Department of Conservation and Recreation (DCR)

NPDES Storm Water Management Program

Permit Year 8 Annual Report

For Coverage Under
National Pollutant Discharge Elimination System (NPDES)

General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s)

Department of Conservation and Recreation
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Submittal: April 29, 2011

Municipality/Organization: Department of Conservation and Recreation

EPA NPDES Permit Number: MAR043001

MaDEP Transmittal Number:

Annual Report Number & Reporting Period: **No. 8: April 10-March 11**

Department of Conservation and Recreation NPDES PII Small MS4 General Permit Annual Report

Part I. General Information

Contact Person:	Robert Lowell	Title:	Environmental Section Chief
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Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on myinquiry of the person or persons who manage the system, or those persons directly responsible for gathering he information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature:

Printed Name: Edward M. Lambert, Jr.

Title: Commissioner

Date: 5/12/11

Part II. Self-Assessment

The Department of Conservation and Recreation (DCR) has completed the required self-assessment and has determined that we are in compliance with all permit conditions, except as noted in the following tables. DCR received authorization to discharge under the general permit from EPA on November 8, 2007 and from DEP on November 21, 2007. DCR understands that coverage under the MS4 is continued until a specified time after the new permits that are currently in draft format are issued by EPA.

DCR continues to work hard to implement a comprehensive storm water program this past year even with limited fiscal and labor resources. DCR storm water management efforts are supported by operating and capital appropriations that remained the same from FY10 to FY11 (July 2010 – June 2011) at $3.9 million. DCR received federal stimulus funds that supplemented certain transportation related projects such as improvements to Nonantum Road, which was constructed by MADOT for DCR. DCR expects to utilize all available funds and to implement practices to reduce pollution in runoff from parks and parkways. The Governor's FY12 budget provisions for DCR are currently proposed at $3.9 million.

Part III. Summary of Minimum Control Measures

The Department of Conservation and Recreation owns and operates many different types of facilities and parkways which are covered by the NPDES Phase II General Permit. In order to accurately reflect the programs DCR has accomplished, both state-wide and for specific facilities, this annual report has been divided into separate tables. Table 1 describes the control measures which are not site specific. Tables 2 through 7 describes site or facility type specific BMPs that are being implemented specifically at water supply/ reservoirs, state forests, state parks, beaches, construction sites or parkways.

A few of the BMPs included in DCR's Storm Water Management Plan (SWMP) are for facilities outside of the urbanized area. Therefore, the facilities addressed by these BMPs are not listed in the site specific tables. We continue to include these BMPs in Table 1 to demonstrate the many diverse programs being implemented by the DCR to raise awareness of storm water and water quality issues in the general public. We have noted these BMPs as facilities that are "outside of the urbanized area" in the table below.

Table 1: State-wide Best Management Practices (BMPs)

1. Public Education and Outreach

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April '11 to March '12
1-1	DCR Storm Water Web Page	External Affairs/IT Dept. (Wendy Fox)	Develop web page and publish storm water related publications (inc. SWMP and NOI), information and links on web page.	*Goal Met* – The following documents were posted on DCR's web site for public access and review: ▪ Permit Year 6 Annual Report. ▪ Permit Year 7 Annual Report ▪ The final Catch Basin Cleaning and Parkway Sweeping Report covering March 2009 through December 2010 has been posted on the website, and can be found in Appendix A.	Continue to update as necessary. Post a copy of Permit Year 8 Annual Report. Post Authorization to Discharge letters from EPA and DEP.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April '11 to March '12
1-5	Mobile Water Quality Education Seminars (statewide)	Operations (Curt Rudge)	Provide storm water/ water quality education educational events at a minimum of nine different locations. These events would be in addition to the facility/ program specific BMPs also listed in this SWMP.	*Goal Met* – DCR offered state-wide Public Education Events including water quality, storm water education (includes forestry practices, healthy ecosystems, water cycle, children's programs) at many DCR facilities statewide at least once (Detailed listing in Appendix B).	Provide educational events at a minimum of nine different locations during the year. Environmental education programs planned in the North Region parks and reservations include: • DCR Coastal Awareness Environmental Education Program on DCR coastal properties; • numerous clean-up days at beaches, marshes and ponds; • canoe trips, • birding trips; • beach activities such as tidepool explorations.
1-6	Charles River Conservancy Volunteer Clean Up Program	Operations (Jack Murray)	Continue to partner with Conservancy on Charles River Clean Up Program	*Goal Met* - DCR assisted with and coordinated support for this year's Park Serve Day held on 4/24/10. More than 4,100 volunteers participated. Nearly 49 tons of trash were removed	DCR continues to assist with this Clean Up Day, which is scheduled for April 16, 2011. This has evolved into a statewide "Park Serve Day", when volunteers perform service at DCR facilities of their choosing. An Earth Day event has also been planned for April 30th at the Wachusett Reservoir.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April '11 to March '12
1-7	Charles River Reservation School Program	Operations (Curt Rudge)	Provide 1 storm water/ water quality related educational program each year.	*Goal Not Met* - Environmental education through the Charles River Reservation School Program was cancelled as of June 2007 due to inadequate staffing. There has continued to be a lack of funding for staffing these programs.	No planned activities.
1-8	Camp Nihan	Operations (Curt Rudge)	Provide 1 storm water/ water quality related educational program each year.	*Goal Not Met* - Environmental education programs at Camp Nihan were cancelled as of June 2007 due to inadequate staffing. There has continued to be a lack of funding for staffing these programs.	No planned activities.
1-9	Quabbin Educational Programs (*outside of the urbanized area*)	Water Resources (Ann Carroll)	Continue to provide multi-session watershed related education programs on an annual basis to two schools in the Quabbin Reservoir watershed.	*Goal Met* - Interpretive Services staff conducted 94 educational programs for 3,500 student and adult participants. In addition, tours were led for a number of local, regional, and even international groups on a variety of watershed-related topics.	Continue activities.
1-10	Wachusett Educational Programs (*outside of the urbanized area*)	Water Resources (Ann Carroll)	Continue to provide multi-session watershed related education programs on an annual basis to two schools in the Wachusett Reservoir watershed.	*Goal Met* - Staff continued to implement the Wachusett Watershed Education Program in five communities: Holden, Boylston, West Boylston, Princeton, and Rutland, with the expansion to additional schools in Holden and Rutland. Public Education Brochures for the Wachusett Watershed have been published regarding swimming pool discharges, household stormwater pollution prevention, and proper pharmaceutical disposal (Appendix C).	Continue activities. An Earth Day event has been planned for April 30th at the Wachusett Reservoir.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April '11 to March '12
1-11	Project WET	Water Resources (Ann Carroll)	Maintain sponsorship of state water education for teachers program.	*Goal Not Met* - Program WET was cancelled as of summer 2007. Conducted two teacher institutes on Watershed Education. Presentation and display at MEES conference.	No planned activities.
1-12	"DownStream" Newsletter	Water Resources (Ann Carroll)	Continue to develop and disseminate newsletter regarding issues relevant to Wachusett Reservoir/ Quabbin Reservoir watersheds twice a year.	*Goal Met* - DCR published and circulated this newsletter. The Spring 2010 issue included discussions on invasive species in MA waterbodies, the 2010 ranger programs, national drinking water week, and facts about the 2010 spring rains. The Fall 2011 issue included discussions on how the Wachusett Rangers protect drinking water and serve the public, "creeping normalcy" and how land protection helps, 10 simple steps to protect ground and surface waters, DCR's National Clean Drinking Water Award, and the Quabbin cemetery. Copies of the newsletters can be found at http://www.mass.gov/dcr/waterSupply/watershed/dwmfactsheets.htm and as Appendix D of this report. The newsletter is sent to members of the Friends of the Watershed (Wachusett, Quabbin and Ware River) Group.	Publish newsletters in May and November 2011. Place newsletters on web page.
1-13	Massachusetts Drinking Water Education Partnership (MADWEP)	Recreation (Gary Briere)	Maintain membership.	*Goal Met* – DCR is an active member of MADWEP.	Maintain membership.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April '11 to March '12
1-14	Low Impact Development Project	Water Resources (Anne Carroll)	Pursue the inclusion of public education component within the planning, permitting and implementation of one LID project a year.	*Goal Met* - DCR implemented raingardens along Nonantum Road in conjunction with MassDOT upgrades.	Review options for LID at Herter Lot 1.
1-15	DCR Storm Water Training Workshop	Planning and Engineering (Mike Misslin)	Provide ½ day training program to address storm water management regulation, policies and procedures relevant to DCR staff.	*Measurable Goal Previously Completed.*	Working on implementing Storm Water Handbook training to similar group of staff members within six months of being issued.
1-16	Ipswich River Demonstration Projects	Director of Water Resources (Anne Carroll)	Continue to include public education and outreach in the projects funded through the EPA Watershed Grant, as appropriate.	*Goal Met* – DCR and the USGS have published a pre- and post-construction groundwater data assessment report for the **Silver Lake Permeable Pavement** and the **Silver Lake Raingardens** Demonstration Projects. The report, a circular, and a fact sheet have been posted on the DCR website. The fact sheet can also be found in Appendix E.	No activities planned.
1-17	Partner with Center for Urban Environmental Studies	Chief Engineer (Michael Misslin)	Partner with Northeastern University to assist development of new pollution control methods for storm water.	*Goal Partially Met* – DCR developed Notice to Partner with Northeastern and National Science Foundation in Permit Year 5. No additional work occurred during this permit year due to attention to other priorities.	No activities are planned.

Additional Practices:

- The Stillwater Farm Educational Site continues regularly scheduled open hours seasonally. The building is open to the public four days a week from Memorial Day through Labor Day.

2. Public Involvement and Participation

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
2-1	Formalize Partnerships with CLF and CRWA	General Counsel (Thomas Larosa)	Continue to work with CLF and CRWA and abide by Memo of Understanding (MOU)	*Goal Met* - DCR provided CLF/ CRWA with the final report summarizing the actions taken to meet the criteria outlined in the MOU.	No activities are planned.
2-2	UMass/DCR Program to monitor WQ in target areas of Wachusett Reservoir (*outside of the urbanized area*)	Water Resources (Ann Carroll)	Continue program with UMass.	*Goal Met* - Program is ongoing. Current focus is development of hydro-dynamic model of Stillwater Basin section of reservoir and invasive species. Update will be provided in the Water Quality report.	Subject will be developed for summer 2011 study.
2-3	Public NPDES Meetings to Discuss Annual Report	Planning & Engineering (Mike Misslin)	Hold one meeting at three locations each year for internal staff, interested parties and public. Track and record comments received.	*Goal Not Met*	Once the new MS4 watershed based permits are issued DCR will follow public meeting requirements outlined in those permits.
2-4	Partnership and Friends Database	External Affairs (Wendy Fox)	Send an annual letter regarding storm water/ NPDES issues to the watershed advocacy groups included in their Partnership and Friends database.	*Goal Met* - Database has over 346 contacts. Use database to send notification of annual report review.	Maintain database. Send email regarding new MS4 permits once issued.
2-5	Storm Water Related Concerns/ Feedback Reported on DCR Web Site	External Affairs (Wendy Fox)	Continue to maintain staffing to forward concerns/ feedback to appropriate department and track response to concerns submitted by the public via DCR's web site.	*Goal Met* - Web site is active. DCR Commissioner has implemented concern/feedback letter tracking and response system.	Continue program.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
2-6	DCR Stewardship Council	External Affairs (Wendy Fox)	Continue to participate. Raise storm water issues, as appropriate. Present summary of annual report to council.	*Goal Met* - DCR attends monthly and is an active participant.	Continue participation. Present summary of Annual Report for Permit Year 8.
2-7	Massachusetts Water Resource Commission (MWRC)	Water Resources (Ann Carroll)	Continue to be involved in program and provide technical and staff support to MWRC.	*Goal Met* - DCR attends monthly and is an active participant.	Continue participation.
2-8	Lakes and Ponds Program	Water Resources (Ann Carroll)	Continue to sponsor program.	*Goal Met* - DCR continues to sponsor this program. Examples of LID installations and demonstration projects for the Ipswich River watershed are available through http://www.mass.gov/dcr/waterSupply/lakepond/lakepond.htm	Program did not receive funding for FY12. Further activities are subject to funding.
2-9	Think Blue Campaign	Planning & Engineering (Mike Misslin)	Explore a partnership with Think Blue. Provide update on program and schedule in annual reports.	*Goal Not Met* – Think Blue has experienced budget and staffing issues and therefore progress did not occur this year.	Once the new MS4 watershed based permits are issued final, DCR will follow public meeting requirements outlined in those permits.
2-10	Partnership with MyRWA	Planning & Engineering (Mike Misslin)	Explore a partnership with MyRWA. Include a summary of collaborative activities in annual reports.	*Goal Met* – DCR staff has volunteered to be on MyRWA Science sub-committee and shared drainage information with MyRWA.	Further define partnerships and implement water quality monitoring program.

3. Illicit Discharge Detection and Elimination

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
3-1	Drainage Outfall Inventory	Planning & Engineering (Mike Misslin)	Locate all known outfalls owned and operated by DCR within urbanized areas. Explore possibility of providing inventory for public review and include "Contact Us" Link.	*Goal Met* - DCR located all known outfalls owned and operated by DCR within urbanized areas by the end of Permit Year 5. The drainage outfall information was gathered from either scanned construction drawings or field surveys. During this past permit year, DCR has continued to add to and update the stormwater infrastructure database by verifying and updating the database during illicit discharge detection field work and catch basin cleaning and maintenance efforts. DCR has used the database to support maintenance activities, quickly understand the scope of potential drainage failures, and facilitate work related to adjacent municipalities. DCR has shared drainage information on infrastructure associated with the roads that were handed over to MassDOT.	DCR will continue to verify the location and condition of outfalls located from paper maps during illicit discharge detection field tasks. DCR will continue to use the "Contact Us" link as the primary method for the public to request drainage system mapping information. The information will be provided to the public in a timely fashion.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
3-2	Drainage Inventory Specification	Chief Engineer (Michael Misslin/AECOM)	DCR will develop and implement a Drainage Inventory Specification which will require submission of drainage infrastructure information from construction and redevelopment projects to add to the infrastructure database.	*Goal Met* - Drainage specifications have been included in revised contract language and standard contract documents for newly issued contracts. DCR received as-built plans for the Mt. Greylock project.	All new construction projects will continue to include the Drainage Inventory Specification. Incorporate as-built information from Mt. Greylock in to drainage mapping.
3-3	Illicit Drainage Connection Policy	General Counsel (Thomas Larosa)	DCR is preparing a policy prohibiting illicit discharges to the DCR storm water system. The Policy will be finalized and issued during Fall 2006. Develop formal agreement with Attorney General's office.	*Goal Not Met* - DCR has developed a drainage connection policy. The draft was circulated last July for comment. The final policy is awaiting final signature from the Director of Policy.	Receive signature and issue drainage connection policy.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
3-4	Drainage Infrastructure Inventory	Chief Engineer (Michael Misslin)	Identify DCR's roadway, parkway and boulevard drainage infrastructure and add to GIS Drainage Outfall Inventory/ database.	*Goal Met* - At the end of 2008, DCR's consultant had mapped drainage information for each of the urbanized area DCR properties. The drainage information was gathered from either scanned construction drawings or field surveys. DCR has continued to update the drainage inventory during its catch basin cleaning, maintenance, and illicit discharge detection efforts this permit year. DCR's consultant performed the field survey over the past year, using two crews daily at the peak of survey in the summer of 2010. Crews investigated 1,625 features, and the infrastructure database was revised to as appropriate to reflect findings.	The infrastructure database is a dynamic work in progress. Updates are made to the database when new construction takes place. Corrections to the database will be made as areas are visited during the illicit discharge investigation and during catch basin cleaning and maintenance efforts. DCR's infrastructure database is now linked to inspection, maintenance and illicit discharge investigation records, providing consolidated records of the features and all work performed on the feature over the years. In addition, DCR will add features identified during maintenance work that were missed from the infrastructure database. DCR will update the database when construction activities alter drainage infrastructure.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
3-5	Illicit Connection Sampling Program	Planning & Engineering (Mike Misslin)	Continue to prioritize and review known potential illicit connections. Once DCR, or its consultant, completes large portions of the drainage infrastructure inventory (BMP 3-4), DCR will develop a priority area list and focus on those systems. DCR will summarize the systems reviewed, the outcome of the reviews and any proposed follow up work in each annual report. The annual report will also include the priority areas list for the next permit year.	*Goal Met* - DCR's consultant performed the third year of a five-year rotating illicit discharge inspection program. The urban stormwater system was split spatially into five regions to facilitate inspections. All regions contain approximately 20% of DCR's system and all contain areas of special concern including public beaches impaired waters, etc. Over this past permit year, areas that primarily drained to the Charles River were inspected for illicit discharges according to the Charles River Illicit Discharge Detection and Elimination Protocol. This region encompasses the Charles River Reservation, and major roads such as Storrow Drive, Memorial Drive Charles River Road, Nonantum Road, Soldier's Field Road, Birmingham Parkway, Greenough Boulevard, Park Drive, and the Fenway. On-site sample analysis was employed to get real-time results to help identify potential sources of illicit flows. *(continued on next page)*	DCR will inspect 20% of their stormwater system within the urbanized area during the summer and fall of 2011. The areas surrounding the Charles River that were not completed in 2010 will be completed this year. DCR will continue to update the drainage inventory and identify needs for maintenance and cleaning as part of this field effort. DCR will follow up on 7 cases of suspect illicit connections from Permit Year 8 inventory.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
3-5 (cont'd)				Over Permit Year 8, 1,625 stormwater features were inspected on 29 miles of DCR property. Ten cases of dry weather flow were identified with seven suspected of illicit connections. A copy of the report is included as Appendix F. The drainage inventory was used to systematically locate stormwater features and trace sources of illicit connections. During the inspections, field crew updated the drainage inventory when data was inaccurate.	
3-6	Drainage Tie-In Policy	General Counsel/ Chief Engineer (Thomas Larosa/ Michael Misslin)	Develop a SOP regarding drainage tie-ins from private entities to DCR's MS4.	*Goal Met* – DCR utilizes their access permit program to "permit" drainage tie-ins when requested or when un-permitted connections are identified in the field. Seventeen drainage connections were made in Permit Year 8. See Appendix G.	Continue to review requested drainage connections through access permit program.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
3-7	Develop Storm Water Control Agreements with Other MS4s	General Counsel (Thomas Larosa)	DCR will implement a program to work cooperatively with operators of interconnected MS4s in the instance where storm water discharges impact either system. DCR will develop control agreements with the discharging municipality.	*Goal Not Met* –DCR has identified interconnections with municipal systems during the infrastructure mapping. Control agreements have not been explored.	No further action is planned. If interconnections with town MS4s are identified related to illicit discharges, DCR will work collaboratively with the town to identify a solution and remove the discharge.
3-8	Illegal Dumping	Operations (Curt Rudge)	Continue training of rangers regarding illegal dumping and work with law enforcement when necessary.	*Goal Met* –DCR cleaned the Muddy River again in December and March. They removed 22 CY's of refuse DCR picks up and appropriately disposed of waste abandoned on the side of road on an on-going basis. DCR also properly disposed of materials from maintenance yards in Stoneham, Cambridge, and Milton.	DCR will perform cleaning at the Alewife Culvert along Route 2 in 2011. Debris such as white goods and a safe have been removed. DCR will again perform cleaning and debris removal at Muddy River. A solid waste dumping investigation is on-going at the Bradley Palmer State Forest.

Additional practices outside the urbanized area:

- DCR EQ staff continued with water quality sampling efforts to characterize storm events. Staff completed a report of options for addressing or eliminating the 50 direct discharges to the Wachusett Reservoir. This report will be used to discuss implementation with MassDOT and Massachusetts Water Resources Authority. DCR staff will continue to work with municipalities to discuss and trace connections.

4. Construction Site Stormwater Runoff Control

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
4-2	E&S/ NPDES Contract Bid Item and Special Provisions	Planning & Engineering (Mike Misslin)	Prepare contract bid item and special provisions. Include in all new contracts which disturb more than one acre. Bid item will include erosion control specifications.	*Goal Met* - Erosion and sedimentation control specifications are included in revised contract language and standard contract documents.	Continue to include Erosion and Sediment Control Specification in all new construction projects.
4-3	Construction SWPPP Template	Planning & Engineering (Mike Misslin)	DCR will develop a SWPPP Template for use by Contractors on DCR projects. Template will be placed on DCR website for download by contractors.	*Goal Met* - DCR is currently instructing consultants and in-house staff to use EPA's template for appropriate projects.	DCR will continue using EPA's template.
4-5	On-going Construction Projects Web Page	External Affairs/ IT Dept. (Wendy Fox)	DCR will maintain the construction related web page that includes information regarding on-going DCR construction projects.	*Goal Partially Met* – The front page of DCR's web site highlights on-going design and construction projects. Information regarding projects that are subject to the Construction GP were not added.	DCR will add a link to EPA's eNOI web site for the public to use in accessing a list of DCR construction sites that exceed 1 acre disturbance.
4-6	Annual Erosion Prevention/ Sediment Control Training	Planning & Engineering (Mike Misslin)	Provide annual training to DCR construction management staff. Report number of attendees, topics covered and dates of training in annual report.	*Goal Not Met* – Training was not performed this year due to staff shortage and agency priorities.	Provide annual training. Coordinate with Engineering this year.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
4-7	Technical Assistance to ConComs	Water Resources (Ann Carroll)	Continue to provide technical assistance and the staffing level necessary to provide timely responses.	*Goal Met* - Technical assistance was provided to fifteen problem sites to correct problems. *Wachusett:* EQ continued to attend meetings of local boards and commissions and provide assistance to the volunteer boards. Technical Assistance funds were expended to provide trainings to watershed Planning Boards and Conservation Commissions. Three workshops were held on Riverfront and the Wetlands Protection Act, Review of Development Plans and on DEP revised Stormwater Regulations. *Quabbin:* Staff continued to provide direct technical assistance to a number of watershed communities on zoning, planning and technical engineering issues. In addition, they continued work on development of model wetland bylaws, a permit checklist, and a USFS-funded guidebook on watershed forest management.	Continue to provide assistance as requested by Conservation Commissions.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
4-7 cont'd				Also, the limited funds available this year for community technical assistance were used to pay registration fees for Conservation Commission members from watershed communities to attend a wetland conference, and to set up three evening workshops that were offered to planning boards, conservation commissions and select boards in watershed communities.	
4-8	Contract Bid Item and Special Provisions Enforceability	Planning & Engineering (Mike Misslin)	Include notice, which defines the procedure to address storm water related problems identified at construction sites, in all new contracts.	*Goal Met* – Continued to require development of SWPPP and filing of NOI for construction sites which disturb more than one acre. Developed specific tasks and staff assignments within a draft action plan for assistance to towns. All active and potential construction sites of >1 acre were regularly inspected (monthly and during storm events) and no problems were noted, even during heavy March rains.	Continue to implement in all new projects which disturb more than one acre. Coordinate on contracts transferred to MassDOT, such as bridge work.
4-9	Construction Runoff Enforcement from DCR and/or Offsite Construction Pollution	General Counsel (Thomas Larosa)	Refer offsite/ non-DCR construction projects that are causing construction related pollution on DCR property to Attorney General's office as necessary. Refer to EPA is appropriate.	*Goal Met* – No construction related pollution action was necessary this year.	Refer problems identified to AG or EPA. Document in annual report.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
4-10	Utility/ Drainage Tie-In Permit	Permitting (Don Guidobone)	Continue to require all offsite projects which need to tie into a DCR MS4 to receive a permit under this program.	*Goal Met* – Offsite projects are required to receive this permit before tying into a DCR MS4. Seventeen (17) permits were issued in Permit Year 8. See Appendix G.	Require tie-ins to apply for a permit.

5. Post-Construction Stormwater Management in New Development and Redevelopment

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-1	Compliance with MA DEP Stormwater Management Policy	Planning & Engineering (Mike Misslin)	Apply Stormwater Management Policy Guidelines to all development/ redevelopment projects.	*Goal Met* - All new/ redevelopment projects were designed to incorporate the current stormwater best management practices.	All new/ redevelopment projects will be designed to incorporate the most current stormwater best management practices. Storm water discharges to tributaries to the Quabbin or Wachusett watersheds will be reviewed for applicable storm water policy and standards.
5-2	DCR Storm Water Handbook	Planning & Engineering (Mike Misslin)	Develop Handbook and issue department-wide and to Contractors. New projects will be designed in accordance with the Handbook.	*Goal Partially Met* - Storm Water Handbook has been updated to be consistent with the 2008 Massachusetts DEP Stormwater Policy. The Handbook is still in draft form.	Finalize Handbook. Conduct appropriate training sessions.
5-3	Storm Water Handbook Training	Director of Human Resources (Patricia Vantine)	Provide 2 seminars within 6 months of issuing handbook to train internal personnel and consultants. Provide annual seminars thereafter. Record # of attendees and dates of training.	*Goal Met* – No action required since Handbook was not finalized.	Once Handbook is finalized, provide two seminars to train internal personnel and consultants on Handbook.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-4	BMP Long-Term Operation and Maintenance	Operations / Planning and Engineering (John Murray/ Mike Misslin)	DCR has committed 1.9 million dollars annually to provide long-term maintenance of BMPs on the schedule indicated in the Maintenance Activity Schedule of the SWMP.	*Goal Met* - Long-term operation and maintenance was accomplished using contracts established for pavement resurfacing and deferred maintenance. DCR's storm water management efforts are supported by operating and capital appropriations that totaled approximately $3.9 million in FY10 and expects to utilize all available funds to provide an appropriate level of service and to identify better practices to reduce pollution in runoff from roads and parkways.	DCR has requested $4.1 million for long-term operation and maintenance of BMPs in FY12. Budget process/ deliberations are still in process.
5-5	Low Impact Development Projects	Water Resources (Anne Carroll)	Actively work on the planning, permitting and implementation of one Low Impact Development (LID) project each year.	*Goal Met* - DCR constructed LID project at Herter Parking Lot #2 on Soldiers Field Road, and permeable pavement was installed in Memorial Drive sidewalk at Jerry's Landing. Also see response to BMP 5-8 and 5-9 below.	Design and permit an LID project with Charles River Watershed Association (CRWA) and at Fort Phoenix. Also see response to BMP 5-8 and 5-9 below.
5-6	Walden Pond Stormwater Improvements *(outside of urbanized area)*	Planning & Engineering (Mike Misslin)	Complete design of storm water improvements and install.	*Goal Met* – Project complete in Permit Year 5. Parking lot with pervious pavement was vacuum swept to maintain infiltration.	Parking lots with pervious pavement will be cleaned using vacuum sweeping equipment.
5-7	Post Construction Runoff Enforcement from Offsite Pollution	Planning & Engineering (Mike Misslin)	Refer off site projects that runoff to DCR property to Attorney General's office as necessary.	*Goal Met* – No post construction runoff enforcement actions necessary this permit year.	Refer problems identified to AG or EPA. Document in annual report.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-8	Ipswich River EPA Targeted Watershed Grant – Low Impact Development (LID) Subdivision Demonstration Project	Water Resources (Anne Carroll)	The DCR received a $1.04 million grant from the EPA's Targeted Watershed program to demonstrate an integrated approach to addressing the problems facing the Ipswich River. This approach encompasses two strategies: LID – landscaping and design techniques that capture stormwater and recharge it to the groundwater Water Conservation – education strategies and technologies that reduce demand on water supplies, and associated groundwater pumping, especially during dry months.	*Goal Met* - The report has been prepared and a link to it can be found here http://pubs.usgs.gov/sir/2010/5007/.	For up-to-date planned activities for all Ipswich River Targeted Watershed Grant projects, please visit http://www.mass.gov/dcr/waterSupply/ipswichRiver /index.htm

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-8a	Ipswich River EPA Targeted Watershed Grant - Green Roof Demonstration Project	Water Resources (Anne Carroll)	Monitor quality and quantity of runoff from the green roof at Whipple Annex and conventional roof at Ipswich Town Hall. Summarize results and include in annual report.	*Goal Met* - The green roof demonstration site, Whipple Annex, is being redeveloped as affordable housing for seniors. Water quality samples collected from the green roof by USGS in 2008 were analyzed for a range of parameters, including conductivity, pH, nitrogen, phosphorus, metals, and total petroleum hydrocarbons. The report has been prepared and a link to it can be found here http://pubs.usgs.gov/sir/2010/5007/. A fact sheet was prepared and is found in Appendix H.	No activities planned?

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-8b	Ipswich River EPA Targeted Watershed Grant - Permeable Paving Demonstration Project	Water Resources (Anne Carroll)	Continue groundwater quality sampling for one year upon completion of project construction. Summarize results in annual report.	*Goal Met* - This project incorporated three LID practices (permeable paving materials, bioretention cells, and vegetated water quality swales) designed to reduce runoff volume, improve water quality, and enhance groundwater recharge. There have been no beach closures, due to fecal bacteria, starting in 2006 and continuing until 2009. However, there was one closure due to a cyanobacteria bloom. USGS installed seven wells in the parking lot to provide data on groundwater levels and groundwater quality. USGS monitored preconstruction conditions quarterly and after a few large storms. Following construction, USGS began monitoring groundwater levels and collecting samples monthly. Sampling is designed to detect any changes in groundwater quality associated with recharge from the parking lot. A fact sheet was prepared and is attached in Appendix I.	USGS has published a report of pre- and post- construction groundwater data, and a link to the report is posted on their website at http://www.mass.gov/dcr/watersupply/ipswichriver/progress.htm

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-8c	Ipswich River EPA Targeted Watershed Grant - LID at Silver Lake	Water Resources (Anne Carroll)	Perform sampling of stormwater volumes and water quality for one year upon completion of project construction. Summarize results versus pre-construction in Year 5 annual report.	*Goal Met* - This project incorporates several LID techniques to replace the conventional stormwater collection system in two streets draining to Silver Lake. Stormwater flow paths were disconnected from the piped drainage system by directing stormwater to rain gardens and porous pavers. Eleven rain gardens are located in the roadway rights-of-way. The roadway edges in three areas along Silver Lake Avenue were resurfaced with porous pavers with underlying infiltration beds. Sampling for changes in water quality and discharge quantity continued for 15 months, post-construction, concluding in October 2007. A fact sheet was prepared and can be found in Appendix I.	USGS has published a report of pre- and post- construction groundwater data, and a link to the report is posted on their website at http://www.mass.gov/dcr/watersupply/ipswichriver/progress.htm

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-8d	Ipswich River EPA Targeted Watershed Grant - Rainwater Harvesting	Water Resources (Anne Carroll)	Continue data collection of outdoor water use or each participating household with rainwater harvesting systems through the irrigation seasons of 2007 and 2008. Compare use with historic records and summarize in annual report. Install large underground system.	*Goal Met* - This project funded installation of roughly 40 rainwater harvesting systems in residential settings. The systems consist of a storage tank, a pressure pump to aid in water distribution, a spigot for a hose, and a water meter to measure flow. Three sizes of storage tanks were installed. A large-capacity (8,000-gallon) underground storage vault was installed at the Boutwell Elementary School in Wilmington in April 2007, to supply water for irrigating the adjacent ball field. The water meter attached to each rainwater harvesting system provided data on the volume of rainwater pumped from the storage tanks for outdoor use. In addition, Wilmington Water Department records on each residential participant's domestic water use were analyzed to compare domestic water demand before and after installation of the rainwater harvesting system. Rainwater was used for outdoor purposes by all participants. Survey results indicate that, in general, the rainwater that participants used replaced the use of domestic water. *(continued on next page)*	No planned activities.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-8d cont'd				A fact sheet has been prepared and is included in Appendix J. Additionally, a paper has been accepted but not yet published by the Journal of American Water Resources Association.	
5-8e	Ipswich River EPA Targeted Watershed Grant - LID Ball Field	Water Resources (Anne Carroll)	Begin data collection of water use and continuous soil moisture retention on field in 2007 and continue through summer of 2008.	*Goal Met* - A portion of a municipal athletic field complex, located adjacent to the river at Ipswich River Park and totaling eight acres, was redeveloped to maximize infiltration and minimize irrigation requirements and application of fertilizer and pesticides. The town monitored the soil moisture of the amended field and the control fields; and the volumes of water used on each of the four fields in the complex. The watering needs of the amended field were much less compared to the conventionally treated fields. A report has been written and is included in Appendix J. Additionally, a paper has been accepted but not yet published by the Journal of American Water Resources Association.	No planned activities.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
5-8f	Ipswich River EPA Targeted Watershed Grant - Weather Based Irrigation	Water Resources (Anne Carroll)	Compile and analyze post-installation water use records for the 25 weather-based irrigation controllers through summer 2008. Summarize in annual report.	*Goal Met* - During Permit Year 5 a total of 25 weather-based irrigation controller switches were installed on both residential properties and municipal athletic fields in five communities. These devices contain devices used to deliver the optimum amount of water needed by the landscape. Data on water use was recorded using readings from individual water meters dedicated to the irrigation system. These readings were compared to water use at control sites using conventional irrigation technologies and to records on pre-installation water use of project participants. A report has been written and is included in Appendix J. Additionally, a paper has been accepted but not yet published by the Journal of American Water Resources Association.	No planned activities.

5. Additional

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
	Breakheart Reservation Pond Improvements Project	Planning & Engineering (Mike Misslin)		DCR's consultant performed site visits, survey and hydrologic analysis of the Breakheart Reservation's pond system (two ponds). During the analysis, DCR discovered that the two ponds are held by poor condition dams. DCR stormwater personnel met with DCR dam personnel to discuss the issues at both ponds and possible improvements.	DCR will continue discussions with DCR dam personnel to determine a course of action at the Breakheart Reservation dams/pond to reduce beach erosion and improve the condition of the dams. It is on a priority list and will be addressed as the priority is reached. They are not high hazard dams.
	Mt. Greylock	Planning & Engineering (Mike Misslin)		DCR is in the process of designing a lodge/conference center and camp ground at Mt. Greylock. 220 catch basins were installed in compliance with historic parkway guidelines. As-built plans were provided to DCR and georeferenced and included in the drainage infrastructure database.	
	Mt. Wachusett (out of UA)	Planning & Engineering (Mike Misslin) Environmental Quality staff		DCR used construction controls during utility installation at this facility. Continued involvement in the planning of a major road upgrade projects in Shutesbury and Hubbardston. Staff continued to review YOPs for National Grid and the Providence and Worcester Railroad.	DCR is working to rebuild the roadway, historic walls and replace the fire tower. The project will include construction controls.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
	Quabbin administration building (out of UA)		Improvements to drainage system.	Plans for a new stormwater treatment system for the area in front of the Quabbin administration building were largely completed, but the project is now on hold pending the availability of funding and staff time. However, a number of other drainage improvements (replaced culverts, drainage ditch and catch basin maintenance) were achieved during the year. Staff worked closely with local and state officials in monitoring and enforcing stormwater regulations and design requirements at a large residential subdivision in Rutland. They also worked with DEP in reviewing several NPDES General Construction Permit applications.	

