# IX. Plan and Schedule for Implementation

Each of the monitoring programs discussed above, in the body of this Strategy, contains a separate section that describes the plan and schedule for the continual development and/or implementation of that module. The plans and schedules were originally presented in this manner because of their varying stages of development. For the most part, each module of the WQM Program has already been implemented. However, the need for continual reevaluations and adaptations to new needs and changing resource availability suggests that a "fully implemented" WQM Strategy will always remain a vision for the future.

The following sections present an historical overview of the evolution and implementation of the WQM Strategy and a summary of its future vision.

## A. Historical Perspective:

DEQ formed a Water Quality Monitoring Task Force workgroup in the spring of 1997, in response to the Water Quality Monitoring, Information, and Restoration Act (WQMIRA - Article 4.01 of the Code of Virginia). The results and progress of that task force, from its inception until the initial draft monitoring strategy was delivered to EPA, are documented in the table "Chronology of WQM Task Force and Strategy Evolution" [I-0c.xls]. In most cases the task force established its own target dates for its accomplishments, but in several instances legislation or other factors outside of the task force dictated timelines. The 'accomplished date' field documents when the task was actually completed. Tasks consisted of meetings, subcommittee progress reports, finished documents delivered, or other activities. The Responsible Person(s) is the individual or group that was responsible for completing the task and the number listed in the MIRA column is the corresponding Section (§B.) of WQMIRA that the task addresses.

Several monitoring initiatives described in the original WQM Strategy draft were implemented contemporarily with the development, revision and initial implementation of the strategy itself. Estuarine probabilistic monitoring was initiated in the summer of 2000, with a federal grant under the auspices of the Coastal 2000 Initiative / National Coastal Assessment Program. Probabilistic monitoring in free-running freshwater streams was initiated with agency 'general funds' resources in the fall (Oct-Nov) of 2001, soon after the Watershed Monitoring Network was defined and established; the first two-year rotation of watershed monitoring sites was initiated on July 1, 2001.

## B. Recent and Current Considerations:

Declining economic trends and the consequent reduction of state and federal resources available for water quality monitoring prior to 2005 resulted in several modifications to DEQ's Water Quality Monitoring Program. Discussions and deliberation among WQM staff and upper-level DEQ administrators during 2002 and 2003 resulted in the drafting and subsequent publication of a guidance document for managing WQM programs while under reduced resources (Guidance Memo No. 03-2004 – 10 February 2003) [III-A-0f.pdf]. This memo, subsequently revoked in June 2009, formally established priorities, relative to resource redistribution and program continuity, for the various monitoring programs and subprograms within the overall WQM Strategy. The agency recognized that there was little discretion allowed to reduce resources dedicated to Priority Group1 monitoring activities because of the need to: (1) Minimize environmental damage from pollution incidents; (2) Provide key agency programs with needed data in a timely fashion; (3) Meet commitments made by the Commonwealth; and/or, (4) Ensure consistency and usefulness for statewide application of data. Every effort should be taken to fully implement the monitoring plans for these activities, including the possible reduction in monitoring resources for activities listed in Priority

Group 2. Priority Group 2 monitoring activities were considered important in providing a broad-based, comprehensive monitoring program for the Commonwealth. The goal was to conduct as much monitoring in these activities as resources allowed, in order to achieve the objectives in the Monitoring Strategy. However, management discretion existed to reduce resources dedicated to these activities, either at the statewide or regional level, based on budget constraints. Any reduction in resources should be designed to maintain a balanced investment in each of these monitoring activities. No monitoring component should be entirely eliminated in any year without consultation among both Central Office and regional staffs.

This guidance was subsequently revoked on 16 June 2009, but further declines in resource availability between 2009 and 2012 stimulated additional discussions relative to prioritizing monitoring activities. The final result was to identify the three monitoring activities with the highest priority and the three with the lowest priority relative to resource redistribution and program continuity. [III-A-0g.xls] TMDL development monitoring, trend monitoring and ambient watershed monitoring, closely Regional reservoir monitoring, follow-ups to citizen's requests or of observed effects waters, and TMDL implementation follow-up monitoring were received the lowest priorities, and would be the first programs to be reduced if resources continue to continue in decline.

### C. Future Vision:

The VA-DEQ has its eyes on the future and is aware that new and often unanticipated water quality concerns will continue to arise, that currently identified concerns may well require increasing resources in the future, and that even an ideally conceived water quality monitoring program will always be limited by resource availability. Wherever possible, we have attempted to anticipate these needs and the increased resources required. The possible effect of future inflation on program costs has not been included in the estimates.

#### 1. Milestones, Timelines and Resource Requirements - 2007-2018

In many cases, the milestones described in the following section correspond to defined objectives already identified for improving implemented programs and subprograms. In some cases, the resources required for meeting these goals or attaining milestones, and the associated timelines, have already been confirmed. In other cases, the milestones identified correspond to the requirements considered necessary to fill perceived gaps in the specific programs or subprograms being discussed. (More detailed discussions of specific components of the WQM Program may be found in Chapter III – Design and Implementation.) Under these conditions, the estimated timelines are themselves often contingent upon acquiring the necessary resources for attaining the identified goals. A generalized summary of goals and milestones is presented in the linked spreadsheet "Implementation Plan and Schedule for of the VA-DEQ Water Quality Monitoring Strategy" [IX-2.xls]. This extensive table includes both historical milestones and future timelines associated with the evolution of the current Water Quality Monitoring Program and DEQ's updated Water Quality Monitoring Strategy.

One notable challenge is the need for additional human resources. The availability of financial resources to pay salaries does not guarantee the acquisition of permanent FTEs. The Virginia General Assembly defines personnel 'caps' for permanent employees hired by each state agency. Requests for additional personnel must be reviewed and approved, and the additional positions authorized by the General Assembly prior to seeking and hiring new personnel. The option of contracting temporary personnel or consulting services is generally not viable for long-term monitoring activities.

