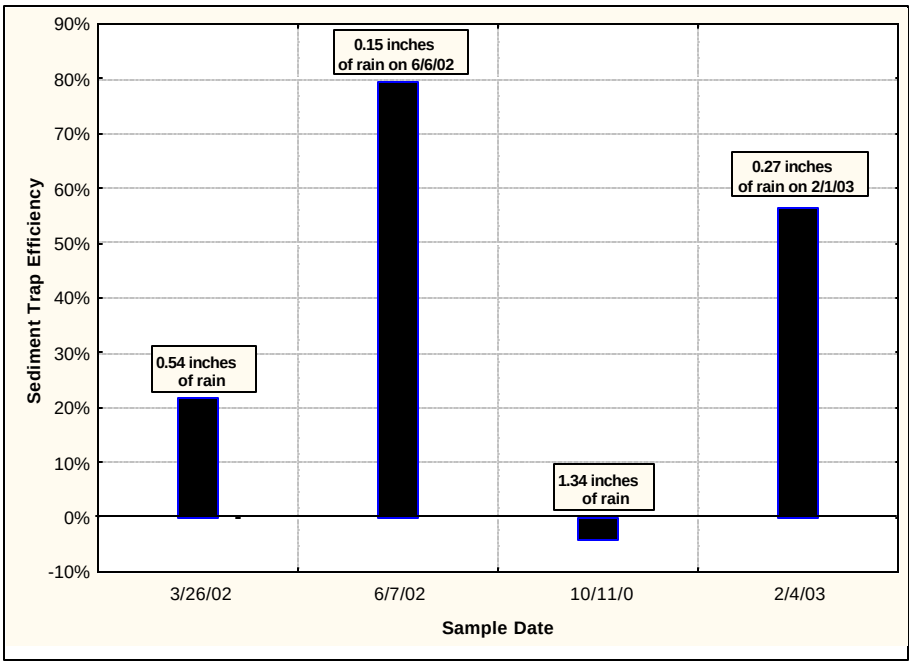

Figure 12 Total Suspended Solids Removal Efficiency of Running Brook Acres Sediment Control Facility

Greenway Village at Clarksburg (Pre-construction)

This site is located south-west of Skylark road and consists of 374 acres. Currently the dominant land use on the site is agriculture (crops) with small patches of woodlands. When developed the site will contain mixed residential and commercial land uses. BMP monitoring requirements are summarized in table 5. Seven ground water wells were installed throughout the site during the period of 11/01 – 1/02 to study the effectiveness of BMP's and site design in maintaining groundwater levels. Because of the extremely dry weather experienced throughout the region, three of the wells have been dry since they were installed and one well has been dry intermittently. All of the dry wells are located on high elevation points and are drilled to depths of 30, 25 and two at 45 feet.

The status of data submitted thus far is presented in Table 5. All data received to date is pre-construction data to be used as baseline to compare against during- and post-construction data.

Highlands at Clarksburg (Pre-construction)

The site consists of 64.6 acres located at the southeast corner of the intersection of Stringtown Road and MD Route 355. Approximately eight (8) acres were acquired and a new water quality plan for the whole 64.6 acre site was finalized in October of 2002. The proposed development is zoned RMX-2/R-200 and will consist of commercial and office uses along with single family and townhouse residential lots. Five groundwater wells have been installed throughout the site to provide information on groundwater elevations. Two temperature loggers are required, one upstream and one downstream of the main sediment control/SWM facility. No monitoring was completed during 2002 because

construction activity had not begun. Results of pre-construction monitoring, completed during 2001, are presented in last years SPA annual report.

Timbercreek (during-construction)

The site (zoned R-200) consists of 12.2 acres and is located on the north side of Newcut Road near the Rt. 355 / Newcut Road intersection. Development of the site includes 24 single-family lots. Water quantity control on the site will be provided via a dry pond that will provide control for the one year storm event with a pre-developed release rate. Quality control will be provided via a treatment train, which consists of vegetated conveyance swales and modified dry swales (infiltration swales) that outfall to a surface sandfilter. The sandfilter is sized to treat one-inch of run-off over the impervious area.

BMP monitoring requirements for the site are summarized in Table 5. Pre-construction BMP monitoring included one year of stream temperature from two locations in Little Seneca Creek (upstream and downstream of the outfall from the sediment control/SWM facility) and one year of groundwater well readings from one well. Construction on the site began in October of 2001.

Stream temperature data from 2002 indicate that flow leaving the sediment control facility has not had an impact on Little Seneca Creek. Water temperature at both the upstream and downstream monitoring points was higher during 2002 then 2001. However, the difference in average temperature between upstream and downstream is the same in 2002 as 2001.

Two groundwater wells were installed in April of 2001. Bedrock was encountered during the installation of one well which has generally been dry since. Well data from this site was identified in 2003 as needing correction. The consultant has agreed to correct the data and provide an updated analysis.

All Souls Cemetery (pre-construction)

The site consists of 166 acres located at the northeastern corner of Brink Road and MD Route 27 (Ridge Road). The property is zoned RDT and the proposed development will include a cemetery, chapel and mausoleum complex. The majority of the property is located within the Wildcat Branch tributary of Great Seneca Creek.

Quantity control of storm water runoff is provided via a dry pond. This structure will provide both twelve-hour extended detention of the one-year storm and detention of the two-year storm. Quality control will be provided via a treatment train that consists of infiltration structures (if feasible) or bioretention structures, coupled with vegetated swales along roadways. Finally, the runoff will be conveyed, via a storm drain system, to a surface sand filter before outfalling to the dry pond. Quality structures are sized to treat a total of one-inch over the impervious area.