6. Pollution Prevention and Good Housekeeping

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-1	Vehicle Washing Policy	Operations (Jack Murray)	Maintain practice of washing vehicles at off-site locations into state-wide written policy and implement. Identify off-site commercial (snow plow equipment) vehicle washing facility.	*Goal Met* - Policy implemented in Winter 06-07 for smaller cars and trucks. Pursued locating off-site commercial (snow plow equipment) vehicle washing facility but were not successful.	DCR is still working with MassDOT to identify off-site commercial (snow plow equipment) vehicle washing facility/vendor.
6-2	Floor Drain Policy	Planning & Engineering (Mike Misslin)	Maintain plan for floor drain use and servicing.	*Goal Met* - Plan is maintained, staffed and funded under Clean State Initiative.	Maintain plan.
6-3	CB Cleaning Policy	Chief Engineer/ Operations (Michael Misslin/John Murray)	DCR will develop a written plan for regular catch basin cleaning to be implemented in DCR's fiscal year 2006 and thereafter.	*Goal Met* - Policy finalized and implemented statewide.	Continue to implement policy.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-4	CB Inspection/ Repair Policy	Stormwater (Rob Lowell)	DCR will develop an agency wide policy for implementing a schedule for inspecting catch basins and prioritizing repairs of catch basins and implement.	*Goal Met* – Policy has been finalized. Priority catch basins identified during 2008-2009 were repaired in the same fiscal year and often within two weeks. Program was moved to the Stormwater Group in DCR for faster repair tied to reporting. Approximately 95% of the repairs were on parkways and 5% on state and urban parks. May 2010 through August 2010 1087 ft. of drainage pipe and 235 catch basins repaired. Sept 2010 through April 2011 2154 ft of drainage pipe and 341 catch basins repaired.	Continue to implement policy.
6-5	Street Sweeping Policy	Operations (Jack Murray)	Create and implement agency-wide policy on all roads, parkways and parking lots.	*Goal Met* – Policy has been finalized and implemented. From September through November DCR and contractors swept urban parks and parkways monthly in accordance with DCR's Maintenance Activity Schedule. DCR added parking lots along the Charles River and the Fells. A total of approximately 6,560 cubic yards of street sweeping were removed from DCR roads and parkways in 2010. The new contractor can target hard to reach areas, therefore no need to purchase sidewalk vacuums.	Continue to implement policy. DCR plans to purchase 4 goose waste buster vacuum units perhaps in 2011. The units will be used at park facilities with significant goose waste. A unit is currently used at Georges Island and found to be effective. DCR has a new contractor – National Watermain Cleaning Company - for the sweeping in the Fall of 2011. They use high performance regenerative sweepers.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-6	IPM Policy	Water Resources (Ann Carroll)	Create and implement agency-wide policy.	*Goal Partially Met* - Create draft plan for internal review. Test studies being performed.	Continue to develop policy.
6-7	VMP Training	Planning & Engineering (Mike Misslin)	Provide training on DCR Vegetation Management Plan (VMP) to internal maintenance staff once every two years. Provide training, if required, for seasonal workers without prior experience on off years.	*Goal Met* – DCR follows VMPs provided by municipalities to the extent possible.	Continue to provide training for seasonal workers. Training will include review of VMPs prior to seasonal brush cutting.
6-9	EMS	Planning & Engineering (Mike Misslin)	Continue to provide first response for emergency management situations such as spills and/ or coordinate with Mass. State Police, as appropriate. Continue to provide annual training in spill response coordinated with DEP, MWRA, emergency responders and other local responders.	*Goal Met* - DCR coordinates responses with Mass State Police, Coast Guard and DEP as necessary. In March 2011 DCR responded to an oil spill at the Houghton Pond bath house. No reportable release resulted, the oil company cleaned it up,	Continue to coordinate responses and provide annual training.
6-10	Waste Disposal	Planning & Engineering / Operations (Mike Misslin/ Jack Murray)	DCR will continue to properly dispose of waste.	*Goal Met* - DCR has budgeted for disposal of catch basin and street sweeping wastes. Spent $145K on waste disposal.	Continue to properly dispose of waste and include in budgets.
6-11	Beneficial Use Determination (BUD)	Planning & Engineering (Mike Misslin)	DCR will work to determine a beneficial use determination (BUD) for catch basin residuals.	*Goal Partially Met* – DCR identified a facility, Apple d'Or, to compost street sweepings. Apple d'Or compost facility in Boston has Beneficial Use Determination.	Continue to use facility with BUD for street sweepings.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-14	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Planning & Engineering (Mike Misslin)	Perform an annual state wide assessment of the condition and cleaning requirements of visible proximate DCR lateral piping and catch basin repair needs. Pilot project in 2005. Agency wide program in 2006. Annual reports will summarize piping requiring cleaning and catch basin to be repaired and report on progress.	*Goal Met* - Over the spring and summer, DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. From March through December, 2,133 catch basins were cleaned and water jetted and 281 were repaired. For the fiscal year ending in June 2010, DCR spent $1.6 M to clean and repair catch basins. DCR has completed drainage repairs on Memorial Drive. DCR has reviewed Quincy Shore Drive at East Squantum Street, Quincy for potential illicit connections. DCR repaired catchbasins at: ▪ Morrisey Boulevard ▪ Day Boulevard ▪ McGrath Highway ▪ Embankment Road ▪ Memorial Drive ▪ Soldiers Field Road ▪ Storrow Drive	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates dedicating similar budget ($1.325 M) and level of effort this year for catch basin cleaning and repair. DCR will investigate additional areas where drainage infrastructure has been identified as obstructed or broken during statewide CB cleaning activities. Use CCTV and/ or magnetic probes to identify necessary repairs or remedy. Areas will include: ▪ Storrow Drive/ Esplanade ▪ Charlesgate ▪ Truman Highway ▪ Riverway ▪ Mystic Valley Parkway ▪ Jamaica Way ▪ West Roxbury Parkway ▪ Morrisey Boulevard ▪ Blue Hills Parkway

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-17	Maintenance Tracking System	Planning & Engineering/ Operations (Mike Misslin/ Jack Murray)	Develop a maintenance tracking system. Add storm water infrastructure information inventoried in BMP 3-4. Include inspection/ maintenance schedule and create reports of BMPs that are "scheduled" for cleaning.	*Goal Met* - DCR's consultant has developed a global positioning system (GPS) program to work with DCR's GPS operating systems and the existing geospatial stormwater infrastructure database to record maintenance activities. DCR employees have been trained in recording and processing data using the new system. The consultant has organized previous DCR maintenance records into a database linked to the stormwater infrastructure database.	DCR's consultant will continue to work with DCR's maintenance team to track maintenance needs and actions. DCR plans on updating their data collection equipment to better work with the growing infrastructure and tracking database and continue to use the GPS program to efficiently track inspections and activities.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-18	Maintenance Activity Schedule	Operations (Jack Murray)	Maintain infrastructure and roadways in compliance with maintenance activity schedule.	*Goal Met* – **Street Sweeping**: To insure adequate street sweeping frequency, DCR entered into a three-year renewable contract in 2007 with a street sweeping contractor to clean certain DCR parkways and roads. The contract provides for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. Car parking in these areas has restricted access to the curb line thereby reducing the effectiveness of street cleaning. The program is outlined on DCR's web site at http://www.mass.gov/dcr/sweep.htm DCR no longer performs maintenance on the seven roads transferred to MassDOT, though it retained O&M operations on Columbia Rd east of I-93. The DCR street sweeper fleet (nine sweeper units) received maintenance periodically during the year and were operated as necessary by DCR to keep parking lots and roadways parkways as clean and trash free as possible. *(continued on next page)*	Continue to comply with maintenance activity schedule. **Street Sweeping**: Continue to provide and fund contract for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. There is a new contract for the sweeping in the Fall of 2010 - 2013. The new contractor has the ability to target hard to reach areas. DCR plans to purchase 4 goose waste buster vacuum units perhaps in 2011. The units will be used at park facilities with significant goose waste. A unit is currently used at Georges Island and found to be effective.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-18 (cont'd)	Maintenance Activity Schedule			Full size street sweepers and smaller vacuum units are used by Division of Urban Parks and Recreation (DUPR.) mostly on beach parkways and parking lots to keep these seasonal facilities as clean and trash free as possible. Beach sand screener/sanitizers were operated on a daily basis at Revere Beach, Nantasket Beach, Wollaston Beach, Nahant Beach and other high use beach areas to reduce contaminants in the beach sand (cigarette butts, plastic bottles, etc.) that threaten surface water quality and to improve beach experiences for visitors. These beach maintenance services are performed by staff that also operates street sweepers when not operating beach sanitizers. DUPR district managers have the responsibility to prioritize and schedule these tasks. DCR also composted algae pulled from select beaches this last year. *(continued on next page)*	

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-18 (cont'd)	Maintenance Activity Schedule			**Leaf Removal:** To improve seasonal leaf removal DCR purchased three (3) high efficiency leaf loader machines to assist removal of leaves and debris from urban parkways. This new equipment enables DCR to better clean those roads lined with oaks and other trees that drop their leaves late in the season and often cannot be removed effectively before winter conditions prevent their removal. DCR removed leaves ahead of streets being swept. **Catch Basins**: Over the spring and summer DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. From March through December 2010, 2,133 catch basins were cleaned and water jetted, and 2199 tons of sediment was removed. For the fiscal year ending in June 2010 DCR spent $1.6M to clean and repair catch basins. *(continued on next page)*	**Leaf Removal:** DCR will continue to remove leaves ahead of streets being swept. **Catch Basins**: DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates a similar budget ($1.325M) and level of effort FY12 when compared to FY11.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-18 (cont'd)	Maintenance Activity Schedule			**Material Storage Yard Maintenance**: MassDOT has taken over the deicing and snow operations for all DCR roads. Four urban parks do store street sweeping and catch basin cleaning on-site. The accumulation areas are marked off for collection to reduce illegal dumping. **Fleet Maintenance**: DCR fleet manager (Joe Suppa) oversees the compliance with fleet maintenance. Individual facilities are reviewed in Table 2-7 of this report.	**Material Storage Yard Maintenance:** Not applicable. **Fleet Maintenance:** Fleet manager will review fleet maintenance schedule.
6-19	Winter Storm Plan	Operations (Jack Murray)	Continue to maintain a responsible winter storm program and provide sufficient funding.	*Goal Met* – DCR continued to maintain a winter storm program, where DCR retains responsibility (e.g. sidewalks, parking lots, certain bike paths, etc.). MassDOT has responsibility for snow and ice control on most other DCR roads and parkways.	Continue to maintain winter storm program where DCR retains responsibility.
6-20	Pet Waste Management	Operations (Jack Murray)	Continue pet waste management program. Continue to train DCR park rangers to monitor this program. Coordinate with law enforcement if necessary.	*Goal Met* – Mutt Mitt" Dog Waste Collection Stations were maintained at locations including the Charles River Reservation. DCR revised the pet waste management map.	Maintain pet waste management program. Install additional new collection stations at Charles River Reservation.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
6-21	Pool Discharge SOP	Planning & Engineering (Mike Misslin)	Update and re-issue SOP. Provide training to pool staff.	*Goal Met* – DCR updated and re-issued SOP including dechlorinization procedures. A Public Education Brochure for the Wachusett Watershed has been published (Appendix C)	Provide training to pool staff, as necessary.

7. BMPs for Meeting Total Maximum Daily Load (TMDL) Waste Load Allocations (WLA)

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
7-1	Wetland Protection Act Compliance	Operations/ Planning & Engineering (Jack Murray / Mike Misslin)	Continue compliance with WPA.	*Goal Met* - Wetlands Protection Act is actively enforced at all DCR properties including those not located within urbanized areas. DCR has staff specifically dedicated to WPA compliance in Wachusett and Quabbin Reservoir watersheds. DCR received multiple Orders of Condition in Boston, Cambridge, Newton, Milton and Somerville for work within wetland resources.	Continue compliance. DCR will be filing for Order of Conditions for work within wetland resources in: • Boston • Milton • Somerville
7-2	401 Water Quality Certification	Operations/ Planning & Engineering (Jack Murray / Mike Misslin)	Continue compliance with 401 WQ Certification.	*Goal Met* - DCR received a 401 WQ certifications for Blair Pond during Year 8.	Continue compliance.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
7-3	Cultural Resources Review	Chief Archeologist (Ellen Berkland)	Continue to review potential impact to historic properties during conceptual design stage.	*Goal Met* - DCR reviews all projects for potential impact to historic properties during design phase.	Continue reviews and use subcontractors as necessary.
7-4	Chicopee Basin, French Basin, Mill River Basin, Northern Blackstone and Connecticut River TMDLs	Water Resources/ Chief Forester (Ann Carroll/ Barbara Black)	These TMDL Reports recommended that during timber harvesting practices DCR shall check that an approved forest cutting plan and BMPs for erosion are followed. DCR will provide a summary table of timber harvesting activities, the date forest cutting plan was approved and proposed BMPs in each annual report.	*Goal Partially Met* – Multiple timber sales were conducted in the Northern Blackstone Basin.	Provide summary report in annual report.
7-5	Connecticut Basin TMDL - Train Conservation Commission on Timber Harvest BMPs	Chief Forester (Barbara Black)	Present short seminar for each Conservation Commission.	*Goal Met* - Training provided for vernal pool identification and erosion control measures.	Perform presentations
7-6	Permit Year TMDL Summary	Planning & Engineering (Mike Misslin)	Include summary of TMDL reports approved by EPA during the previous permit year which include recommendations for actions by DCR in annual report.	*Goal Met* – Section 7b of this annual report includes a summary of the current Final TMDLs and those that include implementation recommendations which impact DCR (Table 8).	Continue to be involved in the development of draft TMDLs and implement recommendations summarized in Table 8.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
7-7	Priority Resource Area Review Program	Planning & Engineering (Mike Misslin)	Implement a program to review the outfalls identified in the outfall inventory which discharge to one or more of the resources outlined in Part V and IX of the permit.	*Goal Partially Met* – DCR has updated the receiving water body table (Appendix C of the March 2008 SWMP) to reflect the outfalls identified in the drainage inventory. The table summarizes the number of outfalls by sub-basin number and identifies the impaired waterbody included in the sub-basin. This analysis showed priority areas distributed throughout the state. From this list, DCR has developed a 5-year illicit discharge inspections rotation that groups areas spatially for ease of program operations. DCR focused its illicit discharge program this year on areas adjacent to the Charles River which is impaired with a TMDL. **Blair Pond Improvements** - DCR identified the need for improvements to Blair Pond to improve hydrologic function and aesthetics of the pond. Blair Pond receives water from Clay Pit Pond in Belmont which is listed on the Massachusetts 303d list as Category 5 for Pesticides and discharges to Alewife Brook which is Category 5 Impaired Needs TMDL for Metals, Nutrients, Organic enrichment/Low DO, Pathogens, *(continued on next page)*	DCR will continue the illicit discharge inspection program performing inspections on the third one-fifth of the system. This upcoming program will include systems that discharge to several impaired waters including the Charles River. DCR will continue to address failing stormwater systems and outfalls to reduce flooding, erosion, rutting and sedimentation. When possible, DCR will include structural stormwater Best Management Practices (BMPs) to improve the quality of water being discharged. **Blair Pond Improvements** – DCR will bid and the project with anticipated construction date of Fall 2011.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
7-7 (cont'd)	Priority Resource Area Review Program			oil and grease, taste +odor + color, and "objectionable deposits". In Permit Year 6, DCR's consultants performed a hydraulic and water quality analysis of Blair Pond and recommend improvements to increase its hydrologic function and aesthetics. In Permit Year 7, DCR's consultants finalized the design and permitting related to the desired alternative. The design includes dredging and disposal of contaminated sediments and the development of a sediment forebay to collect sediments in incoming water. These improvements will increase water depths in the pond, increase water and sediment quality, and give DCR a way of easily removing future sediment deposits. **Lower Charles River Cambridge Boat Club** –DCR installed LID permeable pavement in Herter parking lot #2. DCR has addressed several failing stormwater systems and outfalls to impaired waters including: Charles River.	

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 8	Planned Activities – April 11 to March 12
7-7 (cont'd)	Priority Resource Area Review Program			**Alewife Brook:** DCR's consultant performed an initial assessment including the soft sediment volume, physical characteristics, and chemical properties in Alewife Brook between the Broadway Street Bridge and the confluence with the Mystic River.	

Table 2: Parkway Best Management Practices

Table 2: Parkway Best Management Practices

			Permit Year 8 Activity																		
BMP #			2-1	2-5	2-7	2-8	3-1	3-4	3-5	6-13	6-14	6-15	6-16	6-18							7-7
BMP			Abide by MOU with CLF and CRWA	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Illicit Connection Sampling Program	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Implement Parkways Short Term Measures	Maintenance Activity Schedule							Priority Resource Area Review
Facility/ Town	**Parkway Street Associated With**		**Measurable Goal**	Abide by MOU with CLF as it relates to maintenance of parkway surfaces, curbing and drainage infrastructure	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate outfalls	Develop state-wide drainage infrastructure map.	Continue to prioritize and review known potential illicit connections.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Implement measures. Continue to note progress to CLF, CRWA and EPA in periodic reports until fully addressed.	Sweep Streets Annually	Clean CB and piping every two years.	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review for erosion and storm water issues annually.	Review outfalls which discharge to priority resource
Agassiz Road		Boston	In Prog	Met	Met	Met	Met	Met		Met	Met			Met	Cleaned					Met	Not Evaluated
Alewife Brook- Concord Ave Rotary		Cambridge	In Prog	Met	Met	Met	Met	Met		Met	Met			Met	Cleaned					Met	Not Evaluated
Alewife Brook Parkway		Cambridge, Somerville	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned	Retention/ Recharge Basin				Met	Not Evaluated
Arborway	Emerald Necklace Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned					Met	Not Evaluated
Arlington Street		Medford	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Arsenal Street	Charles River Reservation Parkways	Watertown	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Austin Street		Boston, Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Babe Ruth Park Drive		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Beach Street		Medford	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Beacon Street		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Bellevue Hill Road	Stony Brook Reservation Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Berkeley Street		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Birmingham Parkway	Charles River Reservation Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Blue Hill River Road	Blue Hills Reservation	Canton, Milton	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Blue Hill Street		Canton	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Blue Hills Parkway		Milton	In Prog	Met	Met	Met	Met	Met			Met		In Prog	Swept Monthly	Cleaned					Met	Not Evaluated
Boston University Bridge		Boston, Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Boulevard Road		Wellesley	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Boundary Road	Fellsmere Park Parkways	Malden	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Boylston Street		Boston	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned					Met	Not Evaluated
Broad Sound Avenue		Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Broadway		Chelsea, Revere, Everett	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Brook Road		Milton	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Brookline Avenue		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Brookline Street		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Brooks Street		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Cleaned					Met	Not Evaluated
Brush Hill Road		Milton	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned					Met	Not Evaluated
Bunker Hill Lane		Quincy	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Cambridge Parkway	Chestnut Hill Driveway	Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Not Cleaned					Met	Not Evaluated
Cambridge Parkway Connector		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Cambridge Street		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Carroll Parkway		Lynn	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Casassa Overpass		Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Centre Street		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Charles River Dam Road		Boston, Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Charles River Road	Charles River Reservation Parkways	Watertown	In Prog	Met	Met	Met	Met	Met		Completed repair of fourteen (14) storm water headwalls and drain pipes.	Met			Met	Cleaned					Met	Not Evaluated
Charles Street		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Charlesgate East		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Charlesgate Overpass		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Charlesgate West		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Charlestown Avenue		Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Chestnut Street		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Chickatawbut Road	Blue Hills Reservation	Braintree, Milton, Quincy	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Commandant's Way		Chelsea	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Commercial Avenue		Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Commonwealth Avenue		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Concord Avenue		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Connector Mystic Valley Parkway	Mystic Valley Parkway	Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Connector To Eliot Bridge	Eliot Bridge	Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Constitution Beach Road		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Crowell State Forest Road		Sandwich	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Dam Road		Southborough	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
David G Mugar Way		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Day Boulevard Extension		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Swept Monthly	Portion Cleaned					Met	Not Evaluated
Dedham (Boulevard) Parkway		Boston, Dedham	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Deer Park Road		Brewster	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Earhart Dam Road		Everett	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
East Border Road	Fellsway Connector Parkway	Malden, Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
East Broadway		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Eastern Avenue		Lynn	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Eliot Bridge		Watertown, Brighton	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Eliot Circle		Revere	In Prog	Met	Met	Met	Met	Met			Met				Cleaned					Met	Not Evaluated
Elm Road	Breakhart Reservation Parkways	Saugus	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Elm Street	Middlesex Fells Reservation Parkways	Medford,Saugus, Wakefield	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Embankment Road		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Enneking Parkway	Stony Brook Reservation Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Enneking Parkway Branch		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Cleaned					Met	Not Evaluated
Everett Street		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Fellsway		Malden, Medford, Somerville, Stoneham	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Fellsway East		Malden, Melrose, Stoneham	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned					Met	Not Evaluated
Fellsway West		Malden, Medford, Somerville, Stoneham	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned					Met	Not Evaluated

Table 2: Parkway Best Management Practices

			Permit Year 8 Activity																			
BMP #			2-1	2-5	2-7	2-8	3-1	3-4	3-5	6-13	6-14	6-15	6-16	6-18								7-7
BMP			Abide by MOU with CLF and CRWA	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Illicit Connection Sampling Program	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Implement Parkways Short Term Measures	Maintenance Activity Schedule								Priority Resource Area Review
Facility/ Town	**Parkway Street Associated With**		**Measurable Goal**	Abide by MOU with CLF as it relates to maintenance of parkway surfaces, curbing and drainage infrastructure	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate outfalls	Develop state-wide drainage infrastructure map.	Continue to prioritize and review known potential illicit connections.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Implement measures. Continue to note progress to CLF, CRWA and EPA in periodic reports until fully addressed.	Sweep Streets Annually	Clean CB and piping every two years.	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review for erosion and storm water issues annually.	Review outfalls which discharge to priority resource
Fenway	Emerald Necklace Parkways	Boston	In Prog	Met	Met	Met	Met	Met		Completed closed-circuit television investigations of several catch basins and drains. Repairs are being evaluated to remedy the problems identified. DCR worked with the Museum of Fine Arts, to coordinate necessary repairs and pipe replacement to address long-term flooding problems along the Fenway near Museum Way.	Met		In Prog	Swept Monthly	Portion Cleaned						Met	Not Evaluated
Fenway Connector To Park Drive		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
First Street		Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Forest Grove Road		Waltham	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Forest Street	Breakhart Reservation Parkways	Saugus	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Franklin Park Circle		Brookline	In Prog	Met	Met	Met	Met	Met			Met				Portion Cleaned						Met	Not Evaluated
Fresh Pond Parkway		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Furnace Brook Parkway		Quincy	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Furnace Brook Rotary (Rt. 3 Circle)		Quincy	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Green Street	Blue Hills Reservation	Canton, Milton	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Greenough Boulevard	Charles River Reservation Parkways	Cambridge, Watertown	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned						Met	Not Evaluated
Grove Street		Watertown	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Grove Street Extension		Watertown	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Hammond Pond Parkway		Brookline, Newton	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Harvard Avenue		Arlington, Medford	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Hawthorn Street		Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Swept Monthly	Portion Cleaned						Met	Not Evaluated
Hayden Street		Quincy	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned						Met	Not Evaluated
Hemlock Road	Breakhart Reservation Parkways	Saugus, Wakefield	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Higgins Pond Road		Orleans	In Prog	Met	Met	Met	Met	Met													Met	Not Evaluated
High Street		Medford	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Highland Avenue		Malden, Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Hillcrest Parkway	Middlesex Fells Reservation Parkways	Winchester	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Hillside Street	Blue Hills Reservation	Canton, Milton	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Horace James Circle		Brookline	In Prog	Met	Met	Met	Met	Met													Met	Not Evaluated
Hull Shore Drive	Nantasket Beach Reservation Parkways	Hull	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Humphrey Street		Swampscott	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Hyde Park Avenue		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Cleaned						Met	Not Evaluated
Jamaicaway	Emerald Necklace Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met		In Prog	Swept Monthly	Cleaned						Met	Not Evaluated
Jamaicaway Frontage Road		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Cleaned						Met	Not Evaluated
James Shea Circle		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
JFK-UMass Station Road		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
John F Kennedy Street		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Jordan Marsh Service Center Area (served by Cmdr. Shea Blvd)		Quincy	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Kelley Circle		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Kozciuszko Circle		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Land Boulevard		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Lagrange Street Ext.		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Longfellow Bridge		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Lynn Fells Parkway		Melrose, Saugus	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Lynn Shore Drive		Lynn, Nahant, Swampscott	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned						Met	Not Evaluated
Lynnway		Lynn, Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Lynnway Underpass - Rt 1A Sb To Lynnway		Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Main Street		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Main Street		Everett	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Cleaned						Met	Not Evaluated
Massachusetts Avenue		Boston, Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Medford Street		Arlington	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Medford Veterans Memorial Highway		Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Memorial Drive	Chestnut Hill Driveway	Cambridge	In Prog	Met	Met	Met	Met	Met	Reviewed 4 mile section in Cambridge - no dry weather flows	Completed closed-circuit television investigations of several catch basins and drains. Repairs are being evaluated to remedy the problems identified.	Met			Swept Monthly	Cleaned						Met	Not Evaluated
Memorial Drive Underpass		Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Metropolitan District Commission Road		Southborough	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Metropolitan Road	Bever Brook Reservation	Waltham, Lexington	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Metropolitan Road		Medford	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Middle Street		Randolph	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Middlesex Rotary		Medford	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Middleton Street		North Andover	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Milton Street		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Monsanto Road		Everett	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Morrissey Service Road		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Mount Auburn Street		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Mount Vernon Street		Dorchester	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Murray Circle		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Mystic River Road		Medford	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Mystic Valley Parkway		Arlington, Medford, Somerville, Winchester	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned	8 stilling basins					Met	Not Evaluated

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			Permit Year 8 Activity																			
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BMP			Abide by MOU with CLF and CRWA	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Illicit Connection Sampling Program	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Implement Parkways Short Term Measures	Maintenance Activity Schedule								Priority Resource Area Review
Facility/ Town	**Parkway Street Associated With**		**Measurable Goal**	Abide by MOU with CLF as it relates to maintenance of parkway surfaces, curbing and drainage infrastructure	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate outfalls	Develop state-wide drainage infrastructure map.	Continue to prioritize and review known potential illicit connections.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Implement measures. Continue to note progress to CLF, CRWA and EPA in periodic reports until fully addressed.	Sweep Streets Annually	Clean CB and piping every two years.	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review for erosion and storm water issues annually.	Review outfalls which discharge to priority resource
Mystic Valley Parkway Ext.		Arlington	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Mystic Valley - Alewife Brook Rotary		Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Nahant Beach Boulevard		Nahant	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Nahant Circle		Nahant	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Nantasket Avenue	Nantasket Beach Reservation Parkways	Hull	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Nash Hill Reservoir Road		Ludlow	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Neponset Avenue		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Neponset Valley Parkway		Boston, Milton	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
New South Street		Stoneham	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Noble Street		Revere	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Nonantum Road	Charles River Reservation Parkways	Boston, Newton, Watertown	In Prog	Met	Met	Met	Met	Met		Completed repair of fourteen (14) storm water headwalls and drain pipes.	Met			Met	Not Cleaned						Met	Not Evaluated
Nonantum Road Branch		Newton	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned						Met	Not Evaluated
North Beacon Street	Charles River Reservation Parkways	Boston, Watertown	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned						Met	Not Evaluated
North Border Road		Stoneham	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
North Harvard Street		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
North Shore Road		Revere	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Norumbega Road	Charles River Reservation Parkways	Weston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Oak Island Street		Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned						Met	Not Evaluated
Ocean Avenue		Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Ocean Street		Lynn, Swampscott	In Prog	Met	Met	Met	Met	Met	2 mile section reveiwed - 3 dry weather discharges identified		In Prog			Met	Not Cleaned						Met	Not Evaluated
Old Colony Avenue		Boston	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned						Met	Not Evaluated
Quincy Shore Drive		Quincy	In Prog	Met	Met	Met	Met	In Prog - Under Construction			Met			Met	Cleaned						Met	Not Evaluated
Quinobequin Road	Charles River Reservation Parkways	Newton	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned						Met	Not Evaluated
Park Entrance Road		Chicopee	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Park Drive	Emerald Necklace Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned						Met	Not Evaluated
Park Road		Weston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Park Street		Stoneham	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Parkman Drive		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Pelton Street		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Perkins Street		Boston	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned						Met	Not Evaluated
Pine Tops Road	Breakhart Reservation Parkways	Saugus	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned						Met	Not Evaluated
Pond Street	Middlesex Fells Reservation Parkways	Stoneham	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Ramp to Charles Circle		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Berkeley St to Rt 28 NB		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Bu Bridge to Memorial Dr EB		Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Cleaned						Met	Not Evaluated
Ramp-Cambridgeport Circle to BU Bridge		Cambridge	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Cambridgeport Circle to Mem Dr WB		Cambridge	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Casassa Overpass to Rt 107 NB		Revere	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Charles St to Longfellow Bridge		Boston	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Charlesgate Overpass to Charlesgate		Boston	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Jamaicaway to Rt 9		Boston	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Main Street to Rt 16 WB		Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Ramp-Memorial Dr to Cambridgeport Circle EB		Cambridge	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Memorial Dr to Cambridgeport Cir WB		Cambridge	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-N Harvard St to Soldiers Field EB		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-N Harvard St to Soldiers Field WB		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Roosevelt Circle to Valley St		Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Ramp-Rt 107 NB to Rt 16 EB		Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Ramp-Rt 16 WB to Rt 99		Everett	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Rt 3 to Rt 28 SB		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Rt 9 to Jamaicaway		Boston	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Soldiers Field EB to N Harvard St		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Soldiers Field Rd EB to Western Ave		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Soldiers Field Rd WB to Birmingham		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Soldiers Field Rd WB to Western Ave		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Soldiers Field WB to N Harvard St		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Somerville Ave to Rt 28 SB		Somerville	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Storrow Dr to Rt 2A WB		Boston	In Prog	Met	Met	Met	Met	Met						Met	Cleaned						Met	Not Evaluated
Ramp-Western Ave to Soldiers Field Rd EB		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Ramp-Western Ave to Soldiers Field Rd WB		Boston	In Prog	Met	Met	Met	Met	Met						Met							Met	Not Evaluated
Recreation Road		Weston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated
Reid Rotary		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned						Met	Not Evaluated
Reservation Road	Stony Brook Reservation Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned						Met	Not Evaluated
Reservoir Street		Winchester	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned						Met	Not Evaluated

Table 2: Parkway Best Management Practices

			Permit Year 8 Activity																		
BMP #			2-1	2-5	2-7	2-8	3-1	3-4	3-5	6-13	6-14	6-15	6-16	6-18							7-7
BMP			Abide by MOU with CLF and CRWA	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Illicit Connection Sampling Program	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Implement Parkways Short Term Measures	Maintenance Activity Schedule							Priority Resource Area Review
Facility/ Town	**Parkway Street Associated With**		**Measurable Goal**	Abide by MOU with CLF as it relates to maintenance of parkway surfaces, curbing and drainage infrastructure	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate outfalls	Develop state-wide drainage infrastructure map.	Continue to prioritize and review known potential illicit connections.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Implement measures. Continue to note progress to CLF, CRWA and EPA in periodic reports until fully addressed.	Sweep Streets Annually	Clean CB and piping every two years.	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review for erosion and storm water issues annually.	Review outfalls which discharge to priority resource
Revere Beach Boulevard		Revere	In Prog	Met	Met	Met	Met	In Prog - Under Construction			Met			Met	Cleaned					Met	Not Evaluated
Revere Beach Parkway		Chelsea, Everett, Medford, Revere	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Revere Street		Revere	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
River Street		Boston, Cambridge	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Riverdale Road		Upton	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Riverway	Emerald Necklace Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met		In Prog	Swept Monthly	Cleaned	made repairs to 4 outfalls w/erosion problems/plunge pool & BMPs installed				Met	Not Evaluated
Riverway Frontage Road		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Rocky Woods Reservation Road		Medfield	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Roosevelt Circle		Medford	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Saint Thomas Moore Road		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Santilli Circle		Everett	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
Santilli Circle Connector		Everett	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Sawmill Lane		Dedham	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Shirley Avenue		Revere	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Shore Drive		Somerville	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Shore Road		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
Smith Field Road	Stony Brook Reservation Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Soldiers Field Road	Charles River Reservation Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Soldiers Field Road Extension		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Soldiers Field Service Road Eastbound		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
South Border Road	Middlesex Fells Reservation Parkways	Medford, Winchester	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
South Street	Middlesex Fells Reservation Parkways	Stoneham	In Prog	Met	Met	Met	Met	Met			Met			Met	Not Cleaned					Met	Not Evaluated
Sozio Road		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
State Beach Road		Salisbury	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
State Park Road		Ashland	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Storrow Drive	Chestnut Hill Driveway	Boston	In Prog	Met	Met	Met	Met	Met		Completed closed-circuit television investigations of flood control pumping stations serving road. Repairs are being evaluated to remedy the problems identified.	Met			Swept Monthly	Portion Cleaned					Met	Not Evaluated
Sumner Street		Milton	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Sweetser Circle		Everett	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
Terminal Road		Cambridge	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Truman Highway		Boston, Milton	In Prog	Met	Met	Met	Met	Met			In Prog			Swept Monthly	Cleaned					Met	Not Evaluated
Truman Parkway		Boston, Milton	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Turtle Pond Parkway	Stony Brook Reservation Parkways	Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Turtle Pond Parkway Branch		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Unnamed Road		Boston	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
Unnamed Road		Malden	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
Unquity Road	Blue Hills Reservation	Milton	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Upper Arborway		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Portion Cleaned					Met	Not Evaluated
Veterans Of Foreign Wars Parkway		Boston, Brookline	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Wave Avenue		Revere	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Not Cleaned					Met	Not Evaluated
West Border Road	Fellsmere Park Parkways	Malden	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
West Boundary Road		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
West Roxbury Centre Street Rotary		Boston	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
West Roxbury Parkway		Boston, Brookline	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
West Roxbury VFW Parkway Rotary		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Westland Ave (Entrance)		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
West Line Road		Carver	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
Western Avenue		Boston	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
Wharf Avenue		Hull	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
Willard Street		Quincy	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated
William Day Boulevard		Boston	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
William T. Morrisey Boulevard		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Willow Pond Road		Boston	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Winthrop Parkway		Revere	In Prog	Met	Met	Met	Met	Met			Met			Swept Monthly	Cleaned					Met	Not Evaluated
Winthrop Shore Drive		Winthrop	In Prog	Met	Met	Met	Met	Met						Swept Monthly						Met	Not Evaluated
Wompatuck Road	Blue Hills Reservation	Quincy	In Prog	Met	Met	Met	Met	Met			Met			Met	Cleaned					Met	Not Evaluated
Woodland Road	Middlesex Fells Reservation Parkways	Stoneham	In Prog	Met	Met	Met	Met	Met			In Prog			Met	Portion Cleaned					Met	Not Evaluated
Wyoming Avenue		Melrose	In Prog	Met	Met	Met	Met	Met						Met						Met	Not Evaluated

Table 2: Parkway Best Management Practices

		Permit Year 8 Activity																								
BMP #		2-1	2-5	2-7	2-8	3-1	3-4	3-5	6-13	6-14	6-15	6-16	6-18												7-7
BMP		Abide by MOU with CLF and CRWA	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Illicit Connection Sampling Program	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Implement Parkways Short Term Measures	Maintenance Activity Schedule													Priority Resource Area Review
Facility/ Town	**Parkway Street Associated With**	**Measurable Goal**	Abide by MOU with CLF as it relates to maintenance of parkway surfaces, curbing and drainage infrastructure	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate outfalls	Develop state-wide drainage infrastructure map.	Continue to prioritize and review known potential illicit connections.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Implement measures. Continue to note progress to CLF, CRWA and EPA in periodic reports until fully addressed.	Sweep Streets Annually	Clean CB and piping every two years.	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review for erosion and storm water issues annually.	Review outfalls which discharge to priority resource
Permit Year 8 Notes			DCR provided CLF/ CRWA with the final report summarizing the actions taken to meet the criteria outlined in the MOU.	Web site is active. DCR Commissioner has implemented concern/ feedback letter tracking and response system.	DCR attends monthly and is an active participant.	DCR continues to sponsor this program and it now has its own web link on DCR's web site.	DCR has located outfalls from all facilities owned and operated by DCR within urbanized areas.	DCR has continued to add to and update the stormwater infrastructure database. DCR's consultant performed the field survey over the past year, using two crews daily at the peak of survey in the summer of 2010. Crews investigated 1,625 features, and the infrastructure database was revised to as appropriate to reflect findings.	DCR's consultant performed the third year of a five-year rotating illicit discharge inspection program. The urban stormwater system was split spatially into five regions to facilitate inspections. All regions contain approximately 20% of DCR's system and all contain areas of special concern including public beaches impaired waters, etc. Over this past permit year, the Central Boston metro region was inspected for illicit discharges according to the Charles River Illicit Discharge Detection and Elimination Protocol.	DCR inspects roadways and drainage infrastructure annually. Drainage infrastructure is assessed during catch basin cleaning. Maintenance is performed as determined necessary during the inspection.	In reporting Year 8, contractors cleaned and water jetted 2,133 catch basins and recorded these locations using GPS. 281 catchbasins were repaired. For the fiscal year ending in June 2010, DCR spent $1.6 M to clean and repair catch basins.	DCR inspects roadways for signs of ponding and icing in freezing conditions. DCR makes immediate repairs where ponding causes safety concerns.	DCR submitted a Final Report to CLF/ CRWA that described progress on CB cleaning, street sweeping and drainage repairs from March 2009 to December 2010 to satisfy commitments of the MOU between DCR and CLF/CRWA..	To insure adequate street sweeping frequency, DCR entered into a three-year renewable contract in 2010 with a street sweeping contractor to clean certain DCR parkways and roads. Roads which discharge to impaired receiving waters are cleaned using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. All roads were swept at least once this year.	DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. Contractors cleaned and water jetted 2,133 catch basins and recorded these locations using GPS. For the fiscal year ending in June 2011 DCR spent $1.325 M to clean and repair catch basins.	Unable to comprehensively report on detention basins, water quality swales and infiltration basins since a comprehensive facility specific database is not available. BMPs shown reflect the current database. The database will be finalized upon completion of the drainage system infrastructure inventory. DCR has begun to develop web-based reporting format to better track regional compliance withMaintenance Activity Schedule (MAS).					Met MAS schedule.	Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.
Planned Activities - May 2011 to April 2012		No activities are planned.	Continue system.	Continue participation.	Program was not funded for FY12.	Verify the location and condition of outfalls located from paper maps during illicit discharge detection field tasks.	The infrastructure database is a dynamic work in progress which is updated when new construction takes place. Corrections to the database will be made as areas are visited during the illicit discharge investigation and during catch basin cleaning and maintenance efforts. In addition, DCR will add features identified during maintenance work that were missed from the infrastructure database.	DCR will inspect 20% of their stormwater system within the urbanized area during the summer and fall of 2011. The areas surrounding the Charles River will continue to be investigated. DCR will continue to update the drainage inventory and identify needs for maintenance and cleaning as part of this field effort. DCR will follow up on 7 cases of suspect illicit connections from Permit Year 8 inventory.	Perform state wide assessment of roadways and infrastructure conditions.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates dedicating $1.325 M and similar level of effort this year for catch basin cleaning and repair.	Perform review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	MOU with DCR and CLF/CRWA ended September 2010. No future actions are planned.	Sweep all streets at least once. Continue to provide and fund contract for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates a level budget and level of effort this year when compared to FY11.	Continue to meet Maintenance Activity Schedule (MAS). Complete drainage system infrastructure inventory. Develop web-based reporting format to more effectively track regional compliance with MAS.						Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.

Goal Not Met
Goal in Progress
Goal Achieved
Goal Not Applicable
Goal Metrics Not Available

Several roads appearing in this table for Anuual Report Year 6 are no longer listed because they are not DCR roads. The roads include Arlington Road, Casey Highway (Msgr.), Columbia Road, Gallivan Boulevard, McGrath Highway, Middlesex Avenue, Morton Street, and O'Brien Highway (Msgr.). All but Arlington Road are MassDOT responsibility.