Resource estimates provided in this section are based on current costs and are not corrected for anticipated inflationary increases over the ten-year timeframe under consideration, nor do they include logistical costs or benefits and indirect costs associated with human resource requirements. (If so desired, a standard benefits coefficient of 30% and an additional 28.5% for indirect costs [rent, support, workers compensation insurance, etc.] may be added to the human resource estimates provided here.) Resource requirements for new equipment and for depreciation/replacement of existing equipment also are not included.

### (1) Ambient Monitoring Program

#### (i) Watershed Monitoring Network

The Watershed Monitoring Network is considered a fully implemented, permanent component of DEQ's Water Quality Monitoring Program. It is considered to be a high priority monitoring activity; its intensity of monitoring can be adjusted (thought not permanently suspended) in response to resource availability. The network was initiated in 2001, following implementation of the 1st edition of the WQM Strategy. Initially, adjustments could be made to the density of stations in response to changing evaluations of NPS Pollution risk potential and/or resource availability. The advent of the 2006 NWBD delineation of 1247 6th order (12-digit) sub-watersheds negated this flexibility – resources were only sufficient for a single monitoring site per sub-watershed, based on the established six-year rotation schedule. Flexibility was regained with the addition of several modifications for the initiation of the third six-year watershed rotation, in 2013. Resources at the time were sufficient to monitor approximately 360 sites per two-year rotation following previous guidance. Beginning in 2013, monitoring frequency was increased from bimonthly to monthly, and duration was decreased from two years to one year per site. Under this design, resources were sufficient for monitoring approximately 180 sites per year. A subset of the 180 sites (42 sites in the 2013 MonPlan – Program Code FA) were associated with selected freshwater probabilistic sites (see section III.B.1 - Watershed Station Network [AW]) to characterize temporal variability in select field and analytic parameters (pH, DO, temp, specific conductance, bacteria, nutrients), at an estimated cost of $28,441 for analytical services. Regional Monitoring Coordinators were given flexibility on how to distribute the remaining sites and resources (145 sites in the 2013 MonPlan – Program Code AW; $67,518), concentrating on regional problems as indicated by prior assessments or by trend analyses (Seasonal Kendall and/or IWQ) in the 2012 Integrated Report.

As currently executed (calendar year 2013), estimated annual resource expenditures for the Watershed Monitoring Network are approximately $95,959 for analytical costs (at the state laboratory – down from $179,016.78 in 2007!) and seven Salary Band 4 'full-time equivalents' (FTEs) of human resources for fieldwork (approximately $276,500 annually). Considerations discussed below may significantly alter these resource requirements.

2013-2018 –The final two-year rotation of the second full six-year cycle (2007-2012) of watershed monitoring was completed on 31 December 2012. The first tentative use of a one-year rotation, with monthly sampling, was initiated in January of 2013. The first year of associating watershed monitoring resources with freshwater probabilistic sites, as well as the change from bimonthly to monthly monitoring, is considered a pilot study. Although the current intent is to continue annual rotations and accelerated sampling for a full six-year rotation cycle (2013-2018), the performance of this pilot design will be evaluated during the first year. It is still possible that the siting protocols for both the FA and the AW sites will be modified, that the accelerated sampling and rotation schedules will revert to two years of bimonthly sampling, and that the parameter suites analyzed will be further reduced due to continuing resource limitations.

### (ii) Probabilistic Monitoring Networks

Both freshwater and estuarine probabilistic monitoring (ProbMon) are still relatively new activities to DEQ. Probabilistic monitoring, in general, is considered to be a high priority monitoring activity; it provides information in a form and with a statistical confidence that is not available from other monitoring programs. The representative (completely unbiased) results from the ProbMon programs are capable of providing resource-wide, basin-wide, and statewide characterizations of water quality with a known level of statistical confidence (i.e., known degree of error for the calculated estimates). The results from probabilistic monitoring also provide a basis for evaluating the representativeness or bias of other monitoring designs. Resource availability is a primary concern in the continued development of these ProbMon activities.

#### Free-Flowing Freshwater Probabilistic Monitoring Program (FP)

The freshwater ProbMon Program was initiated in the spring of 2001, and the first five-year demonstration project was completed in 2005. The agency has committed to making this activity a permanent part of its monitoring strategy. Freshwater ProbMon is also an important component of the agency's biomonitoring program. Future improvements to the biomonitoring program using probabilistic data are documented in the "Benthic Biomonitoring Program Self-Assessment 2009" [III-B-4e].

**2010-2020** – Continuation of the freshwater probabilistic monitoring. The state monitoring design already has been integrated into the 2013-2014 National Stream and River Assessment survey (NSRA) and the agency plans to participate in the 2018-2019 NSRA project. The agency would like to fund real-time temperature data collection at all probabilistic sites. Two additional goals of the freshwater probabilistic program are to create a fish community biotic index and reestablish the monitoring of toxic chemicals.

**2013-2018** – Beginning in 2013, the Freshwater Probabilistic Monitoring Program is being enhanced by a modification in the use of resources from the Ambient Watershed Station Network. At carefully selected freshwater probabilistic sites in each DEQ region, watershed stations are being established within the same homogeneous reach of the stream. These adapted watershed stations will be sampled monthly for a period of one year, using a new sub-program code (PA), in order to characterize temporal variability of conventional field, nutrient, and bacterial parameters at probabilistic sites. The intent is to rotate sites annually throughout the next six-year rotation cycle (2013-2018), although the year 2013 is considered to be a pilot study, to evaluate and improve the new sub-program.