BMP monitoring on the site includes one continuous temperature logger and two channel cross- section

study points in the small tributary that receives water from the detention pond. Pre-construction monitoring began in May of 2001. Construction on the site began during the fall of 2001. Some results of baseline temperature monitoring are presented in Table 11 below. Data from 2002 shows stream water temperature exceeded the Use Class III criteria of 68 degrees (F) for long periods of time. Stream temperature was clearly warmer during 2002 then 2001, a trend observed throughout the Little Seneca Creek watershed and caused primarily by severe drought. Stream temperature response to storm events was similar during both pre- and during-construction years. Release of warm water from the sediment control facility during and after storm events has not had an impact on stream temperature.

Table 11 Wildcat Branch Tributary Stream Temperature Data Downstream of All Souls Cemetary

Month/Year		Maxumum Temperature (F)	Median Temperature (F)	Number of Days State Use Class III Criteria was Exceeded	Percent of Time State Use Class III Criteria was Exceeded
June, 2001	Pre-Construction	68.7	62.3	2	0.69
July, 2001		71.0	63.7	4	6.18
August, 2001		74.1	67.5	21	39.74
Sept., 2001		68.4	61.7	1	0.63
June, 2002	During-Construction	68.1	62.0	3	1.16
July, 2002		72.0	68.1	21	50.74
August, 2002		82.2	70.7	25	67.72
Sept., 2002		74.7	63.7	10	13.61

Two stream channel cross sections were each surveyed twice here in 2002. The surveys indicate the stream channel is stable and has not been greatly impacted by construction.

Martens Property

This site consists of 102.8 acres located northwest of the intersection of MD Route 355 and Newcut Road. Zoning of the site is R-200/TDR-4 and is to consist of 106 single-family detached units and 219 townhouse units and associated infrastructure.

Quantity control is to be provided via five extended detention dry ponds to provide control of the one-year storm with a maximum detention time of 12 hours.

Figure 13 Aerial Photo of Martens Property

Quality control is provided via many structures throughout the site including: bioretention, recharge areas, surface sand filters, water quality inlets (both filtering and flow through) and vegetated buffer filtering. The primary water quality structures will be sized to treat one-inch of rainfall over the proposed impervious area.

Phase I of this project (consisting of 52.6 acres) began construction early in 2003. Four (4) groundwater wells were installed during March of 2002 within the Phase II area (consisting of 50.2 acres). Pre-construction groundwater monitoring was completed between March 14, 2002 and Dec. 30, 2002. Results of pre-construction groundwater monitoring will be used to compare against during- and post-construction results.

The mainstem of Little Seneca Creek runs through the middle of the site (figure 13). Stream temperature monitoring is done at two locations in Little Seneca Creek, one upstream of the property the other downstream. Temperature monitoring results, collected by DEP in 2000, are used as pre-construction condition. A summary of this data along with 2002 data (the first year of during-construction monitoring) is presented in Table 12.

Stream temperature was warmer at the downstream monitoring location during both 2000 and 2002 monitoring years. The riparian buffer between the two locations does not provide shade, consequently the stream water temperature increases. Additionally, Beaver ponds are slowing water flow through this section of stream causing prolonged exposure to solar radiation. During the summer of 2002 stream water temperature was higher than previous years throughout the Little Seneca Creek watershed due to drought conditions and warmer then normal air temperature. During the pre-construction monitoring year of 2000 average water temperature increased by 4.0^0 (F) between the upstream and downstream locations. During the summer of 2002, the first during-construction monitoring year, average water temperature increased by 3.0^0 (F) between upstream and downstream locations. The increase between upstream and downstream was less during the summer of 2002, indicating that construction activity had no affect on average stream temperature in Little Seneca Creek.

Table 12 Summary of Stream Temperature Data from Little Seneca Creek - Upstream and Downstream of Martens Property (Summary Statistics are from the Period of June – September During Each year)

Monitoring Location	Year	Max. Temp. (F)	Mean Temp. (F)	Standard Deviation	No. Days Use IV Criterion Exceeded	Percentage of Days Use IV Criterion Exceeded
Upstream	pre-construction (2000)	72.2	64.0	3.4	11	9.0%
Downstream		79.6	68.0	4.1	0	0.0%
Upstream	during-construction (2002)	78.5	66.7	5.4	20	16.7%
Downstream		86.3	69.7	6.9	68	56.7%

Linthicum Property (East) AKA – Summerfield Crossing

This site consists of 127 acres located on both sides of West Old Baltimore Road east of Comsat Drive. Zoning of the site is R-200 and will consist of 157 single-family detached dwelling units, 102 single-family attached dwelling units, a future school site, and the associated infrastructure. Water quantity for the site will be provided via two dry ponds which will provide control of the one-year storm with a maximum detention time of 24 hours. Quality control will be provided via a combination of stormwater structures consisting of forebays, dry swales (vegetated swales underlain with infiltration structures), bioretention structures, surface sand filters, combined sand filter/infiltration structures, and structural water quality filters.

BMP monitoring requirements for the site are summarized in Table 5. Data submitted to date will be used as baseline to compare with during- and post-construction monitoring data.

4.1.4 Summary of Stream Monitoring in the Clarksburg SPA

Stream monitoring in Clarksburg SPA began in 1994 and is done on an annual basis at most of the twenty seven (27) stations shown on figure 2. During 2002, biological monitoring was completed at sixteen (16) stations and water temperature loggers were deployed at five (5) stations. Results, presented in Figure 15 and Figure 16 indicate little change in biological integrity from previous years at most stations. Exceptions include stations LSTM106, LSTM206, LSCB101 and LSCB201 were biological integrity declined from previous years. The record drought caused portions of Ten Mile Creek to go dry during August and September of 2002. No monitoring station in Little Seneca Creek was observed to go dry, but stream flow was much lower then normal. Consequently, stream water temperature during the summer months was considerably warmer in comparison to previous years.

A cooperative monitoring effort between the US EPA, US Geological Survey, USFWS, University of Maryland Baltimore, MNCPPC and DEP began during 2002 to study changes in stream geomorphology, flow and biology as development proceeds.