Table 3: State Park Facilities Best Management Practices

Table 3: Park Facility Best Management Practices

		Permit Year 8 Activity																Permit Year 8 Activity																		
BMP #		1-2	1-4	1-5	1-7	1-8	1-9	2-1	2-5	2-7	2-8	3-1	3-4	3-5	6-12	6-13	6-14	6-15	6-18																	7-7
BMP		CB Stenciling/ Plaques	Interactions with Boat Club Programs	Mobile Water Quality Education Seminars	Charles River Conservancy Clean Up Program	Charles River Reservation School Program	Camp Nihan	Abide by MOU with CLF and CRWA	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Illicit Connection Sampling Program	SPCC Plans	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Maintenance Activity Schedule (MAS)																		Priority Resource Area Review
Facility	**Town**	**Measurable Goal**	CB cleaning and repair contractor will maintain stencil/ plaque each spring as necessary.	Add to boat club permits that they must post and monitor "No Wake" zones.	Provide storm water/ wq education events.	Partner with Charles River Conservancy Clean Up Program.	Provide 1 storm water/ water quality related educational program each year.	Provide 1 storm water/ water quality related educational program each year.	Abide by MOU with CLF as it relates to maintenance of park facilities and drainage infrastructure	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate outfalls	Develop state-wide drainage infrastructure map.	Continue to prioritize and review known potential illicit connections.	Continue to maintain compliance with the requirements in these plans.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep Streets Annually.	Clean CB and piping every two years.	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review for erosion and storm water issues annually.	Perform fleet maintenance twice a year.	Inspect buildings for compliance with good housekeeping measures weekly.	Review outfalls which discharge to priority resource	
Abigail Adams State Park	Hingham, Weymouth	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned					SW Chamber	Met		Met	Not Evaluated	
Alewife Brook Reservation	Arlington, Belmont, Cambridge, Somerville	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Met						Met		Met	Not Evaluated	
Ames Nowell State Park	Abington	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met						Met		Met	Not Evaluated	
Ashland State Park	Ashland	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned	Retention/ Recharge Basin					Met		Met	Not Evaluated	
Beaver Brook Reservation	Waltham, Belmont	Not Met						Met	Met	Met	Met	Met	Met				Met									Met		Met	Not Evaluated	
Belle Isle Marsh Reservation	Boston, Winthrop	Not Met		Met				Met	Met	Met	Met	Met	Met				Met									Met		Met	Not Evaluated	
Blackstone River & Canal HSP	Blackstone, Millville, Northbridge, Uxbridge	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Blue Hills Reservation	Braintree, Canton, Milton, Quincy, Randolph	Not Met		Met				Met	Met	Met	Met	Met	Met		Met - Labor Yard and Ponkapoag Golf Course		Met		Met	Partially Met	2 detention basins					Met	Met	Met	Not Evaluated	
Boston Harbor Islands State Park	Hingham	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Breakheart Reservation	Saugus, Wakefield	Not Met		Met			Met	Met	Met	Met	Met	Met	Met				Met		Met	Met						Met		Met	Category 4C - TMDL Not Needed	
Cape Cod Rail Trail	Eastham	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Charles River Reservation	Medfield	Not Met			Met	Met		Met	Met	Met	Met	Met	Met		Met - Central Services Cambridge		In Prog		Met	Not Cleaned	Detention Basin					Met	Met	Met	Not Evaluated	
Charles River Reservation, Lower Basin	Boston, Cambridge	Not Met	In Prog		Met	Met		Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Charles River Reservation, New Basin	Boston, Cambridge	Not Met			Met	Met		Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Charles River Reservation, Upper Basin	Boston, Cambridge, Brighton, Watertown	Not Met			Met	Met		Met	Met	Met	Met	Met	Met		Met - Upper Basin Labor Yard		In Prog		Met	Not Cleaned						Met	Met	Met	Not Evaluated	
City Square Park	Charlestown	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Cochituate State Park	Framingham, Natick, Sherborn, Wayland	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met	Detention Basin					Met		Met	Not Evaluated	
Columbia Road Park	Boston	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Met						Met		Met	Not Evaluated	
Commercial Point	Boston	Not Met										Met	Met						Met	Not Cleaned						Met		Met	Not Evaluated	
Dunn Pond State Park	Gardner	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Elm Bank	Dover, Wellesley	Not Met										Met	Met						Met	Not Cleaned						Met		Met	Not Evaluated	
Fall River Heritage State Park	Fall River	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met						Met		Met	Not Evaluated	
Fellsmere Park	Malden	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Fort Phoenix State Reservation	Fairhaven	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met						Met		Met	Not Evaluated	
Foss Park	Somerville	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Franklin Park Zoo	Boston	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Hammond Pond Reservation	Newton	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Hampton Ponds State Park	Westfield	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Holyoke Heritage State Park	Holyoke	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
J. Elwell Conservation Area	Northampton	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Lawrence Riverfront State Park	Lawrence	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Leo J. Martin Memorial Golf Course	Weston	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Lowell Heritage State Park	Lowell	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met	Created Wetland, Detention Basin and Field for Overflow					Met		Met	Not Evaluated	
Lowell Park	Cambridge	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Lynn Heritage State Park	Lynn	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Lynn Shore Reservation	Lynn	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned		Created Swale				Met		Met	Not Evaluated	
Mary O'Malley State Park	Chelsea	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Medfield State Hospital	Medfield	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Middlesex Fells Reservations	Malden, Medford, Melrose, Stoneham, Winchester	Not Met						Met	Met	Met	Met	Met	Met		Met - Stoneham Labor Yard		In Prog		Met	Not Cleaned						Met	Met	Met	Not Evaluated	
Mother Brook Reservation	Boston, Dedham	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Museum of Science	Boston, Cambridge	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Mystic River Reservation	Arlington, Everett, Medford, Somerville	Not Met	In Prog					Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned	6 stilling basins					Met		Met	Not Evaluated	
Nashua Street Park	Boston	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Neponset River Reservation	Boston, Canton, Dedham, Milton	Not Met						Met	Met	Met	Met	Met	Met		Met - Old Colony Labor Yard		In Prog		Met	Not Cleaned						Met	Met	Met	Not Evaluated	
Nickerson State Park	Brewster, Orleans	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met						Met		Met	Not Evaluated	
North Point Park	Cambridge	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Old Harbor Reservation	Boston							Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
Pilgrim Memorial State Park	Plymouth											Met	Met																Not Evaluated	
Quincy Shore Reservation (Incl. Caddy Park, Wollaston Beach)	Quincy	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Met						Met		Met	Not Evaluated	
Quinsigamond State Park	Shrewsbury, Worcester	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met	Rebuilt CB in Parking Lot					Met		Met	Not Evaluated	
Riverwalk Park	Waltham	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Robinson State Park	Agawam, West Springfield, Westfield	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Met	Detention Basins, Retention/ Recharge Basin					Met		Met	Not Evaluated	
South Watuppa Boat Ramp	Fall River	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Southwest Corridor	Boston	Not Met						Met	Met	Met	Met	Met	In Prog - Under Construction		Met - Southwest Corridor Park		In Prog		Met	Cleaned						Met		Met	Not Evaluated	
Squantam Point Park/ Dorchester Shore Reservation (Incl. Malibu, Tenean and Savin Hill Beaches)	Dorchester/ Quincy	Not Met						Met	Met	Met	Met	Met	Met				In Prog		Met	Not Cleaned						Met		Met	Not Evaluated	
State Fish Pier	Gloucester	Not Met						Met	Met	Met	Met	Met	Met				Met		Met	Not Cleaned						Met		Met	Not Evaluated	
Stone Zoo	Stoneham											Met	Met																Not Evaluated	
Stony Brook Reservation	Boston, Dedham	Not Met						Met	Met	Met	Met	Met	Met		Met		In Prog		Met	Not Cleaned	Replaced 2 brook culverts					Met	Met	Met	Not Evaluated	
Permit Year 8 Notes		CB Stenciling was performed in certain areas including Wollaston Beach and Revere Beach.	Permits are issued for five year term. Requirement will be added when permit is renewed.	DCR offered state-wide Public Education Events including water quality, storm water education (includes forestry practices, healthy ecosystems, water cycle, children's programs).	Environmental education through the Charles River Reservation School Program was cancelled as of June 2007 due to inadequate staffing. DCR now has ParkServe Day where volunteers and DCR employees work to remove trash, plant new trees and clean-up the parks for team building and community participation.	see above	see above	DCR submitted a Final Report to CLF/ CRWA that described progress on CB cleaning, street sweeping and drainage repairs from March 2009 to December 2010 to satisfy commitments of the MOU between DCR and CLF/CRWA..	Concern/ feedback tracking and response system implemented.	DCR attends monthly and is an active participant.	DCR continues to sponsor this program and it now has its own web link on DCR's web site.	DCR has located outfalls from all facilities owned and operated by DCR within urbanized areas.	DCR has continued to add to and update the stormwater infrastructure database. DCR's consultant performed the field survey over the past year, using two crews daily at the peak of survey in the summer of 2010. Crews investigated 1,625 features, and the infrastructure database was revised to as appropriate to reflect findings.	DCR's consultant performed the third year of a five-year rotating illicit discharge inspection program. The urban stormwater system was split spatially into five regions to facilitate inspections. All regions contain approximately 20% of DCR's system and all contain areas of special concern including public beaches impaired waters, etc. Over this past permit year, the Central Boston metro region was inspected for illicit discharges according to the Charles River Illicit Discharge Detection and Elimination Protocol.	Complied with SPCCC requirements.	DCR inspects roadways and drainage infrastructure annually. Drainage infrastructure is assessed during catch basin cleaning. Maintenance is performed as determined necessary during the inspection.	In reporting Year 8, contractors cleaned and water jetted 3,126 catch basins with these locations recorded using GPS.	DCR inspects roadways for signs of ponding and icing in freezing conditions. DCR makes immediate repairs where ponding causes safety concerns.	To insure adequate street sweeping frequency, DCR entered into a three-year renewable contract in 2010 with a street sweeping contractor to clean certain DCR parkways and roads. Roads which discharge to impaired receiving waters are cleaned using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. All roads were swept at least once this year.	DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. Contractors cleaned and water jetted 3,126 catch basins with these locations recorded using GPS. For the fiscal year ending in June 2010 DCR spent $1.6M to clean and repair catch basins.	Unable to comprehensively report on detention basins, water quality swales and infiltration basins since a comprehensive facility specific database is not available. BMPs shown reflect the current database. The database will be finalized upon completion of the drainage system infrastructure inventory. DCR has begun to develop web-based reporting format to better track regional compliance with Maintenance Activity Schedule (MAS).	Met MAS schedule.	Met MAS schedule.	Met MAS schedule.	Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.	

Table 3: Park Facility Best Management Practices

Permit Year 8 Activity

Facility	Town											
		BMP #	1-2	1-4	1-5	1-7	1-8	1-9	2-1	2-5	2-7	2-8
		BMP	CB Stenciling/ Plaques	Interactions with Boat Club Programs	Mobile Water Quality Education Seminars	Charles River Conservancy Clean Up Program	Charles River Reservation School Program	Camp Nihan	Abide by MOU with CLF and CRWA	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program
Facility	**Town**	**Measurable Goal**	CB cleaning and repair contractor will maintain stencil/ plaque each spring as necessary.	Add to boat club permits that they must post and monitor "No Wake" zones.	Provide storm water/ wq education events.	Partner with Charles River Conservancy Clean Up Program.	Provide 1 storm water/ water quality related educational program each year.	Provide 1 storm water/ water quality related educational program each year.	Abide by MOU with CLF as it relates to maintenance of park facilities and drainage infrastructure	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.
Planned Activities - May 2011 to April 2012			Park managers will review if their facilities have catch basins and, if appropriate, request a cleaning through the DCR's asset management system. CB cleaning contract will include inspection of stencil/ plaque message and update as necessary.	Continue to include in permits when they are renewed.	Region parks and reservations include DCR Coastal Awareness Environmental Education Programs, clean up days, canoe trips, birding trips and beach activities.	Park Serve Day is scheduled for April 16, 2011.	Provide diverse environmental education curricula including water quality.	Provide diverse environmental education curricula including water quality.	MOU with DCR and CLF/CRWA ended September 2010. No future actions are planned.	Continue system.	Continue participation.	Continue sponsorship.

BMP #	3-1	3-4	3-5	6-12	6-13	6-14	6-15		
BMP	Drainage Inventory	Drainage Infrastructure Inventory	Illicit Connection Sampling Program	SPCC Plans	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair		
Measurable Goal	Locate outfalls	Develop state-wide drainage infrastructure map.	Continue to prioritize and review known potential illicit connections.	Continue to maintain compliance with the requirements in these plans.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep Streets Annually.	Clean CB and piping every two years.
Planned Activities - May 2011 to April 2012	Verify the location and condition of outfalls located from paper maps during illicit discharge detection field tasks.	The infrastructure database is a dynamic work in progress which is updated when new construction takes place. Corrections to the database will be made as areas are visited during the illicit discharge investigation and during catch basin cleaning and maintenance efforts. In addition, DCR will add features identified during maintenance work that were missed from the infrastructure database.	DCR will inspect 20% of their stormwater system within the urbanized area during the summer and fall of 2011. DCR will continue to update the drainage inventory and identify needs for maintenance and cleaning as part of this field effort. DCR will follow up on 7 cases of suspect illicit connections from Permit Year 8 inventory.	Continue to comply with SPCCC requirements.	Perform state wide assessment of roadways and infrastructure conditions.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates dedicating $1.325 M and similar level of effort this year for catch basin cleaning and repair.	Perform review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep all streets at least once. Continue to provide and fund contract for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff.

Permit Year 8 Activity

BMP #	6-18								7-7
BMP	Maintenance Activity Schedule (MAS)								Priority Resource Area Review
Measurable Goal	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review for erosion and storm water issues annually.	Perform fleet maintenance twice a year.	Inspect buildings for compliance with good housekeeping measures weekly.	Review outfalls which discharge to priority resource
Planned Activities - May 2011 to April 2012	Continue to meet Maintenance Activity Schedule (MAS). Complete drainage system infrastructure inventory. Develop web-based reporting format to more effectively track regional compliance with MAS.								Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.

Goal Not Met
Goal in Progress
Goal Achieved
Goal Not Applicable
Goal Metrics Not Available

Table 4: Beach Facilities Best Management Practices

Table 4: Beach Facility Best Managment Practices

			Permit Year 8 Activity														
		BMP #	1-3	1-5	3-1	3-4	6-12	6-13	6-14	6-15	6-18						7-7
		BMP	Publish Water Quality Reports and Post Beaches	Mobile Water Quality Education Seminars	Drainage Inventory	Drainage Infrastructure Inventory	SPCC Plans	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Maintenance Activity Schedule (MAS)						Priority Resource Area Review
Facility	**Town**	**Parent Facility**	**Measurable Goal**	Publish WQ reports daily on website.	Provide storm water/ wq education events.	Locate Outfalls	Develop state-wide drainage infrastructure map.	Continue to maintain compliance with the requirements in these plans.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep streets monthly (or more frequently as needed).	Clean CB and piping every two years.	Inspect Detention Ponds Annually	Inspect water quality swales annually	Inspect drainage swales annually	Inspect infiltration systems 2x/yr.	Inspect water quality inlets 2x/ yr.	Review outfalls which discharge to priority resource
Ashland Reservoir	Ashland	Ashland State Park		Met		Met	Met			Met		Met	Not Cleaned						Not Evaluated
Carson Beach	Boston	Old Harbor Reservation		Met		Met	Met			Met		Met	Cleaned						Not Evaluated
Constitution Beach	Boston			Met		Met	Met			Met		Met	Cleaned					2 Oil Grit Seperators	Not Evaluated
City Point Beach	Boston	Old Harbor Reservation		Met		Met	In Prog			In Prog		Met	Not Cleaned						Not Evaluated
Cliff Pond	Brewster	Nickerson State Park		Met		Met	Met			Met		Met	Not Cleaned						Not Evaluated
Havey Beach	Boston			Met		Met	Met			Met		Met	Not Cleaned						Not Evaluated
King's Beach	Lynn	Lynn Shores Reservation		Met		Met	Met			Met		Met	Cleaned						Not Evaluated
Lynn Beach	Lynn	Lynn Shores Reservation		Met		Met	Met			Met		Met	Cleaned						Not Evaluated
M Street Beach	Boston	Old Harbor Reservation		Met		Met	In Prog			In Prog		Met	Not Cleaned						Not Evaluated
Malibu Beach	Boston			Met		Met	Met			Met		Met	Not Cleaned						Not Evaluated
Nahant Beach	Nahant	Lynn Shores Reservation		Met	Met	Met	Met - Nahant Labor Yard			Met		Met	Cleaned						Not Evaluated
Nantasket Beach	Hull			Met		Met	Met	Met - Nantasket Beach Labor Yard		Met		Swept Daily During Season	Cleaned						Not Evaluated
Pleasure Bay Beach	Boston	Old Harbor Reservation		Met		Met	In Prog			In Prog		Met	Not Cleaned						Not Evaluated
Revere Beach Reservation	Revere	Revere Beach Reservation		Met	Met	Met	Met			Met		Swept Daily During Season	Cleaned						Not Evaluated
Sandy Beach	Winchester	Mystic River Reservation		Met		Met	Met			In Prog		Met	Cleaned						Not Evaluated
Savin Hill Beach	Quincy	Squantum Point Park/ Dorchester Shores Reservation		Met		Met	In Prog			In Prog		Met	Not Cleaned						Not Evaluated
Short Beach	Revere, Winthrop			Met		Met	Met			In Prog		Met	Cleaned						Not Evaluated
Tenean Beach	Boston			Met		Met	Met			In Prog		Met	Cleaned						Not Evaluated
Winthrop Beach Reservation	Winthrop	Winthrop Shore Reservation		Met		Met	Met			Met		Met	Cleaned						Not Evaluated
Wollaston Beach	Quincy	Quincy Shore Reservation		Met		Met	Met			Met		Met	Cleaned						Not Evaluated
Permit Year 8 Notes				Weekly beach water quality monitoring and reporting through 2010 season (June through September).	DCR offered state wide Public Education Events including water quality, storm water education (includes forestry practices, healthy ecosystems, water cycle, children's programs).	DCR has located outfalls from all facilities owned and operated by DCR within urbanized areas.	DCR has continued to add to and update the stormwater infrastructure database. DCR's consultant performed the field survey over the past year, using two crews daily at the peak of survey in the summer of 2010. Crews investigated 1,625 features, and the infrastructure database was revised to as appropriate to reflect findings.	Complied with SPCC requirements.	DCR inspects roadways and drainage infrastructure annually. Drainage infrastructure is assessed during catch basin cleaning. Maintenance is performed as determined necessary during the inspection.	In reporting Year 8, contractors cleaned and water jetted 3,126 catch basins with these locations recorded using GPS.	DCR inspects roadways for signs of ponding and icing in freezing conditions. DCR makes immediate repairs where ponding causes safety concerns.	To insure adequate street sweeping frequency, DCR entered into a three-year renewable contract in 2010 with a street sweeping contractor to clean certain DCR parkways and roads.	DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. Contractors cleaned and water jetted 3,126 catch basins with these locations recorded using GPS. For the fiscal year ending in June 2010 DCR spent $1.6M to clean and repair catch basins.	Unable to comprehensively report on detention basins, water quality swales and infiltration basins since a comprehensive facility specific database is not available. BMPs shown reflect the current database. The database will be finalized upon completion of the drainage system infrastructure inventory. DCR has begun to develop web-based reporting format to better track regional compliance with MAS.					Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.
Planned Activities - May 2010 to April 2011				Provide wq reports on web for all beaches throughout the season.	Region parks and reservations include DCR Coastal Awareness Environmental Education Programs, clean up days, canoe trips, birding trips and beach activities.	Verify the location and condition of outfalls located from paper maps during illicit discharge detection field tasks.	The infrastructure database is a dynamic work in progress. Updates will be made to the database when new construction takes place. Corrections to the database will be made as areas are visited during the illicit discharge investigation.	Continue to comply with SPCC requirements.	Perform state wide assessment of roadways and infrastructure conditions.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates dedicating $1.325 M and similar level of effort this year for catch basin cleaning and repair.	Perform review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Continue to provide and fund contract for sweeping.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff.	Continue to meet Maintenance Activity Schedule (MAS). Complete drainage system infrastructure inventory. Develop web-based reporting format to more effectively track regional compliance with MAS.					Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.

Goal Not Met
Goal in Progress
Goal Achieved
Goal Not Applicable
Goal Metrics Not Available

Table 5: Water Supply/ Reservoir Facilities Best Management Practices

Table 5: Water Supply/ Reservoir Facility Best Managment Practices

Permit Year 8 Activity

		BMP #	1-12	2-5	2-7	2-8	3-1	3-4	4-7	6-8	6-13	6-15	6-18							7-7
		BMP	"Downstream" Newsletter	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Technical Assistance to Conservation Commissions	Chemical Applications Review Meetings	Roadway and Drainage Infrastructure Assessment	Wet Weather Review and Repair	Maintenance Activity Schedule (MAS)							Priority Resource Area Review
Facility	**Town**	**Measurable Goal**	Continue to develop and disseminate newsletter regarding issues relevant to Wachusett Reservoir/ Quabbin Reservoir watersheds.	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate Outfalls	Develop state-wide drainage infrastructure map.	Provide technical assistance and the staffing level necessary to provide timely responses.	Meet with railroad and utility companies which have property, easements or access privileges within the Division of Water Supply Protection's (DWSP) watershed lands each two years.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep streets annually.	Clean CB and piping every two years.	Inspect detention ponds annually, clean per inspection recmndn.	Inspect water quality swales annually, clean per inspection recmndn.	Inspect drainage swales annually, clean per inspection recmndn.	Inspect water quality inlets 2x/yr, clean per inspection recmndn.	Inspect infiltration systems 2x/yr, clean per inspection recmndn.	Building maintenance weekly, clean per inspection recmndn.	Review outfalls which discharge to priority resource
Brighton Upper Basin Facility (Charles River Reservation)	Brighton		Met	Met	Met	Met	Met	Met					Met	Met						Met	Priority Resource - Water Supply
Charles River Dam (Charles River Reservation)	Newton, Waltham, Cambridge		Met	Met	Met	Met	Met	Met					Met	Met						Met	Priority Resource - Water Supply
New Charles River Dam	Boston		Met	Met	Met	Met	Met	Met					Met	Met				Pretreatment Chamber		Met	Priority Resource - Water Supply
Chestnut Hill Reservoir	Boston		Met	Met	Met	Met	Met	Met					Met	Met						Met	Priority Resource - Water Supply
Medfield Charles River Street Reservation	Medfield		Met	Met	Met	Met	Met	In Prog					Met	Not Cleaned						Met	Priority Resource - Water Supply
Middlesex Fells Reservoir	Stoneham		Met	Met	Met	Met	Met	Met					Met	Met						Met	Priority Resource - Water Supply
Nash Hill Reservoir	Ludlow		Met	Met	Met	Met	Met	Met	Met	Met			Met	Not Cleaned						Met	Priority Resource - Water Supply
Permit Year 8 Notes			The Spring 2010 issue included discussions on invasive species in MA waterbodies, the 2010 ranger programs, national drinking water week, and facts about the 2010 spring rains. The Fall 2011 issue included discussions on how the Wachusett Rangers protect drinking water and serve the public, "creeping normalcy" and how land protection helps, 10 simple steps to protect ground and surface waters, DCR's National Clean Drinking Water Award, and the Quabbin cemetery.	Concern/ feedback tracking and response system implemented.	DCR attends monthly and is an active participant.	DCR continues to sponsor this program and it now has its own web link on DCR's web site.	DCR has located outfalls from all facilities owned and operated by DCR within urbanized areas.	DCR has continued to add to and update the stormwater infrastructure database. DCR's consultant performed the field survey over the past year, using two crews daily at the peak of survey in the summer of 2010. Crews investigated 1,625 features, and the infrastructure database was revised to as appropriate to reflect findings.	Technical assistance was provided to 12 of 17 Conservation Commission regarding projects within the Quabbin and Wachusett Reservoirs, as requested by Conservation Commissions.	DWSP meets with railroad annually to review Yearly Operation Plan and vegetation management plans.	DCR inspects roadways and drainage infrastructure annually. Drainage infrastructure is assessed during catch basin cleaning. Maintenance is performed as determined necessary during the inspection.	DCR inspects roadways for signs of ponding and icing in freezing conditions. DCR makes immediate repairs where ponding causes safety concerns.	To insure adequate street sweeping frequency, DCR entered into a three-year renewable contract in 2007 with a street sweeping contractor to clean certain DCR parkways and roads. Roads which discharge to impaired receiving waters are cleaned using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. All roads were swept at least once this year.	DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. Contractors cleaned and water jetted 3,126 catch basins with these locations recorded using GPS. For the fiscal year ending in June 2011 DCR spent $1.325M to clean and repair catch basins.	Unable to comprehensively report on detention basins, water quality swales and infiltration basins since a comprehensive facility specific database is not available. BMPs shown reflect the current database. The database will be finalized upon completion of the drainage system infrastructure inventory. DCR has begun to develop web-based reporting format to better track regional compliance with MAS.			Met MAS schedule.	Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.
Planned Activities - May 2011 to April 2012			Publish issues in May and November 2011. Place issues on web page.	Continue system.	Continue participation.	Continue sponsorship.	Verify the location and condition of outfalls located from paper maps during illicit discharge detection field tasks.	The infrastructure database is a dynamic work in progress. Updates will be made to the database when new construction takes place. Corrections to the database will be made as areas are visited during the illicit discharge investigation.	Continue to provide technical assistance.	Continue to meet with railroad yearly and review Yearly Operation and Vegetation Management Plan.	Perform state wide assessment of roadways and infrastructure conditions.	Perform review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep all streets at least once. Continue to provide and fund contract for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates a budget ($1.325M) and level of effort this year when compared to FY11.	Continue to meet Maintenance Activity Schedule (MAS). Complete drainage system infrastructure inventory. Develop web-based reporting format to more effectively trac regional compliance with MAS.				Identify outfalls which discharge to priority resources. Summarize projects to address impairments in annual reports.

Goal Not Met
Goal in Progress
Goal Achieved
Goal Not Applicable
Goal Metrics Not Available

Table 6: State Forest Facilities Best Management Practices

Table 6: State Forest Best Management Practices

		Permit Year 8 Activity																
		BMP #	2-5	2-7	2-8	3-1	3-4	6-13	6-14	6-15	6-18							
		BMP	Public Concerns/ Feedback on DCR Website	Massachusetts Water Resource Commission	Lakes and Ponds Program	Drainage Inventory	Drainage Infrastructure Inventory	Roadway and Drainage Infrastructure Assessment	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Wet Weather Review and Repair	Maintenance Activity Schedule (MAS)							
Facility	**Town**	**Measurable Goal**	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Provide technical and staff support to MWRC.	Continue to Sponsor Program.	Locate Outfalls	Develop state-wide drainage infrastructure map.	Perform state wide assessment of roadways and infrastructure conditions annually.	Perform assessment annually. Create assessment report.	Perform an annual review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep streets annually.	Clean CB and piping every two years.	CB rehabilitation and repair annually and clean per inspection recmndn.	Inspect detention ponds annually, clean per inspection recmndn.	Inspect water quality swales annually, clean per inspection	Inspect drainage swales annually, clean per inspection recmndn.	Inspect water quality inlets 2x/yr, clean per inspection recmndn.	Inspect infiltration systems 2x/yr, clean per inspection recmndn.	Building maintenance weekly, clean per inspection recmndn.
Lowell-Dracut-Tyngsboro State Forest	Lowell, Dracut, Tyngsboro		Met	Met	Met	Met	Met		Met		Met	In Prog							Met
Shawme-Crowell State Forest	Bourne, Sandwich		Met	Met	Met	Met	Met		Met		Met	In Prog		Created Wetland					Met
Permit Year 8 Notes			Concern/ feedback tracking and response system implemented.	DCR attends monthly and is an active participant.	DCR continues to sponsor this program and it now has its own web link on DCR's web site.	DCR has located outfalls from all facilities owned and operated by DCR within urbanized areas.	DCR has continued to add to and update the stormwater infrastructure database. DCR's consultant performed the field survey over the past year, using two crews daily at the peak of survey in the summer of 2010. Crews investigated 1,625 features, and the infrastructure database was revised to as appropriate to reflect findings.	DCR inspects roadways and drainage infrastructure annually. Drainage infrastructure is assessed during catch basin cleaning. Maintenance is performed as determined necessary during the inspection.	In reporting Year 8, contractors cleaned and water jetted 3,126 catch basins with these locations recorded using GPS.	DCR inspects roadways for signs of ponding and icing in freezing conditions. DCR makes immediate repairs where ponding causes safety concerns.	To insure adequate street sweeping frequency, DCR entered into a three-year renewable contract in 2007 with a street sweeping contractor to clean certain DCR parkways and roads. Roads which discharge to impaired receiving waters are cleaned using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. All roads were swept at least once this year.	DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. Contractors cleaned and water jetted 3,126 catch basins with these locations recorded using GPS. For the fiscal year ending in June 2011 DCR spent $1.325M to clean and repair catch basins.	Unable to report on detention basins, water quality swales and infiltration basins since a comprehensive facility specific data base is not available. Drainage system infrastructure inventory proposed will make this possible. Begun to develop web-based reporting format to better track regional compliance with Maintenance Activity Schedule (MAS).						Met MAS schedule.
Planned Activities - May 2011 to April 2012			Continue system.	Continue participation.	Continue sponsorship.	Verify the location and condition of outfalls located from paper maps during illicit discharge detection field tasks.	The infrastructure database is a dynamic work in progress. Updates will be made to the database when new construction takes place. Corrections to the database will be made as areas are visited during the illicit discharge investigation.	Perform state wide assessment of roadways and infrastructure conditions.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates dedicating $1.325 M and similar level of effort this year for catch basin cleaning and repair.	Perform review of roads and parking lots within UA during wet weather conditions to identify ponding or flooding areas.	Sweep all streets at least once. Continue to provide and fund contract for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff.	Continue to meet Maintenance Activity Schedule (MAS). Complete drainage system infrastructure inventory. Develop web-based reporting format to more effectively track regional compliance with MAS.						

Goal Not Met
Goal in Progress
Goal Achieved
Goal Not Applicable
Goal Metrics Not Available

Table 7: Construction Sites Best Management Practices

Table 7: Construction Site Best Management Practices

		Permit Year 8 Activity				
		BMP #	1-2	2-5	3-4	4-1	4-4
		BMP	CB Stenciling/ Plaques	Public Concerns/ Feedback on DCR Website	Drainage Infrastructure Inventory	NPDES Storm Water Construction General Permit	Construction Site Monitoring
Facility	**Town**	**Measurable Goal**	Install catch basin grates with integrated plaques on all park facilities where construction includes drainage systems.	Forward concerns/ feedback received to appropriate dept. Track response to concerns.	Develop state-wide drainage infrastructure map.	All projects which exceed one acre will file for coverage.	Continue to staff each project with either a Resident Engineer or Inspector.
Bryan/Roche Rink & Parking	West Roxbury		Met	In Prog		Met
BU Bridge (Phase 1)	Cambridge		Met	Met	Met	Met
Canton Airport (superfund site)	Canton		Met	In Prog		Met
Charles River Basin Master Plan construction	Boston		Met	In Prog		Met
Constitution Beach Bathhouse	Boston		Met	Met		Met
Cronin Rink Redevelopment	Revere		Met	In Prog		Met
DCR parking lot restoration	Cambridge		Met	In Prog	Met	Met
DCR lot restoration, CDP	Cambridge		Met	In Prog	Met	Met
DCR parking lot, CDP	Cambridge		Met	In Prog	Met	Met
DCR lot restoration, CDP	Cambridge		Met	In Prog	Met	Met
Dilboy Memorial Stadium	Somerville		Met	In Prog	Met	Met
Dorchester Shores Restoration	Dorchester		Met	In Prog	Met	Met
Horseneck Beach Building & Septic	Westport		Met	In Prog	Met	Met
Houghtons Pond Bath House	Milton		Met	In Prog	Met	Met
Magazine Beach Improvements	Cambridge		Met	In Prog		Met
Marsh Post/Cambridge Boat House Sewer	Cambridge		Met	Met	Met	
Memorial Drive Demonstr Proj	Cambridge		Met	In Prog	Met	Met
Memorial Drive Demonstr Proj ph 2	Cambridge		Met	In Prog	Met	Met
Middlesex Fells Tudor Barn	Stoneham		Met			Met
Mount Greylock Road	Lanesboro		Met		Met/ Completed	Met/Completed
Mystic Valley Parkway	Arlington, Somerville		Met	In Prog		Met
Nahant Beach Bathhouse	Nahant		Met			Met
Nahant Beach Reservation Rehabilitation	Nahant		Met	In Prog	Met	Met
Nantasket Beach Seawall	Hull		Met	In Prog		Met
Neponset River Esplanade	Hyde Park		Met	In Prog	Met	Met
Nonantum Road Improvements	Boston-Newton-Watertown		Met	In Prog	Met	Met
Ponkapoag Dam Rehabilitation	Canton		Met	In Prog	Met	Met
Ponkapoag Dam Rehabilitation	Canton		Met	In Prog	Met	Met
Ponkapoag Dam Rehabilitation	Canton		Met	In Prog	Met	Met
Recreation Road (Bridge over Rt. 128)	Wellesley		Met	In Prog		

Table 7: Construction Site Best Management Practices

Revere Beach Improvements	Revere		Met	In Prog		Met
Rocky & Short Beaches	Revere, Winthrop		Met	In Prog		Met
Salisbury Beach Construction	Salisbury		Met	In Prog		Met
Scusset Beach Improvements	Sandwich		Met	In Prog		Met
Spectacle Island Improvements	Boston		Met	In Prog		Met
Technology Building	West Barnstable		Met	In Prog	Met	Met
Upper Charles Master Plan, Watertown	Waltham, Newton		Met	In Prog		Met
Wachusett Earthday Regional Collection Center	West Boylston		Met	In Prog	Met	
Wachusett Mountain Parkway Road System	Princeton		Met	In Prog	Met	
West Link Park	Boston		Met	In Prog		Met
Permit Year 8 Notes			Concern/ feedback tracking and response system implemented. DCR Construction Activity Updates: http://www.mass.gov/dcr/construction.htm	Drainage infrastructure constructed as part of construction projects require submission of drainage infrastructure as-builts which will be added to GIS database.	Projects which exceed one acre of disturbance filed for coverage under the Construction GP and developed a SWPPP for the site. All projects were reviewed in Fall 2010 and DCR filed for coverage for all those which disturb more than an acre and were not covered under a Construction General Permit currently.	Resident Engineer is on site.
Planned Activities - May 2011 to April 2012			Continue system.	Require submittal of as-builts.	Continue to file for coverage for construction sites which disturb more than one acre.	Continue to staff construction projects with Resident Engineer.

	Goal Not Met
	Goal in Progress
	Goal Achieved
	Goal Not Applicable

7b. WLA Assessment

TMDL reports were reviewed for discussion of implementation activities which may impact or directly mention DCR's facility or roadways and are summarized in Table 8. DCR will continue to review compliance with these recommended activities. Table 8 summarizes the final TMDLs approved as of March 31, 2011 and the implementation recommendations which impact DCR facilities.

Table 8: TMDL Summary

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Nashua River/ Final TMDL for Bare Hill Pond	Bare Hill Pond	Phosphorus (Nuisance Aquatics)	Yes	Yes	1. The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean Lakes Program now administered by EPA and, in Massachusetts, the DEM. 2. DEM forester should check that an approved forest cutting plan is in place and BMP's for erosion are being followed.	Yes Yes	Refer to BMP 2-8. Refer to BMP 7-4
Chicopee River/ Final Phosphorus TMDL for Selected Chicopee Basin Lakes	Browning Pond, Oakham Long Pond, Springfield Sugden Reservoir, Spencer Mona Lake, Springfield Minechoag Pond, Ludlow Spectacle Pond, Wilbraham Wickaboag Pond, Brookfield	Phosphorus	Yes	Yes	1. The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communitites and the Clean Lakes Program now administered by EPA and, in Massachusetts, the DEM. 2. DEM forester should check that an approved forest cutting plan is in place and BMP's for erosion are being followed.	Yes Yes	Refer to BMP 2-8. Refer to BMP 7-4
Cape Cod/Final TMDL Report of Bacteria for Frost Fish Creek, Chatham	Frost Fish Creek	Bacteria	Yes	No	--	--	--

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Cape Cod/Final TMDL Report of Bacteria for Muddy Creek, Chatham	Muddy Creek	Bacteria	Yes	No	--	--	--
Cape Cod/Final Nitrogen TMDL for Oyster Pond	Oyster Pond	Total Nitrogen	Yes	No	--	--	--
Cape Cod/Final Nitrogen TMDL for Little Pond	Little Pond Embayment System	Total Nitrogen	Yes	No	--	--	--
Connecticut Basin/ Final TMDLs of Phosphorus for Selected Connecticut Basin Lakes	Aldrich Lake East, Granby Aldrich Lake West, Granby Leverett Pond, Leverett Lake Wyola, Shutesbury Loon Pond, Springfield Lake Warner, Hadley	Phosphorus	Yes	Yes	1. The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean Lakes Program now administered by EPA and, in Massachusetts, the DEM. 2. DEM forester should check that an approved forest cutting plan is in place and BMPs for erosion are being followed. Also, DEM should provide training to local ConComms on harvesting BMPs.	Yes Yes	Refer to BMP 2-8. Refer to BMP 7-4
French River/ Final TMDLs of Phosphorus for Selected French Basin Lakes	Buffumville Lake, Charlton Cedar Meadow Pd, Leicester Dresser Hill Pond, Charlton Dutton Pond, Leicester Gore Pond, Charlton/Dudley Granite Reservoir, Charlton Greenville Pond, Leicester Hudson Pond, Oxford Jones Pond, Charlton/Spencer Larner Pond, Dudley Lowes Pond, Oxford	Phosphorus	Yes	Yes	1. The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Selected French Basin Lakes (cont'd)	McKinstry Pond, Oxford Mosquito (Tobins) Pond, Dudley New Pond, Dudley Peter Pond, Dudley Pierpoint Meadow Pond, Dudley/Charlton Pikes Pond, Charlton Robinson Pond, Oxford Rochdale Pond, Leicester Shepherd Pond, Dudley Texas Pond, Oxford Wallis Pond, Dudley Cedar Meadow Pond, Leicester Dresser Hill Pond, Charlton Gore Pond, Charlton/Dudley Granite Reservoir, Charlton Hudson Pond, Oxford Jones Pond, Charlton/Spencer Larner Pond, Dudley New Pond, Dudley Peter Pond, Dudley Robinson Pond, Oxford Shepherd Pond, Dudley Mosquito (Tobins) Pd, Dudley Wallis Pond, Dudley				2. DEM forester should check that an approved forest cutting plan is in place and BMPs for erosion are being followed.	Yes	Refer to BMP 7-4
Blackstone River/ Final TMDLs for Phosphorus for Indian Lake	Indian Lake, Worcester	Phosphorus	Yes	Yes	The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean Lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
SuAsCo/ Final TMDLs of Phosphorus for Lake Boon (Boons Pond)	Lake Boon, Hudson/Stow	Phosphorus	Yes	Yes	1. The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.
					2. DEM forester should check that an approved forest cutting plan is in place and BMPs for erosion are being followed.	Yes	Refer to BMP 7-4.
Blackstone River/ Final TMDLs of Phosphorus for Lake Quinsigamond and Flint Pond	Flint Pond, Grafton/ Worcester/ Shrewsbury Lake Quinsigamond, Worcester/ Shrewsbury	Phosphorus	Yes	Yes	The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean Lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.
Blackstone River/ Final TMDLs of Phosphorus for Leesville Pond	Leesville Pond, Auburn/Worcester	Phosphorus	Yes	Yes	The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean Lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Millers River/ Final TMDLs of Phosphorus for Selected Miller River Basin Lakes	Bents Pond Bourn-Hadley Pond Brazell Pond Lake Ellis Greenwood Pond Lake Monomonac Ramsdall Pond Reservoir No. 1 Wallace Pond Whitney Pond Beaver Flowage Pond Cowee Pond Davenport Pond Lake Denison Depot Pond Hilchey Pond Lower Naukeag Lake Minott Pond South Minott Pond Parker Pond Reservoir No. 2 Riceville Pond South Athol Pond Stoddard Pond Ward Pond Whites Mill Pond Wrights Reservoir	Phosphorus	Yes	Yes	1. The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.
					2. DEM forester should check that an approved forest cutting plan is in place and BMPs for erosion are being followed.	Yes	Refer to BMP 7-4.

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Boston Harbor/ Final TMDLs of Bacteria for Neponset River Basin	Beaver Meadow Brook East Branch, Outlet Forge Pond Germany Brook Gulliver Creek Hawes Brook Massapoag Brook Mill Brook Mine Brook Mother Brook Neponset River Pequid Brook Pine Tree Brook Ponkapoag Brook Purgatory Brook School Meadow Brook Traphole Brook Unquity Brook	Bacteria	Yes	No	--	--	--
Blackstone River/ Final TMDL for Northern Blackstone Lakes	Auburn Pond, Auburn Curtis Pond North, Worcester Curtis Pond South, Worcester Dorothy Pond, Millbury Eddy Pond, Auburn Pondville Pond, Auburn Smiths Pond, Leicester Southwick Pond, Leicester Stoneville Pond, Auburn	Phosphorus	Yes	Yes	1. The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.
	Brierly Pond, Millbury Green Hill Pond, Worcester Howe Reservoir, Millbury Jordan Pond, Shrewsbury Mill Pond, Shrewsbury Newton Pond, Shrewsbury Shirley St Pond, Shrewsbury				2. DEM forester should check that an approved forest cutting plan is in place and BMPs for erosion are being followed.	Yes	Refer to BMP 7-4.