#### Estuarine Probabilistic Monitoring Program (C2)

The original five-year 'Coastal 2000' grant from EPA/ORD expired on 30 September 2004. A one-year no-cost extension was requested and authorized in order to complete summary reports on fish community data that were collected during the first five years of the program. Because the field collection phase was not completed until September 2004, a one-year extension was required to allow for data analyses, summarization and reporting. A request was also submitted and approved for the reallocation of carry-over funds to pay for a special study of sampling gear carried out during the summer of 2004 and for the production of three reports to be completed in 2005. All three final reports were completed by June of 2005:

1. "National Coastal Assessment 5-Year Summary Report on Fish Species Distribution and Abundance" (June 2005) - summary report (Chesapeake Bay and Atlantic coastal), with statistics on species richness, diversity, and evenness. A report for public distribution will

include GIS elements, mapping all sampled sites and selected indices of interest of interest across all of the state's estuarine waters. The VIMS Fisheries Science Laboratory produced the report at a cost of $12,000.

2. "Toward the Development of a Fish Community Assessment Tool (Modified Index of Biotic Integrity) for Virginia's Small to Moderate Sized Tidal Tributaries" (June 2005) – multivariate statistical analyses of fish community data were used to evaluate the possibility of developing a Fish IBI for Virginia's minor tidal tributaries to Chesapeake Bay and the Atlantic coast. Drs. Gregory Garman and Stephen McIninch of Virginia Commonwealth University produced the report at a cost of $14,000. The study concluded that trawl sampling of fish communities on a single (summer) field day did not provide sufficient information to reliably relate fish community structure to environmental stresses at the site.

3. "Side-by-Side Comparison of 'Standardized Young Grab' and Composite 'Petite Ponar Grab' Samples for the Calculation of Benthic Indices of Biological Integrity (B-IBI)" (April 2005) – During the summer of 2004 a side-by-side comparison study of benthic IBI results using 'Petite Ponar' and standardized 'Young' grab samplers was performed by Dr. Dan Dauer of Old Dominion University. The Coastal 2000 grant contributed ~$15,000 and an additional ~$50,000 was provided by the Chesapeake Bay Program. (Total cost ~$70,000). The results confirmed that benthic results (individual metrics and CBP B-IBI scores) from two-sample composites using six-inch Petite Ponar grabs did not differ significantly from a single sample using a standard eight-inch Young grab.

An interim two-year EPA grant (2005-2006) permitted Virginia's continued participation in the National Coastal Assessment during its transition from a research program, under the auspices of the Office of Research and Development (EPA/ORD), to an established program under the Office of Water (EPA/OW). Beginning in the summer of 2005, DEQ's estuarine probabilistic monitoring (total of 50 sites annually - 35 sites within the Chesapeake Bay drainage) was partially integrated with the probabilistic elements of the Chesapeake Bay Benthic Monitoring Program. This provided additional resources to complement the reduced resources available for the NCA Program during 2005 and 2006.

At that time, the estimated annual cost for continuing the program under the original design, with 50 sites annually and a full suite of parameters, was at least $190,000, not including the costs for personnel, logistics, and the replacement of field equipment. Eliminating the fish community sampling and the chemical analysis of fish tissues substantially reduced this estimate. From 2001-2006, contracting for these services had represented approximately 40% of the annual budget. Without sampling fish, DEQ was able to maintain its state sampling design of 50 sites annually (~35 within the Chesapeake drainage and ~15 Atlantic Coastal) at a cost of approximately $100,000, exclusive of agency personnel and logistical costs. DEQ's Chesapeake Bay Program (CBP) and the Ambient Water Quality Monitoring (WQM) Program both contributed to this activity. This design permitted the continued use of the sediment quality triad (SQT – sediment chemistry, sediment toxicity, and benthic infauna) for weight-of-evidence assessment of contaminant-related stressors in estuarine waters.

Infusion of federal funds from the National Aquatic Resources Survey, National Coastal Condition Assessment in 2010 once again permitted the inclusion of fish community and tissue analyses at 22 estuarine sites. The coincidental availability of EPA's Oceanic Survey Vessel, the O.S.V. Bold, and field crews from EPA Headquarters and EPA Region 3, permitted DEQ to conduct an oceanic survey at 50 near-shore sites. The agency suspended its state design estuarine survey in 2010 and devoted its resources to the oceanic survey. Additional resources from DEQ's general monitoring fund and its Petroleum Spill Program

permitted sampling and analysis of trace metals and dissolved PAHs at all 50 oceanic and 22 estuarine sites. The results of the oceanic survey were reported as Chapter 4.8 - Near-shore Oceanic Survey [III-A-1b-3-3a] in DEQ's 2012 305(b)/303(d) Integrated Report.

**2013 –2020**

DEQ intends to maintain its normal state design of 50 sites annually - 35 sites within embayments and minor tributaries to Chesapeake Bay and 15 sites in coastal drainages - during the summers of 2013, 2014, and beyond. Resource availability at present will not permit us to do more. The current schedule of national surveys (NARS) indicates field seasons for coastal (estuarine) surveys in 2015 and 2020. The agency intends to participate in and contribute actively to both. The infusion of NARS resources will permit us to improve our own program, but it is doubtful that another near-shore oceanic survey will be possible. EPA has had to give up the Bold because of declining resources.

### (iii) Trend Monitoring Network

The Trend Monitoring Network is considered a fully implemented, permanent component of DEQ's Water Quality Monitoring Program. The current network was initiated in 2001, following implementation of the 1st edition of the WQM Strategy. In 2004, it was complemented by the "Non-Tidal Trend Monitoring Network" (NTMN) of the agency's Chesapeake Bay Program. Trend monitoring is considered to be a high priority monitoring activity.