4.1.4.a Biological Monitoring Results

Land disturbance during 2002 was mostly confined to two areas; 1) Clarksburg Town Center and 2) Clarksburg Detention Center. Two other smaller construction projects (Timber Creek and Running Brook Acres) were also active during 2002.

Clarksburg Town Center

Stream impairment related to construction activity on the Clarksburg Town Center is assessed by monitoring the biological community and habitat condition at two stations along the Town Center Tributary, 1) LSLS103C, located just downstream of Stringtown Road and 2) LSLS103B, located in the lower end of Town Center Tributary. The SPA Annual Report for 2001 stated that the fish community at LSLS103C was still recovering from the drought of 1999 and that some species, i.e. sculpins, are slower to recolonize then others i.e. blacknose dace. Consequently, IBI scores remained low at LSLS103C. Results of monitoring in 2002 show unchanged condition of the fish community at LSLS103C. The more sensitive sculpin species continue to represent a low proportion of the overall fish community. Considering how low the stream flows were during 2002 this is expected. Results of benthic macroinvertebrate monitoring in 2002 indicate no change from 2001. Downstream at station LSLS103B, IBI scores indicate no change to the fish or benthic macroinvertebrate community in 2002. In summary, both the fish and benthic macroinvertebrate communities in the Town Center Tributary were found to be healthy and un-impacted by construction activities on the Clarksburg Town Center. However, DEP did note the continued presence of fine sediment and an apparent increase in algae growth within the Town Center tributary. (Figure 14).

Figure 14 Fine Sediment and Algea in Town Center Tributary

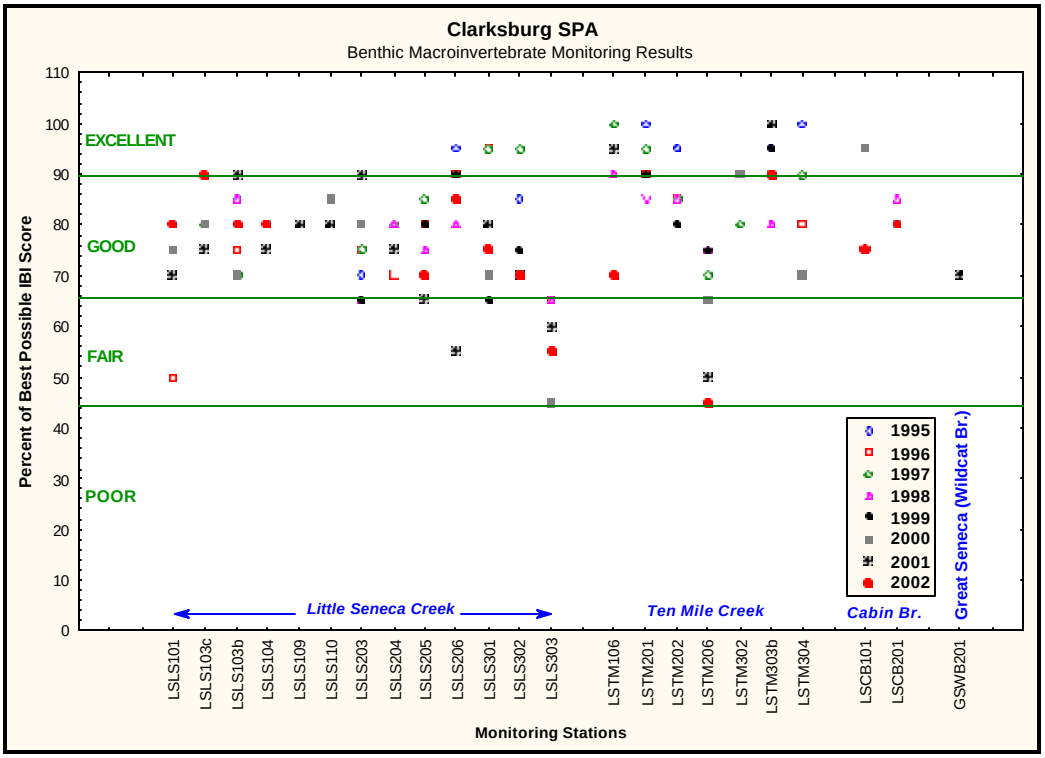

Figure 15 Results of Benthic Macroinvertebrate Monitoring in Clarksburg SPA (1995 – 2002)