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Blackstone River/ Final TMDLs of Phosphorus for Salisbury Pond	Salisbury Pond, Worcester	Phosphorus	Yes	Yes	The MA DEP will endorse in-lake remediation efforts that meet all environmental concerns, however, instituting such measures will rest with communities and the Clean Lakes Program now administered by EPA and, in Massachusetts, the DEM.	Yes	Refer to BMP 2-8.
Shawsheen River/ Final TMDLs of Bacteria for Shawsheen River Basin	Shawsheen River	Bacteria Stormwater	Yes Yes	No No	-- --	-- --	-- --
South Coastal/ Final TMDL of Bacteria for Little Harbor, Cohasset	Little Harbor, Cohassett	Fecal Coliform	No	No	--	--	--
SuAsCo/ Final Nutrient TMDL Report for the Assabet River	Assabet River	Phosphorus	Yes	No	--	--	--
Cape Cod/ Final Nitrogen TMDL Report for Five Sub-Embayments of Popponesset Bay	Mashpee River Shoestring Bay Popponesset Bay	Total Nitrogen	Yes	No	--	--	--
Multi-State/ Final Bacteria and Total Phosphorus TMDL Report for the Kickemuit River (Rhode Island-Massachusetts)	Kickemuit Reservoir Upper Kickemuit River Kickemuit River	Bacteria, Phosphorus	Yes	No	--	--	--
Multi-State/ Final Northeast Regional Mercury TMDL	Fresh waters in CT, MA, ME, NH, NY, RI, VT	Mercury	Yes	No	--	--	--

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Cape Cod/ Final Nutrient TMDL for Centerville River/East Bay	Centerville River Bumps River	Total Nitrogen	Yes	Yes	MassDEP will work with the towns to develop specific implementation strategies to reduce N loadings, and will assist in developing a monitoring plan for assessing the success of the nutrient reduction strategies.		Refer to BMP 5-1, 5-2 and 3-5.
Cape Cod/ Final Nitrogen TMDL for Phinneys Harbor	Phinneys Harbor Back River Eel Pond	Total Nitrogen	Yes	No	--	--	--
Cape Cod/ Final Nitrogen TMDL for Pleasant Bay System	Pleasant Bay Crows Pond Frost Fish Creek Ryder Cove Muddy Creek	Total Nitrogen	Yes	No	--	--	--
Cape Cod/ Final Nitrogen TMDL Report for the Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River in the Waquoit Bay System	Quashnet River Hamblin Pond Little River Jehu Pond Great River	Total Nitrogen	Yes	No	--	--	--
Cape Cod/ Final Nitrogen TMDL Report for Three Bays System	Cotuit Bay North Bay Prince Cove Seapuit River West Bay	Total Nitrogen	Yes	No	--	--	--
Cape Cod/ Final Nitorgen TMDL West Falmouth Harbor	Harbor Head West Falmouth Harbor	Total Nitrogen	Yes	No	--	--	--
Cape Cod/ Final TMDLs of Nitrogen for Great, Green, and Bournes Pond Embayment Systems	Great Pond Perch Pond Green Pond Bounes Pond	Total Nitrogen	Yes	No	--	--	--

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Charles River/ Final Phosphorus TMDL Report for the Lower Charles River Basin	Lower Charles River	Total Phosphorus	Yes	Yes	1. DCR is subject to the Phase II MS4 stormwater permit regulations, as is any other state or federal facility with a separate storm sewer system with the identified urbanized areas. 2. Initially DCR will need to collect source monitoring data and additional drainage area information to better target source areas for controls and also evaluate the effectiveness of on-going control practices. 3. DCR's existing stormwater management program should be enhanced to optimize reductions in nutrient loadings with initial emphasis on source controls and pollution prevention practices.	Yes	DCR has received authorization to discharge under the NPDES Phase II MS4 permit. Refer to BMP 3-5. Refer to BMP 5-1 and 5-2.
Charles River/ Final Pathogen TMDL Reports for the Charles River	Beaver Brook Bogastow Brook Charles River Cheese Cake Brook Fuller Brook Muddy River Rock Meadow Brook Rosemary Brook Sawmill Brook South Meadow Brook Stop River Unnnamed tributaries	Pathogens	Yes	No	--	--	--

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Chicopee River/ Final TMDLs of Phosphorus for Quaboag and Quacumquasit Ponds	Quaboag Pond Quacumquasit Pond	Total Phosphorus	Yes	No	The MADEP will support in-lake remediation efforts that are cost-effective, long-term and meet all environmental concerns, however, instituting such measures will depend on continued Federal support via EPA and State support via the MA DEM. DEM forester should check that an approved forest cutting plan is in place and BMPs for erosion are being followed.		Refer to BMP 2-8. Refer to BMP 7-4.
Narragansett Bay/ Final Bacteria TMDL for Palmer River Basin	Palmer River - West Branch Palmer River - East Branch Rumney Marsh brook Beaver Dam Brook Bad Luck Brook Fullers Brook Clear Run Torrey Creek Old Swamp Brook Rocky Run	Bacteria	Yes	No	--	--	--
Buzzards Bay/ Final Pathogen TMDL for the Buzzards Bay Watershed	Acushnet River Agawam River Apponagansett Bay Aucoot Cove Beaverdam Creek Broad Marsh River Buttermilk Bay Buttonwood Brook Cedar Island Creek Clarks Cove Crooked River	Bacteria	Yes	No	--	--	--

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Buzzards Bay Watershed (cont'd)	East Branch Westport River Hammett Cove Mattapoisett Harbor New Bedford Inner Harbor Onset Bay Outer New Bedford Harbor Sippcan Harbor Sippican River Slocums River Snell Creek Wankinco River Wareham River West Branch Westport River Westport River Wewantic River						
Cape Cod/ Final Nitrogen TMDL Report for Five Chatham Embayments (Stage Harbor, Sulphur Springs, Taylors Pond, Bassing Harbor and Muddy Creek)	Oyster Pond Oyster Pond River Stage Harbor Mill Pond	Nutrients and Pathogens	Yes	No	--	--	--
	Harding Beach Pond Bucks Creek	Pathogens	Yes	No	--	--	--
	Taylors Pond Mill Creek	Pathogens	Yes	No	--	--	--
Islands/ Final TMDLs of Total Nitrogen for Nantucket Harbor	Nantucket Harbor Polpis Harbor	Nitrogen	Yes	No	--	--	--
Cape Cod/Final Pathogen TMDL for the Cape Cod Watershed (49 Water Bodies)	Barnstable Harbor Bass River Boat Meadow River Bournes Pond Bucks Creek Bumps River Centerville River	Bacteria	Yes	No	--	--	--

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Cape Cod Watershed (cont'd)	Chase Garden Creek						
	Duck Creek						
	Falmouth Inner Harbor						
	Great Harbor						
	Great Pond						
	Green Pond						
	Hamblin Pond						
	Harding Beach Pond						
	Herring River						
	Herring River						
	Hyannis Harbor						
	Lewis Bay						
	Little Harbor						
	Little Namskaket Creek						
	Little River						
	Maraspin Creek						
	Mashpee River						
	Mill Creek						
	Mill Creek						
	Namskaket Creek						
	Oyster Pond						
	Oyster Pond						
	Oyster Pond River						
	Pamet River						
	Parkers River						
	Perch Pond						
	Popponesset Creek						
	Provincetown Harbor						
	Quashnet River						
	Quivett Creek						
	Rock Harbor Creek						
	Ryders Cove						
	Saquatucket Harbor						
	Scorton Creek						

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Cape Cod Watershed (cont'd)	Sesuit Creek Shoestring Bay Stage Harbor Swan Pond River Taylors Pond Town Cove Waquoit Bay Wellfleet Harbor						
Cape Cod/Final Pathogen TMDL for the Three Bays Watershed	Cotuit Bay North Bay Prince Cove Seaouit River West Bay	Bacteria	Yes	No	--	--	--
Buzzards Bay/Final Pathogen TMDL for the Buzzrds Bay Watershed (52 Water Body Segments)	Acushnet River Acushnet River Acushnet River Agawam River Apponagansett Bay Aucoot Cove Back River - Estuary Beaverdam Creek Bread and Cheese Brook Broad Marsh River Buttermilk Bay Buttonwood Brook Buzzards Bay Cape Cod Canal - Estuary Cedar Island Creek Clark Cove Crooked River East Barnch Westport River East Barnch Westport River Eel Pond - Estuary Eel Pond - Estuary	Pathogens	Yes	No	--	--	--

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Buzzards Bay Watershed (cont'd)	Great Sippewisset Creek - Estuary Hammett Cove Harbor Head - Estuary Herring Brook - Estuary Hiller Cove Little Bay Little Sippewisset Marsh - Estuary Mattapoisett Harboe Mattapoisett River Nasketucket Bay New Bedford Harbor Onset Bay Outer New Bedford Harbor Phinneys Harbor - Estuary Pocasset Harbor - Estuary Pocasset River - Estuary Quissett Harbor - Estuary Red Brook Harbor - Estuary Sippican Harbor Sippican River Slocums River Snell Creek Snell Creek Snell Creek Wankinco River Wareham River West Branch Westport River West Falmouth Harbor - Estuary Westport River Weweantic River Wild Harbor - Estuary						
Buzzards Bay/Final TMDL of Total Phosphorus for White Island Pond	White Island Pond East and West Basir	Phosphorus	No	No			
Narragansett Bay/Final	Taunton River	Phosphorus	Yes	No			

Table 8: MA TMDL Reports with DCR Related Implementation Recommendations

Watershed/TMDL	Specific Waterbodies	Pollutant of Concern	Does TMDL include a WLA?	Does the TMDL include BMP recommendations or performance requirement regarding DCR (or former DEM/ MDC)?	If yes, what are the recommendations?	Is Agency meeting these recommendations through existing or proposed programs?	How is Agency currently meeting these recommendations or how does Agency plan to meet them in the future?
Pathogen TMDL for the Narragansett/Mt. Hope Bay Watershed	Lee River Cole River Kickamuit River Palmer River Runnins River						

Part IV. Summary of Information Collected and Analyzed

No additional information collected and/or analyzed.

Part V. Program Outputs & Accomplishments

All programs and accomplishments are summarized in the appropriate tables.

Appendix A:

Final MOU Report on DCR Parkway Sweeping and Catch Basin Cleaning

dcr
Massachusetts

March 17, 2011

Cynthia Liebman
Conservation Law Foundation
62 Summer Street
Boston, MA 02110-1016

Kate Bowditch
Charles River Watershed Association
190 Park Road
Weston, MA 02493

RE: Final MOU Report on DCR Parkway Sweeping and Catch Basin Cleaning

Dear Cynthia and Kate:

DCR is pleased to provide you with this final report on DCR street sweeping and catch basin cleaning and drainage repair activities in accordance with the our storm water management policy and the Memorandum of Understanding between DCR and CLF and CRWA. This report contains a summary of work completed from March 2009 to present.

DCR continues to update its drainage infrastructure database with the 10,890 catch basins, 4,547 manholes, 2,183 outlets, 1,774 outfalls and 1,083,535 linear feet (+/- 205 miles) of pipes, swales and linear drainage features. Drainage data has been reviewed and error checked. Several portable computer hardbooks with GPS capabilities are loaded with the drainage infrastructure database and are used to

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Deval L. Patrick
Governor

Timothy P. Murray
Lt. Governor

Richard K. Sullivan Jr., Secretary
Executive Office of Energy & Environmental Affairs

Edward M. Lambert Jr., Commissioner
Department of Conservation & Recreation

record maintenance visits and histories for each structure in the field. DCR will continue to visit drainage locations in the course of maintenance and collect maintenance information as work progresses.

DCR continues to implement its illicit discharge detection and elimination (IDDE) program through targeting and investigating specific areas on a 5-year rotating schedule. In 2009 and 2010 DCR used consultant AECOM to visit locations throughout the lower Mystic River and lower Charles River watersheds. In 2009 and 2010 respectively, approximately 2,554 and 3,753 locations were visited, sampled and analyzed in accordance with DCR's Storm Water Management Plan. Summaries of the IDDE studies are available through the DCR storm water web page and filed with EPA and DEP as appendices to the 2009 and 2010 annual reports.

During 2009 and 2010 DCR used contractor American Sweeping to provide mechanical and vacuum street sweepers services for roads and parkways that discharge to impaired waters or are part of DCR's street sweeping program. When DCR staff and equipment was available, DCR swept the bridges, parks and parkways for the Charles River basin, Nantasket Beach and Revere Beach Reservations. Vacuum sweepers were used on permeable pavement parking lots at Walden Pond Reservation in Concord and Hurter Parking lot #2 in the Charles River Reservation.

DCR continues to contract and provide services for catch basin cleaning and water jetting of connecting drainage pipes. Catch basin inspections from March 2009 through December 2010 are shown below. DCR staff cleaned catch basins in throughout the urban park and parkway system as well as state parks in Concord, Holyoke, Natick, Worcester and other locations.

No catch basin residuals were removed from DCR sites during March 2009 through February 2010 due to a lapse in contract services for waste disposal and limited staffing during this period. Waste removal

actions resumed in March 2010, and all accumulated catch basin wastes were removed from DCR maintenance yards in 2010.

DCR Catch Basin / Drainage Manhole Maintenance

	Inspected	Cleaned	Repaired	Tons Removed
Mar. to Sept. 2009	2,112	1,724	211	-----
Oct. 2009 to Feb. 2010	1,341	1,249	10	-----
Mar. to Sept.2010	2,074	1,506	266	919
Oct. to Dec. 2010	956	627	15	1,280

In July 2010 DCR removed 976 tons of accumulated sediment from the Spot Pond Brook Flood Control sediment basin at Oak Grove in Malden and recycled this material through Apple D'Or Tree & Landscaping, Inc. The Oak Grove sediment basin had not been maintained in over 25 years. In June 2010 DCR removed 80 tons of accumulated sediments from Town Brook Flood Control sediment basin in Quincy. In December 2008, 2009 and 2010, DCR removed a total of 71 cubic yards of floating debris, dead vegetation and refuse from the Muddy River at Charlesgate.

Working with Boston Conservation Commission and Boston Parks Department, DCR completed repairs to catch basins, drainage piping and outfalls at five locations on the Jamaicaway and Riverway at Brookline Avenue and Longwood Avenue where slow street drains had resulted in street flooding and erosion had disturbed large areas of parkland. DCR is working with US ACOE on its Phase 1 Traffic and Waterway Improvement Project to the Muddy River at Monument Square. Also, DCR completed drainage repairs and installed low-pressure sewer service to Cambridge Boat Club and Marsh (American Legion) Post on Greenough Boulevard in 2009. Flexi-pave, a pervious pavement product, was used on approximately

1,200 feet of sidewalk along Memorial Drive and to re-surface Herter Parking Lot #2 which eliminated one catch basin and outfall to the Charles River.

In November 2009, DCR transferred care and control of most the vehicular bridges and eight parkways formerly owned and controlled by DCR to MassDOT under terms of the MOU between DCR and MassDOT. These parkways include Casey Overpass (Arborway), Morton Street, certain sections of Columbia Avunue, Gallivan Boulevard, McGrath Highway, O'Brien Highway and Middlesex Avenue. DCR continued to provide storm water maintenance services on these roads and parkways through November 2010. Beginning December 2010, MassDOT will have responsibilities for storm water and other roadway maintenance obligations as set forth in the DCR-MassDOT MOU and any associated agreements.

In FY11 DCR storm water management efforts are supported by operating and capital appropriations that will total approximately $3.9 million, approximately equal to FY10 funding levels. DCR will continue to utilize all available funds to maintain the level of service throughout the state park and parkway system.

Sincerely,
Department of Conservation and Recreation

Robert Lowell
Environmental Section Chief /Storm Water Manager

CC: Edward Lambert, Jr., Commissioner
Thomas LaRosa, Office of General Counsel

Appendix B:

Statewide Listing of Public Educational Events

DCR BUREAU of RANGER SERVICES
WATER RELATED INTERPRETIVE PROGRAM ATTENDANCE
JANUARY 2010 - MARCH 2011

DATE	LOCATION	PROGRAM	#
SOUTH REGION			
4/22/10	Blue Hills Reservation	Vernal Pools	14
6/27/10	Stony Brook, Hyde Park	Mother Brook Paddle	90
8/1/10	Neponset River, Hyde Park	Peposnset Paddle	17
8/15/10	Stony Brook, Hyde park	Neponset Paddle	90
10/14/10	Chestnut Hill, Brookline	Chestnut Hill Walk (Reservoir)	7
SOUTHEAST REGION		**Swamp Tromp*** (use aquatic life to determine water quality)	
2/6/10	Myles Standish State Forest	Fire and Ice Hike	45
6/12/10	Myles Standish State Forest	Cranberry Bog Tour	8
6/26/10	Myles Standish State Forest	Cranberry Bog Tour	8
7/1/10	Myles Standish State Forest	**Swamp Tromp***	9
7/4/10	Myles Standish State Forest	Cranberry Bog Tour	8
7/11/10	Myles Standish State Forest	Cranberry Bog Tour	4
7/15/10	Myles Standish State Forest	**Swamp Tromp***	11
7/22/10	Myles Standish State Forest	**Swamp Tromp***	17
7/23/10	Myles Standish State Forest	Fishing Clinic	30
7/25/10	Myles Standish State Forest	Cranberry Bog Tour	4
7/29/10	Myles Standish State Forest	**Swamp Tromp***	5
8/5/10	Myles Standish State Forest	**Swamp Tromp***	7
8/8/10	Myles Standish State Forest	Cranberry Bog Tour	3
8/19/10	Myles Standish State Forest	**Swamp Tromp***	12
8/26/10	Myles Standish State Forest	**Swamp Tromp***	8
8/27/10	Myles Standish State Forest	Fishing Clinic	27
8/29/10	Myles Standish State Forest	Cranberry Bog Tour	9
9/16/10	Myles Standish State Forest	Cranberry Bog Tour	6
9/25/10	Myles Standish State Forest	Take Me Fishing Festival	150
12/29/10	Myles Standish State Forest	Fire and Ice Hike	22
6/20/10	Massasoit State Park	Pond Investigation	9
6/26/10	Massasoit State Park	Fishing Clinic	6
7/2/10	Massasoit State Park	Fishing Clinic	10
7/3/10	Massasoit State Park	Pond Investigation	5
7/9/10	Massasoit State Park	Fishing Clinic	6
7/16/10	Massasoit State Park	Fishing Clinic	9
7/23/10	Massasoit State Park	Fishing Clinic	7
7/24/10	Massasoit State Park	Pond Investigation	10
7/30/10	Massasoit State Park	Fishing Clinic	7
7/31/10	Massasoit State Park	Pond Investigation	4
8/1/10	Massasoit State Park	Pond Investigation	5
8/6/10	Massasoit State Park	Fishing Clinic	3
8/14/10	Massasoit State Park	Pond Investigation	9
8/20/10	Massasoit State Park	Fishing Clinic	11
8/21/10	Massasoit State Park	Pond Investigation	8
8/27/10	Massasoit State Park	Fishing Clinic	6
10/13/10	Massasoit State Park	Cranberries & Cannonballs	10
6/20/10	Schooner Ernestina	Dockside Discovery	3
6/24/10	Schooner Ernestina	Dockside Discovery	4
7/10/10	Schooner Ernestina	Dockside Discovery	2
7/29/10	Schooner Ernestina	Dockside Discovery	2
5/8/10	Borderland State Park	Exploring Vernal Pools	3
5/10/10	Borderland State Park	Pond Investigation	5
5/28/10	Borderland State Park	Pond Investigation	7
5/30/10	Borderland State Park	Fishing Festival	233
5/31/10	Borderland State Park	Pond Investigation	78
6/7/10	Borderland State Park	Pond Investigation	5
6/21/10	Borderland State Park	Pond Investigation	25
6/25/10	Borderland State Park	Pond Investigation	15
6/28/10	Borderland State Park	Pond Investigation	25
7/2/10	Borderland State Park	Pond Investigation	11
7/5/10	Borderland State Park	Pond Investigation	8
7/9/10	Borderland State Park	Pond Investigation	17
7/12/10	Borderland State Park	Pond Investigation	12
7/23/10	Borderland State Park	Pond Investigation	14
7/26/10	Borderland State Park	Pond Investigation	13
7/30/10	Borderland State Park	Pond Investigation	17
8/2/10	Borderland State Park	Pond Investigation	13

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6/19/10	Scusset Beach State Reservation	Family Beach Exploration	37
6/26/10	Scusset Beach State Reservation	Feature Creature - Crabs	60
7/3/10	Scusset Beach State Reservation	Family Beach Exploration	21
7/15/10	Scusset Beach State Reservation	Feature Creature - Lobster	69
7/17/10	Scusset Beach State Reservation	Family Beach Exploration	28
7/22/10	Scusset Beach State Reservation	Feature Creature - Marine Mammals	64
7/24/10	Scusset Beach State Reservation	Family Beach Exploration	4
7/31/10	Scusset Beach State Reservation	Family Beach Exploration	18
8/5/10	Scusset Beach State Reservation	Creature Feature - Crabs	21
7/31/10	Wompatuck State Park	Pond Investigation	3
8/14/10	Wompatuck State Park	Pond Investigation	3
7/14/10	Nickerson State Park	Fishing Clinic	29
7/17/10	Nickerson State Park	Vernal Pools	13
7/22/10	Nickerson State Park	Stroll By the Bay	6
7/28/10	Nickerson State Park	Fishing Clinic	16
7/31/10	Nickerson State Park	Exploring Grassy Nook Pond	10
8/3/10	Nickerson State Park	Watershed Wisdom	7
8/11/10	Nickerson State Park	Fishing Clinic	16
8/14/10	Nickerson State Park	Nickerson State Park Watershed	4
8/21/10	Nickerson State Park	Vernal Pools	21
8/26/10	Nickerson State Park	Stroll By the Bay	12
1/10/10	Waquoit Bay National Estuarine	Coastal Zone Management class	17
12 dates	Research Reserve (WBNERR)	Grade 8 pond study	1457
20 dates	WBNERR	Estuary program	733
1/23 1/24	WBNERR	Teacher training on weather & climate	28
8 dates	WBNERR	Grade 6 watershed study	446
2/13/10	WBNERR	Teacher training: coastal geology	36
5/1/10	WBNERR	MA Marine Educators conference	85
4 dates	WBNERR	Grade 5 Watershed field trips	298
3/23/10	WBNERR	Water quality Monitoring training	21
5/11/10	WBNERR	Pond Watcher Training	12
2/27/10	WBNERR	Teacher Training: Coastal Ecology	37
8 dates	WBNERR	Teachers on the Estuary	139
4/20 2/24	WBNERR	Quashnet River Walk	27
5/5/10	WBNERR	Beyond Pipe & Pond Stormwater Workshop	40
6/22/24	WBNERR	Coastal Training- DCR staff and others	58
9/25/10	WBNERR	Estuaries Day Paddle Tour	8
5/21/10	WBNERR	Bay Watcher Training	15
10 dates	WBNERR	Estuary Adventure	240
7/24/10	WBNERR	Wild Edibles of the Bay	10
5 dates	WBNERR	Women in Science	50
6 dates	WBNERR	Go N'seine	77
10/7/10	WBNERR	Wet Festival Training	32
15 dates	WBNERR	Bayside Buddies	190
5 Dates	WBNERR	TIDAL Quest	40
8/10/10	WBNERR	Watershed Block Party	350
5/18/10	WBNERR	Protecting Cape Water Resources Conf	105
7/23/10	WBNERR	South Cape-Wings over Wetlands	13
5 dates	WBNERR	South Cape beach Walk	32
6 dates	WBNERR	Environmental leadership	72
2/24/11	WBNERR	Winter Wetland Walk	10
NORTHEAST REGION			
7/27/10	Cochituate State Park	Wetlands in Your Neighborhood	0
July & Aug	Cochituate State Park	Paddling Lake Cochituate	0
July & Aug	Cochituate State Park	Learn to Fish	34
May 9,14,18,20,21,31	Halibut Point State Reservation	Tidepools - May	300
June 1,3,7,28	Halibut Point State Reservation	Tidepools - June	55
July 2,4,16,23	Halibut Point State Reservation	Tidepools - July	44
Aug 1,2,3,6,31	Halibut Point State Reservation	Tidepools - August	75
Sept 3 & 13	Halibut Point State Reservation	Tidepools - September	15
May 10,26,29,30	Harold Parker State Forest	Fishing - May	60
5/27/10	Harold Parker State Forest	Ponding - May	4
June 3,10,24	Harold Parker State Forest	Fishing - June	41
June 3,10,23	Harold Parker State Forest	Ponding - June	22
July 8,10,22,24	Harold Parker State Forest	Fishing - July	44
July 1,15,29	Harold Parker State Forest	Ponding - July	37
Aug 5,8,19	Harold Parker State Forest	Fishing - August	114

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8/26/10	Harold Parker State Forest	Ponding - August	22
Sept 2 & 11	Harold Parker State Forest	Fishing - September	146
9/9/10	Harold Parker State Forest	Ponding - September	8

DCR BUREAU of RANGER SERVICES
WATER RELATED INTERPRETIVE PROGRAM ATTENDANCE
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May 2,16,30	Maudslay State Park	Ponding - May	41
May 19,21,22	Sandy Point State Reservation	Tidepooling - May	87
5/27/10	Sandy Point State Reservation	Beach cleaning	55
5/29/10	Sandy Point State Reservation	Beach vegetation	0
June 2,3,4,7,8,9,10,11,16,17,18,22,30	Sandy Point State Reservation	Tidepooling - June	590
6/30/10	Sandy Point State Reservation	Piping Plovers	28
Sept 9,13,27	Sandy Point State Reservation	Beyond the Beach	0
Sept 7 & 14	Sandy Point State Reservation	Just Dig It! Clam Plant Tour	14
Sept 13,16,28,30	Sandy Point State Reservation	Tidepooling	105
9/18/10	Sandy Point State Reservation	Coastsweep	25
July 8,16,22,29	Salisbury Beach State Reservation	Estuary Exploration	31
July 3 & 17	Salisbury Beach State Reservation	Explore our Shore	17
7/4/10	Salisbury Beach State Reservation	For the Birds (Plover Survival Game)	29
July 12 & 19	Salisbury Beach State Reservation	Coastal Ecology and Climate	0
7/20/10	Salisbury Beach State Reservation	Salt Water Tank Collection Adv.	16
Aug 2,14,19,26	Salisbury Beach State Reservation	Estuary Exploration	26
8/16/10	Salisbury Beach State Reservation	For the Birds (Plover Survival Game)	20
Aug 10,16,27	Salisbury Beach State Reservation	Get the Most from your Coast	17
Aug 3,12,17,27	Salisbury Beach State Reservation	Salt Water Tank Collection Adv.	70
8/5/10	Salisbury Beach State Reservation	Just Dig It! Clam Plant Tour	15
4/20/10	Walden Pond State Reservation	Pond Geology - Tufts	40
4/21/10	Walden Pond State Reservation	Pond Geology - Tufts	38
4/22/10	Walden Pond State Reservation	Earth Day, Composting	62
4/22/10	Walden Pond State Reservation	Pond Geology - Tufts	40
4/23/10	Walden Pond State Reservation	Pond Geology - Tufts	40
4/24/10	Walden Pond State Reservation	Kids Fishing Clinic	2
4/26/10	Walden Pond State Reservation	Pond Geology - Tufts	40
5/6/10	Walden Pond State Reservation	Concord Academy Water Study	16
5/13/10	Walden Pond State Reservation	Concord Academy Water Study	15
5/17/10	Walden Pond State Reservation	Disabled Veterans Fishing Clinic	10
6/1/10	Walden Pond State Reservation	Daley Middle School - Pond Geology	54
6/2/10	Walden Pond State Reservation	Daley Middle School - Pond Geology	54
6/5/10	Walden Pond State Reservation	Fishing clinic	3
6/12/10	Walden Pond State Reservation	High Water at Walden - Geology	8
6/22/10	Walden Pond State Reservation	High Water at Walden - Geology	10
6/25/10	Walden Pond State Reservation	High Water at Walden - Geology	7
6/30/10	Walden Pond State Reservation	High Water at Walden - Geology	12
7/1/10	Walden Pond State Reservation	High Water at Walden - Geology	5
7/3/10	Walden Pond State Reservation	Fishing Program	2
7/12/10	Walden Pond State Reservation	Adaptive Kayaking	36
7/15/10	Walden Pond State Reservation	High Water at Walden - Geology	12
7/17/10	Walden Pond State Reservation	Fishing Program	14
7/19/10	Walden Pond State Reservation	Adaptive Kayaking	35
7/26/10	Walden Pond State Reservation	Junior Rangers - Ponding	17
8/1/10	Walden Pond State Reservation	Adaptive Kayaking	28
8/4/10	Walden Pond State Reservation	Harvard University - Geology	6
8/7/10	Walden Pond State Reservation	Fishing Program	4
8/9/10	Walden Pond State Reservation	Adaptive Kayaking	35
8/16/10	Walden Pond State Reservation	Adaptive Kayaking	36
8/16/10	Walden Pond State Reservation	Rivers and Revolutions	28
8/1/10	Walden Pond State Reservation	Fishing Program	6
8/26/10	Walden Pond State Reservation	Beaver Dam Walk	8
9/4/10	Walden Pond State Reservation	Fishing Program	4
3/15/11	Walden Pond State Reservation	Story of Ice Harvesting at Walden	9
CENTRAL REGION			
2/23/10	Skinner State Park	Aquatic Animal Adaptations	69
4/1/10	Holyoke Heritage State Park	Aquatic Animal Adaptations	13
6/5/10	Forest Park Springfield	Critter Search, Aquatic Habitats	22
6/9/10	Mt. Tom State Reservation	Critter Search, Aquatic Habitats	55
6/16/10	New Braintree-Interpretive Training	Critter Search, Aquatic Habitats	5
7/6/10	Mt. Tom State Reservation	Learn to Fish	15
7/15/10	Mt. Tom State Reservation	Learn to Fish	7
7/20/11	Chicopee Memorial State Park	Critter Search, Aquatic Habitats	32
7/27/10	Chicopee Memorial State Park	Learn to Fish	21
7/28/10	Wendell State Forest	Critter Search, Aquatic Habitats	21
8/3/10	Great Falls Discovery Center	Watersheds-Branching Out	17
8/4/10	Chicopee Memorial State Park	Critter Search, Aquatic Habitats	15

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8/10/10	Wendell State Forest	Critter Search, Aquatic Habitats	25
8/11/10	Great Falls Discovery Center	Watersheds-Branching Out	27
8/16/10	Chicopee Memorial State Park	Learn to Fish	14

Appendix C:

Educational Brochures, Swimming Pool Discharges, Household Stormwater Pollution Prevention, and Unused and Expired Pharmaceutical Disposal

It's Up to You!

During every rainstorm, pollutants left on parking lots, driveways, roads and yards are washed down storm drains that flow into natural waterways. The Department of Conservation and Recreation is working with watershed towns, citizens and businesses to clean-up stormwater runoff and improve the health of our lakes, ponds, streams, wetlands, and the Wachusett Reservoir.

Homeowners can do their part in improving the health of our waterways by adopting the swimming pool discharge practices listed within this brochure.

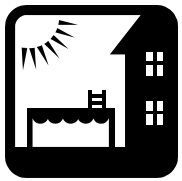
It's the Law

Sending pollutant-laden runoff down the storm drain is not only bad for the health of our waterways, it's illegal. State and federal laws prohibit the discharge of pollutants into surface water, stormwater, and groundwater.

Report Pollution

If you notice illegal dumping, or see, hear about, or even suspect activity that you believe is against the law and placing people's health or natural resources at risk, contact the Massachusetts Environmental Strike Force at: **1-888-VIOLATE (1-888-846-5283).**

Many pool owners who live within the Wachusett Reservoir watershed drain their swimming pools to reduce maintenance and potential damage from freezing during the winter. Please follow the pollution prevention practices listed in this brochure when draining your swimming pool or hot tub to ensure you have done your part to keep all of our waterways clean and healthy.



Wachusett Reservoir Watershed
Department of Conservation and Recreation
Division of Water Supply Protection
180 Beaman Street
West Boylston, MA 01583
(508) 792-7806
www.mass.gov/dcr/watersupply.htm
March 2011

dcr
Massachusetts

Swimming Pools and Surface Water Quality

Best Practices Guide for Swimming Pool Owners in the Wachusett Reservoir Watershed

Pollutants that enter most storm drains within the Wachusett Reservoir watershed ultimately end up in a drinking water supply - the Wachusett Reservoir.

Swimming pools are a major source of chlorinated water discharged into storm drainage systems.

Chlorinated water discharged directly to surface waters or via storm drains has an adverse effect on local water quality.

Chlorinated water from swimming pools that has been discharged into a storm drain, street or gutter ends up in a stream or river where it produces by-products that are highly toxic and carcinogenic to fish and other wildlife.

These by-products then can combine with other organic materials to form extremely toxic organic chemicals.

Best Practices

Never drain pool or hot tub water directly into a body of water (lake, stream, wetland). The best option is to discharge chlorinated water over landscaping when the following provisions are met:

- Shut off the chlorination system or stop adding chlorine several days before draining pool water. Chlorine levels in discharge and filter backwash should be lowered.
- Make sure the pH level is between 6.5 and 8.5, the normal pH range of surface and ground waters.
- If your pool contains algae or a black film, collect the algae and flush down the toilet. Do not put it in a stream, lake, or river because algae is a potential pollutant.
- If your pool is cleaned through an acid cleaning or by water pressure, make sure pH levels are normal before draining the water. Filter out any paint chips that may break away.
- Direct pool water and backwash over grassy or landscaped areas to help filter discharge before it reaches a storm drain. Drain pool water where it will not flow directly into a street, gutter, or someone else's property.

More Pollution Control Practices

- Store pool chemicals safely, where they will not be subjected to rain events.
- Use fertilizers and pesticides sparingly or not at all.
- Landscape your yard with bushes, trees, and mulched beds to produce less runoff.
- Do not dump yard waste in streams.
- Inspect and repair your septic system regularly.
- Wash cars on a grassy area with phosphorus-free detergents or use a car wash that recycles wash water.
- Sweep sidewalks and driveways and dispose of sweepings in the trash.
- Pick up pet waste and cat litter and dispose of in the trash.
- Fix any vehicle leaks.

Save money and avoid the problem of disposing unneeded or unused household hazardous waste!

Consider reducing your purchase of products that contain hazardous ingredients. Learn about the use of alternate methods or products without hazardous ingredients for some household needs. Some household cleaner recipes can be found at **www.ecocycle.org/hazwaste/recipes.cfm**

If the use of hazardous substances cannot be avoided, please follow these tips to avoid any possible risks:

- Use and store products carefully.
- Keep in original containers and do not remove labels. Never store in food containers.
- Never mix leftovers with other products. Incompatible products might react, ignite or explode.
- Follow any instructions for use and disposal provided on product labels.

What is Household Stormwater Pollution?

Household stormwater pollution happens when contaminants from our homes and cars go down the storm drain. This can happen through illegal dumping into storm drains, or more commonly, when rainwater washes pollutants and other debris from our yards and driveways to the storm drain and into our streams, lakes, and wetlands. Common sources of household pollution are motor oil and antifreeze left on driveways, soapy water from car washing, fertilizers and pesticides in lawns and pet waste left in yards.

What You Can Do

You can protect our water quality by following the simple, but effective, steps outlined in this brochure.

It's Up to You!

Your actions make a difference! You have a direct impact on the health of our streams, lakes, ponds, ground-water, and reservoirs.

Wachusett Reservoir Watershed
Department of Conservation and Recreation
Division of Water Supply Protection
180 Beaman Street
West Boylston, MA 01583
(508) 792-7806
www.mass.gov/dcr/watersupply.htm
March 2011. This brochure has been modified and used with permission from the City of Bonney Lake, WA.

dcr
Massachusetts

Household Stormwater Pollution Prevention

Practical steps to stop pollution from entering storm drains in the Wachusett Reservoir watershed that flow untreated to lakes, streams, wetlands, and reservoirs.

Around the House

Properly dispose of household chemicals. Never wash or pour chemicals, cleaners, or solvents into the storm drain, or down any drains in your home. It is toxic to aquatic life and it is also illegal. Take antifreeze, solvents, gas, brake fluid, and other hazardous substances to an approved disposal location.

Residents of Boylston, Holden, Paxton, Princeton, Rutland, Sterling, and West Boylston can take household oil-based paint and chemicals to the **Wachusett Regional Recycling Center *Household Paint and Chemical Collection*** event held four times a year at the facility in West Boylston. Check **www.wachusettearthday.org** or local newspapers for collection dates, fees, and directions.

Some of the materials accepted include: paint thinners, varnishes, solvents, strippers, pesticides, herbicides, kerosene, gasoline, swimming pool chemicals, aerosols, photo chemicals, chemistry sets, oven and drain cleaners, motor oil, and antifreeze. Contact Wachusett Earthday for a complete list of accepted items.

Sweep your driveway. Sweep up debris instead of hosing off or pressure washing your driveway. Not only is the sediment harmful, but there can also be residue from vehicles on the driveway.

Working on Vehicles

Wash your car on a lawn or at a licensed facility. Car wash water contains dirt, road grime, heavy metals, oils and soaps that are toxic to fish and aquatic life. Sending soap runoff down the driveway and into a storm drain is not only harmful to the environment; it could be a violation of local, state and/or federal laws.

Maintain your vehicle. The liquids from leaky cars are harmful to aquatic life and are washed directly into the storm drain every time it rains. Test to see if your vehicle is leaking by placing clean cardboard on the ground under your engine and checking it the next day. Repair all leaks as soon as they are discovered.

Properly dispose of oil and other auto waste at an approved waste facility. Don't pour liquids down the drain.

Clean up Spills. Use kitty litter, sawdust, or commercial absorbent pads to dry up any spilled liquid, then sweep it up and place it in the garbage. Don't wash it into the street or storm drain.

In the Lawn & Garden

Pick up after your pets. Rainwater can wash bacteria and parasites from pet waste into the storm drain, which flows untreated into our natural waterways.

Use organic, time-release fertilizers. These fertilizers slowly release nutrients to your lawn, reducing the amount of pollutants washed into our waterways.

Avoid pesticides and herbicides when possible. Not only is it better for the health of our lakes and streams, but it is also better for the health of your family. If you must use pesticides, use them sparingly and only where needed to ensure excess will not be washed into the storm drain. Always follow the label directions.

Dispose of yard waste properly. Compost yard debris or have it hauled away. Yard debris can release excess nutrients, which promotes algae growth in waterways.

Use a mulching mower. You can decrease your use of fertilizers by 25 percent by using a mulching lawnmower.

Around the Neighborhood

Pick up litter. Clean up any trash to reduce the chance of litter or contaminants entering the stormwater system.

Report pollution. It is illegal to dump chemicals or other materials in the storm drain. If you notice illegal dumping, or see, hear about, or even suspect activity that you believe is against the law and placing people's health or natural resources at risk, contact the MA Environmental Strike Force at: 1-888-VIOLATE (1-888-846-5283).

Educate neighbors. Share the importance of adopting stormwater pollution prevention practices with your neighbors.

Concerns About Medicine Disposal

- Medicines that are flushed down a toilet or sink contaminate water resources, resulting in reproductive and developmental problems in fish and other aquatic wildlife.
- Improperly discarded containers provide personal information that can be used illegally, including identity theft.
- There is the possibility of poisoning from accidental ingestions, particularly by small children and pets, if medicines are thrown "as is" in the trash or unneeded or expired medicines are kept in the house.

For More Information:

- MA Department of Environmental Protection: **www.mass.gov/dep/toxics/stypes/ppcpedc.htm**
- MA Water Resources Authority: **www.mwra.com/04water/html/pharmaceuticals.htm**
- SMAR$_x$T Disposal: **www.smarxtdisposal.net**
- US Environmental Protection Agency: **www.epa.gov/ppcp**
- White House Office of National Drug Control Policy: **www.whitehousedrugpolicy.gov/publications/pdf/prescrip_disposal.pdf**

DIVISION OF WATER SUPPLY PROTECTION
Department of Conservation and Recreation
Office of Watershed Management
Wachusett/Sudbury Section
180 Beaman St.
West Boylston, MA 01583
(508) 792-7806
www.mass.gov/dcr/watersupply.htm

Unused & Expired Pharmaceuticals

Reduce water pollution and promote a healthy environment by properly disposing of unneeded or expired medications

dcr
Massachusetts

Medications Impact the Environment

Prescription and over-the-counter medications are a source of pollution when they are flushed down the toilet or drain. Waste-water facilities and septic systems are not currently designed to process pharmaceutical products. Compounds passing through these systems can impact surface waters, groundwater, and drinking water supplies. Pharmaceuticals can also be released into waterways via stormwater run-off from fields applied with manure or biosolids.