As currently executed (2013), estimated annual resource expenditures for the Trend Monitoring Network are approximately $189,443 for analytical costs (at the state laboratory) of 376 stations, and seven 'full-time equivalents' (FTEs) of human resources for fieldwork (~$335,000). These estimates exclude resources for a number of Chesapeake Bay Program stations that are included in the statewide Trend Monitoring Network. Scheduled milestones for the program deal mostly with trend analyses and exploratory data investigations.

**2004** – WQ3 software updates were completed at a contractual cost of ~$20,000, provided by agency general funds. Required SAS analytical software updates and re-licensing costs were approximately $10,000, also provided by agency general funds.

**2006** – The results of trend analyses performed in 2004-2005 were summarized in the 2006 305(b) Water Quality Assessment Report.

**2007-2010** - Continued data exploration with traditional site-specific trend analyses, and the development of a new nonparametric "Integrated Water Quality Index" (IWQ) for watershed-wide trend characterizations, contributed two trend chapters to the 2012 305(b)/303(d) Integrated Water Quality Report: Chapter 4.5 - Trend Analysis [III-B-3-1b.pdf] and Chapter 4.6 - IWQ Assessment [III-B-3-1c.pdf].

**2013–2018** – Continued exploratory data analysis to refine trend characterization, especially with the IWQ. Preparation for including the third statewide trend analysis in the 2018 305(b)/303(d) Integrated Water Quality Report,

### (iv) TMDL Support Program

Because of the large number of impaired water body segments to be considered, the variety of identified and potential causes that exist, and the resultant disparate complexities of TMDL development, specific milestones, timelines and associated resource requirements are difficult to predict for the TMDL support program. Expectations are that total TMDL resource requirements will increase geometrically, at least doubling over the next ten years. This is especially the case as DEQ allocates resources to document water quality improvements in TMDL implementation areas. The current human resource requirements for TMDL-related field activities are also difficult to estimate because they are often integrated with those of other monitoring activities.

Lists of the TMDLs scheduled for development in 2012 and 2013 are posted on the DEQ TMDL WebPages. [http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment.aspx] Planning for TMDL development in 2014 and 2015 is underway.

### (v) Special Studies Programs

Special studies programs, because they are generally established to resolve recently perceived or newly arising water quality problems, or to investigate new sampling or analytical methodologies, are by their very nature difficult to anticipate and document in terms of future expectations. This applies to both generic special studies and permit-related special studies, which are determined by regional permit planners. Both types vary considerably in their requirements for parameters analyzed, frequency of sampling, and duration.

#### (a) Fish-tissue/Sediment-related Special Studies

When levels of toxic chemicals detected in fish tissues are at elevated levels that are of concern, additional special studies are conducted to better determine the severity, source and extent of the pollution. These special studies typically involve expanding the number of sampling sites within the water body as well as the sampling of additional fish species.

The recent adaptations of the Fish Tissue and Sediment Monitoring Program to severely reduced resources has defined an increased focus on re-sampling known areas of contamination that currently require TMDL development. A number of special studies in this category will probably be developed in the coming years.

The work plan for 2013 sampling is not yet available. Sampling is tentatively planned for 20 sites for TMDL support activities in the following watersheds: Mountain Run (Rappahannock River), Roanoke (Staunton) River between Leesville Lake dam and Kerr Reservoir, Dan River from Danville to Kerr Reservoir, Hyco River and Banister River below Banister Lake dam, primarily for PCBs.

Follow-up work subsequent to the Mercury and PCBs “special studies” over the past few years have been picked up by the affected regional offices, either as: (1) source investigation and identification work and/or (2) TMDL related work. There are no specific “special studies” planned for Fish Tissue and Sediment Program at Central Office in the few of years.

## (b) Ambient Toxics Special Studies

### (i) Toxic Trace Metals in Surface Waters

The interpretation of results from the freshwater and saltwater probabilistic monitoring will determine the direction for future monitoring of dissolved trace metals in ambient waters. Until then the estimated resource requirements are unknown. Trace metals sampling in the water column was suspended from estuarine probabilistic monitoring after 2010. After evaluations of samples from over 180 estuarine and 50 oceanic sites, only a single exceedance of a saltwater chronic water quality standard had been observed.

**2011-2013** – An artificial hardness special study was initiated in 2011 to investigate the effects on stream concentrations of total and dissolved metals in relation to hardness addition by wastewater treatment plants. Three Publicly Owned Treatment Works, (POTWs), were selected for sampling of clean metals, various other associated variables, and field parameters. Sampling at each outfall and in stream above and below the discharge provided the necessary data to determine if changes in metal speciation are occurring. Sampling was to occur for eight consecutive months beginning in May 2011, but quality assurance considerations required that the sampling be repeated at one of the sites.

**2013 and beyond** - As yet to be determined special studies related to toxics metals impairments, VPDES permit needs, and other pollution releases will occur. Estimated resources required are to be determined in Annual Monitoring Plans.

Among other objectives, Department Guidance Memorandum 01-2011 – "Monitoring Toxic Trace Metals in Surfacewaters," [IX.3.pdf] issued on April 16, 2001, recommended targeting "Acid Mine Drainage Sites" and performing "Background Monitoring" of pristine "ancient waters" from springs and wells to establish a basis of comparison with other trace metal monitoring sites. The two pending trace metal special studies that follow have been postponed because of resource limitations.

a. The Department of Mines, Minerals, and Energy has identified approximately 1300 acid mine drainage sites, where targeted monitoring should be initiated. This study would require at least $500,000 for analytical costs and an estimated 325 man-days of field time, to be spread out over approximately a five-year period.

b. Also, a proposal exists to begin sampling of ancient spring waters and ground waters (identified by USGS age dating data) to determine pre-anthropogenic concentrations of trace metals. Estimated cost would be $2000 and would require 15 man-days.