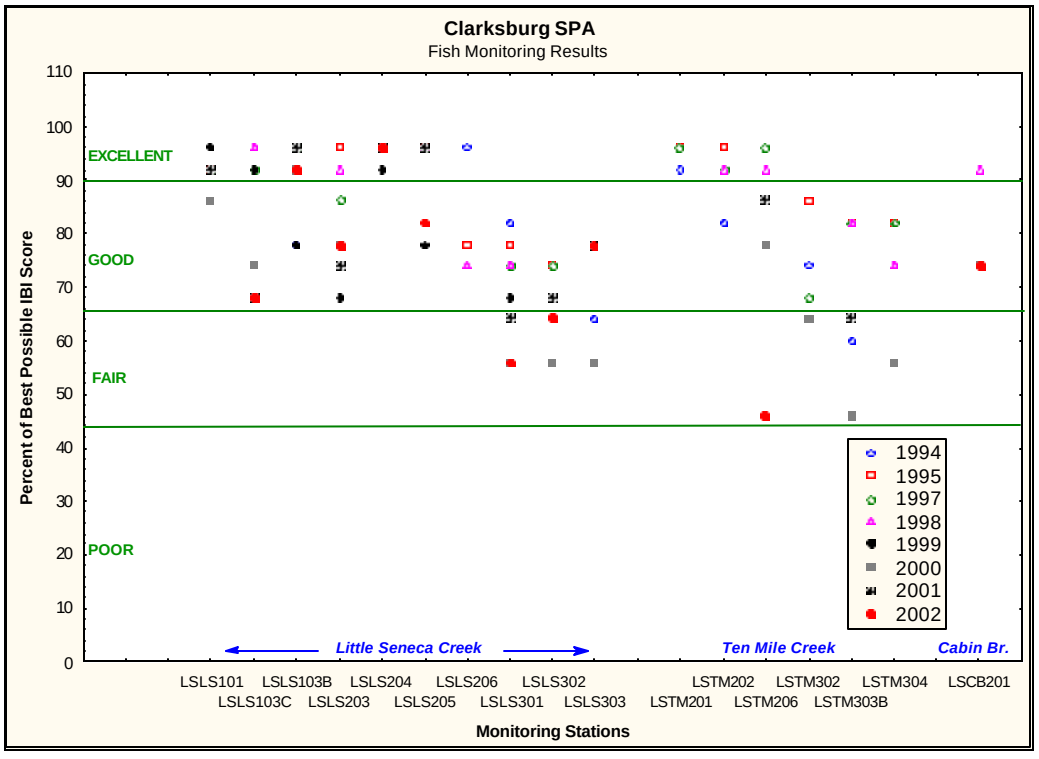

Figure 16 Results of Fish Monitoring in Clarksburg SPA (1994 – 2002)

Clarksburg Detention Center

Construction of the new Clarksburg Detention Center was completed in April of 2003. Runoff from the site drains to two tributaries of Ten Mile Creek, both of which have stream monitoring stations - LSTM106 and LSTM206 (Figure 17). Most of the site drains to a small un-named tributary. Monitoring station LSTM106 is located at the lower end of the tributary just before its confluence with Ten Mile Creek. Because the stream at station LSTM106 is too small for fish sampling only benthic macroinvertebrate sampling is done. Monitoring results have shown the benthic macroinvertebrate community consistently in the excellent range between 1998 and 2001. Results from 2002 are in the lower portion of the good range. The drop in IBI score may be related to very low flow in this small tributary during the spring of 2002 in the early portion of the drought. Future monitoring results will determine if this is a short term condition related to flow or a long term water quality issue.

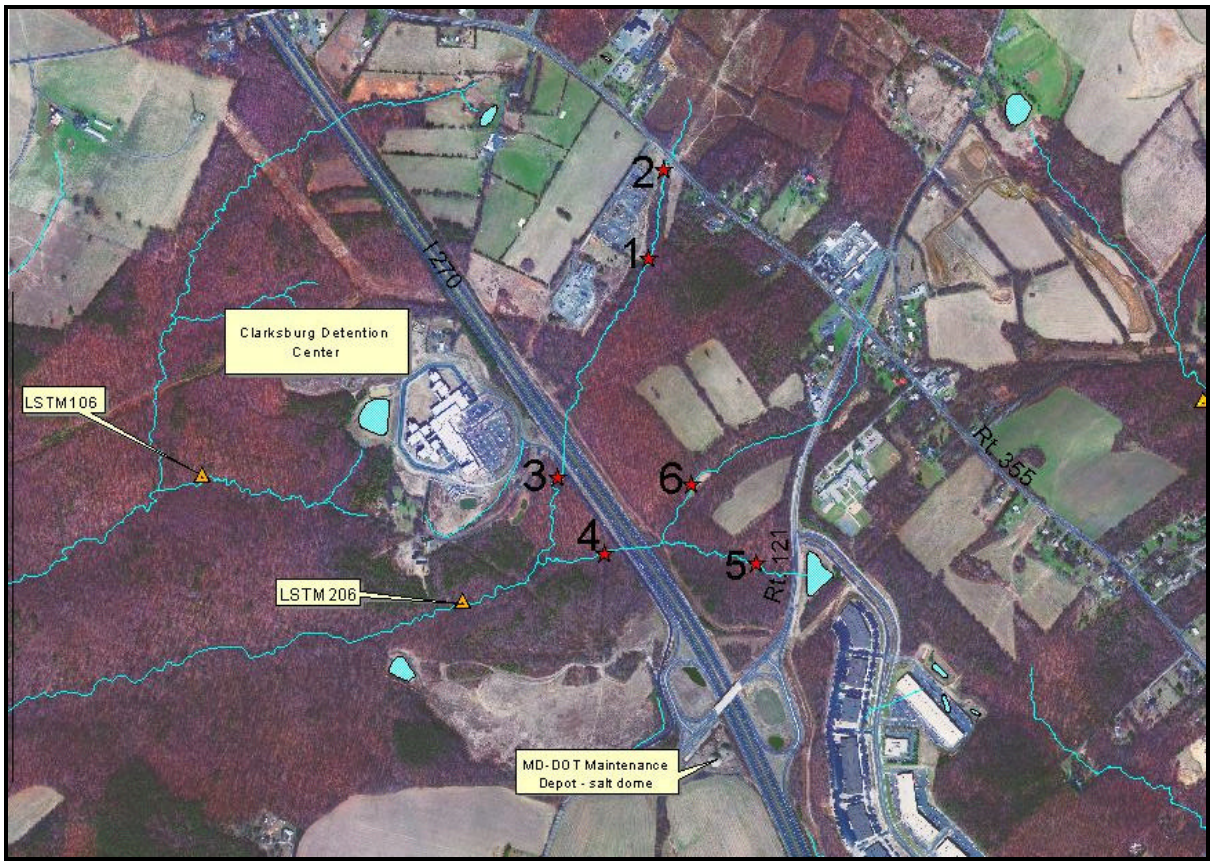

Figure 17 Aerial Photo of Clarksburg Detention Center **(taken 12/2002)**

A small portion of the Detention Center site drains to LSTM206 located on a tributary that skirts the southern edge of the property. Monitoring results have consistently shown the benthic macroinvertebrate community is somewhat degraded in comparison to the rest of Ten Mile Creek. Results from 2001 and 2002 indicate further decline of biological health. Additionally, fish monitoring results show a decline in overall community health in 2002.
Conductivity readings are considerably higher in the Detention Center tributary (LSTM206 and

LSTM202) then the rest of Ten Mile Creek (Figure 18). The cause(s) of impaired biological condition here may be related to high conductivity. In the 2001 SPA report DEP identified a need for further monitoring to identify the source of these readings. Causes of high conductivity can include: 1) natural geology (e.g. limestone formation), 2) road salts, 3) failing septic systems, 4) high concentration of various pollutants.