Modern technology can detect more substances, at lower levels, than ever before. Fortunately, tests done in the spring of 2008 detected no compounds in Boston's source drinking water that comes from the Wachusett and Quabbin Reservoirs. According to the American Water Works Association, research has not demonstrated an impact on human health from pharmaceuticals at the very low levels reported nationally in some drinking water supplies. Studies have shown, however, that medicines that reach streams, rivers, and lakes do affect wildlife, as fish and wildfowl face continuous exposure to the drugs. Medications thrown haphazardly in the trash can also be eaten by wildlife that frequent landfills.

DCR's Division of Water Supply Protection
The Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection, Office of Watershed Management manages and protects the drinking water supply watersheds that provide water for approximately 2.2 million Massachusetts residents. Its legislatively mandated mission is to utilize and conserve water and other natural resources to protect, preserve and enhance the environment of the Commonwealth and to assure the availability of pure water for future generations.

Guidelines for Proper Disposal

These guidelines are taken from the White House Office of National Drug Control Policy, the Department of Health and Human Services, and the Environmental Protection Agency.

DO NOT DISPOSE OF MEDICATION DOWN THE TOILET!*

- **Take unused, unneeded, or expired prescription drugs out of their original containers.**
- **Remove ALL personal identification or prescription label from the container before placing in the trash.**
- **Mix the prescription drugs with an undesirable substance, like used coffee grounds or kitty litter, and put them in impermeable, non-descript containers, such as empty cans or sealable bags, further ensuring that the drugs are not diverted or accidentally ingested by children or pets.**
- **Throw these containers in the trash.**

*The Food and Drug Administration advises, however, that medications that have a high abuse potential be disposed of by flushing down the toilet rather than being placed in the trash. These medicines include:

- Actiq (fentanyl citrate)
- Daytrana Transdermal patch (methylphenidate)
- Duragesic Transdermal System (fentanyl)
- OxyContin Tablets (oxycodone)
- Avinza Capsules (morphine sulfate)
- Baraclude Tablets (entecavir)
- Reyataz Capsules (atazanavir sulfate)
- Tequin Tablets (gatifloxacin)
- Zerit for Oral Solution (stavudine)
- Meperidine HCl Tablets(Percocet, Oxycodone and Acetaminophen)
- Zyrem (Sodium Oxybate)
- Fentora (fentanyl buccal tablet)

Appendix D:

Downstream Newsletters

dcr
Massachusetts

downstream

NUMBER 23
Spring 2010

Massachusetts Department
of Conservation and Recreation
Division of Water Supply Protection
www.mass.gov/dcr/watersupply.htm

Unwanted Guests

Aquatic invasive species foul the state's water bodies

By Paula D. Packard
DCR Aquatic Biologist

While quietly paddling a canoe along the shoreline of the Sudbury Reservoir, checking the diversity of plant life, my fellow aquatic biologist and I noticed an unfamiliar island come into view up ahead. Having visited the area many times, we wondered how this could be since there was never an island there before. Suddenly, we realized what we were looking at was not an island at all, but a huge mass of invasive Water Chestnut plants clumped together on the surface of the water!

Invasive species have been a concern to environmentalists for years, but now it seems they are coming at us at a fast and furious rate! The list of invasive species grows almost as quickly as some of the species themselves, once they are introduced in new territory.

What exactly is an invasive species? The term "invasive species" is used to describe any organism that is introduced into an area where it is not normally found; it often out-competes native or naturally occurring plants or animals. Invasive species that pose the greatest threat typically come from places where the climate and conditions are very similar to ours. They are already adapted to cold, harsh winters and seasonal changes so the transition to our area is simple for them.

In their new location, invasive species encounter few predators or naturally occurring diseases. They are usually not recognized as a food source by other species. Invasives may crowd out similar native species, use up available nutrients, and, in extreme cases, out-compete rare species, causing local extinctions. When free from the checks and balances of their place of origin, their populations may increase uncontrollably, giving them unfair competitive advantage.

Unfortunately, once introduced, eradication can be expensive, time consuming, or even virtually impossible. The best way to keep invasive species at bay is to prevent their introduction in the first place. Simple as this may sound, careless or uninformed behavior can easily bring this about. This article presents a few of the aquatic invasive species that are of top-most concern to the State's natural resource managers.

Continued on Page 4

Wachusett Watershed Rangers Say Hello

By Rebecca Baronoski DCR Wachusett Watershed Ranger

Spring is finally here! After a long and cold winter – and very wet March – it's time once again to think about getting outdoors and enjoying the wonders that surround us. A great way to take in the nice weather is to participate in the Wachusett Watershed Rangers 2010 interpretive programs. The Wachusett Watershed Rangers will be conducting a series of fun and educational programs that span from learning how to fish to exploring old cellar holes. All of these programs are designed to educate visitors and watershed residents about watershed protection and environmental stewardship. So come on down to the Wachusett Reservoir, bring your friends and family, and let the Rangers share with you the history and knowledge that the watershed has to offer.

Be sure to look forward to the fall edition of *Downstream*, when a new regular feature by the Wachusett Rangers will be introduced that covers both what we do and why we do it. There will also be an "Ask the Ranger" column that will answer the inquisitive public's questions. Please email rebecca.baronoski@state.ma.us to submit a question and look for a reply in the next issue of *Downstream*.

In This Issue:

Photo Credits
Page 1 Paula D. Packard
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Page 3 Clif Read
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Bottom - Jeff Gunderson, MN Sea Grant
Page 5 Left - US Aquatic Nuisance Species Task Force
Right - Dave Worden (all three)
Page 6 Bruce Fant
Page 7 Darrin Freshwater Institute
Page 8 Left - Clif Read
Top R. - Becky Baronoski
Bottom R. - Edward M. Connor

2010 Ranger Programs

May 8: 10:00 a.m.
WAUSHACUM PARK TOUR

Join the Rangers and the Sterling Historic Society for an approximate mile-long walking tour of the site of the former Waushacum Park. This park was once a number one destination for company picnics and rail-going vacationers. The merry-go-round, dance hall, steam boat, and other attractions were dismantled by the state in the early 1900s to protect the water quality of the Wachusett Reservoir. Meet at the Gates Rd. Rail Trail parking lot in Sterling.

June 5: 9:00 - 11:00 a.m.
LEARN TO FISH

This program will focus on fishing techniques, species that live in the reservoir, the importance of keeping the water clean (lead and mercury free), and being an environmentally responsible angler. A group fishing license as well as fishing poles and tackle will be provided by the MA Department of Fish and Game. Meet at the Old Stone Church on Beaman Street in West Boylston.

June 19: 9:00 - 11:00 a.m.
INTRODUCTION TO FLY FISHING

This program will include an introduction on the basic equipment needed to get started, basic fly casting lessons, and techniques used for fly fishing. Rods and ties will be available for use but feel free to bring your own equipment. At the conclusion, participants will have a chance to use their newly learned skills on the Quinapoxet River. Bring along waders if you wish to fish above the dam. Meet at the MWRA Facility, 51 River Rd., West Boylston.

July 24: 1:00 p.m.
PROTECTING YOUR WATERSHED

Ever wonder why dogs aren't allowed on watershed land? Or why DCR staff harasses gulls off the reservoir waters? Watershed Rangers will answer all of these questions and more. Learn about the steps you can take toward watershed protection and water conservation.

The program will also provide an overview of the primary function of each section of the DCR Watershed Management Division, a tour of the MWRA facility, and a water quality demonstration. Meet at the MWRA Facility, 51 River Road, West Boylston.

August 21: 10:00 a.m.-2:00 p.m.
WATERSHED GEOCACHING

All are invited for a fun day of Geocaching at the Wachusett Watershed. Adults and families are welcome to come and locate caches at historical and scenic locations. Please bring your GPS and a sense of adventure.

Continued on Page 6

May Heralds National Drinking Water Week

By Kelley Freda
DCR Environmental Analyst

May 2nd to 8th was National Drinking Water Week! Every year, the American Water Works Association (AWWA) and an alliance of organizations, including the U.S. Environmental Protection Agency, sponsor National Drinking Water Week to highlight the importance of tap water and the need to invest in our nation's drinking water infrastructure A safe, reliable water supply is critical to the success of any community, creating jobs, attracting industry and investment, and providing for the health and welfare of citizens in ways ranging from disease prevention to fire suppression. A clean, abundant water supply is often taken for granted until it is threatened, either by drought, water main breakage, or some other catastrophic event.

Drinking Water Week has been a custom for more than 50 years. The AWWA marked this celebration for the first thirty years with just its members. In 1988, AWWA brought the event to the attention of the federal government, culminating in a joint congressional resolution signed by then-President Ronald Reagan declaring the first week of May as National Drinking Water Week. Since that time, National Drinking Water Week has been observed throughout the United States and Canada, evolving into a week for water utilities to highlight their work and educate the public on drinking water, water quality, and infrastructure issues.

Drinking Water Week is also a great time for teachers to educate their students on ways to protect and conserve our resources. For example, did you know that water utilities in the United States treat nearly 34 billion gallons of water every day? Or that in the United States and Canada, the total miles of water pipeline and aqueducts equal approximately one million miles…enough to circle the globe 40 times?

Americans drink more than one billion glasses of tap water a day. Do you know where your water comes from when you turn on the faucet? In the Wachusett Reservoir watershed, residents of Sterling, West Boylston, most of Holden and Boylston get their public drinking water

Continued on Page 6

DCR Wins National Source Water Protection Award

DCR's Division of Water Supply Protection, Office of Watershed Management has won the most prestigious award for water supply protection in North America - the Exemplary Source Water Protection Award for large systems from the American Water Works Association. This award was based on three criteria: the effectiveness of the program; the innovativeness of the program approach; and the difficulties overcome by the organization in satisfying the eligibility criteria.

Several of the factors for granting the award were:

- A well established working relationship between DCR and the MA Water Resources Authority (MWRA), as well as the use of the Water Supply Protection Trust as a funding mechanism.
- Extensive citizen input through advisory committees.
- Creation of a comprehensive protection program that includes Watershed Protection Plans, Land Management Plans, and Public Access Plans.
- Maintenance of excellent source water quality required for a filtration waiver.
- Successful implementation of the Watershed Protection Act.
- Land acquisition that utilizes a GIS-based prioritization model.
- Active forest management specifically designed for water supply protection.
- Water quality monitoring that details program effectiveness.
- Innovative programs such as: microbial tracking to identify dog waste as a problem coupled with a program to change behavior on waste disposal; emergency response training and equipment deployment (with MWRA); Watershed Ranger outreach; assistance with bylaw development; and operation of the Quabbin Visitor's Center.

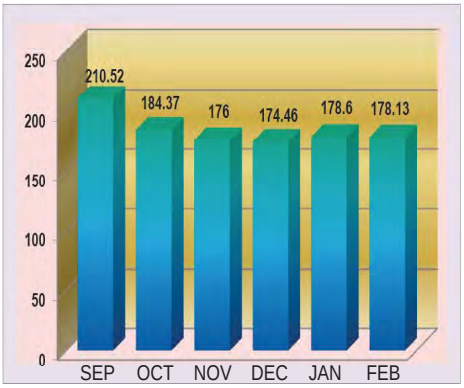
Look for more information on these topics and more in past and future editions of *Downstream*.

Reservoir Watch

Reservoir levels and 6-month precipitation

Reservoir	Quabbin	Wachusett
Minimum	526.84'	389.81'
% Full	94.1%	89.5%
Date	11/19/09	12/3/09
Maximum*	528.82'	392.80'
% Full*	97.8%	95.6%
Date	2/28/10	2/28/10
Precipitation	18.8"	18.84"
Seasonal Avg	23.11"	22.23"

System-wide 6-month Water Usage (in million gallons per day) September 2009 to February 2010



** Both reservoirs were over-capacity by mid-March. Quabbin reached maximum elevation of 530.58' (417.2 billion gallons of water in storage) and Wachusett peaked at 396.35' (67.5 billion gallons of water in storage).*
See story on page 8.

Aquatic invasive species foul the state's water bodies

Zebra mussels, though small, can cause significant damage to underwater equipment.

From Page 1

Zebra Mussels *(Dreissena polymorpha)* were first found in North America in 1985 at the Great Lakes. Native to the Black, Caspian, and Aral Seas in Eastern Europe, they were most likely introduced in ballast water released from cargo ships. Since that time they have spread, colonizing many water bodies in the United States, causing considerable economic loss as well as severe impairment of native ecosystems. In the summer of 2009, Zebra Mussels were discovered in western Massachusetts. Due to the level of potential damage they can cause, this little mollusk has quickly become the "poster child" for aquatic invasive species. They are of great concern to water suppliers because they affix themselves in great numbers to any hard surface and then grow, clogging intake systems and distribution pipes, costing exorbitant amounts of money to correct. This threat is also very real to boaters or anyone else with machinery or equipment in affected waters.

In the food chain, Zebra Mussels are filter feeders. They filter algae out of the water, depleting the food source of many small organisms, thereby disrupting the food chain from the bottom up. Clarity of affected waters may actually increase, allowing sunlight to penetrate deeper, thus increasing the growth of rooted aquatic plants, some of which may also be invasive.

Female Zebra Mussels can produce hundreds of thousands of eggs every year. The larval stage of the Zebra Mussel, called veligers, are microscopic and freely float throughout a water body. After about 2 to 4 weeks, they begin to develop a shell and will attach to any suitable substrate, such as rocks, logs, man-made structures, and even living crayfish or turtles. Veligers are very often unknowingly introduced to other locations in live well, bilge, or bait bucket water that is transferred from one water body to another.

Fortunately, the water chemistry at the Quabbin and Wachusett Reservoirs is not considered conducive to Zebra Mussel survival. However, this does not mean that we should passively assume that they cannot become established. As a result, the DCR is vigilantly working to keep Zebra Mussels, as well as all known invasive species, from entering our waters.

DCR staff regularly monitor for the presence of invasive species including Didymo, Spiny water flea, Zebra mussels, as well as many plants.

Spiny water fleas can coat fishing lines, making riggers so heavy that the lines must be cut.

The Spiny Water Flea *(Bythotrephes longimanus)* is a type of zooplankton similar to some of our native species, however they have a long tail equipped with spines (thus their name) so few fish find them palatable. The Spiny Water Fleas compete with small fish for food, therefore harming fisheries. During the day, they migrate down into the deep, darker water to further avoid predation then come back up to the water's surface at night to feed. Females are parthenogenic at times, meaning they can reproduce without a male counterpart. They also produce what are called resting eggs that are able to withstand drying. In large numbers, Spiny Water Fleas may coat fishing line and down riggers becoming so heavy that the line must be cut. Due to this problem, a new type of fishing line called "flea flicker" is being marketed. Spiny Water Fleas are often transported in water like Zebra Mussel veligers, but also on carpeted wheel wells and trailer bunks, and on felt-soled waders. These areas provide some moisture and protection that may harbor resting eggs. Few predators, efficient reproductive strategies, and the ability to withstand drying drastically increase the threat of Spiny Water Flea's successful colonization of new areas.

Didymo (*Didymosphenia geminata*, also called "rock snot") is a member of a common group of algae known as diatoms. Didymo typically prefers flowing water; however, there is some evidence that it is adapting to different habitats. Didymo forms a thick, sticky mat that smothers other organisms. It can also withstand long periods of partial drying. Like the other invasives in this article, it is most often transported to new locations on felt-soled waders used by fishermen, on

Dydimo, otherwise known as "rock snot," forms a thick, sticky mat that smothers other organisms.

equipment or in water that is transferred from one body of water to another. Once established, it is impossible to eradicate. This invasive was first found in northern New England in 2007. DCR is closely monitoring for the arrival of Didymo; to date it has not been found in the reservoir system.

Some of the invasive aquatic plants that concern DCR biologists include **Fanwort** *(Cabomba caroliniana)*, **Eurasian Water-milfoil** *(Myriophyllum spicatum)*, **Hydrilla** *(Hydrilla verticillata)*, **Common Reed** *(Phragmites australis)*, and **Water Chestnut** *(Trapa natans)*. Invasive plants crowd out native plants and compete for available nutrients. Like the animal species, invasive plants also have few predators so they will grow unchecked. As they multiply, biomass increases, eventually degrading water quality by adding excess nutrients. Some invasive plants such as Eurasian Water-milfoil spread by fragmentation, where small pieces of the plant break off, float to new areas and take hold. Water Chestnut reproduces by growing nuts that can float for some distance, sink to the bottom, and then germinate. The rosette of floating leaves of this plant forms a dense mat on the water's surface that blocks the sunlight from reaching any plants that may try to grow beneath it. Water Chestnut is an annual plant so infestations respond well to hand harvesting over several years. Hand harvesting is being used to control Water Chestnut at the Sudbury Reservoir and Fanwort and Eurasian Water-milfoil at the Wachusett Reservoir. At this time, none of these invasive plants are present in Quabbin Reservoir.

What is DCR doing about invasive species? DCR staff regularly monitor for the presence of invasive species including Didymo, Spiny Water Flea, Zebra Mussels, as well as many plants. An extensive boat inspection and decontamination program has been implemented at the Quabbin Reservoir. Statewide, a comprehensive plan to address invasive species is under development as we continue to provide outreach and public education. While no program can ensure complete protection, the steps we have taken dramatically reduce the threat of aquatic invasive species.

What can you do? Be a part of the solution! Clean boats, equipment, fishing gear, clothing or any other material that is brought from one body of water to another, especially if traveling from a place that is known to be infested with any invasive species. Educate yourself and learn to recognize and identify invasive species (a great place to start is DCR's Lakes and Ponds program, which offers hands-on Weed Watcher classes as well as a wealth of information on-line at www.mass.gov/dcr/watersupply/lakepond/lakepond.htm). Immediately report any invasive you may find. Please be vigilant and cooperate with DCR's efforts to protect our valuable natural resources from the steady stream of invasive species.

Fanwort, having few predators, can out-compete native plants.

Eurasian Water-milfoil is becoming a hazard in many of the state's water bodies.

While rooted in water, *Phragmites* interferes with native shore plants.

2010 Wachusett Watershed Ranger Programs

From Page 2

The event will be posted on www.geocaching.com. Meet the Rangers at the DCR Division of Water Supply Headquarters, 180 Beaman St., West Boylston. Participants will be given the coordinates to seven different locations within the watershed. Sites will vary in terrain so visit as many or as few as you like. Locate them all and win a prize!

September 11: 11:00 a.m.
WACHUSETT RESERVOIR HISTORY
Come and meet the Rangers and hear all about the history behind the Wachusett Reservoir. Learn how and why the reservoir was constructed in the Nashua River Valley over 100 years ago. Listen to spooky legends and fun facts about the reservoir. There will be a slideshow presentation inside the Old Stone Church as well as a display of actual photographs taken before and during the reservoir construction. Bring a chair along if you would like to sit. Meet at The Old Stone Church on Beaman Street in West Boylston

Scouts gather together with Watershed Rangers for the annual Chuckwagon Derby.

September 25: 10:00 & 1:00 p.m.
SPRINGDALE MILL DAY
RANGER BIKE TOUR
Wachusett Greenways will be hosting their annual Springdale Mill Day. During this event, the DCR Rangers will be offering an interpretive bicycle tour of the area. Rangers will take participants on a bike ride stopping at points of interest along the way to the historic Springdale Mill site. This program is designed to educate the general public in the uses, responsibilities, and benefits of living in a protected watershed. Please bring your own bike, helmet, and water. Meet at the Mass. Central Rail Trail parking lot in West Boylston.

October 9: 10:00 a.m.
NATURE HIKE
Take a hike with Ranger Nate to explore the natural wonders of the Reservoir. He will lead a 1½ hour hike exploring the watershed and talking about why and how DCR protects the land for water quality. Please bring comfortable shoes, water, and your questions about the watershed. Meet at Reservoir Gate 22, Route 140, West Boylston.

October 23: 10:00 a.m. - 2:00 p.m.
CELLAR HOLES AND
STONE WALLS
The rangers and interpretive staff will lead a guided hike into the woodlands surrounding the reservoir and will explore the former homestead sites that once stood in the valley. The rangers will discuss land use changes, reservoir history, and clean drinking water needs. Interpretive staff will explore the stonewalls that surround the area and discuss their history, age, and purpose. Please wear hiking boots or sneakers. Meet at the parking lot at the intersection of Route 110 and Chase Hill Rd. in Sterling.

How to maintain safe water quality

From Page 3

from ground water sources via municipal wells; the Leominster water supply consists of three surface water reservoirs, one ground water supply, and an emergency connection to the Wachusett Reservoir. Several communities that encompass the Quabbin Reservoir and Ware River watersheds, such as Ware, Belchertown, Orange, Athol, Hardwick, and Barre, have some form of public water supply; however, practically every household that is actually within the watershed boundaries is serviced by private wells. The major exception is in Rutland, where a portion of the town gets its drinking water from the Muschapoag Reservoir.

DCR's Office of Watershed Management encourages residents in the DCR/MWRA watersheds to take the opportunity of Drinking Water Week to learn more about your own drinking water – where it comes from, how it is treated, its quality, and ways you can protect it. For folks who have a municipal supply, a good way to find this information is through the annual Consumer Confidence Report (CCR), a requirement of the federal Safe Drinking Water Act for all community Public Water Systems. These reports, which provide details on water supply and quality, must be delivered to each utility's customers by July 1 for the previous calendar year. The Massachusetts Department of Environmental Protection (MassDEP) is the state agency authorized to implement and enforce drinking water mandates such as the CCR rule.

The Division of Water Supply Protection encourages you to not only learn about your drinking water supply, but also the water supply for more than 2.2 million residents provided by the Wachusett and Quabbin Reservoirs, and why it is important for residents who live within the watershed system to help protect these vast natural resources. Some ways you can help to maintain safe water quality for both your own drinking water and the metropolitan Boston water supply include: regular maintenance and inspection of septic systems; not flushing unused medications down drains; making sure home heating oil tanks are in good condition; picking up after your pet; and properly disposing of hazardous materials, including used motor oil and household cleaning products (please take advantage of municipal collection events). Sweeping road sand away from storm drains is another small but important way to help protect surface waters. All of your individual actions combined will make a difference in keeping everyone's drinking water pure, for now and into the future.

Kids Corner

Zebra Mussels Multiplied!

By Jim Lafley
DCR Wachusett Section
Education Coordinator

Zebra Mussels *(Dreissena polymorpha)* are small, fingernail-size clams native to the Caspian Sea region of Poland and Russia. The mussels were introduced accidentally by hitching a ride in large, ocean-going ships coming to the United States. The ships add water to ballast tanks before they leave their harbor to help stabilize the ship as it travels. When they unload the water in the new location, the species living in the water are unloaded too.

These mussels can threaten the new ecosystem to which they have been added. As filter feeders they removed small plants (phytoplankton) and small animals (zooplankton) from the water that would provide food for native mussels, clams, and fish.

Zebra Mussels also tend to clump

together as they build a colony. This trait can clog systems in boats and water intake pipes at power plants and water supply facilities.

They are capable of reproducing rapidly. On average a female can produce 30,000 eggs per year, but only about 1% of the offspring survive. The potential for rapid overpopulation is great.

You can figure out how many Zebra Mussels would be produced after just 3 years by using the following information and the chart below:

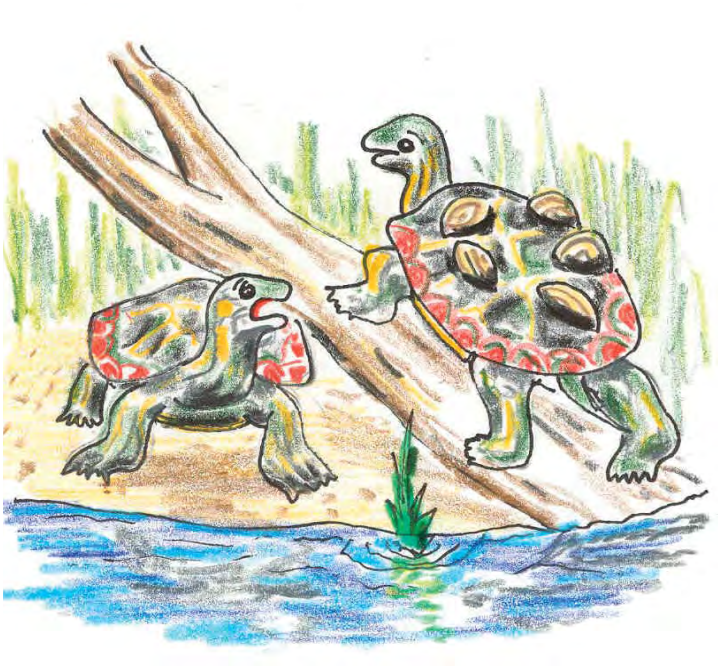
- Begin Year 0 with 2 Zebra Mussels, a male and a female.
- Assume 1% of the 30,000 offspring each Zebra Mussel produces survives.
- At the end of Year 1, there will be 302 Zebra Mussels (300 survivors and the 2 originals)
- Assume ½ the population is female.

Year	Number of Zebra Mussels
0	2
1	302
2	
3	

Year 2 - 45,602 • Year 3 - 6,885,902

And another thing...

by J. Taylor



"When you said you had 'muscles,' I thought...

For more information about Aquatic Invasive Species:

DCR Lakes and Pond Program
www.mass.gov/dcr/watersupply/lakepond/lakepond.htm

US Geological Survey Nonindigenous Aquatic Species Program
http://nas.er.usgs.gov/

For more information about drinking water:

DCR Division of Water Supply Protection
www.mass.gov/dcr/watersupply.htm

American Water Works Association
www.awwa.org

New England Water Works Association
www.newwa.org

EPA Ground and Drinking Water Program
www.epa.gov/safewater

MA Dept of Environmental Protection
www.mass.gov/dep/water/drinking.htm

MA Drinking Water Education Partnership
www.madwep.org

It's a Hard Rain...That Fell

Unless you were away this past March, you may have noticed lots of rain. The reservoir system was, to say the least, full and then some. At peak runoff times, the Quabbin Reservoir (right), Wachusett Reservoir (far right) and the Sudbury Reservoir (bottom right) were filled to over-capacity. In such cases, the spillway of each reservoir diverts excess water safely downstream: Quabbin into the Chicopee River, Wachusett into the Nashua River, and the Sudbury into the Sudbury River. At maximum flow this spring, Quabbin was spilling 7,333 gallons of water per second – enough to fill a 660,253 gallon Olympic-sized swimming pool in about 90 seconds. At the same time, Wachusett was spilling 24,200 gallons per second – enough to fill that same swimming pool in about 27 seconds, while the flow at the Sudbury Dam could fill the pool in two minutes, 11 seconds!

While we all hope for a long, hot summer, a possible dry spell could easily change this bounty. DCR encourages ongoing conservation measures to ensure adequate water supplies all year.

downstream

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Division of Watersupply Protection
Office of Watershed Management
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Downstream is produced twice a year by the Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection. It includes articles of interest to the Watershed System communities. Our goal is to inform the public about watershed protection issues and activities, provide a conduit for public input and promote environmentally responsible land management practices.

Governor: Deval L. Patrick
Lt. Governor: Timothy P. Murray
EOEEA Secretary: Ian A. Bowles
DCR Commissioner: Richard K. Sullivan Jr.
DWSP Director: Jonathan L. Yeo
Downstream Editor: James E. Taylor

Wachusett Rangers

Protecting water, serving the public

By DCR Watershed Ranger Staff

Visitors and watershed residents alike often ask about the Watershed Rangers' duties and responsibilities. This article provides some insight into the role of the Watershed Ranger throughout the seasons in the Wachusett Reservoir watershed.

The Rangers' focus changes depending on the time of the year and the type of activities occurring on watershed lands, however all functions are guided by the Watershed Ranger's mission statement (see box). The Wachusett Reservoir has nine full-time Rangers and the Quabbin Reservoir has seven. Although guided by the same mission statement, the Ranger's specific duties at Quabbin differ from the Rangers at Wachusett. The following descriptions focus primarily on the Wachusett Reservoir Rangers; look forward to hearing about the Quabbin Rangers' role in protecting the watershed in a future edition of *Downstream*.

…the Rangers seek to help safeguard the quality of the MWRA Water Supply by maximizing public compliance with the Department of Conservation and Recreation, Division of Water Supply Protection's rules, regulations, and policies. The Rangers strive to achieve their mission by being a proactive presence on watershed property and by education of the public through formal and informal means.

-DCR Watershed Rangers Mission Statement

Spring

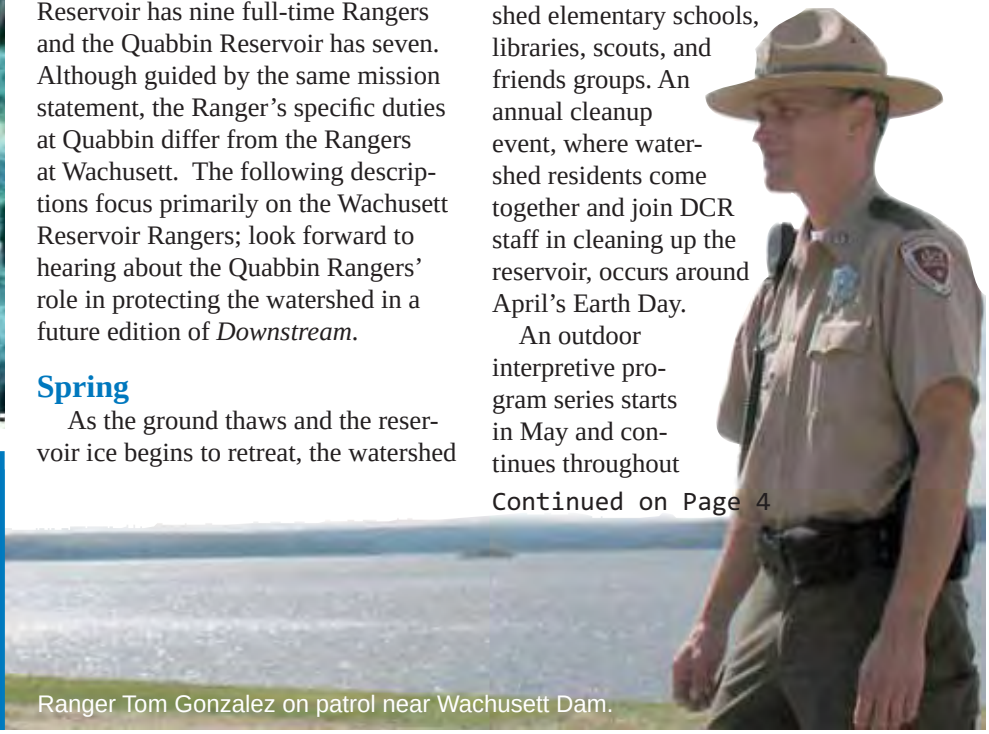
As the ground thaws and the reservoir ice begins to retreat, the watershed lands and waters begin to teem with life. Fish rise from the deep, cold water attracting anglers from all around the state. The main event of springtime at the reservoir is the beginning of a new fishing season.

Opening day is always on the first Saturday in April, provided that the reservoir is ice free. It is a very busy weekend, as several hundred anglers are anxious to cast for a bite from the reservoir's abundant fishery. Wachusett holds six state fishing records, including lake trout and land-locked salmon. The Rangers' role at this time is to speak with the fishermen, check their fishing licenses and creel, check for lead sinkers (which are banned at Quabbin and Wachusett Reservoirs), and educate people on the rules and regulations of the reservoir, as well as the impacts from invasive aquatic species. Patrols are conducted by boat, bike, foot, and ATV.

Visitors also come to the reservoir in springtime to catch a glimpse of loons, eagles, hawks, and many other wildlife species. The Rangers switch to the role of interpreter by providing information and answering questions. Spring also sees the start of organized education programs. The Rangers offer historical presentations for the watershed elementary schools, libraries, scouts, and friends groups. An annual cleanup event, where watershed residents come together and join DCR staff in cleaning up the reservoir, occurs around April's Earth Day.

An outdoor interpretive program series starts in May and continues throughout

Continued on Page 4



Ranger Tom Gonzalez on patrol near Wachusett Dam.

NUMBER 24
Fall 2010

Massachusetts Department
of Conservation and Recreation
Division of Water Supply Protection
www.mass.gov/dcr/watersupply.htm

Creeping Normalcy

Three decades of successful land protection efforts

By Jim French, DCR/DWSP Land Acquisition Coordinator

This privately owned forest is permanently protected from development by a DCR Watershed Preservation Restriction.

"Buy Land, they aren't making any more of the stuff."
Will Rogers

"The law locks up the man or woman who steals the goose from the common; but the greater villain the law lets loose, who steals the common from the goose." *Anonymous, 17th century*

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Page 1 Jim Taylor
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Page 4 Top - Rebecca Baronoski
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Bottom Right - Boylston Fire Department
Page 5 Top - Kelley Freda
Bottom - Tim O'Connor
Page 7 DCR Staff
Page 8 Left - Quabbin Visitors Center
Right - Clif Read

To work to protect landscape is to work for the prosperity of our children's children while expecting them to ever do the same. They will only carry on this work if we succeed in passing on a reverence for the natural world around us.

Long ago one could bend and drink from a cool New England stream without a thought of any health consequences. Open water anywhere was safe to slake one's thirst. The air was pure and the soil was chocolate dark and rich with the promise of robust sustenance. Soft rain delivered chemical-free moisture gathered from vast unbroken oxygen-producing forests. The incredible diversity of plant and animal life would astound the modern observer, for we cannot even imagine all that has been lost.

Creeping normalcy is the term coined to describe the loss of great things so slowly that they are not noticed. No better example of this phenomenon exists than in describing the deliberate and persistent surrender of our natural land base to suburban development sprawl. Each house and lawn, mall and parking lot, school and soccer field, takes without giving back a small piece of the pristine pre-colonial conditions now collectively forgotten. Landscape amnesia, as it has also been described, robs us without our knowing we are being robbed.

Clean air and water is our lowest common denominator for a healthy life. Therefore, we start there in our efforts to protect many of the remaining tracts of our natural landscape - lest the shaded tree-lined rivers and reed-washed wetlands creep from our conscience one grove and one river bend at a time. In one of many successful synergistic accomplishments of the DCR/MWRA water supply protection team, the land protection program has proven highly effective in converting acquisition funding opportunities into swaths of green along our rivers and streams.

Since the first open space funding specifically for protecting the water supply acreage was established 25 years ago, DCR has acquired 22,000 acres of carefully selected watershed lands within the Wachusett Reservoir, Ware River, and Quabbin Reservoir watersheds – the 400 square mile region in Central Massachusetts from which the pure water consumed by 2.4 million Bay State residents and businesses is collected.

Hundreds of private landowners within this region have participated in the land acquisition program, with the 500th purchase having been recorded this past summer. An additional milestone for 2010 was crossing the 100,000-acre threshold of land under the DCR Division of Water Supply Protection's care and ownership. Within that figure is yet another significant and celebratory number: the acquisition of DCR's 5,000th Watershed Preservation

Continued on Page 6

10 Ways to Cleaner Water

Simple steps to protect ground and surface waters

By Kelley Freda, DCR Environmental Analyst

1 Pick up after your pet and put the waste in the trash. For more information, go to www.mass.gov/dcr/watersupply/watershed/documents/wachdogwaste.pdf.

2 Limit the use of fertilizers and pesticides. NEVER apply before a heavy rain.

3 Don't sweep sand into the roadway and keep it away from storm drains (especially in the springtime after the snow melts).

4 Fix automobile leaks.

5 Wash your car on the lawn, where water won't flow directly into storm drains, or take it to a car wash.

6 Dispose of household hazardous materials properly. Residents of the Wachusett Reservoir watershed can utilize the recently opened Wachusett Watershed Regional Recycling Center operated by Wachusett Earthday (http://wachusettearthday.org)

7 Plant grass if there are bare spots in your yard. Fix any eroded areas.

8 Make sure your septic system is functioning properly.

9 Don't feed or attract wildlife. Feces from wildlife (such as raccoons) can cause high bacteria counts in nearby streams.

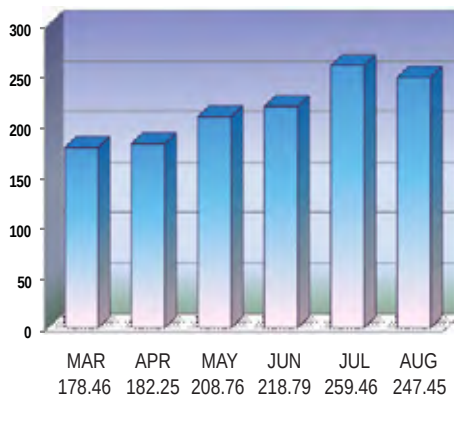
10 Dispose of unused medications properly. NEVER flush in the toilet or down the drain. For more information, go to www.mass.gov/dcr/watersupply/watershed/documents/DWSPPharmbrocure.pdf.

Reservoir Watch

Reservoir levels and 6-month precipitation

Reservoir	Quabbin	Wachusett
Minimum	525.71'	389.78'
% Full	92.0%	89.6%
Date	8/31/10	5/6/10
Maximum	530.58'	396.35'
% Full	101.2%	102.7%
Date	4/2/10	3/16/10
Precipitation	21.31"	22.92"
Seasonal Avg	25.05"	23.2"

System-wide 6-month Water Usage (in million gallons per day) March to August 2010



Planning Spotlight on Public Access

Sudbury completed, Wachusett up next

by Joel Zimmerman, DCR/DWSP Planner

There are four Public Access Plans that detail management policies and explain the programs and activities used to limit and control access to the lands and waters of the DCR water supply system. These plans are periodically updated to identify changes in existing conditions, evaluate the policies that have been implemented, and assess additional needs to meet the mandate of water quality and resource protection.

The Sudbury and Foss (Framingham #3) Reservoirs are the reserve source water supplies for metropolitan Boston. ***The Sudbury and Foss Reservoirs 2010 Public Access Plan Update*** was completed in July. Building upon information from the 1994 and 2002 versions, needs assessments and implementation objectives were developed for nine major issues: Structural and Access Controls, Signs, Mapping, Enforcement, Encroachments, Public Education/Interpretive Services, Partnerships, Open Space Coordination, and Monitoring/Program Evaluation. The plan can be found on-line at *www.mass.gov/dcr/watersupply/watershed/sudaccplan.htm.*

Updating the ***Wachusett Reservoir Watershed Public Access Plan***, originally developed in 1996 and last revised in 2003, is a major task for this coming year. A kick-off event explaining the process was held at John Augustus Hall in West Boylston on October 28. A survey has been developed to help DCR gain a perspective on how people recreate on the public water supply lands around the Wachusett Reservoir.

Take the Wachusett Public Access survey on-line at www.mass.gov/dcr/watersupply/watershed/wachaccess.htm.