### (ii) Toxic Trace Organics in Surface Waters

Although extremely expensive, the use of Semi Permeable Membrane Devices (SPMDs) in recent years has proved to be a viable methodology for monitoring trace toxic organics in ambient waters, as well as for targeted special studies. Depending upon resource availability and the development of new methodologies, their use may continue in the future.

**2005-2007** – The increased use of passive sampling using Semi Permeable Membrane Devices supported a number of TMDL special studies related primarily to PCB impairments. The target batch size for each PCB project was 10 samples with analytical costs of $33,000, supplies and equipment equaling $600, and man-days equal to 5. More recently (2010), EPA's low-detect Method 1668 has permitted PCB analyses of

whole water samples at pg/L (one picogram or one trillionth of a gram per liter) concentrations at a fraction of the SPMD cost.

**2007** – In April of 2007, the Virginia DEQ co-hosted the 7th Passive Sampling Workshop and Symposium with the U.S. Geological Survey. The event was held at the U.S. Geological Survey National Center in Reston Virginia on 24-26 April 2007. Additional details of the conference are available on line.

**2013 and beyond** - Other passive sampling technologies may be used to detect a broader range of organics with low octanol to water partitioning coefficients, as well as to investigate the prevalence of emerging contaminants of environmental concern (e.g., various pharmaceuticals and other household products). Costs and manpower estimates for these studies are yet to be determined. EPA's low-detect Method 1668 will probably continue to be the preferred method for developing PCB TMDLs.

### (2) Program Specific Monitoring

A number of monitoring programs integrated into the agency's overall Water Quality Monitoring Strategy are carried out by other offices within the agency, by independent organizations, or are resource-specific.

#### (i) Chesapeake Bay Monitoring Program

Virginia-specific annual reporting of CBP monitoring results are provided each year through updates to technical "Basin Summaries" for the James, York, and Rappahannock Rivers. Analysis of Virginia's CBP monitoring results are also performed and reported as part of Bay-wide efforts coordinated through the Monitoring and Assessment Subcommittee of the Federal-Interstate Chesapeake Bay Program. The signing of Executive Order 13508 (Chesapeake Bay Protection and Restoration) May 12, 2009 and the establishment of a Bay-wide TMDL in December 2010 with the requirement of two-year milestones will likely result in the monitoring data-collection components of the Tributary Water Quality Monitoring, Mainstem Water Quality Monitoring, Phytoplankton Community Monitoring, Benthic Community Monitoring, and River Input Monitoring continuing basically unchanged through 2019. Shallow Water Habitat and Non-tidal aspects of CBP monitoring programs will hopefully be expanded as new funding is obtained.

**2004** – The Chesapeake Bay Non-Tidal Water Quality Monitoring Program and Shallow Water Habitat Monitoring Program were initiated (see descriptions in Chapter III – Design and Implementation).

**2005** – Applicable CBP monitoring data were included in the preparation of the 2006 Integrated Water Quality Assessment Report to EPA.

**2006** – The Shallow Water Habitat monitoring was rotated from the York River system to the James River for the next three years.

**2007** – Applicable CBP monitoring data were included in the preparation of the 2008 Integrated Water Quality Assessment Report to EPA.

**2008** – There were no significant changes to the monitoring program.

**2009** – Applicable CBP monitoring data were included in the preparation of the 2010 Integrated Water Quality Assessment Report to EPA. As a result of the establishment of the TMDL, the Chesapeake Bay Program and its partners participated in a Monitoring Re-Alignment exercise to explore ways to re-align

existing funds to expand the non-tidal network for the 2010 monitoring year. The Shallow Water Habitat monitoring was rotated from the James River to the Rappahannock and Potomac Rivers.

**2010 –** The non-tidal network was expanded to include monitoring on Smith Creek, a showcase watershed for the EPA.

**2011 –** Applicable CBP monitoring data were included in the preparation of the 2012 Integrated Water Quality Assessment Report to EPA. The non-tidal network was expanded to include storm-targeted sampling at Accotink Creek and for USGS to monitor Muddy Creek, Difficult Run, South Fork of Quantico Creek, Dragon Swamp and Rivanna River.

**2012 –**The non-tidal network was expanded to include storm-targeted sampling at additional sites on the South Fork of the Shenandoah, Rappahannock, Mattaponi and Appomattox Rivers. A site was also established on Polecat Creek for routine and storm monitoring.

**2013** – CBP monitoring data will be included in the preparation of the 2014 Integrated Water Quality Assessment Report to EPA. The Benthic Index of Biotic Integrity (B-IBI) will be recalibrated to address concerns voiced by the Chesapeake Bay Assessment Protocol workgroups regarding a few sites whose B-IBI scores appear inconsistent with what would be expected given known issues at those sites.

**2014-2019** - The pursuit of increased funding will continue to be a priority for Shallow Water Habitat monitoring and Non-tidal Water Quality monitoring. The goal of the Chesapeake Bay TMDL is to restore the Bay by 2025 with all actions required to achieve 60% reductions in Nitrogen, Phosphorus and sediment in place by 2017 and will necessitate continued monitoring to ensure Best Management Practices that are implemented will achieve the desired outcomes.

**2015** – CBP monitoring data will be included in the preparation of the 2016 Integrated Water Quality Assessment Report to EPA.

**2017** – Applicable CBP monitoring data will be included in the preparation of the 2019 Integrated Water Quality Assessment Report to EPA.

### (ii) Lakes Monitoring Program

The Lakes Monitoring Program is considered to be a lower priority monitoring activity. It is considered important in providing broad-based comprehensive monitoring, but management discretion exists to reduce activities based on resource constraints. As with most other monitoring activities, increased resource availability could provide for expanded geographic coverage.

Although the Lakes Monitoring Program is considered to be a fully implemented component of DEQ's Water Quality Monitoring Program, several additional needs and their timelines for implementation were defined between 2004 and 2012.