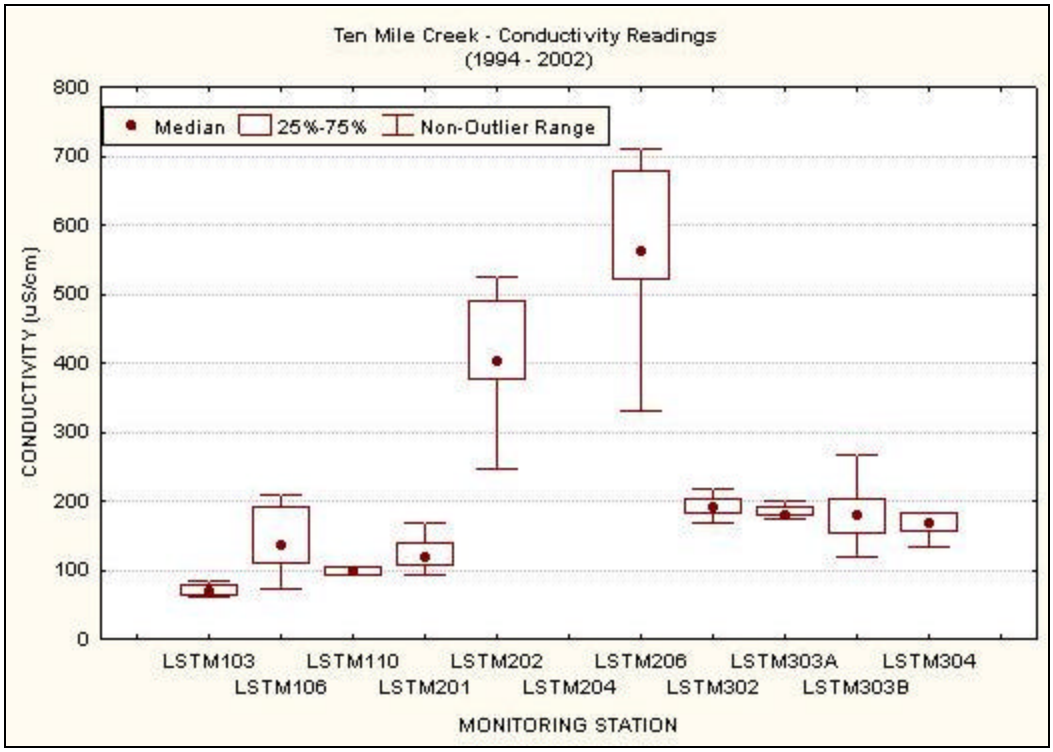

Figure 18 Summary Of All Conductivity Readings Taken In Ten Mile Creek (1994 - 2002)

In 2002 DEP took conductivity readings at six (6) locations throughout the drainage area upstream of LSTM206 (Figure 18) in an attempt to isolate a source. Results show conductivity is high throughout the upstream drainage area (Table 13). These results suggest that the cause is broad based. DEP plans to investigate this further during 2003 with nutrient and chloride sampling.

Table 13 Water quality in the LSTM206 drainage area on 11/14/2002

Station	Water Temperature (Celcius)	pH	**Conductivity (uS/cm)**	Dissolved Oxygen (mg/l)
1	10.6	7.4	**597**	8.4
2	11.6	7.6	**602**	9.0
3	10.2	7.7	**466**	11.5
4	10.8	7.6	**753**	10.0
5	10.6	6.8	**506**	9.3
6	10.4	7.3	**629**	8.7

4.1.4.b Habitat Monitoring

Rapid habitat assessments completed along with biological monitoring are visual based assessments where stream habitat is broken out into10 parameters. The scores for each parameter are summed and the total score is used to assign a narrative habitat condition of optimal, sub-optimal, marginal, or poor. Rapid habitat assessments are helpful in determining if stream habitat condition is playing a role in biological health.

Results of all rapid habitat assessments completed from 1994 to 2002 are presented in Figure 19. Over the eight year period, most monitoring stations have remained in the optimal/suboptimal range. Exceptions are stations LSLS205, LSLS206, LSLS302 where quality of stream habitat is impaired by a lack of riparian vegetation, i.e. forested flood plain. These stations have sometimes been rated as marginal. In 2002 LSLS205 and LSLS302 were rated as sub-optimal. LSLS206 received a rating slightly below sub-optimal.