All DCR Watershed plans can be found at www.mass.gov/dcr/watersupply/watershed/dwmplans.htm. For additional information, contact the Wachusett/Sudbury Regional Headquarters at (508) 792-7806.

Wachusett Rangers protect and serve from Page 1

Outdoor activities, such as biking, are popular during the summer months. Ranger Will Anderson chats with a frequent rider of the Mass Central Rail Trail at DCR's West Boylston parking lot.

the summer. All programs are free and open to the public and can be viewed on the DCR website at www.mass.gov/dcr/events.htm. In addition, spring is the time for the Rangers to refresh the kiosks, bulletin boards, and brochure boxes that provide visitors with information about the reservoir.

Summer

As spring turns to summer, the hot weather forces the fish into the deep cold waters and fishing begins to slow down. However, activities such as biking and hiking increase, so patrols change focus to high use areas such as the Rail Trails and the Old Stone Church. Rules signs that use universal symbols to show allowed and prohibited activities are posted at every access gate. These signs also have the phone numbers for the Ranger Station and the State Police so visitors can report emergencies or illegal activity.

The Ranger's major summertime focus is keeping visitors out of the water. The reservoir is patrolled by boat to check the shoreline for people wading or swimming. While on the boat, the Rangers are also looking for other unlawful behavior on watershed lands, such as low flying planes, fires, dogs, and people in areas posted as "No Trespassing."

Fall

Autumn lures the fishermen back to the reservoir as the cooler waters rise to the surface. Lake Trout prefer water temperatures around 50°F; in the fall they can be found closer to shore following bait fish. Wild, non-native, landlocked Atlantic Salmon also travel up the rivers to spawn at this time. Rangers walk the shorelines talking to the fishermen, making sure they are in compliance with the rules. Many visitors also come to the reservoir to enjoy the fall foliage and scenic vistas, providing the Rangers an opportunity to interact with people from all over New England and educate them about watershed management.

Fall also brings the start to deer hunting season, keeping the Rangers very busy with both legal and illegal hunters. Hunting is allowed, following all other state regulations, on DCR Watershed lands that are north and west of I-190. Lands immediately around the reservoir, however, are off-limits to hunting. Some people do not follow the law – illegal tree stands are often confiscated and the Environmental Police work with DCR to investigate poaching on watershed lands.

Another large part of the Watershed Ranger's role is hazardous materials response. Fall is the time for training, both on water and land, in boom deployment and spill containment. Ranger staff have the capability to provide spill response equipment and personnel to assist in the detection and containment of hazardous material that releases into

Shoreline fishing is most popular at Wachusett Reservoir in the spring and fall. Captain Derek Limantainen provides an angler information about the fish population, checks for a proper fishing license and teaches about the water supply system.

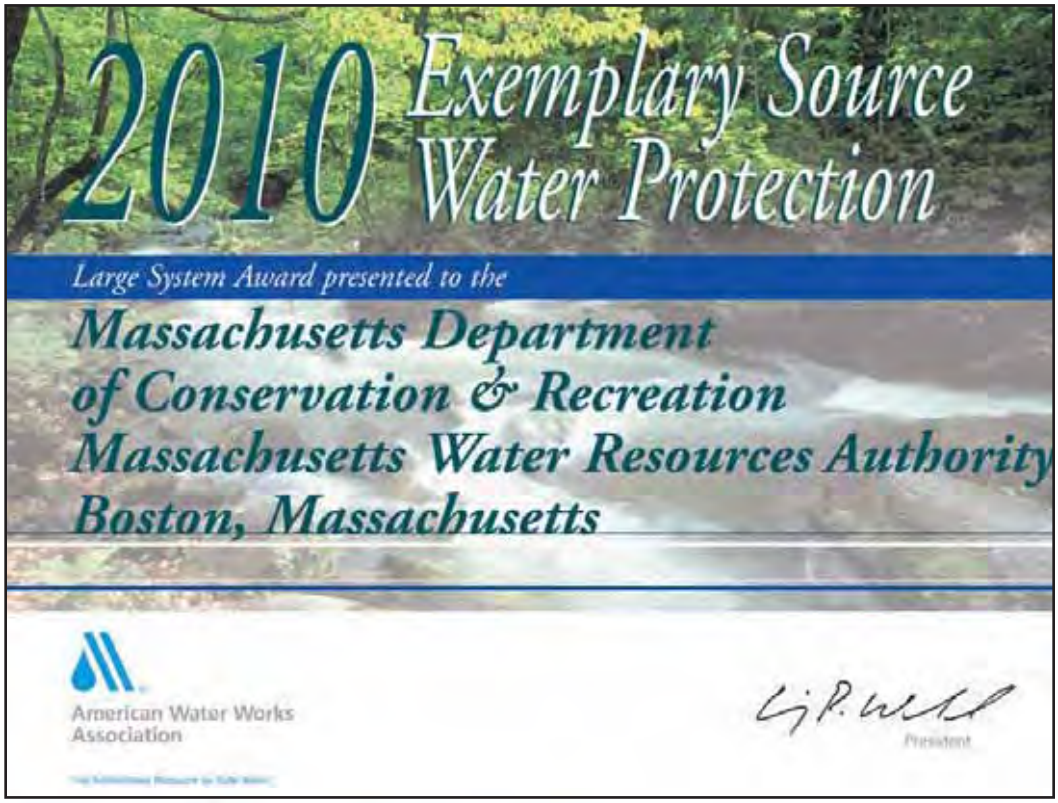
In addition to patrols and educational services, the Watershed Rangers are also trained to assist in emergency spill response situations on the reservoir. In this picture, they are deploying a spill containment boom as part of a training operation.

DCR Wins National Clean Drinking Water Award

The Massachusetts Department of Conservation and Recreation's Division of Water Supply Protection (DCR/DWSP) has received the American Water Works Association (AWWA) 2010 Exemplary Source Water Protection Award for Large Systems. The Division's Office of Watershed Management has a long-standing reputation for successfully providing pure water to the Massachusetts Water Resources Authority (MWRA) for treatment and distribution to more than 2 million people. This award certifies DCR as an international role model for drinking water quality protection.

AWWA, an international nonprofit and educational society, is the largest and oldest organization of water professionals in the world, with membership of more than 60,000 people and 4,600 utilities that supply water to roughly 180 million people in North America. Members represent treatment plant operators and managers, scientists, environmentalists, manufacturers, academicians, regulators, and others who hold genuine interest in water supply and public health. AWWA is the authoritative resource on safe water.

The significance of this award is magnified by the fact that DCR's advocate was its regulating agency, the MA Department of Environmental Protection (DEP). DEP's detailed nomination to the award committee was based on its intimate knowledge of DCR's work, derived from DEP's annual inspections and on-going program review, which are required for DCR's source water to maintain MWRA's federal filtration waiver. DEP's recommendation was supported by the New England chapter of the AWWA, which subsequently submitted the nomination material to be considered with other applicants from around the country.



The water at Quabbin Reservoir is crystal clear.

A tranquil day on the Ware River.

The nominations were judged on how well a water system meets six components of AWWA's Source Water Protection Standard: 1) program vision; 2) source water characterization; 3) explicit protection goals; 4) development of an Action Plan; 5) implementation of the Action Plan; and 6) periodic evaluation and revision of the entire program. The award was also based on three additional factors: the 1) documented effectiveness of the program; 2) innovativeness of the approach; and 3) the difficulties overcome by the organization.

Quabbin Reservoir, frozen over in winter.

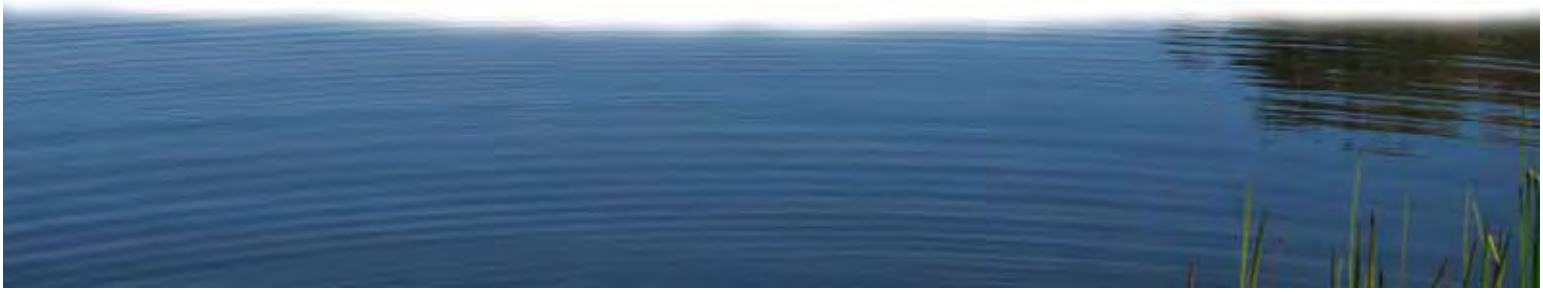
DCR's watershed management programs excel in all of these areas. DEP explicitly noted DCR's extensive planning processes, water quality monitoring, natural and cultural resource stewardship activities, and community outreach through advisory committees, interpretive services, technical assistance, ranger patrols, and publications. All of these elements are unified into an annual Work Plan and corresponding budget that is reviewed and approved by the Water Supply Protection Trust. The following are factors that contributed to AWWA's recognition of DCR's efforts.

Effective. The source water provided by DCR to MWRA continuously meets the federal standard for unfiltered source water fecal coliform. Components to this success include:

- A bird harassment program at both reservoirs that is a major element in DCR's ability to meet critical water quality parameters.
- A strong understanding of water quality issues throughout the watersheds and reservoirs.
- An excellent track record of planning, entailing periodic updates to the Watershed Protection Plans, Public Access Plans, and Land Management Plans, with appropriate public involvement integrated into the process.
- The ability to control harmful land uses across the watershed system provided by the targeted expenditures of the Land Acquisition Program and implementation of the Watershed Protection Act regulations.
- A team of scientists, labor and craftsmen, planners, engineers, rangers, foresters, educators, and managers who work together to accomplish the 100+ programs and projects identified in each annual Work Plan.

Innovative. DCR's professional staff draws upon the resources of experts and academic institutions to bring the most advanced strategies into its watershed protection programs, such as:

- Research tracking the migratory habits of gulls that will advise components of the bird harassment program.
- Microbial tracking on tributaries to the Wachusett Reservoir that identified the need for educational programs focusing on dog waste.
- Multi-jurisdictional emergency planning, training, and equipment deployment, performed in association with MWRA, state, and local officials.



- Ongoing water quality related education programs at the Quabbin Visitors Center, in watershed community classrooms, out in the field, and on-line.
- Community infrastructure developments that address long-term waste issues, such as the Wachusett Earthday recycling site.
- The Quabbin boat decontamination program, rapidly developed and implemented, which minimizes the threat from invasive aquatic species while allowing private fishing boats on the reservoir.

Perseverance. DCR has a long history of addressing myriad political and logistical challenges.

- Creating a source water protection program that encompasses four watersheds and close to 500 square miles, coordinating with dozens of individual community governments, legislators, and stakeholder groups.
- Working with the citizens of the watersheds, who do not consume the water from either the Quabbin or Wachusett Reservoirs. DCR identifies projects that promote protection of both the locally utilized natural resources as well as the drinking supply for people close to 100 miles away.
- Respecting and honoring the sacrifices made by previous generations that had their communities transformed into a drinking water supply.

At a ceremony in the Division's field headquarters in West Boylston, DCR Commissioner Rick Sullivan heralded the daily efforts of the 150 staff dedicated to Watershed Protection. Division Director Jonathan Yeo recognized the men and women who have worked for the agency as it has evolved over the past century. The Director also praised the support and team efforts of the MWRA, whose ratepayers provide the money for operations, land acquisition, payments in lieu of taxes, and long-term capital investments. The Water Supply Protection Trust's five trustees – MWRA Executive Director Fred Laskey, Katherine Haynes Dunphy, Judith Eisman, William Meehan, and Kathy Baskin (EEA Secretary Ian Bowles' representative) – were also acknowledged for their effective oversight and support of the Division.

DWSP Director Jonathan Yeo proudly displays the AWWA Clean Drinking Water Award with DCR Commissioner Rick Sullivan.

The AWWA award would not have been possible without the commitment and expertise of the Division of Water Supply Protection staff. Commissioner Sullivan and Director Yeo thanked the current employees in the Office of Watershed Management for all of their contributions that help protect some of the best drinking water in the world.

For more information:

www.mass.gov/dcr/watersupply.htm

dcr
Massachusetts

Department of Conservation and Recreation
Division of Water Supply Protection
Office of Watershed Management
251 Causeway Street
Boston, MA 02114
(617) 626-1250

November 2010

Wachusett Reservoir on a crisp fall morning.

The DCR Watershed System at a Glance

Quabbin Reservoir

Maximum Capacity	412 billion gal.
Maximum Depth	151 ft
Elev. Above Sea Level	530 ft
Reservoir Surface Area	39.4 mi^2
Watershed Land Area	187 mi^2

Wachusett Reservoir

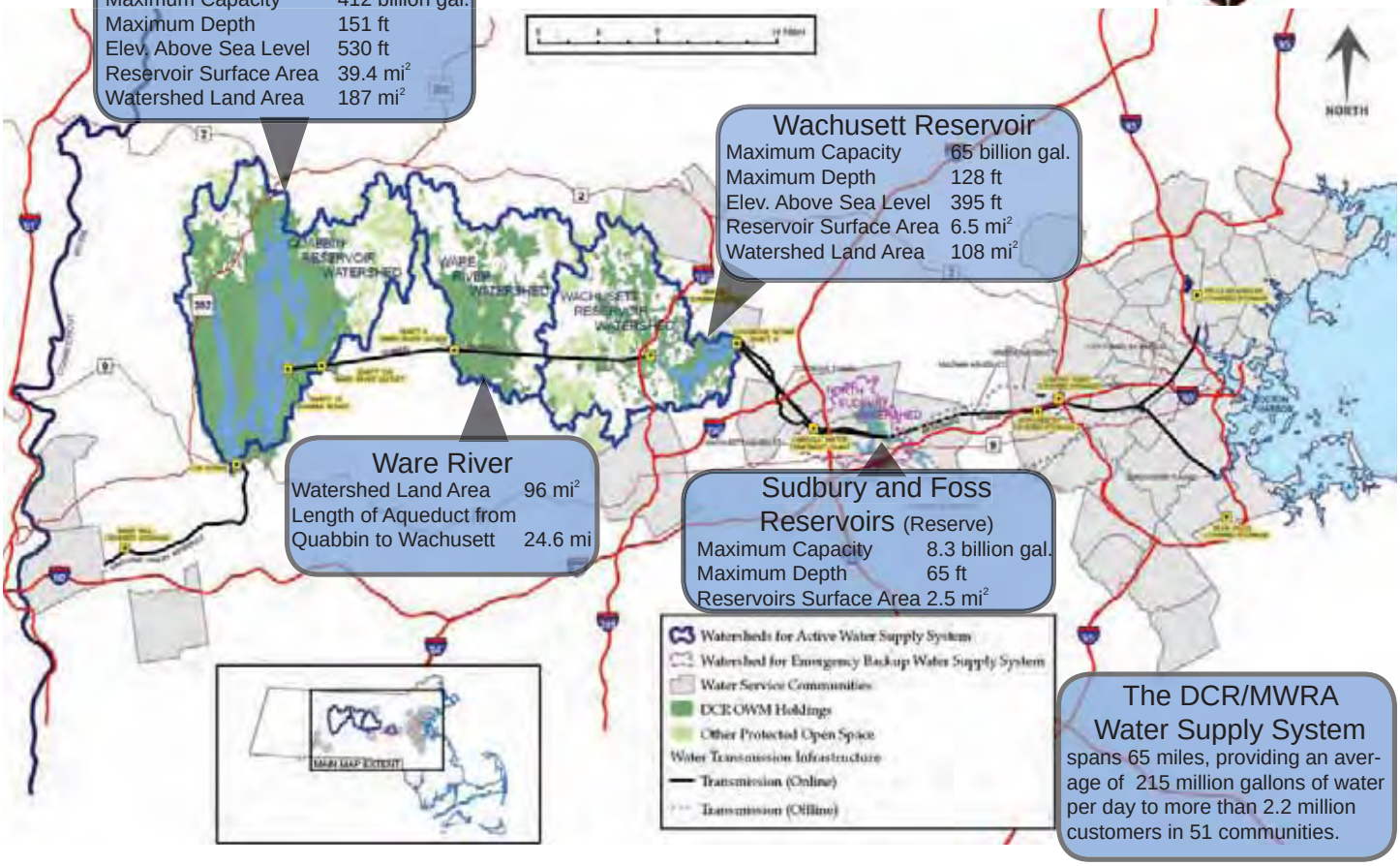
Maximum Capacity	65 billion gal.
Maximum Depth	128 ft
Elev. Above Sea Level	395 ft
Reservoir Surface Area	6.5 mi^2
Watershed Land Area	108 mi^2

Ware River

Watershed Land Area	96 mi^2
Length of Aqueduct from Quabbin to Wachusett	24.6 mi

Sudbury and Foss Reservoirs (Reserve)

Maximum Capacity	8.3 billion gal.
Maximum Depth	65 ft
Reservoirs Surface Area	2.5 mi^2



The DCR/MWRA Water Supply System

spans 65 miles, providing an average of 215 million gallons of water per day to more than 2.2 million customers in 51 communities.

Congratulations and Special Thanks to the DCR Division of Water Supply Protection, Office of Watershed Management 2010 Staff!

Director: Jonathan Yeo. ***Regional Directors:*** Quabbin – Bill Pula; Wachusett – John Scannell.
Assistant Regional Directors: Quabbin – Dave Small; Wachusett – Scott Murphy.
Natural Resource Director: Dan Clark. ***Budget Manager:*** Eileen Honen.
Environmental Quality: Quabbin – Bob Bishop, Rebecca Budaj, Peter Deslauriers, Lisa Gustavsen, Yuehlin Lee, Paul Reyes, Bernadetta Susianti-Kubik; Wachusett – Pat Austin, Kelley Freda, David Getman, Tristan Lundgren, Paula Packard, Larry Pistrang, Steve Sulprizio, Vincent Vignaly, Dave Worden.
Natural Resources: Steve Anderson, Jim French, Kiana Koenen, Thom Kyker-Snowman, Ken MacKenzie, Jillian Pereira, Caroline Raisler, Jim Taylor.
Forestry: Quabbin – Herm Eck, Derek Beard, Dennis Morin, Randall Stone, Steven Ward, Steve Wood; Wachusett – Greg Buzzell, Brian Keevan.
Watershed Protection Act: Quabbin – Jeff Lacy; Wachusett – Nancy McGrath, Allan Rantala; Boston – Joel Zimmerman.
Watershed Engineering: Quabbin – Scott Campbell, Peter Izyk, Douglas Williams, Steve Mansfield; Wachusett – Bill Moulton, Ed Connor, Paula Davison, Ross Goodale.
Administrative and Technical Support: Quabbin – Paul Lyons, Linda Boulette, Sandra Conkey, Philip Lamothe, Kimberly Turek, Jennifer Peterkin; Wachusett – Marybeth Bonin, Craig Fitzgerald, Christine Muir, Christy Power; Boston – Ashley Chan, Joanne Driggs-Williams, Flora Martinez, Paul Penner, Mulunesh Sisay, Cynthia Smith.
Watershed Rangers: Quabbin – Dave Zaganiacz, Peter Baldracchi, Gerard Houle, Jamie Hogan, Tiffany Leclair, John Maslon, Sean McQuaid; Wachusett – Rick Mathews, Derek Liimatainen, Rebecca Baronoski, Bruce Fant, Thomas Gonzales, Tim O'Connor, Benjamin Pollini, Nathan Tobey, Keith Vicari, Dave Wright.
Interpretive Services: Quabbin – Clif Read, Maria Beiter-Tucker, Dale Monette; Wachusett – Jim Lafley, Roger Clifford.
Watershed Maintenance & Operations: Quabbin – Al Walsh, Jeffrey Adams, Bruce Andrew, Steven Baran, Michael Barnes, Ray Cusson, Al Detour, Camille Domina, Randall Florence, Gary Gaines, Laurie Gauvin, Jason Holden, Gordon Humphrey, Allyn Hurlburt, Stephen Jarvis Jr, David Kenyon, John Krasnecky, Chet Krol, Paul Lapierre, Lars Larson, Conrad Letourneau, Thomas Peloquin, Ronald Peters, Frederick Provost, Andrew Ohlson, Donald Sorrenho, Craig Stoddard, Michael Strzemienski, Michael Wisnoski; Wachusett – Mike Tomaiolo, Ronald Anderson, John Buckley, Albert Bull, Robert Carlson, Glenn Cheries, Wayne Chestna, Zack Costa, Brian Dziokonski, Terry Fellowes, Paul Gosselin, Francis Guy, Terance Kearney, Sean Lovejoy, Fred Mellor, George Nelson, Tim O'Connor, Robert Parker, Vincent Pasquale, Ray Pelletier, John Pingeton, Michael Ponyta, Ed Power, Pete Ramig, Paul Silvestri, Dave Simmons, Chris Tuff, Dan Valerio, John Vento, Dan Wolski, Ted Zdonczyk.

Ranger Rebecca Baronoski leads an outdoor aquatic environmental education seminar with the assistance of DCR Aquatic Biologist Jamie Carr.

the water supply. The Rangers are also responsible for the monthly inventory and upkeep of the equipment in the three response trailers that are located around Wachusett Reservoir.

Winter

The unofficial start of winter at the Wachusett Reservoir is the November 30 closing of the fishing season. Even though visitation is low, Rangers are still very busy and active in the field. Once the snow starts, the public continues to recreate on the trails around the reservoir, so patrolling is done on snowshoes and cross-country skis. Snowmobiles are used to cover a lot of ground, checking property boundaries and investigating illegal activity on DCR lands. The Rangers look for signs of prohibited activities such as ice fishing, snowmobiling, property encroachment, dumping, and poaching. There is ongoing coordination with both the State Police and Environmental Police to try to put a stop to these activities.

Watershed Rangers are required to hold their certifications in First-Responder and CPR. In-service training is held during the winter months to re-certify qualifications. Attendance at other training sessions, such as Railroad Safety, Search and Rescue, Boating Safety, and Incident Command, keep the Rangers up to date on public safety issues and techniques.

Year-round Services

In addition to these seasonal patrols, there are a number of year-round, daily responsibilities, including: security inspections of DCR and MWRA buildings and grounds, response to emergency situations on DCR property, reservoir patrols looking for any rule violations, and maintenance of a daily log of all activities and visitor contacts.

The offices for the Wachusett Watershed Rangers, led by Captain Derek Limantainen, are at 506 Wilson St. in Clinton; the phone number is (978) 365-3800. The "Ask the Ranger" column will continue in future editions of *Downstream*, so please send in your questions to rebecca.baronoski@state.ma.us.

Wachusett Watershed Ranger Captain Rick Mathews retired in December 2009 after an exemplary 13-year career with DCR. His love of the outdoors and the environment brought him to DCR as an entry-level Ranger after positions with both Digital Equipment Corp. and New England Power. He quickly rose to a supervisor level and ultimately to the captain's position as the head ranger at Wachusett Reservoir. Rick advanced the role of the Watershed Ranger as an environmental educator who gains rules compliance through user interactions. Rick was also instrumental in developing the emergency response program at Wachusett Reservoir, leading DCR in the post-9/11 world of watershed protection and water supply security. Rick leaves DCR with a proud legacy of a committed, professional Watershed Ranger.

Ask the Ranger

Answers to questions from *Downstream* readers

Q. In *Reservoir Watch* you show reservoir measurements at 526.84' for the Quabbin and 389.81 for Wachusett. Is that depth or above sea level?

A. The reservoir measurements are measured in height above sea level. The Reservoir system is a marvel of late 19th and early 20th Century engineering. This height differential allows an average of 200 million gallons a day to flow by gravity from Quabbin Reservoir through Wachusett Reservoir into Boston. No pumps are used for 100 miles, until there is a need at distribution points around the city.

Q. Why are there logging operations on watershed lands?

A. A primary goal for the Division of Water Supply Protection is to establish and maintain a vigorous, actively regenerating forest, diverse in both species mix and age structure. This watershed protection forest provides a living, green, solar powered, 24 hour-a-day bio-filter that rivals the most responsibly engineered water treatment plant in the efficiency and reliability of its water quality protection, yielding a consistent supply of clean water. Forestry operations have been conducted across the watershed system for decades without creating any water quality problems. DCR Watershed lands are transitioning from a mostly even-aged condition to a forest comprised of inter-mixed, variously-sized patches of at least three age classes. Please visit www.mass.gov/dcr/watersupply/watershed/forestry.htm for additional information.

Continued on Page 6

Ask the Ranger

from Page 5

Q. Why is bodily contact with the water prohibited?

A. The link between water contact activities and the spread of water-borne disease is well documented. Swimming and wading can introduce pathogens, as well as increase nutrients and turbidity. DCR Watershed policy, as described in the Public Access Plans developed for each of the four watersheds in the DCR/MWRA water supply system, prohibits body contact with the source water supplies for more than 2 million people.

Q. I am overwhelmed by the number of agencies who have regulations that impact my property…it seems like a never ending list of town, state, and even federal laws. I know DCR works closely with MWRA, but I'm not clear of their respective responsibilities. It would be helpful to have a brief explanation for each group that regulates the activities on my land, or at least the ones that work with DCR.

A. A basic answer to the first part of this question is that DCR is responsible for providing "pure water" to the Massachusetts Water Resources Authority (MWRA) for treatment and distribution; DCR manages the state-owned property and reservoirs in the watershed system, and the water comes under MWRA control once it enters the distribution pipes. These functions are detailed in a Memorandum of Understanding between the two agencies, whose staff work closely together to ensure safe, high quality drinking water for more than 2 million people. MWRA ratepayers, through the Water Supply Protection Trust, fund DCR's Office of Watershed Management, as well as the long-term financing to maintain the dams.

Public health and safety rely on private landowners meeting myriad local, state, and federal land use and environmental laws. There are differences by each community, so we can't answer this question based on a particular town, but the following are some of the laws that are in effect in the Quabbin Reservoir, Ware River, and Wachusett Reservoir watersheds. They are presented by name, regulation, and agency(ies) that implement the law, as well as a short description. ***Please note that this information is provided for educational purposes only; consult counsel for legal advice.***

Watershed Protection Act (350 CMR 11 – DCR Office of Watershed Management). This law provides important land use restrictions within 400' of tributaries in the DCR/MWRA watershed system. Section 11.09 of these regulations provides additional water quality protections for the entire watershed system.

Wetlands Protection Act (310 CMR 10 – Local Conservation Commission and MA Department of Environmental Protection (DEP)). The law requires careful review of any proposed work that may alter wetlands, as well as land subject to flooding, the riverfront area (added by the Rivers Protection Act), land under water bodies, waterways, salt ponds, fish runs, and the ocean. There may also be additional local wetlands bylaws.

Title 5 (310 CMR 15 – Local Board of Health and DEP). This law controls permitting, designing, siting, installing, and maintaining septic systems.

Endangered Species Act (321 CMR – Department of Fish and Game). The Natural Heritage Program administers these regulations that protect rare species and their habitats.

National Pollutant Discharge Elimination System Stormwater Construction General Permit (33 USC 1251 et. seq. – US EPA). This federal law requires construction activities that disturb one or more acres to obtain a permit for a stormwater pollution prevention plan, including sediment, erosion, and pollution prevention control measures.

There is not enough space in this newsletter to provide a comprehensive description of every possible regulation you may encounter. DEP provides a detailed matrix of the primary environmental state statutes and regulations and the agencies that implement them at www.mass.gov/dep/service/matrix.htm. Every community will also have a unique set of bylaws that govern development, including zoning, land subdivision, and historic preservation. If you have any questions about DCR Watershed Protection Regulations, contact staff in either West Boylston (508-792-7806) or Belchertown (413-323-6921).

Creeping normalcy

from Page 5

Restriction acre (WPR, sometimes called Conservation Restrictions or CRs). Land is purchased by DCR either outright (in fee) or by acquisition of partial interests (WPR), where the private citizen maintains ownership of land committed to conservation.

MWRA has provided $127 million since 1985 to achieve these milestones. Most notably, the Wachusett Reservoir watershed, the least protected and most urbanized basin within the DCR/MWRA system, is now afforded a permanent land protection level of 27.4% of the watershed – up from just 7.9% in 1985. This represents an increase in DCR-protected land – primarily along rivers, streams and aquifers - from 5,700 acres to 19,500 acres.

Important and strategic acquisitions within the Ware River and Quabbin Reservoir watersheds have also bolstered crucially needed protection of tracts flanking numerous drinking water tributaries.

DCR watershed protection has come a long way in 25 years, and there is still much to be accomplished in the land protection arena. DCR will continue its efforts to keep the most water sensitive lands green and pristine, for to be sure, "they aren't making any more of the stuff".

Kids Corner

A Water Supply Jumble

by Jim Lafley, DCR/DWSP Wachusett Education Coordinator

Unscramble the list of eight jumbled words, one letter to each square.

Hint: The jumbled words are all towns and rivers that the Watershed Rangers patrol.

Use the letters in the circle boxes to form two words, fitting in the box at the bottom of the list, which is one of the sources of Boston's water supply.

You will find the Jumble answers at the bottom of this page...no peeking!

Good Luck!

OYEWSNTBNOLS

AEIOUTPXQN

TALITELRSW

ANSUHA

NLIGERST

LDNOEH

RDNUATL

CNONTEPIR

And another thing...

by J. Taylor

"I dunno what it is, but it has appeal"

Jumble Answers West Boylston, Quinapoxet, Stillwater, Nashua, Sterling, Holden, Rutland, Princeton, Wachusett Reservoir

For more information about the Wachusett Rangers:

Watershed Ranger Events
www.mass.gov/dcr/events.htm

For more information about environmental regulations:

Watershed Protection Act
www.mass.gov/dcr/watersupply/watershed/wspa.htm

Wetlands Protection Act
www.mass.gov/dep/water/resources/wetlands.htm
www.maccweb.org

Title 5
www.mass.gov/dep/water/wastewater/septicsy.htm

Endangered Species Act
www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_home.htm

National Pollutant Discharge Elimination System Stormwater Construction General Permit
http://cfpub.epa.gov/npdes/stormwater/cgp.cfm

Matrix of Massachusetts Environmental Regulations
www.mass.gov/dep/service/matrix.htm

Quabbin Cemetery Remembers the Past

by Clif Read, Quabbin Visitors Center

When Quabbin Reservoir was built in the 1930s, about 2,500 people still lived in the Swift River Valley. There were also more than 7,500 known deceased scattered throughout the valley. Thirty four cemeteries in eight towns had to be relocated. Thirteen acres of the 104-acre Quabbin Park was set aside outside the watershed boundary for use as a cemetery, which was formally dedicated in 1933.

Exhumation and reinterment was an awesome, unsettling task. Eventually 6,551 persons were reinterred at the Quabbin Cemetery while another 1,101 were buried in cemeteries in other communities. Careful records were kept of where remains were taken from and where they were reinterred. They are now part of the Vital Records available for public review at the Quabbin Visitor Center in Belchertown.

In addition to headstones and family monuments, town monuments from Dana, Enfield, Greenwich, and Prescott were also moved to a central location in the Quabbin Park Cemetery. Each May, a special Memorial Day Service is held at the Cemetery at the town monuments. The four former Swift River Valley communities taken for the Quabbin Reservoir Project as well as the Veterans are honored. The Services are held the Sunday before Memorial Day and are co-sponsored by DCR, local veterans groups, and the Friends of Quabbin, Inc. All programs are open to the public.

Right: The Enfield Civil War Monument in its original location on the Enfield Town Common, 1937. This location is now under about 100 feet of water.

Far right: The present location of the monument in the Quabbin Cemetery off Rt. 9 in Ware.

downstream

Department of Conservation and Recreation
Division of Watersupply Protection
Office of Watershed Management
180 Beaman Street
West Boylston, MA 01583
(508) 792-7806 ex. 363

Downstream is produced twice a year by the Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection. It includes articles of interest to the Watershed System communities. Our goal is to inform the public about watershed protection issues and activities, provide a conduit for public input and promote environmentally responsible land management practices.

Governor: Deval L. Patrick
Lt. Governor: Timothy P. Murray
EOEEA Secretary: Ian A. Bowles
DCR Commissioner: Richard K. Sullivan Jr.
DWSP Director: Jonathan L. Yeo
Downstream Editor: James E. Taylor

Appendix E:

Silver Lake Stormwater Improvement Project Fact Sheet

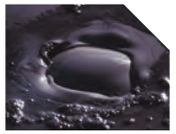
How YOU Can Help!

- Keep litter, leaves, and debris out of street gutters and storm drains. These outlets drain directly to Silver Lake, local streams, and wetlands.

- Don't feed waterfowl! Bread and snack food is harmful to waterfowl and can lead to malnutrition. Feeding waterfowl discourages winter migration, can lead to aggressive behavior, and encourages large bird flocks that degrade the Silver Lake beach and shoreline with droppings.

- Apply lawn and garden chemicals sparingly (if at all) and according to directions.

- Dispose of used oil, antifreeze, paints, and other household chemicals properly. Do not dump these products in storm drains or on the ground!



- Clean up spilled brake fluid, oil, grease, and antifreeze. Do not hose them into the street where they eventually reach Silver Lake or other water bodies.

- Pick up after your pet! Use biodegradable doggie bags to collect pet waste. Don't dispose of pet waste in storm drains.

- Control soil erosion on your property by planting ground cover and stabilizing erosion-prone areas.

- Wherever possible, re-use rainwater for irrigation. Rain barrels are a low-cost way for homeowners to capture and re-use roof runoff for lawn and garden watering.

Contact Information:

The Silver Lake Stormwater Improvement project is a cooperative effort of:

MA Department of Conservation and Recreation
For more information about this project, including opportunities to become involved as a volunteer, please contact:
Sara Cohen (617) 626-1374

The Town of Wilmington
Contact: Jamie Magaldi, Asst. DPW Superintendent (978) 658-4481

Project Partner:
United States Geological Survey

Project funding provided by:
U.S. Environmental Protection Agency - Targeted Watersheds Grant

For more information on **how you can help keep our lakes and ponds clean**, please visit
www.mass.gov/lakesandponds

For more information on **Low Impact Development** stormwater techniques, please visit
www.mass.gov/envir/lid

This brochure was developed by **GeoSyntec Consultants**
289 Great Road, Suite 105, Acton, MA 01720
Phone: (978) 263-9588

The Silver Lake Stormwater Improvement Project

Actions YOU Can Take to Protect Silver Lake

The Silver Lake Stormwater Improvement Project

As part of a restoration project for the Ipswich River Watershed, the Massachusetts Department of Conservation and Recreation and the Town of Wilmington are developing innovative designs to reduce the amount of stormwater runoff entering Silver Lake, improve the lake's quality, and reduce beach closures.

To reduce polluted stormwater runoff from paved surfaces, "porous paving" systems will be installed at the Silver Lake beach parking lot.

"Porous Pavers are permeable alternatives to concrete or asphalt."

Porous Pavers are permeable alternatives to concrete or asphalt. Porous pavers allow stormwater to soak into the ground between paving units, reducing the surface runoff pollution while improving groundwater recharge.

Porous asphalt is similar to standard asphalt, except that the smallest particles have been screened out, allowing water to pass through. Underneath the pavement is a bed of sand and gravel which allows stormwater to slowly percolate into the underlying soil.

Both of these porous paving systems will be part of the Silver Lake parking lot demonstration project.

Low Impact Development (LID) techniques will be used in three stormwater drainage areas.

Attractively landscaped "bioretention cells" and "raingardens" will be used to temporarily retain and filter stormwater using specialized plantings and soils. An important goal of the project is to control stormwater in ways that not only protect water quality, but are an attractive part of the Silver Lake neighborhood.

Raingardens will be constructed on selected residential properties in the Silver Lake neighborhood to promote infiltration and improve stormwater runoff quality.

A planted swale will be installed on the southeastern end of the Town Beach to filter and infiltrate runoff, replacing a stormwater pipe and preventing erosion during large rain storms.

A "pocket wetland" will be created to provide a natural filter where a stormwater pipe currently discharges directly to Silver Lake at Lake Street.

In addition to the above LID techniques, select catch basins in the Silver Lake neighborhood will be improved, including replacement with deep-sump catch basins and infiltrating devices to trap sediment and pollutants and recharge groundwater.

Silver Lake Facts

- Silver Lake is a 28.5 acre "kettlehole lake" formed approximately 15,000 years ago by an ice deposit from a retreating glacier.
- Silver Lake has a maximum depth of 29.5 feet and a volume of approximately 108 million gallons.
- The Silver Lake watershed (the land area that drains toward the lake) includes 132 acres in Wilmington and Tewksbury.
- Silver Lake flows to Lubbers Brook, a tributary of the Ipswich River.
- Silver Lake is located within the Ipswich River watershed, a 155-square mile area encompassing all or part of 22 communities in northeast MA. From its headwaters in Burlington, Wilmington, Andover, Reading and North Reading, this watershed eventually drains to the Atlantic Ocean in the town of Ipswich.
- Silver Lake was once a summer resort destination with its own railroad station. Today, the lake is still a popular local spot for fishing, swimming, boating, and ice hockey.

Appendix F:

Potential Illicit Discharge Detection and Elimination Report

AECOM Environment

Prepared for:
Department of Conservation and Recreation
Boston, Massachusetts

Submitted by:
AECOM
Westford, MA
60138611
April 2011

Illicit Discharge Detection Report

Permit Year 8 - 2010

AECOM Environment

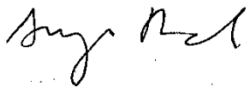
Prepared for:
Department of Conservation and Recreation
Boston, Massachusetts

Submitted by:
AECOM
Westford, MA
60138611
May 2011

Illicit Discharge Detection Report

Permit Year 8 - 2010

Suzy Baird



Prepared By

Theresa McGovern, PE

Reviewed By

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1.0 Introduction

At the request of the Massachusetts Department of Conservation and Recreation (DCR), AECOM Environment (AECOM) developed and performed an illicit discharge detection (IDD) program to identify possible illicit discharge sources in urbanized portions of the DCR's stormwater collection system. This project supports the provisions of Minimum Control Measure No. 3 of DCR's NPDES Small MS4 General Permit. This provision mandates the development and implementation of an illicit discharge detection and elimination plan to identify potentially hazardous releases into the stormwater system and establish the means to eliminate these discharges.

The U.S. Environmental Protection Agency (EPA) defines illicit discharges as any non-permitted discharge to a storm sewer system that is not composed entirely of stormwater. Sources for these flows include direct connections to a sanitary sewer line, piped floor drains from garages or basements, and illegally dumped fluids like motor oil and paint. These discharges can result in serious consequences for the ultimate receiving waterbody, including decreased water quality, the destruction of wildlife habitat, and a decrease in the aesthetic value of the waterbody. Illicit discharges are of particular concern in urbanized areas because of the high concentration of development and industrial and commercial facilities. However, non-permitted discharges that do not carry pollutants are not considered illicit including culverted streams, groundwater seepage, and potable water (Brown, Caraco & Pitt 2004).