**2004-2006 -** Nutrient criteria for lakes were developed by, and approved in 2006 and were implemented in "significant" lakes (those listed in 9 VAC 25-260-187) in the following field season. Dissolved oxygen assessment issues were resolved by defining the "lacustrine" portion of dammed reservoirs as opposed to the "riverine" portions. Recommendations were also developed for reduced frequency/innovative monitoring under reduced resources.

**2007-2008** – Parameter coverage was reviewed and adapted to the newly adopted nutrient standards.
In 2012, the Lake Monitoring Program was classified in the bottom three in the priority matrix of monitoring activities. Subsequently, it was decided that, to conserve resources, the program would not sample lakes on the 'master list' unless they had public access.

No additional resource requirements are anticipated, beyond the Lake Program's general budget that in 2013 provides $55,356 for analytical services.

### (iii) Citizens and other Non-Agency Monitoring Programs

Support for the Citizens Monitoring Program is considered a lower priority monitoring activity. Support for monitoring by citizens provides the Commonwealth with broad-based supplemental data; however discretion exists to reduce resources dedicated to this activity based on budgetary constraints.

Total resources currently required for this program (including grants to citizen monitoring groups) are approximately $90,000/year, plus 1.5 FTE, Pay Band 5, at an approximate total cost of $75,000/year (plus benefits) for the positions.

**2004-2006** – DEQ focused on five priority projects to promote citizen monitoring and incorporate volunteer and non-agency submitted data. These projects were

1. DEQ promoted the use of a dissolved oxygen titration standard that would enable the use of dissolved oxygen data from citizen groups for directly listing impaired waters by 2008.
2. The responsibilities of the former Citizen Monitoring Coordinator position were expanded to include other non-agency data sources under the title of "Water Quality Data Liaison." Expanded duties will include the solicitation and evaluation of all non-DEQ water quality monitoring data for potential use in the 305(b) Assessment.
3. An on-line database was developed for non-agency water quality monitoring data. It is now available via the Internet for the direct entry of non-agency data by authorized representatives, and all non-agency data is now available to the public via the same Website. This will facilitate the review, approval and assessment of non-agency data for future biennial 305(b) Reports.
4. The WQDL has developed and implemented new agency guidance to evaluate where follow-up monitoring by DEQ is most needed in response to citizen monitoring, citizen nominations, and citizen concerns. [Section VII of DEQ's Water Quality Monitoring Consolidated Guidance Memorandum (Guidance Memorandum No. 04-2005) [VII-1a.pdf] deals specifically with this subject.
5. Grants to support citizens' monitoring activities were re-established following resource appropriations by the General Assembly in 2004 and will continue year-by-year as funding allows.

**2007-2012** – DEQ focused on developing a tracking mechanism to measure how much citizen monitoring (and other non-agency data) are incorporated into the 305(b) Assessment process. This was necessary to accurately report where citizen volunteer data helped the agency in assessing at least 3000 stream miles by 2010. For the 2010 Report, which covered monitoring years 2003 to 2008, 3499 stream miles were assessed using volunteer data. In the 2012 305(b)/303(d) Report, which covered monitoring years 2005 to 2010, the mileage increased to 3,887 miles.

**2013-2015** – For the next two years, DEQ will focus on two avenues to continue promoting volunteer monitoring above the previously implemented items outlined above. These two avenues involve standardizing methods and making training and reporting more efficient.

1. Develop enhanced training materials such as an updated *Virginia Citizen Water Quality Monitoring Methods Manual* and produce online training videos for popular volunteer monitoring methods. These new training materials will encourage more volunteer monitoring by providing additional training avenues instead of relying on traditional in person training. Such training materials will help standardize monitoring methods and protocols. In addition, such materials will significantly reduce staff requirements to prepare and conduct trainings.

2. As part of a continued effort, DEQ will develop and promote the use of templates for developing Quality Assurance Project Plans (QAPP) and Standard Operational Procedures (SOP) for popular volunteer methods. Previous work done on a case-by-case basis showed faster turnaround and development of DEQ approved QAPP and SOP documents of volunteer and non-agency groups. Continued development of these templates in conjunction with the updated manual and training videos will make developing a DEQ approved project much easier. This will result in increased data submission and participation of monitoring organizations to share data with the agency.

### (iv) Biological Monitoring Program

The Regional Biological Monitoring Program is considered to be a moderate priority monitoring activity. Biomonitoring related to the Freshwater Probabilistic Monitoring Program is rated among the top four priorities. Biological monitoring considered important in providing broad-based comprehensive monitoring, but management retains the flexibility to reduce activities based on resource constraints. Increased resource availability could provide for research on and the possible inclusion of additional biological assemblages, the possible expansion of habitat analyses, and expanded geographic coverage.

The Biological Monitoring Program also provides the majority of the specialized human resources for the statewide Freshwater Probabilistic Monitoring Program, which completed its twelfth year in 2012, as well as necessary support to the TMDL Program (especially for benthic TMDLs). The desire for and necessity of additional regional biologist's positions were discussed under both ProbMon and TMDL Support Monitoring. The additional biologist (Salary Band 5) per regional office, approved and filled in 2006, required added resources of approximately $240,000 annually (salaries only), and has contributed significantly to the support of all three programs – Regional Biological Monitoring, Freshwater Probabilistic Monitoring, and the TMDL Program.

2**006-2007** - The final report on the validation study for the Virginia Scream Condition Index (VA-SCI) was completed in November of 2006. Formal guidance on its use for DEQ's 2008 Integrated 305(b)/303(d) Report was developed as soon as EPA Region 3 approved the proposed guidelines submitted with the validation report. Data collection and evaluation of fish community sampling in free-flowing streams began in 2006, in association with the Freshwater Probabilistic Monitoring Program. A December 2006 meeting included discussions of the results from the initial study and of contract renewal with Virginia Commonwealth University. This study continued through 2007 and the evaluation of the fish community assemblage has become a permanent addition to the Biological Monitoring Program.