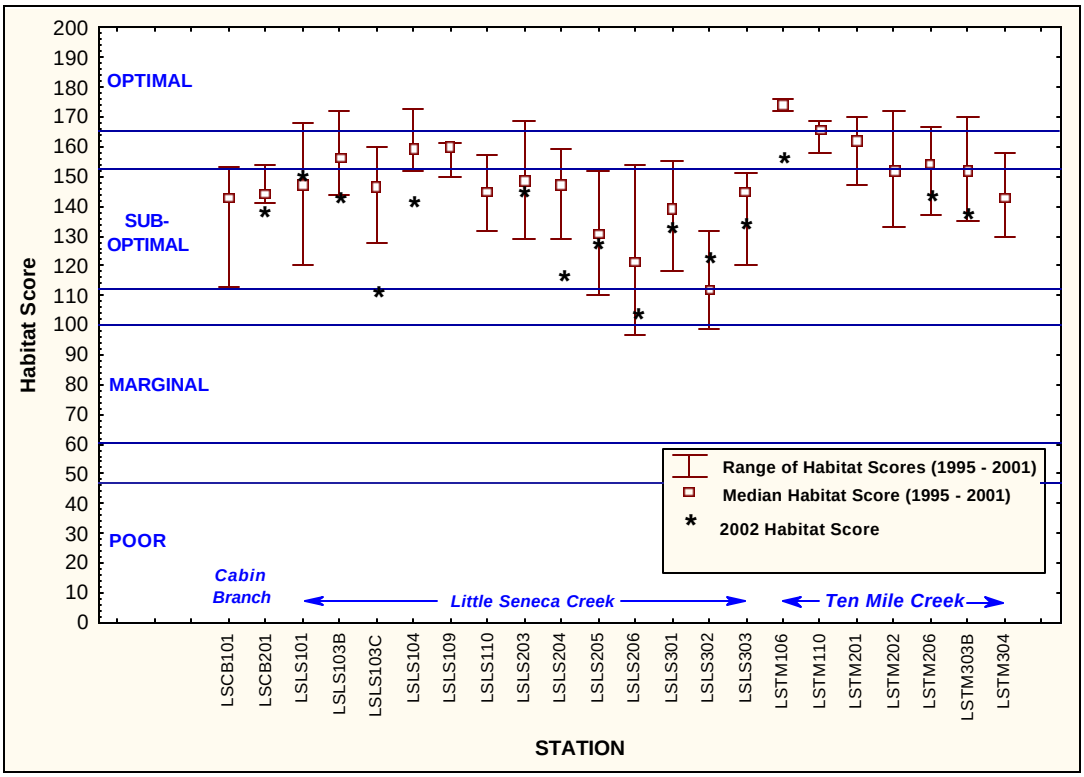

Figure 19 Rapid Habitat Scores From Clarksburg SPA

Habitat scores from 2002 are generally within the range of previous years except at four (4) stations (LSLS103C, LSLS104, LSLS204 and LSTM106) where scores are lower. The habitat parameter that best accounts for these lower scores is 'channel flow status', which evaluates the proportion of stream channel that contains water. The record drought was the cause of reduced wetted area in the stream channel. The effects were greater in the smaller headwater areas of the watershed where streams were reduced to a trickle of water flowing between pools or were completely dry. Because

observable changes in channel morphology are generally slow, quantitative monitoring has been scaled back in frequency. We did very little quantitative monitoring in Clarksburg SPA in 2002.

4.1.4.c Stream Temperature Monitoring

Clarksburg Town Center Tributary

Continuously recording temperature loggers were deployed at LSLS103C and LSLS103B during the summer of 2002. Results, presented in Figure 20, show water temperature remained below the 75^0F criteria for Use IV streams at both locations.

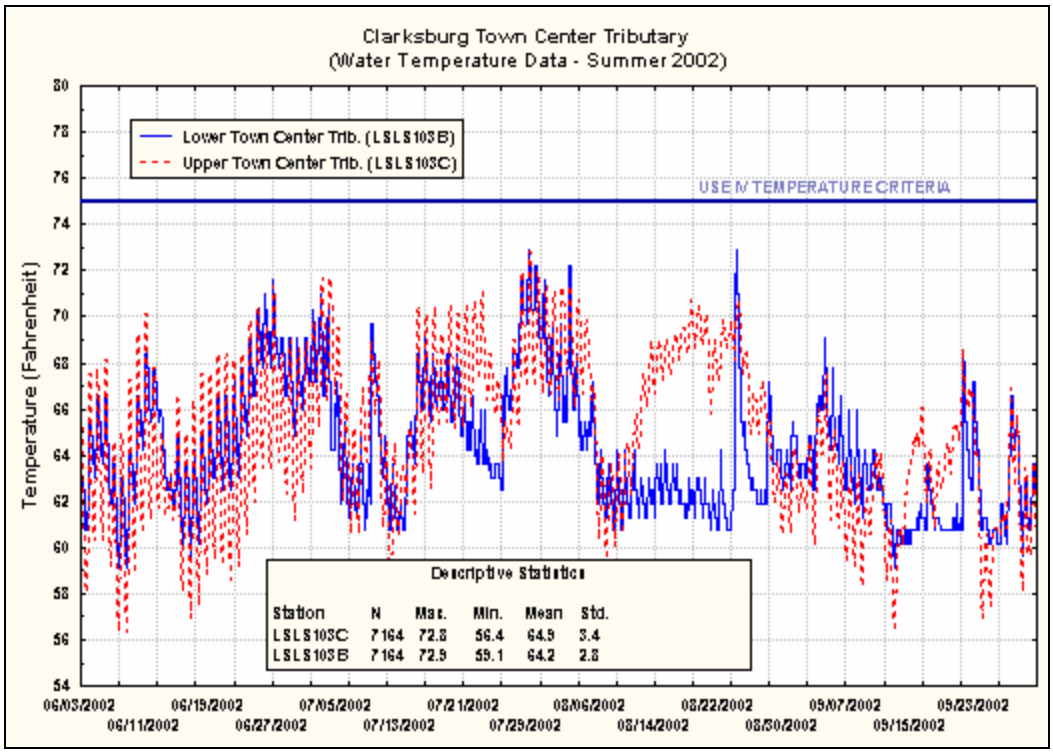

Figure 20 Water temperature data from the Town Center Tributary

Results from 2002 along with four previous years at LSLS103C are summarized in Table 14. Water temperature data from 1997 and 1998 were collected before construction activity began at the Town Center and will be used as baseline stream water temperature at this site. The first sediment control pond was constructed on the Town Center property in August of 1999. Data collected during 2000, 2001 and 2002 are from the during-construction period. There does appear to be some thermal impact from the new sediment control ponds, particularly with maximum stream water temperatures. Maximum temperature spikes are greater for the during-construction years of 2000 and 2001. Flushing of sediment ponds during large storms sending a pulse of warm water downstream is the probable cause. Sediment ponds are designed to have a permanent pool of water that is exposed to solar radiation resulting in very warm temperatures. Large storms can flush out the warm water resulting in brief pulses of warm water downstream. While this is undesirable, without the pond large amounts of sediment

would be entering the stream.