Since this program began in 2008, AECOM has performed the following tasks to assess DCR's stormwater systems for illicit discharges:

- Program Year One - 2008
  - Produced a five year inspection schedule and rotation
  - Developed an illicit discharge identification and testing protocol
  - Performed illicit discharge inspections on approximately 20% of the DCR's stormwater systems in urban areas
- Program Year Two – 2009
  - Modified IDD protocol to reflect improvements identified in Program Year One
  - Performed illicit discharge inspections on approximately 20% of the DCR's stormwater systems in urban areas
- Program Year Three – 2010
  - Modified IDD protocol to reflect changes to field testing procedure
  - Modified IDD rotation to reflect new priority areas
  - Performed illicit discharge inspections on approximately 20% of the DCR's stormwater systems in urban areas

The next sections detail the procedure and summarize the results from the IDD Program Year Three.

2.0 Methods

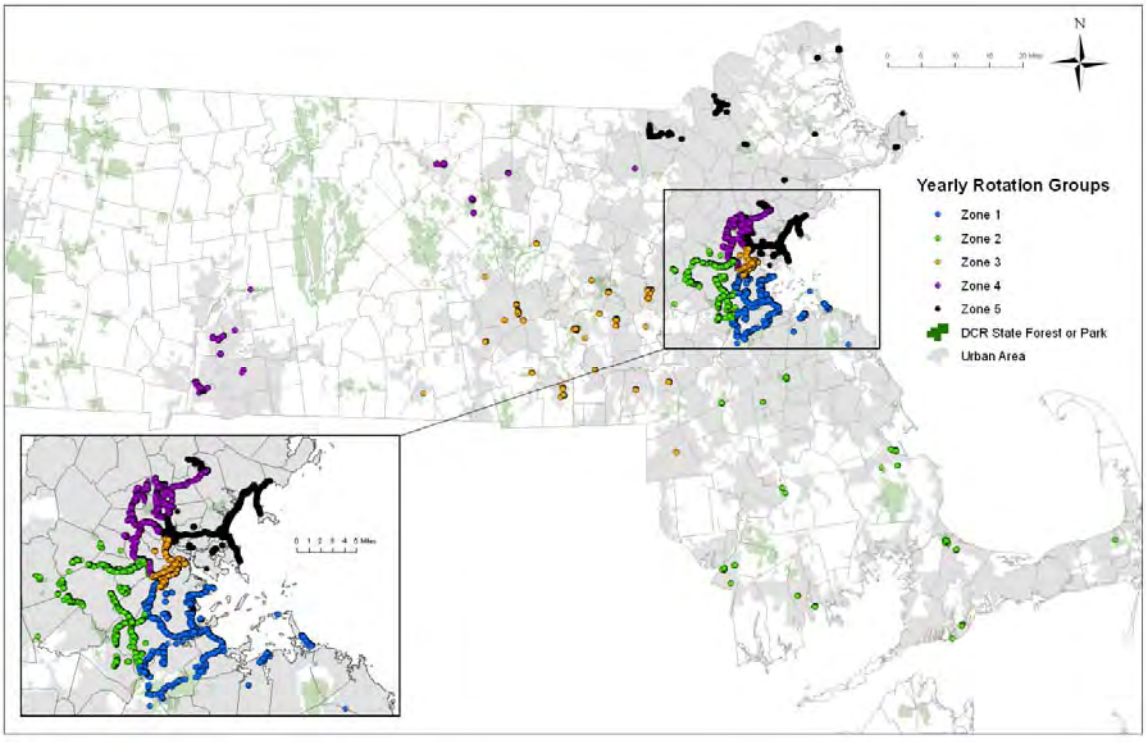
This section presents the methods AECOM used to develop and implement an IDD program for the DCR. In Program Year One (2008), AECOM divided the DCR's urban stormwater systems into five inspection zones, as presented in Section 2.1 and Figure 2-1. The IDD protocol developed in Program Year One was updated in the second and third year of the program to reflect improvements and modifications as explained in Section 2.2. Section 3.0 describes AECOM's results for Program Year Three.

2.1 Five Year Inspection Rotation

In support of NPDES requirements, AECOM designed a rotating schedule to ensure that urban portions of DCR's stormwater systems will be investigated once every five years. AECOM previously mapped DCR's stormwater infrastructure in urban areas using digitized, scanned drainage plans and field recorded global positioning system (GPS) data. Several aspects of these data were analyzed to establish five comparable IDD zones, shown in Figure 2-1, including:

- Spatial continuity
- Number of stormwater features
- Total road miles
- Proportion of data from drainage plans versus GPS surveys

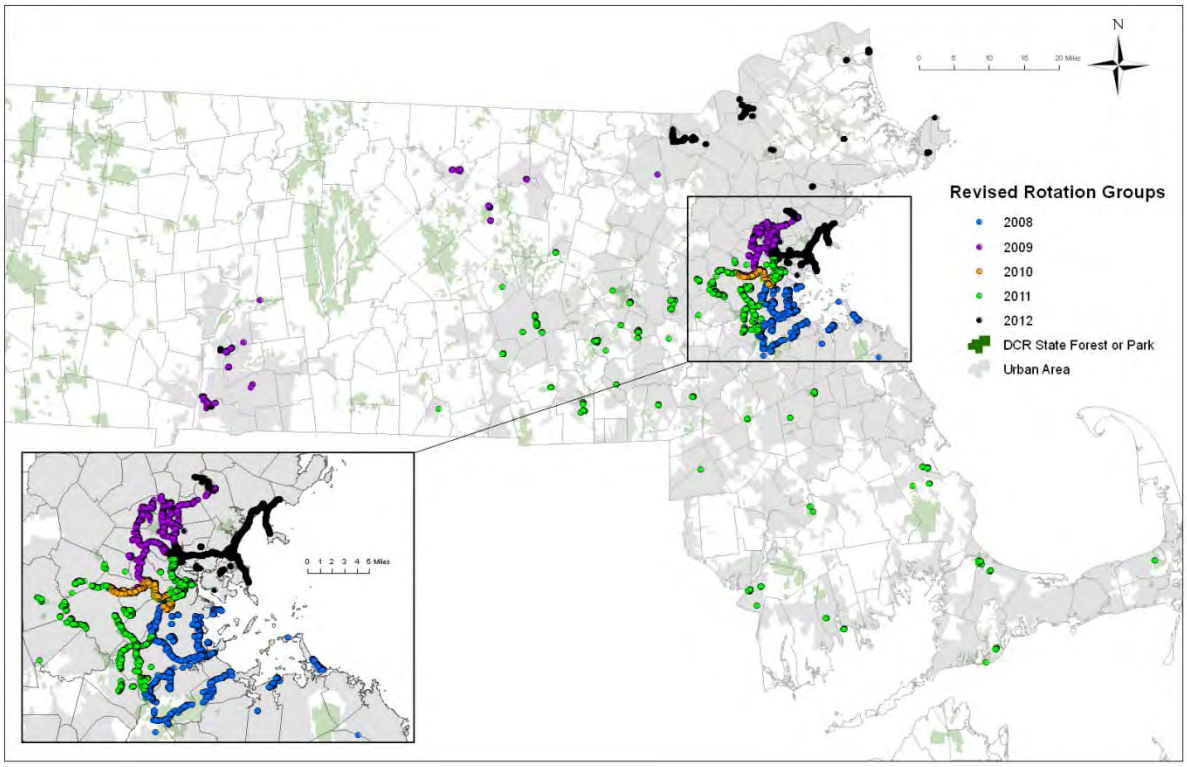
Figure 2-1. Yearly Rotation Groups



Prior to developing an inspection rotation, AECOM examined priority areas listed in the Stormwater Management Plan including suspected illicit connections based on previous site visits and direct discharges to impaired waterbodies. With the DCR, AECOM determined that these priority areas have a state-wide spatial distribution that would hinder IDD program implementation. Therefore, each rotation zone contains stormwater features and road miles grouped by spatial location. Approximately 50 percent of the infrastructure data for each zone are from scanned plan data and therefore have not been field verified prior to AECOM's IDD investigations.

At the request of the DCR, AECOM modified this inspection rotation prior to implementing Program Year Three. The new survey zones prioritized the parkways and parks that drain to the Charles River for the next two years of the field program (Figure 2-2). Due to the highly developed nature of these areas, and increased traffic volume, field crews surveyed fewer stormwater features in 2010 than in 2008 and 2009.

Figure 2-2. Revised IDD Inspection Zones



2.2 Illicit Discharge Detection General Procedure

AECOM performed illicit discharge detection investigations according to the protocol it developed with the DCR in 2008, and revised in 2009 (see Appendix A), based on the Charles River Illicit Discharge Detection and Elimination Protocol, adopted from BWSC (2004) and Pitt (2004). The protocol relies primarily on visual observations and the use of field sampling and analysis using portable instrumentation during dry weather to complete a preliminary inspection and analysis of stormwater systems. AECOM compiled a field analytical kit designed to isolate the general source of a discharge based on its chemical characteristics. This process of testing samples and reviewing results in real-time

provides a significant advantage in allowing field crews to perform further field reconnaissance and potentially identify the source of flow as a sanitary sewer, industrial discharge, or domestic water.

The AECOM team attempted to schedule field investigation activities to occur at times with less than a tenth of an inch of rain in the preceding 48 hours to ensure observed flows were the result of non-stormwater discharges. However, in cases when surveys took place within 48 hours of a rain event, field teams noted any observed flows and noted those stormwater systems for a future visit during dry weather conditions. Using the stormwater system spatial database as a guide, field crews visited each accessible manhole or catch basin in a stormwater system, removed their covers and performed a thorough visual inspection. Notable visual indicators of illicit discharges consisted of dry weather flow, suspicious pipes, or any evidence to suggest potential contamination from intermittent sources. Signs of potential contamination included odors, staining, floatables, and foaming which could indicate the presence of sewage or wash water. Non-debris floatables could also indicate the presence of sanitary sewer water. Flows that field crews determined to be culverted streams or groundwater (by visual observation) were not noted as potentially illicit.

The field crew recorded illicit discharge observations and updates to the stormwater system spatial database in real-time on a hand-held field computer (Panasonic CF-U1 Toughbook). Field crews used a Trimble Pro XT external GPS receiver with sub-meter accuracy connected via Bluetooth technology to the handheld computer to record locations and data. Field crews recorded IDD program data in AECOM-designed data entry forms and associated data tables on the handheld computer using ESRI ArcPad version 8.0. The field computer contained aerial photographs, road maps, and the existing stormwater system data for reference and editing purposes. In areas where the stormwater system had been previously field surveyed, the field crew only recorded IDD program specific observations. When stormwater data was developed from scanned design plans, the field crew took GPS coordinates and updated attributes for features within that system. Following field inspections, illicit discharge records and revised infrastructure data were then downloaded into a Geographic Information System (GIS) to update the DCR's stormwater database.

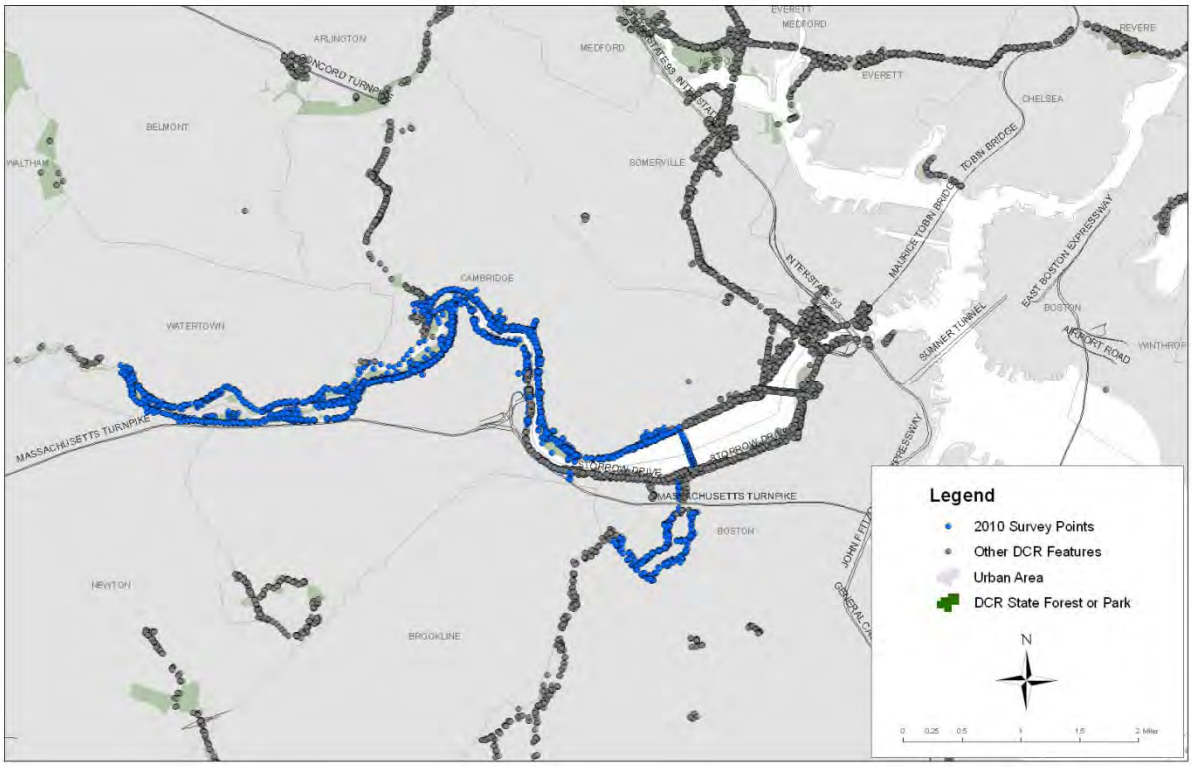
Improvements to the IDD Protocol made prior to the Program Year Two field season included use of the Toughbook hand-held computer, implementing advanced feature symbology, and enhancing data validation tools. These modifications led to the field inspection of nearly 100% of the stormwater features in the Program Year Two and Three investigation areas. A further modification made prior to Program Year Three was to replace the previously used boron test with an anionic surfactant test to identify non-borate based detergent contamination in analyzed flows.

AECOM notified the DCR of observations and sampling results that indicated the presence of an illicit discharge. Evidence of intermittent illicit discharges, including staining and odors, noted during the field effort are recorded in DCR's stormwater database and will be available to future field and maintenance crews to help identify potentially problem areas.

3.0 Results

AECOM implemented the IDD protocol outlined in Appendix A, commencing field investigations of the DCR's stormwater systems on May 18, 2010. The effort focused on the DCR parks and parkways located along the Charles River, including the Charles River Reservation, a large sprawling park that lines a majority of the Charles River, and several smaller parks (Figure 3-1) along with Ashland State Park. Major roads surveyed in this area included Storrow Drive, Memorial Drive, Charles River Road, Nonantum Road, Soldier's Field Road, Birmingham Parkway, Greenough Boulevard, Park Drive, and the Fenway. This section presents AECOM's inspection activities and results.

Figure 3-1. Program Year Three Survey Area



NOTE: Features surveyed in Ashland State Park not included on figure

3.1 Sample Location Statistics

During the 2010 field season, AECOM field crews investigated over 1,600 stormwater features, mostly along the Charles River. Work was conducted in five cities and towns on 29 miles of roadway, as shown in Table 3-1.

Table 3-1. Summary of Work by Town

Town	Features	Roads (miles)
Ashland	23	*
Boston	955	17
Cambridge	455	7
Newton	59	1
Watertown	133	4
Total	1,625	29

*Features in parks only

Within this zone, crews inspected 1,625 features for indications of illicit discharges.

Table 3-2 shows the breakdown of stormwater features by type. The stormwater systems were comprised primarily of catch basins, manholes, outlets and inlets, but also include other features such as yard drains, drywells, and oil/grit separators.

Table 3-2. Summary of Investigated Features

Feature	Total
Catch basins	986
Manholes	379
Outlets	222
Inlets	13
Other	25
Total	**1,625**

3.2 Flow Results

Field crews collected samples from 10 features with flow and field tested the discharge for a series of analytes according to the IDD protocol, described briefly in Section 2.2 and outlined in Appendix A. Table 3-3 details the visual observations, analytical results, and recommendations for each suspected illicit discharge.

Table 3-3. Summary of IDD Analyte Results

Figure	Feature ID	Flow	Turbidity	Floatables	pH	Temp (°F)	Surfactants (mg/L)	Ammonia (mg/L)	Potassium (mg/L)	NH_4/K Ratio	Fluoride (mg/L)	Potential Source	Justification	Recommendation
Not Likely Illicit														
-	11952	1/4 Full	None	None	6.9	66.9	0.13	0.0	1.0	0.0	0.00	Natural water	Low surfactant, low fluoride	No action necessary
-	11956	Trickle	None	None	NT	45.3	0.13	0.0	4.0	0.0	0.07	Natural water	Low surfactant, low fluoride	No action necessary
-	21536	1/4 Full	None	None	6.5	65.1	0.20	2.0	3.0	0.7	0.23	Natural water	Low surfactant, low fluoride	No action necessary
Possibly Illicit														
3-3	3171	Trickle	None	Oil Sheen	6.8	66.4	0.37	1.0	5.0	0.2	0.31	Washwater	High surfactant, low ratio	Visited within 48 hrs of rain event; revisit during dry weather. TV inspection
3-4	12174	Trickle	None	None	7.6	71.8	0.12	2.0	3.0	NT	1.10	Tap or irrigation	Low surfactant, high fluoride	Inspect manhole structure for pipe and/or damage; if pipe is found, follow upstream to source on private property
3-5	19196	Trickle	None	None	7.3	61.7	0.25	0.0	2.0	0.0	0.32	Washwater or tap or irrigation	Borderline surfactant, high fluoride, low ratio	Visited within 48 hrs of rain event; revisit during dry weather. Follow up with property owners to determine extent of system and investigate further upstream
3-6	19571	Trickle	None	None	7.7	63.1	0.13	0.0	5.0	0.0	0.26	Natural or tap or irrigation	Low surfactant, borderline fluoride	Visited within 48 hrs of rain event; revisit during dry weather. Revisit and inspect for deterioration and work with property owners to determine potential illicit connection
3-7	20036	Trickle	None	None	7.6	66.9	0.40	0.0	18.0	0.0	0.63	Washwater	High surfactant, low ratio	Contact park staff about sprinkler and fountain source in park
3-8	20057	Trickle	None	None	7.7	70.5	0.50	0.0	5.0	0.0	2.30	Washwater	High surfactant, low ratio	Follow up with private property owner
3-9	21250	Trickle	None	None	6.8	68.2	0.12	2.0	9.0	0.2	0.31	Tap or irrigation	Low surfactant, high fluoride	Visited within 48 hrs of rain event; revisit during dry weather

NT=Not tested

Based upon field analytical test results and field observations, AECOM crews categorized flows as either possibly illicit or not likely illicit. Figure 3-2 shows the procedure used to characterize flow samples from chemical analysis results based on the Charles River Illicit Discharge Detection and Elimination Protocol. In general, high surfactant levels indicate a wastewater source (sanitary sewer or washwater contamination, depending on ammonia to potassium ratio); low surfactant and high fluoride levels indicate a tap or irrigation source; and low surfactant and fluoride levels indicate a natural water source. Field tested temperature and pH, as well as visual inspection of the flow and stormwater system, also contributed to flow characterization.

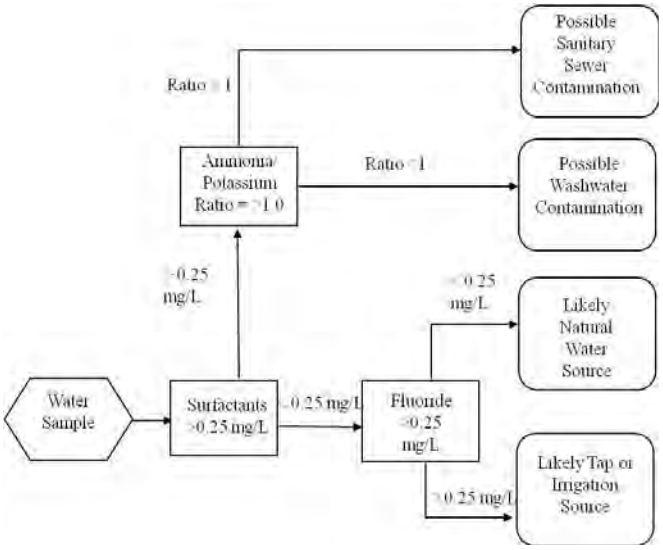


Figure 3-2 Field Analysis Flow Chart

Stormwater features noted by the field crew as having suspect characteristics such as odors or staining, but no dry weather flow, are not summarized in this report but can be identified through the stormwater infrastructure database.

3.3 Summary of Suspected Illicit Discharges

The following figures summarize the results of the analytical tests and field observations for the discharges determined by the field crew to be possibly illicit. The summaries include:

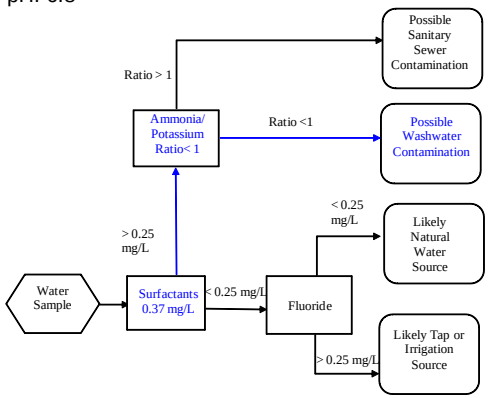
- Feature location
- Associated stormwater system
- Descriptions of the discharge
- Suspected source
- Recommended actions
- Photograph of feature

Figure 3-3.
Summary for Feature 3171
Nonamtum Road, Brighton, MA
Inspection Date: 5/21/2010

Flow observed in catch basin 3171 originating from the direction of an upstream catch basin, although no flow observed in that feature. Testing indicated potential washwater contamination due to a high surfactant level and low ammonia/ potassium ratio. Observed flow potentially related to precipitation of 0.89" 2 days prior.

IDD Test Results:

Days since last rain event: 2, (0.89")
Temperature: 66 F
pH: 6.8

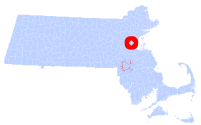


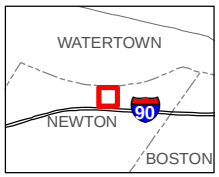
Potential Source:

-Recent precipitation
-Mid-pipe connection

Recommended Actions:

-Revisit during dry weather conditions
-TV inspection





- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

dcr

AECOM

Note: Red features represent observed dry weather flow path

Catch basin 3171

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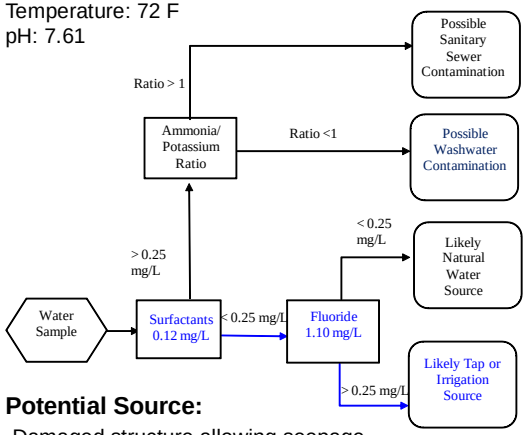
Figure 3-4.
Summary for Feature 12174
River Street,Cambridge, MA
Inspection Date: 6/17/2010

Dry weather flow observed at outfall 34353 and traced upstream to manhole 12174 on River Street in Cambridge. Flow was a colorless, odorless trickle; unable to discern if a pipe enters manhole or if the structure wall was cracked and allowing seepage. Low surfactant and high fluoride levels indicate a tap or irrigation water source. The flow originated from the north; vicinity of a Shell Gas station and Riverside Press Park (not DCR property).

IDD Test Results:

Days since last rain event: 5, (0.18")
Temperature: 72 F
pH: 7.61

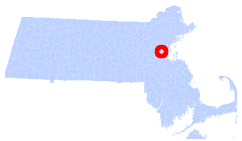


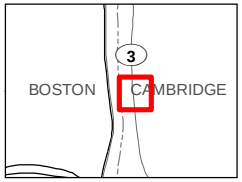
Potential Source:

-Damaged structure allowing seepage
-Connection to gas station or park or other domestic/ irrigation source

Recommended Actions:

-Inspect manhole structure for pipe and/or damage
-If pipe is found, follow upstream to source on private property





- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

Outfall 34353

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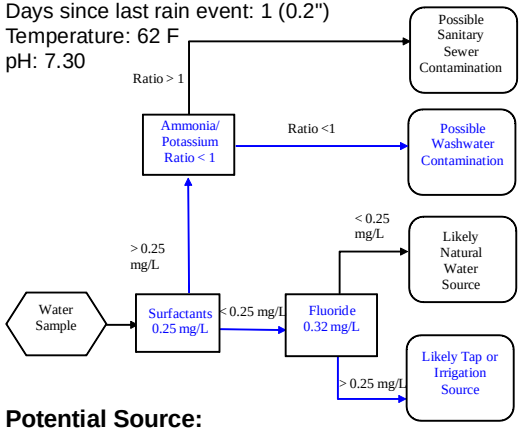
Figure 3-5.
Summary for Feature 19196
Mt. Auburn Street,Watertown, MA
Inspection Date: 5/28/2010

Colorless, odorless dry weather flow was observed in manhole 19196 on Mt. Auburn Street in Watertown. One day prior, a 0.2" precipitation event occurred. Borderline surfactant, high fluoride, and low ammonia/ potassium results indicated a tap, irrigation, or wash-water contamination source. The flow entered the manhole via a pipe in the direction of Mt. Auburn St. Downstream the flow connected to a concrete storage vault. A brick building complex was noted upstream across Route 16.

IDD Test Results:

Days since last rain event: 1 (0.2")
Temperature: 62 F
pH: 7.30

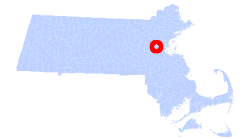


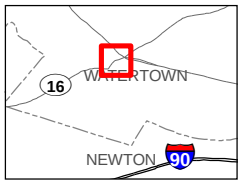
Potential Source:

-Tap, irrigation, or washwater from private property

Recommended Actions:

-Revisit during dry weather conditions
-Follow up with town and/or propery owners to determine direction and extent of system
-Investigate upstream to determine if source is a natural culverted stream, an illicit connection, or possibly both (an illicit connection to a culverted stream)



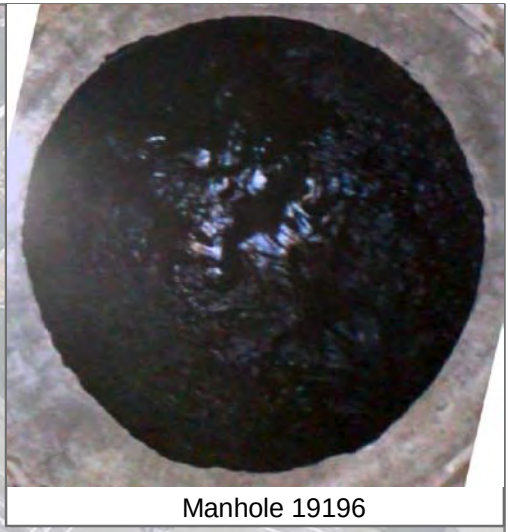


dcr

AECOM

- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path



Manhole 19196

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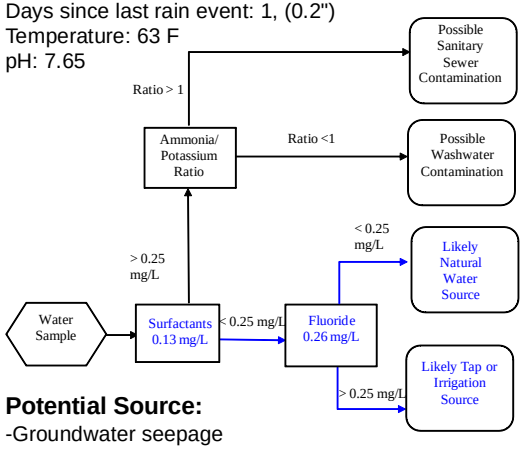
Figure 3-6.
Summary for Feature 19571
Charles River Road, Watertown, MA
Inspection Date: 5/28/2010

Colorless, odorless dry weather flow observed in manhole 19571 on Charles River Road in Watertown. The system continued upstream off of DCR property. No potential source noted and no flow observed in pipes upstream of the manhole. Low surfactant and borderline fluoride levels indicated a possible tap, irrigation, or natural source. One day prior, a 0.2" precipitation event occurred.

IDD Test Results:

Days since last rain event: 1, (0.2")
Temperature: 63 F
pH: 7.65

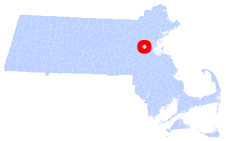


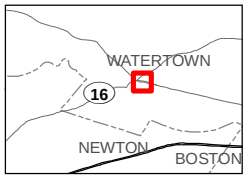
Potential Source:

-Groundwater seepage
-Tap or irrigation water from a nearby business

Recommended Actions:

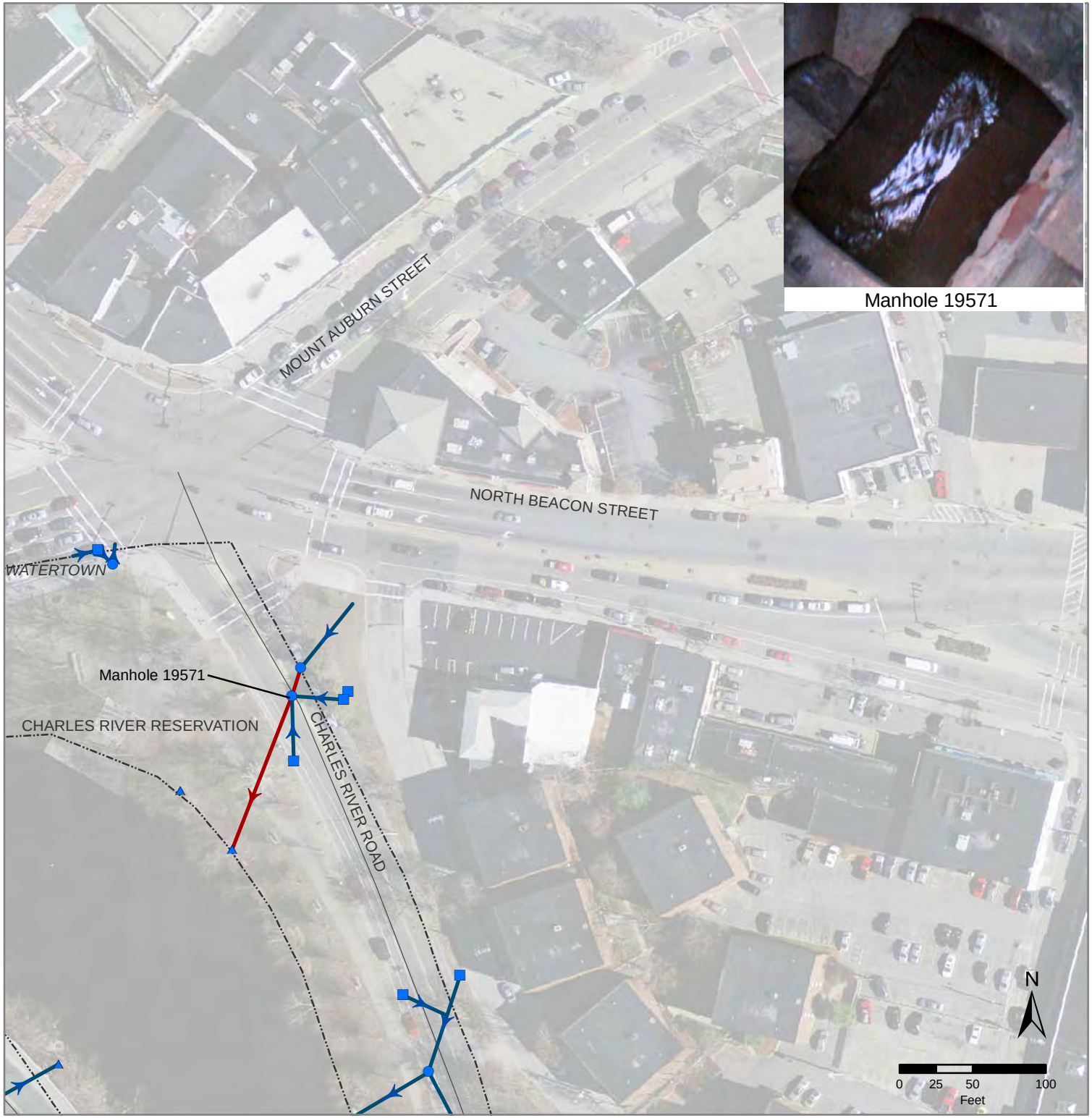
-Revisit during dry weather conditions
-Inspect pipe/manhole for deterioration and seepage into system
-Work with adjacent property owners to determine potential illict connection





- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path



Manhole 19571

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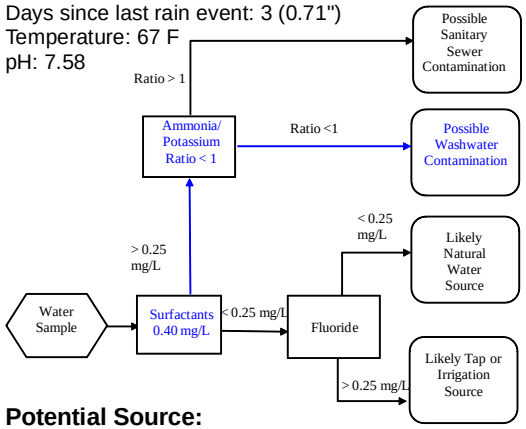
Figure 3-7.
Summary for Feature 20036
Memorial Drive, Cambridge, MA
Inspection Date: 6/9/2010

Observed dry weather flow in a Kennedy Park/ Charles River Reservation system on Memorial Drive in Cambridge. Discovered and sampled flow at manhole 20036 and followed upstream. Two sources identified: catch basin with flow from sprinklers and overflow drain from nearby fountain. High surfactant and low ammonia/ potassium ratio indicated a possible washwater source, and high fluoride indicated a possible tap or irrigation source, consistent with the fountain/sprinkler observations. The field team did not identify any potential sources for washwater contamination.

IDD Test Results:

Days since last rain event: 3 (0.71")
Temperature: 67 F
pH: 7.58

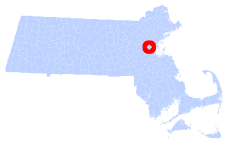


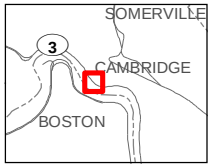
Potential Source:

-Flow from park sprinkler system (observed)
-Overflow from park fountain

Recommended Actions:

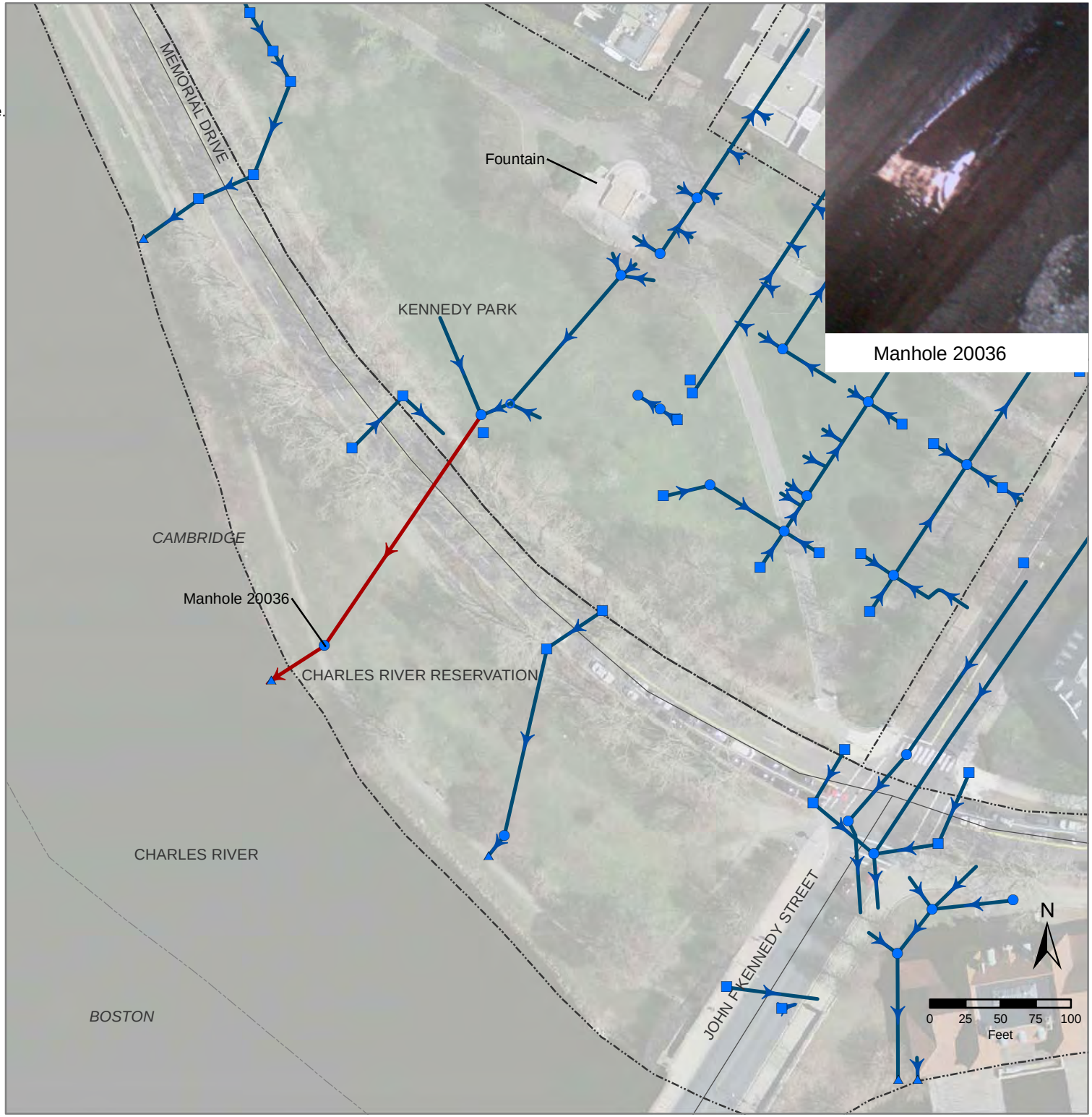
-Contact park staff about sprinkler and fountain sources in park





- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path



Manhole 20036

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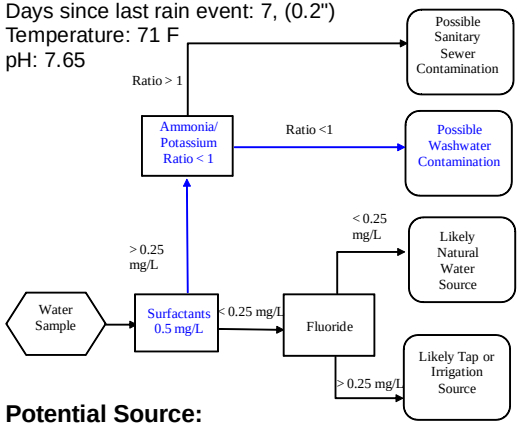
Figure 3-8.
Summary for Feature 20057
Soldiers Field Road,Boston, MA
Inspection Date: 5/26/2010

Observed dry weather flow (trickle) in manhole 20057 on Soldier's Field Road in Boston. The system originated upstream from private property. No potential source was observed. High surfactant and low ammonia/potasium ratio indicated possible washwater contamination.
No flow observed in the manhole or outfall downstream; flow may have dissipated en route.