**2008** - In 2008 a self-assessment of the biological program found the Coastal Plain Macroinvertebrate Index (CPMI) needed improvement in its discrimination power between unimpaired and impaired coastal plain streams. A follow-up study statistically evaluated the CPMI's performance and a new calibration was carried out. The coastal plain workgroup plans to issue its final report in May 2013 and DEQ expects to use the refined CPMI in the 2014 Integrated Report.

**2012** - In 2012 the biologist's earned national genus level macroinvertebrate identification certification for EPT taxa from the Society of Freshwater Science to facilitate transitioning from family to genus level benthic macroinvertebrate taxonomy assessments.

**2007-2012** - Pilot studies have been conducted investigating the possibility of adding periphyton and fish community sampling to the biological and freshwater probabilistic monitoring networks for the development of additional biological indices.

**2013-…** - Recalibration of the Coastal Plain Macroinvertebrate Index (CPMI) was completed in 2012. A final Report is scheduled for May of 2013, and the recalibrated index will be used in the 2014 303(b)/303(d) Integrated Water Quality Report.

The program plans to begin addressing biological monitoring strategies in non-wadeable streams and rivers over the next few years.

### (v) Targeted Fish Tissue and Sediment Monitoring Program

The Targeted Fish Tissue and Sediment Monitoring Program is considered to be a fully implemented, component of DEQ's Water Quality Monitoring Programs. It is important in providing broad based comprehensive monitoring, but management discretion exists to reduce activities based on resource constraints. The Fish Tissue and Sediment Monitoring Program was originally designed to attain statewide coverage so that each of the fourteen river basins and sub-basins would be sampled at least once every five years. From 2000 through 2008, the program operated either a five- or a three-year cycle, as dictated by available funding. The five-year statewide basin rotation sampling cycle was accelerated to a three-year basin rotation cycle whenever sufficient resources were available.

However, in 2009, the program was temporarily suspended due to inadequate funding as a result of State government budget reductions. The program was redesigned and resumed in 2012 on a much smaller scale than previous monitoring efforts. The refined program will focus primarily on TMDL support and follow up monitoring of watersheds which are under fish consumption advisories. Up to 20 sites will be scheduled annually for follow up monitoring to track changes in levels of PCBs and/or Mercury in fish tissue to support TMDL efforts. The analyses of PAHs and pesticides have been eliminated to minimize cost.

To maintain this program at its current level, two additional FTEs are needed to replace technicians lost due to resource limitations in the late 1990s. At present, the program depends upon annually hired summer interns and part-time support from personnel assigned to other monitoring activities.

No new milestones / initiatives are currently planned for this program, except for continuing and completing the currently planned TMDL support schedule and follow up monitoring of watersheds that are under fish consumption advisories.

### (vi) Wetlands Monitoring Program

DEQ's Wetlands Monitoring Program was designed and its implementation initiated by the agency's Office of Wetlands, Water Protection and Compliance (now called the Office of Wetlands and Stream Protection), with the aid of an EPA State Wetland Development Grants. Milestones and timelines for the period are described below for the years 2004 through 2012.

**2004** – The final Wetlands Monitoring & Assessment Strategy, completed internal agency review, was submitted to EPA in August 2004.

**2005** – A public workshop on the Monitoring and Assessment Strategy was held in January of 2005. The Final Report for the Floristic Study was submitted to EPA in July 2005, following a peer review workshop on Wetland Assessment Methodologies that was carried out in late June. The QMP, QAPP, and Sampling Plan for Level 3 Assessment in Coastal Plain were submitted to EPA in August. The Final Analysis and Report for Level 2 Assessment by Watershed was also submitted to EPA at that time.

**2006** – The complete Phase 1 Wetland Inventory was provided for the 2006 Integrated 305(b)/303(d) Report, which was submitted to EPA in September of 2006.

**2007 – 2008** - Phases 2 and 3 completed for the entire State of Virginia.

**2010 -** Design and implement procedures to facilitate the routine application of inventory and monitoring data for Phase 4 have been completed. Phase 5 resulted in the development of a prototype web based tool for the assessment of wetlands. Work is ongoing to improve the use interface of the website.

**2011 -** Development of a Wetland Program Comprehensive Plan, refinement of our environmental database, and continued development of the wetlands monitoring and assessment program for Phase 6 has been completed.

**2012** – Phase 7 is currently in progress.

### (vii) Surface Water Investigations Program

This program is independent of, but intimately integrated with the Water Quality Monitoring Program.

Background

**2004** – GOES Satellite equipment was purchased in FY2004 for the conversion of 67 DEQ-operated surface water (SW) gauging stations to real-time satellite transmission. Eleven ground water (GW) wells were converted to satellite transmission of GW quantity data. Surface and ground water quantity data were submitted to the USGS for publication in April

**2005 – 2012** Data from 67 surface water gauges and 170 ground water wells were submitted to USGS for publication in April of each year for inclusion in the annual USGS Water Resources Data Report. The conversion of 67 stream gages to Satellite transmission also was completed in 2005.

**2013 - 2018** Data from 67 SW gauges and 170 GW wells will be submitted to USGS for inclusion in Water Resources Data for Virginia publication by April of each year. Annual maintenance of the SWI monitoring network will continue. Although further expansion of the gauging network is always an objective when resources are available, no further milestones for the period have been established at his time (March 2013)

### (viii) Ambient Ground Water Monitoring Program

**2013 and beyond** – 2013 is the target date for submission, review and approval of the Ambient Groundwater Monitoring Strategy document and companion implementation manual. The document will include details of trend network design and probabilistic selection methodology, vertical distribution,

province-specific sampling considerations, and QA/QC procedures. The objective is to document natural chemical conditions of ground water in aquifers throughout Virginia. Estimated sampling/analytical budget is of $50,000 annually; per sample analytical cost of ~$800.00 for 76 analytes. A five year rotating schedule is proposed – annual or quarterly sampling is under consideration. The project is currently behind schedule and the program may be initiated in 2014.