Table 14 Summary of Continuous Water Temperature Data From Station LSLS103C (period of data collection for each year is June 1 – Sept. 30)

Year	Number of Observations	Maximum (Fahrenheit)	Mean (Fahrenheit)	Standard Deviation	Percent of Time 75^0 F Criteria Was Exceeded	Mean Air Temp. (F) *
1997	7320	71.7	61.7	3.69	0 %	72.9
1998	3196	71.7	64.1	3.36	0 %	74.0
2000	7320	74.1	64.9	3.88	0 %	70.6
2001	7320	73.1	63.1	3.96	0 %	72.3
2002	6660	72.8	64.8	3.43	0 %	76.0

* Air temperature data from Damascus, MD

Little Seneca Creek Mainstem

During the summer of 2002 temperature loggers were deployed along the mainstem of Little Seneca Creek at two locations, LSLS301 and LSLS303 (Figure 21). Results show water temperature was warmer during 2002 than previous years. Average temperature at LSLS301 (just downstream of Rt. 355) was five degrees (F) warmer during 2002 then 2000. Additionally, 9 percent of the readings exceeded the Use IV criteria during 2002 while no readings exceeded 75^0F during 2000. The difference between 2002 and 2000 has more to do with weather conditions then development impact. There was a record drought in 2002 and air temperatures were, on average, 5.4 degrees warmer then 2000.

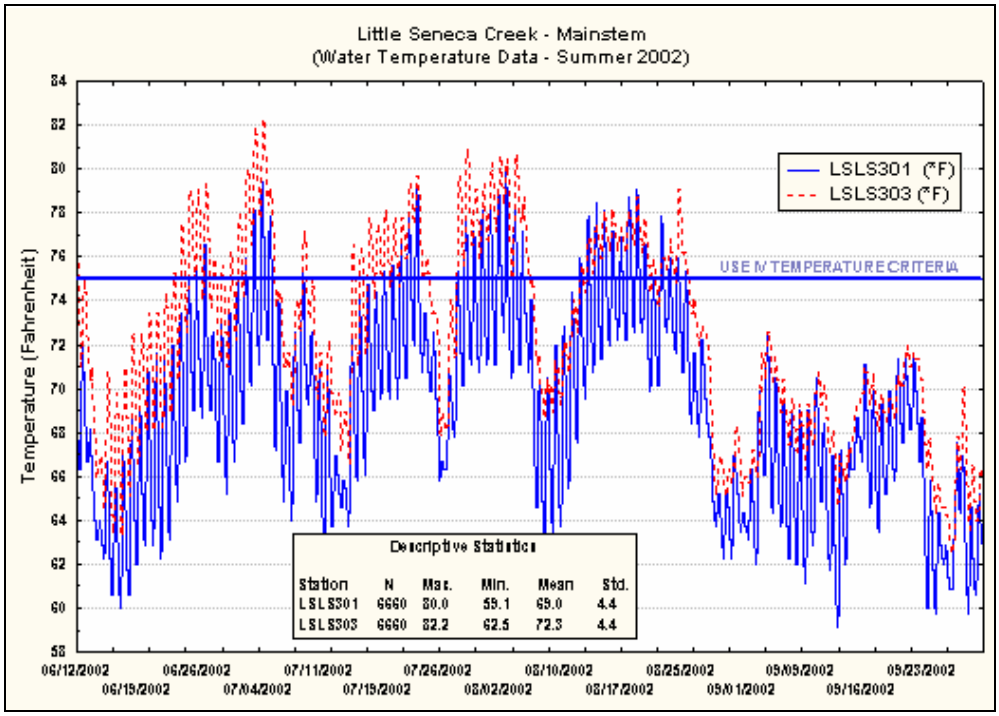

Figure 21 Water Temperature Data From The Mainstem of Little Seneca Creek

Cabin Branch

Data from a temperature logger placed in Cabin Branch at LSCB201 during the summer of 1998 show water temperature generally remaining below the Maryland Use Class III criteria of 68^0 F (Figure 22). During the summer of 2002 water temperature was warmer then 1998 by 2^0 F on average. However, water temperature did remain below the MD. Use IV criteria of 75^0F throughout the summer of 2002.