### (ix) BEACH Monitoring Program

The Division of Environmental Epidemiology, of the Virginia Department of Health (VDH), administers the BEACH Monitoring Program. DEQ's primary role in this program is the inclusion of the bacterial monitoring results in the biennial 305(b) assessment process. Coordination between the two agencies and guidance for 305(b) assessment methodologies were first defined for the 2006 305(b) Report. No specific additional resource requirements are anticipated by DEQ, although additional coordination and assessment methodology requirements may arise for future Reports.

**2005** – Establishment of the interagency coordination requirements with VDH (data form and format, data transfer protocols) and the assessment guidance for the use of BEACH monitoring 'swimming advisory' and bacterial data for 305(b) reporting were completed in April.

**2006** – BEACH Monitoring results were included in the 2006 Integrated 305(b)/303(d) Report.

**Present** – VDH is currently reviewing and conducting activities that could potentially impact the VDH BEACH Program in the near future. These activities include the completion of a Quantitative Polymerase Chain Reaction (qPCR) performance evaluation/demonstration project and EPA's recently released 2012 Recreational Water Quality Criteria.

Using current culture-based methods, beach water quality results are available approximately 24 hours after beach water samples are collected. As a result, swimming advisories are usually based on results from the previous morning. VDH is currently developing a project to evaluate the Quantitative Polymerase Chain Reaction (qPCR) molecular method in Virginia's beach waters. The qPCR method can be used for the detection of *enterococci* in marine water within approximately 4 hours and are expected to allow for advisories to be issued and lifted sooner. The project will evaluate qPCR method performance and sample interference to determine if this method is adequate for use in Virginia's BEACH program.

EPA recently released the 2012 Recreational Water Quality Criteria during the fall of 2012. This new criterion provides updated standards for *enterococci* and *E. coli* bacteria based on recent epidemiological studies and science. These recommendations are intended as guidance to states in developing revised water quality standards. A revision to Virginia's Water Quality Standards according to EPA's recommendations would directly impact the VDH BEACH Program, as well as DEQ's monitoring and assessment programs. EPA's recommended Recreational Water Quality Criteria are expected to be considered during the next review of Virginia's Water Quality Standards.

## (3) 305(b) / 303(d) Assessment - Listing and Reporting

Future objectives and milestones for the Water Quality Assessment process are based on the biennial reporting schedule (even numbered years) for submission of the 305(b)/303(d) Integrated Reports (IR). Biennial updates of the Water Quality Assessment Guidance Manual incorporate orientation on the implementation of assessment methods for newly established criteria and Water Quality Standards as they are established, approved and adopted.

**Future Odd-Numbered Years** – Preparation of updated Assessment Guidance Manuals

**Future Even-Numbered Years** – Submission of new Integrated Reports to EPA Region 3 by 1 April of even-numbered years.

### (4) Water Quality Standards Program

The majority of the scheduled milestones and timelines associated with the Water Quality Standards Program are related to amendments expected under EPA strategies (e.g. nutrients) or updates to the regulation needed for assessment and implementation [e.g. 305(b) and 303(d)].

**2007 –** Several streams in Amherst County and several tributary streams to the Cowpasture River were approved by EPA for Exceptional State Waters (Tier 3) designation in mid-2007.

**2010 -** Triennial Review initiated in 2007 completed and effective for the Commonwealth in early 2010.

**2010 -** Incorporated the October 2007, September 2008, and May 2010 Chesapeake Bay Criteria Assessment Protocols Addenda by reference into the Chesapeake Bay criteria section of the regulation in late 2010.

**2011 –** In mid-2011 a study was undertaken to reexamine the chlorophyll *a* criteria for the tidal James River, a major tributary to the Chesapeake Bay. The study is scheduled to conclude by 2015. If it is determined that a change to the existing criterion is necessary a rulemaking will be initiated.

**2013 –** A Triennial Review of the regulation is scheduled to begin in 2013. River & stream nutrient criteria are still under technical development and scientific evaluation.

### (5) General Water Quality Monitoring and Assessment Initiatives - 2013

#### (i) Program Enhancement (Capability) and Development

(a) Implement changes to Chesapeake Bay criteria assessment rules
(b) Incorporate recalibrated CPMI into Assessment Guidance Manual for the 2014 305(b)/303(d) IR – see above
(c) Continued progress towards 2014 final IR by spring of 2013 – see above
(d) Complete triennial updates to Water Monitoring Consolidated Guidance Memorandum (04-2005, Amendment 2) [VII-1c.pdf] - This revision is scheduled for the spring of 2013.
(e) 2013 revision of Water Monitoring Strategy

#### (ii) Community Outreach

(a) Update the water monitoring program web page content
(b) Link non-agency database to VWMC web page
(c) Participate in planning/implementation of Virginia Water Monitoring Council and other events (e.g. Water Monitoring Day, state and regional conferences)

#### (iii) Resource Management (Fiscal/Data)

(a) Complete WQS GIS data layer for use in 2014 305(b)/303(d)

### 2. Final Note

It must be emphasized one last time that the attainment of objectives for new initiatives within the estimated timelines is dependent upon the availability of increased resources… the prospects of which are uncertain under existing economic conditions. In addition, the Water Quality Monitoring Strategy is subject to continuous planning and modification in response to changing environmental conditions and legislative requirements, and should be considered a "living document" which never attains a static final form.