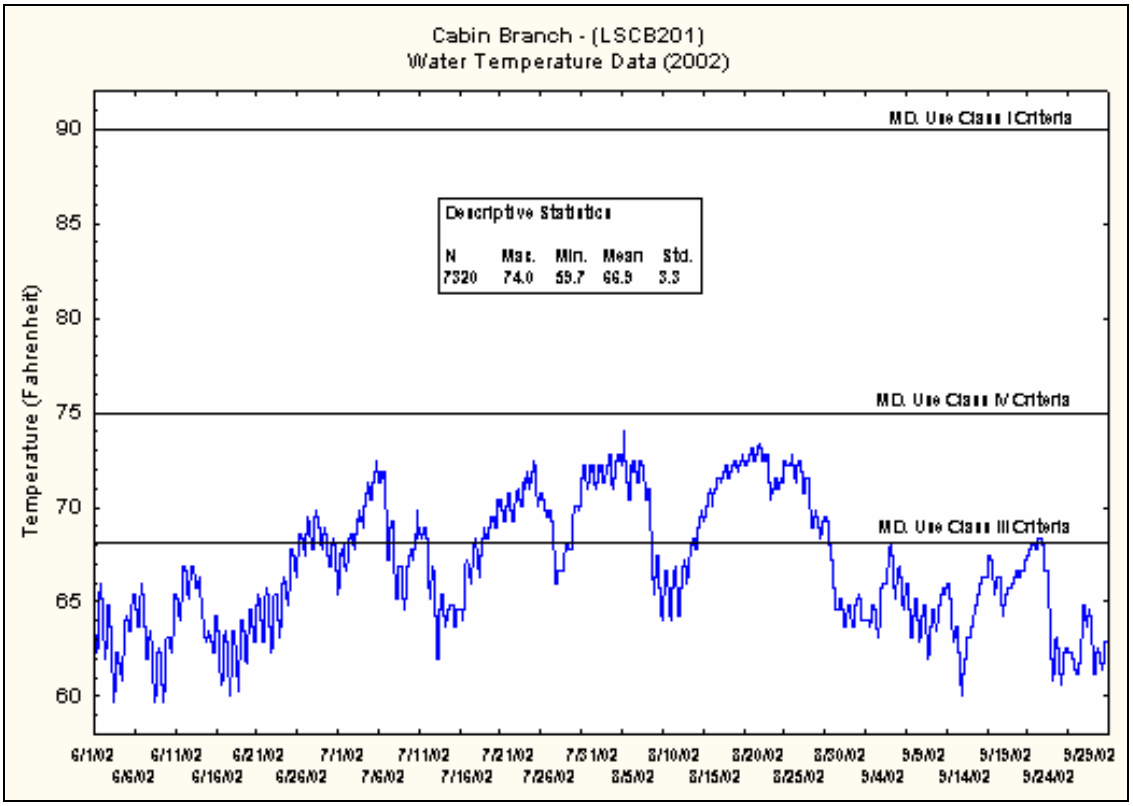

Figure 22 2002 Temperature Data from Cabin Branch – LSCB201

Cabin Branch is currently designated by Maryland as a Use Class I stream, which means that discharges to the stream must not result in ambient stream temperature to exceed 90^0 F. The biological integrity of Cabin Branch is currently rated as good. However, continued elevations in water temperature would very likely impair the biological integrity.

4.1.4.d Development Impact Study

A cooperative study to evaluate the impacts of development and BMPs, and the usefulness of LIDAR (LIght Detection And Ranging) as a monitoring tool for quickly collecting large amounts of very accurate data on surface elevations, was initiated during 2002. Participating federal and local agencies include the U.S. Geological Survey, EPA, USFWS, M-NCPPC, Montgomery County DEP and the University of Maryland.

One goal of the project is to evaluate the degree to which LIDAR can be used to monitor changes in stream channels and other environmental features. It is uncertain how well this technology will work in this new application. If LIDAR is accurate enough, there are many possible ways that the data could be used. Topographic maps showing stream channel shapes, locations of erosion, sediment deposition and vegetation coverage are among the numerous potential mapping products that might result. From that data additional products could possibly emerge including calculations of the amounts of sediment deposited in stream channels, and eroded from them. LIDAR may have a big impact on our ability to document stream channel characteristics. It is currently only practical to accurately survey very small sections of stream channel at widely spaced sample sites while LIDAR might be able to produce accurate images of entire watersheds. We hope that LIDAR will allow us to gain a much clearer idea of how stream channels are behaving over time and reacting to development impacts although it is uncertain how well this experimental application will work.

LIDAR data was collected over the area delineated in Figure 23 which includes most of the Clarksburg SPA. The area to the north, Sopers Branch - a tributary to Little Bennett Creek, was included as a positive control (ie, minimal land disturbance).

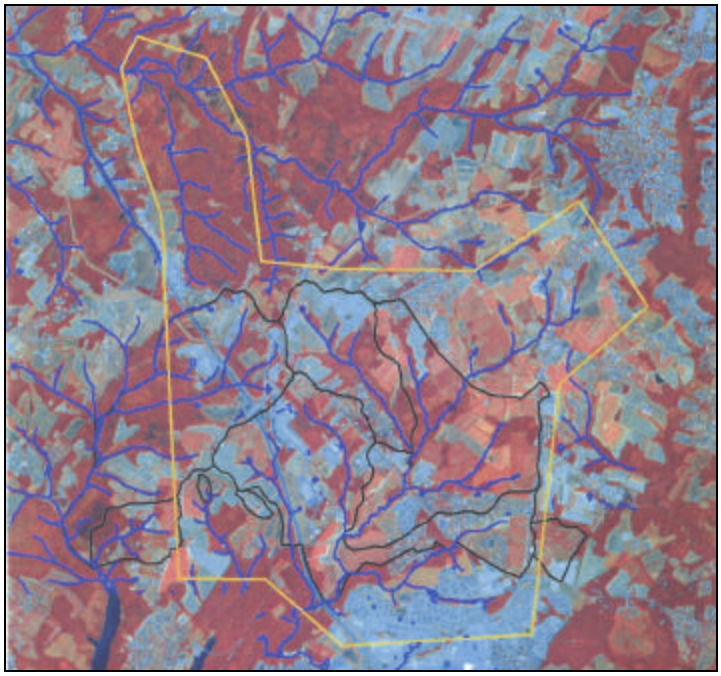

Figure 23 Area from which LIDAR data was collected in Dec. 2002, includes all of Little Seneca Creek watershed (upstream of I 270), a portion of Little Bennett Creek water shed (Sopers Branch) to the north and a portion of Ten Mile Creek to the west.

To complement the LIDAR data, the USGS and DEP are cooperating to install five flow gages in Clarksburg SPA tributaries. The USGS and DEP are to cooperatively install and operate these gages. This collaboration will give DEP access to the expertise of the USGS in collecting and analyzing information on stream flow. It will also provide DEP access to additional technological capabilities, including real-time data dissemination, which we have not had in the past.