IDD Test Results:

Days since last rain event: 7, (0.2")
Temperature: 71 F
pH: 7.65

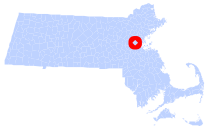


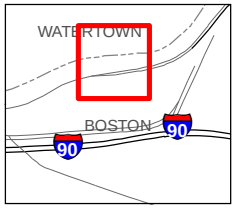
Potential Source:

-Washwaster contamination from business on private property.

Recommended Actions:

-Follow up with private property owner to determine upstream source.





- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

dcr

AECOM

Note: Red features represent observed dry weather flow path

Manhole 20057

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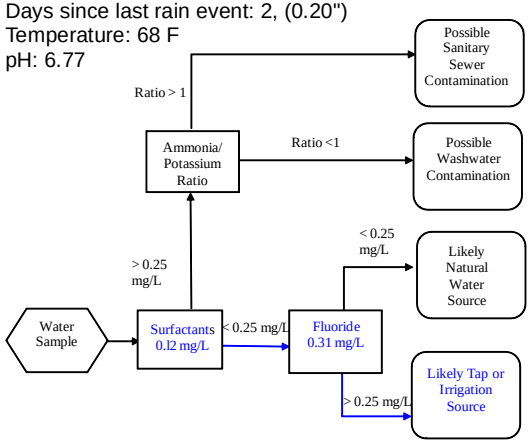
Figure 3-9.
Summary for Feature 21250
Community Rowing Center, Boston, MA
Inspection Date: 5/21/2010

Flow with orange precipitate observed in outfall 21250 near Community Rowing Center in Boston. Low surfactant and high fluoride indicated potential tap or irrigation source. The observed flow could be related to precipitation of 0.20" 2 days prior. Water draining from boats associated with the Rowing Center may be another potential source.

IDD Test Results:

Days since last rain event: 2, (0.20")
Temperature: 68 F
pH: 6.77

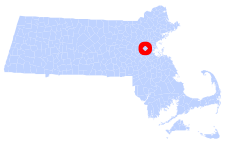


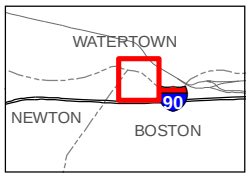
Potential Source:

-Recent precipitation
-Water draining from boats

Recommended Actions:

-Revisit during dry weather conditions





dcr

AECOM

- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

Outfall 21250

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4.0 Discussion and Conclusion

The AECOM field team collected samples from 10 flows within the 2010 survey area. For three of the locations, analytical results of the samples and field observations suggested a natural water source for the discharge, such as groundwater seepage into the stormwater system. Analytical results and field observations suggested that seven identified flows were potentially illicit discharges.

AECOM recommends further investigation of the seven potentially illicit discharges, including additional follow up visits and extended surveys of the stormwater system in conjunction with adjacent property owners to identify, characterize, and eliminate the potentially illicit flows. In cases where flows originated from or continued onto property not owned by DCR, DCR will need to work with local municipalities or private landowners to address the suspected flows.

The field teams surveyed four of the potentially illicit flows (Feature 3171, Figure 3-3; Feature 19196, Figure 3-5; Feature 19571, Figure 3-6; Feature 21250, Figure 3-9) less than 48 hours after rain events greater than 0.1 inches. Therefore, these samples may have consisted of stormwater runoff; AECOM recommends that these features be reevaluated under dry weather conditions to verify the presence of the discharge.

The flow at Feature 20036 (Figure 3-7) originated from Kennedy Park, a DCR owned property in Cambridge. The AECOM field team identified two potential sources for the flow including irrigation water draining into a catch basin and overflow from a nearby fountain, however, the high surfactant results in the sample suggest potential washwater contamination. AECOM recommends that the DCR work with Kennedy Park staff to identify any potential sources of detergent into the system.

It was unclear in the field if the flow observed at Feature 12174 (Figure 3-4) was the result of a discharge from a hidden pipe or from groundwater seepage through the deteriorated manhole barrel. The high fluoride value suggests that there was input from a tap water or irrigation source. Although this discharge would not be considered illicit according to EPA standards, DCR has the option to follow up with the adjacent business owner and the City of Cambridge to determine if there is a known cross connection with the city water line or consistent runoff from irrigation activities.

The flow at Feature 20057 (Figure 3-8) originated off of DCR property. AECOM recommends that the DCR work with the private property owners to further characterize the flow to determine the source and eliminate the discharge.

The Illicit Discharge Detection Program developed in 2008 and improved upon over the last two field seasons allowed AECOM field crews to efficiently and safely investigate 1,625 features on over 29 miles of highly urbanized roadway during Program Year Three. Field crews identified potentially illicit flows at seven out of the 1,625 features, or 0.43%. This occurrence of illicit discharges is similar to the low rates observed in Program Year One (0.19%) and Program Year Two (0.63%) and suggests that the Charles River area is not more likely to have illicit connections despite the highly developed nature of the surrounding neighborhoods.

5.0 References

Boston Water & Sewer Commission, 2004. *A Systematic Methodology for the Identification and Remediation of Illegal Connections.* 2003 Stormwater Management Report, chap 2.1.

Brown. E., D. Caraco, and R. Pitt. 2004. *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments.* Center for Watershed Protection, Elliott City, MD. http://www.epa.gov/npdes/pubs/idde_tableofcontents.pdf

Pitt, R. 2004 Methods for Detection of Inappropriate Discharge to Storm Drain Systems. *Internal Project Files.* Tuscaloosa, AL, *in* The Center for Watershed Protection and Pitt, R,, Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and *Technical Assessments:* Cooperative Agreement X82907801-0, U.S. Environmental Protection Agency, variously pages. Available at: http://www.cwp.org.

Datasheet for Trimble GPS Pathfinder ProXH Reciever. Trimble Navigation Limited, Westminster, CO. available at http://www.trimble.com/pathfinderproxh.shtml

Datasheet for Panasonic CF-U1 Toughbook, Panasonic Corporation of America, available at http://catalog2.panasonic.com/ webapp/wcs/stores/servlet/ModelDetail?storeId=11201&catalogId=13051&modelNo=Toughbook-U1

Edwards, P. 2007. HACH DR/890 Colorimeter Procedures Manual, 8th edition, HACH Company, Loveland, CO.

Appendix A

Standard Operating Procedures

DCR Illicit Discharge Detection

Field Investigation

Standard Operating Procedure

Summer 2010

1.0 Site Characterization Notes

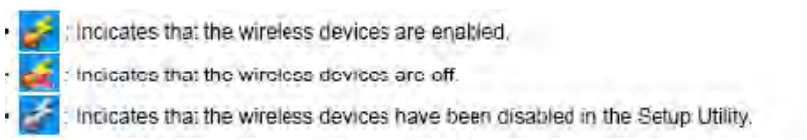
- Review stormwater infrastructure map of area and determine most effective approach for IDD survey.
- Establish safe working area using traffic control contractor and state police detail.
- Open stormwater feature and confirm/update attributes in database for both points and lines. If from plans you will be prompted to collect a GPS location for the feature.
- If change point location then also need to move line endpoints.
- Deleted features Points: Delete box set to yes, feature should disappear once map is refreshed
- Deleted features Lines: actually delete features by selecting and deleting
- Duplicate points: Choose which one is "more right" and update that feature. Set the duplicate feature to Delete "yes" and in the Notes include the ENSR_ID of the "right" feature we are keeping.
- If a feature does not appear on the GPS unit, create a new feature and enter attributes. A GPS point will automatically be collected for point features.

2.0 GPS Notes

- To open program, either choose Button 1 or click on IDDE shortcut folder and choose the map file.
- Bluetooth trouble shooting: The GPS should automatically connect. Note that it may take a few minutes. Try the following actions:

  <u>On Computer:</u>

  - Check GPS Preferences:
    - Protocol-- NMEA 0183
    - Port-- COM Port 40
    - Baud Rate-- 4800
  - Check to see if the Wireless Switch is turned on



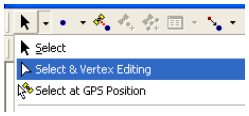
  <u>On GPS Reciever:</u>

  - Make sure GPS receiver is on and Bluetooth is activated (blue light slowly flashes) If not, press and hold power button for >5 seconds to turn on Bluetooth

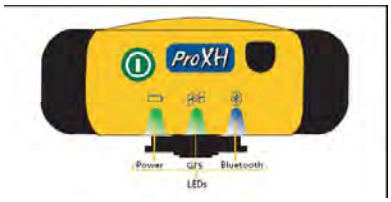
- Camera instructions: Choose Button 2 or Start>Programs>AMCap

- Will save picture to folder with shortcut on desktop

- Must be in editor mode to change point/record data and must click “OK” to save GPS form.



- To edit pipes, choose the vertex editor. Digitize pipes from upstream to downstream.
- The GPS unit must be turned off during lunch and at the end of the day to save battery.
- The GPS unit needs to be charged every night; either in the office or at home (make sure you have the charger).



During operation, the LEDs provide the following status information:

LED	Color	Mode	Status
Power	Green	Solid	Good
	Red	Short flash[1]	Low
	Amber	Short flash	Charging
	Amber	Solid	Fully charged and on external power
GPS	Green	Long flash[2]	Generating positions
	Green	Rapid flash[3]	Too few satellites or poor geometry
Bluetooth	Blue	Waiting heartbeat flash[4]	Activated and waiting
	Blue	Long flash	Activated and connected
	Blue	Off	Bluetooth has not been activated or has been turned off
	Blue	Toggle flash[5]	Bluetooth toggled on and off event

[1] Short flash - one flash ever three seconds
[2] Long flash - one flash per second
[3] Rapid flash - two flashes per second
[4] Waiting heartbeat flash - one flash every three seconds
[5] Toggle flash - five short flashes over two seconds

3.0 Illicit Discharge Detection Steps

1. Examine stormwater feature for dry weather flow.
2. If no flow is present look for signs of potential contamination from intermittent sources (staining, floatables, foam etc.), input observations on the IDD page of the GPS form and photograph the evidence (noting the photo filename in the IDD record).
3. If dry weather flow present don latex gloves and safety glasses and collect a water sample using the remote collection device. Use caution to only sample the dry weather flow and avoid sampling water from the sump.
4. Immediately measure pH and temperature using the YSI pH10. Record the results, along with physical observations of the flow, on the GPS form.
5. Cap, label with feature ENSR ID and store the sample jar. Note on the maps and in the field book the location of any samples taken.
6. Photograph the discharge and note the photo name any additional relevant information on the GPS form. Save the GPS data by clicking “OK”.
7. Continue to survey the remaining features of the system. Trace the dry weather flow upstream until the source is discovered, the drainage comes from off DCR property, or the flow disappears.
8. Collect, label and retain the most upstream water sample of the dry weather flow. The previous downstream flow samples are not required and can be emptied into the stormdrain.
9. Once the most upstream location of the discharge has been identified, edit the feature point which will create another IDD record for that feature, perform chemical analysis on this sample and enter the new temperature and sample analysis results in the form.

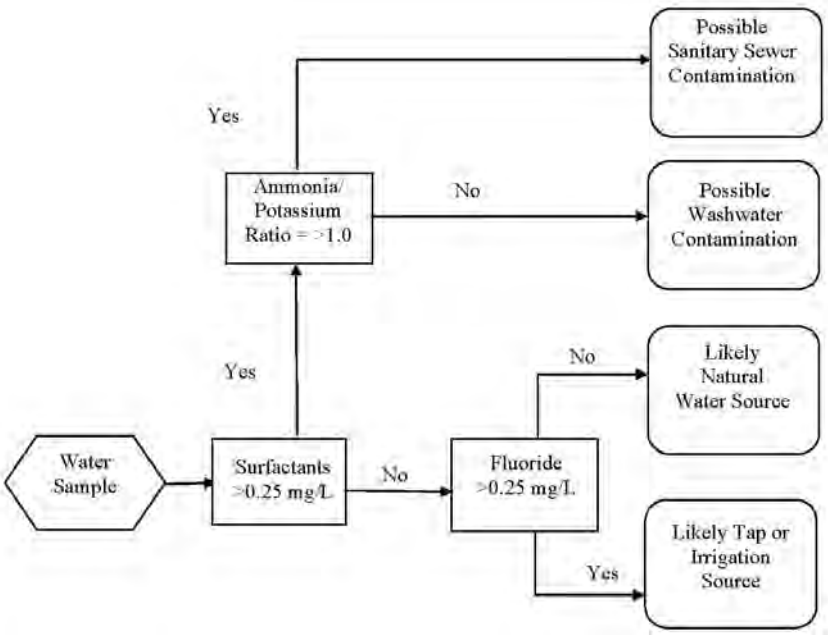
4.0 Calibration of Equipment

- Kaitlin Hartman will calibrate the YSI pH10 weekly and record the calibration results in the field notebook.
- The Horiba Compact Ion meter must be calibrated using the 1-point calibration before use (max once per day) and record the calibration results in the field notebook.
- The 2-point calibration for the Horiba Compact Ion meter should be preformed once a month and record the calibration results in the field notebook.

5.0 Chemical Analysis Steps

1. Temperature and pH of the sample is taken a second time preceding the testing.
2. For Ammonia and Fluoride, test using the DR/890 Colorimeter and follow the appropriate HACH procedures included in the field kit. For Potassium, test using the Horiba Compact Ion Meter. For Surfactants use the Detergents detection kit and follow appropriate procedures in the field binder.
3. Press the “Ratio” button the GPS form to calculate the NH_3/K Ratio for comparison with the benchmark.

4. Visually inspect surroundings and note the land use, buildings and utilities in the area. Also note any non-stormwater surface water; landscaping, irrigation, streams, etc.
5. If possible, determine the likely source of the discharge using the chemical results, physical conditions, visual observations and the information on Tables 1 and 2.
6. Notify Theresa McGovern or Aaron Hopkins about the location, characteristics and likely source of any illicit discharges encountered during the survey.



6.0 Contaminated Equipment and Disposal

- All samples and liquids exposed to testing chemicals must be stored in an appropriate waste holding container for proper disposal and ***not*** discharged back into the stormdrain.
- Any remaining sample which has not been tested can be placed back into the stormdrain.
- Contaminated testing supplies should be rinsed once with tap water and separated from the remaining equipment. Place the rinse water in the waste container for proper disposal.
- Residuals from the Surfactants analysis must be placed in a Ziploc bag, and secondly contained in a plastic Nalgene container labeled “surfactants waste”. This waste will be transferred in Westford to a holding container and contained in a chemical waste cabinet to later be disposed of appropriately.
- Supplies which need to be used multiple times per field day must be thoroughly cleaned. Wash twice with tap water then a third time using deionized water.
- At the end of the day, properly dispose all chemicals down a sink drain with running water to dilute. If appropriate, the waste container can be emptied directly into a sewer main in the field.

- Before reuse, all used equipment should be thoroughly washed with Liquinox detergent in the office, rinsed three times and allowed to air dry.

Appendix G:

Utility/Drainage Tie-In Permits

DRAINAGE TIE-IN PERMITS ISSUED IN PERMIT YEAR 8		
Permit #	LOCATION	SOURCE
P#23473	Dedham Blvd	PJ Hays
P# 23481	Cambridge	SEA
P#24507	Mystic Valley Parkway	EWE
P#24555	Woodland Rd.	MWRA
P#24556	Neponset Valley Parkway	BWSC
P#24558	Lynn Fells Parkway	Melrose, City of
P#24563	Charles Gate Yacht Club	?
P#24577	Centre St. Boston	Atlantic
P#24583	Quincy Shore Drive	VHB
P#24608	Lynn Fells Parkway	Melrose, city of
P#24613	Memorial Drive	?
P#24594	Birmingham Parkway	BWSC
p#23462	JFK Park	MWH
P#23487	Dedham Parkway	P.J. Hays+ Amer. Berghol;
P# 23489	?	BWSC
p#24500	Gillis pump station, MWRA	
P#24515	Canton	Fed. Corp.
P#24617	Charles Gate West	BWSC

Appendix H:

Ipswich River Fact Sheet – Green Roof

dcr
Massachusetts

IPSWICH RIVER WATERSHED ASSOCIATION

Ipswich River Targeted Watershed Grant Fact Sheet:

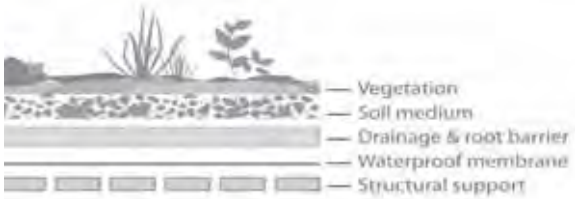
Green Roof Case Study

Prepared by:

Massachusetts Department of Conservation and Recreation and The Ipswich River Watershed Association

What is a green roof?

A green roof is a rooftop that is covered with plants. Most green roofs involve a layered system that commonly includes (from bottom to top): a waterproof membrane; a drainage layer and root barrier; lightweight soil; and hardy, drought-resistant plants. Different types of green roofs may be chosen, depending on the steepness of the roof, the building's ability to sustain the added weight, the primary purpose of the green roof, and the maintenance requirements of the plants. Plantings can include trees and shrubs, especially where the green roof is intended to be used as garden space, but more often lighter-weight and lower-maintenance plants - such as Sedums, grasses, and mosses - are selected because they are drought tolerant, able to grow in shallower soil depths, and do well in sunny locations.



Dominated by succulent Sedums, green roofs need very little water or fertilizer and can survive temperature extremes.

What does a green roof do?

Rain water soaks into green roof soils. From there it is either taken up by plants, evaporates to the air, or slowly drains off the roof. In contrast, rain on conventional roofs drains off quickly and in larger amounts, typically picking up contaminants from the roof before it is discharged to the ground. Once on the ground, large runoff volumes from conventional roofs can cause flooding, erode soil, pick up more pollutants, destabilize river banks and slopes, and deposit sediment and other contaminants in lakes and streams. The lower volumes and slower release of runoff from green roofs greatly reduce these problems.

Green roofs serve many other functions. They insulate buildings from heat loss in the winter and heat gain in the summer, which in turn reduces the heating and cooling costs of the buildings. Green roofs can also extend the life of the underlying roofing materials by protecting them from ultraviolet light, temperature extremes, and harsh weather. In urban areas, green roofs can help reduce air temperatures during very hot days because green roofs absorb less solar energy than traditional black roofs. The plants can also trap the harmful contaminants found in dust particles. Finally, green roofs are attractive and provide natural habitat for birds, butterflies, and other small wildlife.

Despite the many benefits of green roofs, they are heavy, usually adding a minimum of 15 lbs per square foot, but possibly adding as much as 150 lbs per square foot, if larger trees and shrubs are planted. As a result, green roofs must have stronger structural support than a conventional roof. Additionally, green roofs are likely to require some maintenance over their life, especially during the first few years, as the plants establish.

Ipswich green roof case study

The case-study green roof was constructed in September 2006 on an existing roof (top) and is home to at least 10 species of flowering plants (bottom). The roof area is 3,000 ft^2 and the weight is 20 lbs. per ft^2 (saturated).

As part of a demonstration project funded by the United States Environmental Protection Agency (USEPA) under a cooperative agreement, the Massachusetts Department of Conservation and Recreation worked with the North Shore Housing Trust (now Harborlight Community Partners) to construct a green roof in the town of Ipswich, Massachusetts. The building was historically used both as a factory and a school, and the North Shore Housing Trust had undertaken the effort of renovating the building and converting it to affordable senior housing. With assistance from the cooperative agreement, the green roof was incorporated into the redevelopment plans. For more information about the cooperative agreement, funded under the USEPA Targeted Watersheds Grant Program, please see the last page of this publication.

The 3,000-square-foot green roof was constructed with the following layers: a waterproof membrane, a plastic drainage layer, a fabric root barrier, and a 3-inch layer of specially engineered soil (crushed clay and organic matter). Low-growing, drought-tolerant species were planted, including 8 varieties of Sedum (*Sedum spp.*), chive (*Allium schoenoprasum*) and fame flower (*Talinum calycinum*). The structure of the original roof was sufficiently strong to bear the added weight of this green roof, without the need for structural enhancements.

Project Lead: Massachusetts Department of Conservation and Recreation (MA DCR)
Project Funding: U.S. Environmental Protection Agency (USEPA)
Project Host/Partner: The North Shore Housing Trust (subsequently merged with Harborlight Community Partners)
Project Design: K. J. Savoie Architecture
Project Installation: Magco Inc., A TectaAmerica Company
Green Roof Maintenance: Apex Green Roofs
Data Collection and Analysis: U.S. Geological Survey (USGS)

Monitoring study and research question

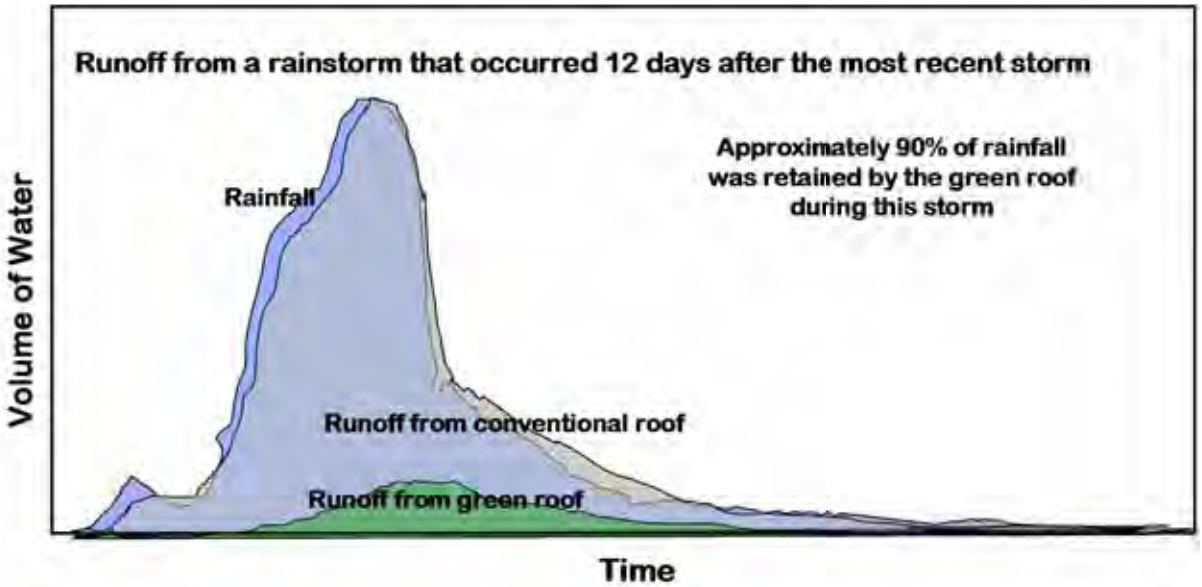
Does the demonstration green roof reduce stormwater runoff and pollution?

DCR contracted with the U.S. Geological Survey (USGS) to compare the quality and the quantity of the stormwater running off the green roof to that running off the conventional rubber roof on the adjacent building, Ipswich Town Hall. Both the green roof and the Ipswich Town Hall roof were fitted with flow gauges (to measure the rate and volume of runoff) and water quality samplers (to collect runoff for chemical analysis). A rain gauge was also installed on the Ipswich Town Hall roof to collect rainfall and keep track of total rainfall amounts. Rainfall and runoff from the two roofs were monitored for 18 months over 2007 and 2008. In all, 70 storms were analyzed for runoff volume, and 5 storms were analyzed for water quality. Contaminants investigated included nitrogen and phosphorus compounds and heavy metals.

Water quality monitoring station below the green roof— Photo: DCR

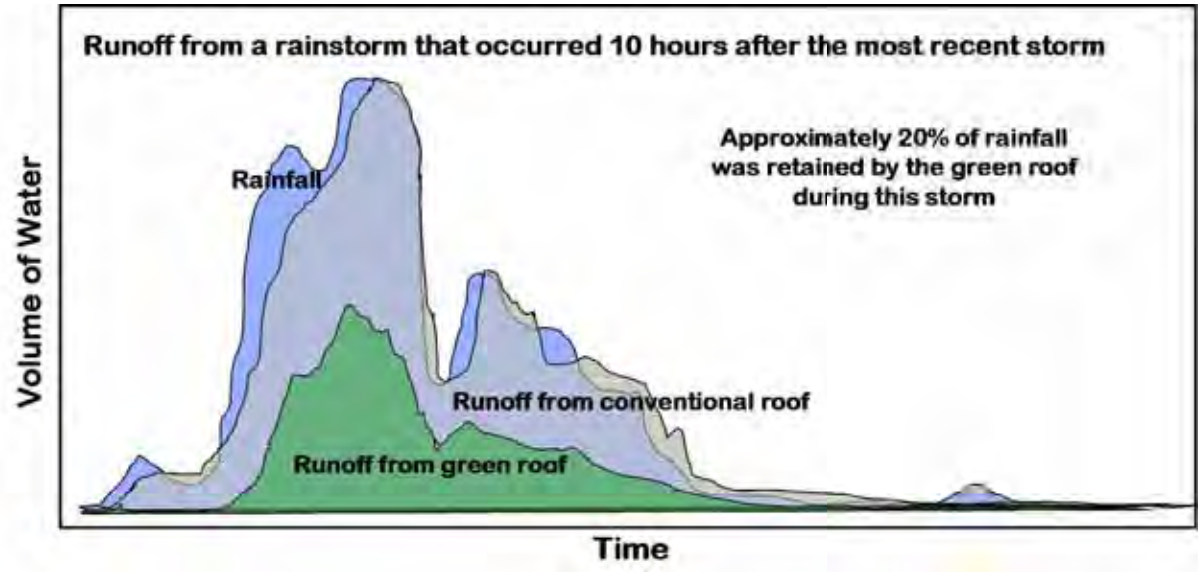
Water quantity findings

Overall, the green roof was very successful at capturing and holding water. Almost 100% of the rain falling on the Town Hall roof ran off quickly, whereas the green roof captured anywhere from 20% to 100% of rainfall in the soil, where it was taken up by plants or evaporated. The amount of rain captured by the green roof varied depending on how long it had been since the last storm. The longer the period of dry weather before a rainstorm, the drier the soil and the greater the volume of rainwater the green roof could absorb. Overall, the green roof retained over 50% of the rainfall from most storms. The green roof also delayed and slowed down the rate of runoff, releasing water slowly over several hours. Even when the green roof was still wet from a previous storm and could not hold much more water, runoff from new storms was often delayed by an hour or more. This type of delay and slow release reduces erosion and helps moderate spikes in flows that can damage stream channels and increase flooding.



This unitless conceptual graph shows that 90% of rainfall was retained by the green roof during a storm that occurred 12 days after the most recent storm. The amount of rainfall retained by green roofs depends, in part, on the period of dry weather preceding the storm.

Water quantity findings (continued)



This unitless conceptual graph shows that only 20% of rainfall was retained by the green roof during a storm that occurred 10 hours after the most recent storm. The green roof retained less rainwater in this case, because the soil was still holding water from the previous storm.

Water quality findings

Nutrients: Both the green roof and Town Hall roof runoff had measurable levels of nitrogen and phosphorus. Likely sources of these compounds include dust particles in the air ("atmospheric deposition"), leaves and pollen from nearby trees, and bird and insect droppings. Runoff from the green roof, however, tended to have higher levels of phosphorus compounds than the Town Hall roof, suggesting that organic matter in the green roof soil and the fertilizer that was applied to help the plants establish may have served as additional sources of phosphorus. Though fertilizer was applied at the time of construction and the following two summers, it is not expected to be used once the plants are fully developed.

Nitrogen and phosphorus compounds are called "nutrients" because they aid in plant growth. They are considered pollutants because when high levels of these nutrients are washed into water bodies, they lead to an overgrowth of plants and algae, which can reduce water clarity and the amount of oxygen available for fish and aquatic wildlife.

Metals: The amounts of heavy metals detected in the runoff from the two roofs seemed to reflect differences in roofing and drainpipe materials on each roof. For example, the building with the green roof retained the original copper flashing, and the runoff from this roof contained high levels of copper. Similarly, the older drainpipes used at Town Hall are suspected to contain lead, and the runoff from the Town Hall roof had high levels of lead. While these results do not necessarily help us understand the effect of green roofs on heavy metal contamination in general, they do highlight the importance of building materials as contributors of heavy metals in stormwater. The soil used on the green roof was also found to contain trace amounts of copper and zinc, elements which were found in this study.

Overall: The greatest water quality benefit of green roofs comes from stormwater retention—when the annual volume of rainfall that runs off a roof is reduced, the contaminants associated with that rainwater are also reduced. The findings from this study suggest that pollutant loads from green roofs may be even further reduced by selecting appropriate roofing and soil materials and using fertilizers sparingly.

Things to keep in mind

Groundwater recharge: In some areas, the primary danger to streams and wetlands is groundwater levels becoming too low. Groundwater replenishes streams and wetlands between rain storms, and when levels drop significantly, stream flow can drop too low to support fish and wildlife. Dropping groundwater levels can also lead to the drying of wetlands, which provide critical habitat to many species of plants and animals. Such conditions can occur when not enough rainfall is able to soak into the ground, because of extensive areas of pavement and rooftops. In these areas, rather than retain rain water on roof tops through green roofs, it can help the nearby streams and wetlands more to direct roof runoff to areas where it can soak into the ground, "recharging" groundwater levels. **Green roofs are most appropriate in areas where the primary dangers to streams and wetlands are flooding, erosion, and pollution.**

New versus existing buildings: Because of the increased weight of a green roof, buildings require greater structural support for a green roof than for many conventional roofs. Installing sufficient structural support at the time a building is being constructed can be more practical and less expensive than increasing the structural capacity of a roof already in place. **Therefore, from a cost perspective, green roofs are generally most appropriate in either new construction projects or on existing buildings that already have sufficient structural capacity for a green roof.**

Choosing the right system: Green roof technologies range from pre-planted modular systems to roofs in which the membrane, soil, and plants are assembled on site. The costs and practicality of different technologies depend on the roof size and slope, as well as installation and maintenance constraints. The following factors can also play a role: public access and safety, aesthetics, building codes, and historic designation. **A system should be chosen and designed based on the particular needs and opportunities of a site.**

Fertilization: While fertilization may be necessary in the first few years to establish the plants, care should be taken to minimize fertilizer application and choose fertilization techniques that minimize runoff of excess nutrients. **Green roofs should ideally be designed to thrive without any added fertilizers, once plants are established.**

The Ipswich River Targeted Watershed Grant

In 2004, through its Targeted Watersheds Grant Program, the United States Environmental Protection Agency (EPA) provided $1 million through a cooperative agreement to the Massachusetts Department of Conservation and Recreation (DCR) to demonstrate and study practices to help conserve water, reduce storm water pollution, and increase groundwater recharge throughout the Ipswich River watershed, in northeastern Massachusetts. Under this cooperative agreement, four low impact development (LID) and five water conservation projects were undertaken by DCR in cooperation with EPA, the United States Geological Survey (USGS), eight municipalities, the Ipswich River Watershed Association, and other cooperating partners. The projects were designed to (1) implement and quantify the benefits of LID and water-conservation techniques and (2) evaluate the impact of wide-spread application of these techniques throughout the watershed, using computer modeling simulations. Additional funding for this work was provided by DCR; USGS; the Ipswich River Watershed Association; and the towns of North Reading, Reading, Topsfield, and Wilmington. In-kind support was provided by DCR; the towns of Hamilton, Ipswich, Middleton, North Reading, Reading, Topsfield, Wilmington, and the city of Peabody; AquaSave LLC; the Martins Companies; the North Shore Housing Trust (since merged with Harborlight Community Partners); and Rainwater Recovery.

This is one in a series of three fact sheets that describes the work conducted under the cooperative agreement. The complete series includes:

- **Ipswich River Targeted Watershed Grant Fact Sheet: Green Roof Case Study**
- **Ipswich River Targeted Watershed Grant Fact Sheet: Water Conservation Case Studies**
- **Ipswich River Targeted Watershed Grant Fact Sheet: Three Low-Impact Development Case Studies**

For more information on the Ipswich River Targeted Watershed Grant, including links to study results and other publications, please visit:

http://www.mass.gov/dcr/watersupply/ipswichriver/index.htm.

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, and dams, whose mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources. To learn more about DCR, our facilities, and our programs, please visit www.mass.gov/dcr. Contact us at mass.parks@state.ma.us.

Commonwealth of Massachusetts
Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Executive Office of Energy and Environmental Affairs
Ian A. Bowles, Secretary
Department of Conservation and Recreation

This publication was developed, and the work described in this publication was funded, under Cooperative Agreement No. WS – 97117501 awarded by the United States Environmental Protection Agency to the Massachusetts Department of Conservation and Recreation. EPA made comments and suggestions on this publication intended to improve its technical accuracy. EPA does not endorse any commercial product or service mentioned in this publication.

Appendix I:

Ipswich River Three LID Case Studies

dcr
Massachusetts

IPSWICH RIVER WATERSHED ASSOCIATION

Ipswich River Targeted Watershed Grant Fact Sheet:

Three Low-Impact Development Case Studies

Prepared by:

Massachusetts Department of Conservation and Recreation and The Ipswich River Watershed Association

Low Impact Development (LID) overview

Low impact development (LID) describes an array of land planning and development practices that manage stormwater and reduce pollution to streams, lakes, wetlands, and coastal areas. A key objective in LID is designing a landscape so that the movement, treatment, and storage of stormwater are similar to what occurs on a natural landscape. To meet this objective, engineers and developers design and install stormwater treatment practices that allow rain water to soak into the ground ("infiltrate") close to where it falls, and make use of soil and plants to filter and absorb stormwater. Sound LID design involves the preservation of natural areas, especially those in low-lying places that naturally collect stormwater, and the grading of the landscape to disperse runoff from roofs, roads, and parking areas into existing natural areas or specially planted areas (called "rain gardens" or "bioretention" areas). In areas where pavement is required, strategies are used to minimize the area of pavement, and, in some cases, to use permeable paving materials that allow stormwater to infiltrate into the ground.

Stormwater-related problems LID can help address:

By promoting infiltration of stormwater, reducing overland runoff, and protecting vegetated areas, LID practices can help reduce each of the problems below, typically associated with conventional development:

Groundwater Depletion: Groundwater enables streams to continue to flow between rain storms and keeps wetlands saturated. When extensive paved surfaces and rooftops prevent rain from replenishing groundwater, stream and wetland levels can drop, endangering fish and wildlife.

Flooding: When rain water is unable to soak into the ground, the large volumes of runoff can exceed the ability of storm drains, culverts, and streams to transport it during large storms, potentially causing these structures to fail and inundating roads and other developed areas.

Erosion: When stormwater cannot soak into the ground, it runs over surfaces in large quantities at high velocity, removing topsoil, scouring stream banks, and destabilizing slopes.

Nonpoint Source Pollution: When stormwater flows directly over land, it picks up sediment and other pollutants from sources such as pet waste, fertilizers, and automobile by-products that can contaminate streams, lakes, wetlands, and coastal areas.

LID considerations for new development

Architects, builders and planners have many options when incorporating LID into new construction projects. One of the most effective strategies is to leave as much of the land as possible undeveloped, by clustering buildings together on only a portion of the available land and establishing legal protections that ensure the undeveloped parts of the parcel remain in their natural condition. Also, during site excavation, underground drywell systems can be installed to store rooftop runoff until it can slowly absorb into the ground. Roads and driveways can be designed to be shorter or narrower than found in typical construction to reduce the area of paved surfaces. Also, by eliminating curbs or adapting their design, planted road edges and parking lot islands can be used to collect and infiltrate stormwater, which reduces or eliminates the need for catch basins and underground storm drain systems.

Some LID design strategies require waivers from local zoning, land use, or building regulations which were often put in place before the benefits of LID were well understood. As a result, incorporating LID into new development may require spending longer periods of time, and sometimes more money, during the permitting phase of a project. These costs are often recuperated during the construction phase, because dispersed, natural stormwater treatment systems are generally less costly to build than centralized, conventional stormwater infrastructure. Also, as the benefits of LID become increasingly recognized, local, state, and federal regulations are being revised to provide incentives for LID design choices and make it easier and less costly to obtain approvals for these designs. Like all stormwater treatment practices, LID practices need to be maintained in order for them to perform optimally. The expected lifespan of the practices and the cost and time associated with maintenance should be clearly understood and planned for, during design.

New developments can save open space by clustering homes and minimizing paved surfaces.

LID considerations for retrofitting existing development

Opportunities to use LID in areas where development and critical infrastructure already exist can be challenging. In these cases, catch basins and storm drains have usually been installed to flush stormwater directly into nearby streams and wetlands. A primary LID retrofit strategy is to redirect stormwater away from existing storm drains and toward natural or constructed planted areas, where it can infiltrate into the ground or be taken up by plants. Subtle changes to site grading or small alterations of road edges may be all that is required to change stormwater flow paths. LID strategies can also be incorporated into existing development by replacing traditional pavement with "pervious" paving materials, designed to allow stormwater to soak through, into the ground. (However, if the underlying soils are severely compacted, that will limit the infiltration of stormwater.) In areas where groundwater replenishment isn't a critical concern, another LID option is installing vegetated roof tops, called "green roofs," on buildings that are structurally capable of handling the load. This not only reduces stormwater runoff, but can insulate the building, provide pockets of habitat for birds or insects, and improve views from neighboring buildings. However, by intercepting rainfall, green roofs can also reduce the amount of rainfall that replenishes groundwater. For more information on green roofs, see Ipswich River Targeted Watershed Grant Fact Sheet: Green Roof Case Study.

Installing rain gardens along streets to collect runoff is a common retrofit.

Retrofits may be more expensive than incorporating LID into new construction because builders must work around or upgrade existing drainage systems. LID retrofits may be most cost-effective to install if major reconstruction is already planned for a site. In many cases, LID retrofits in highly developed areas will not be able to treat and infiltrate all the runoff from larger storms. As a result, LID retrofit features are often designed to direct stormwater that exceeds their capacity back into the traditional storm drain system. As with LID in new development areas, LID practices in retrofit areas need to be maintained in order to perform optimally, and the expected lifespan of the practices and the cost and time associated with maintenance should be understood and provided for before construction begins.

Ipswich River Targeted Watershed Grant Case Studies

A watershed is an area of land in which all surface and most ground water flows downhill to a common point, such as a river or stream outlet, lake, or estuary.

As part of a demonstration project designed to showcase practices that can help improve low-flow and water quality conditions in the Ipswich River and its tributaries, the Massachusetts Department of Conservation and Recreation (DCR), with funding from the United States Environmental Protection Agency (EPA) under a cooperative agreement, implemented four LID case study projects. The purpose of the projects was to assess, quantify, and demonstrate the benefits of LID. Three of the LID projects are described in this fact sheet. The fourth, a green roof, is the subject of a separate fact sheet: Ipswich River Targeted Watershed Grant Fact Sheet: Green Roof Case Study. For more information about the cooperative agreement, funded under the EPA Targeted Watersheds Grant Program, please see the last page of this publication.

The Ipswich River Watershed, in northeastern Massachusetts, has suffered from extreme low-flow condtions in recent decades.

Partridgeberry Place LID Subdivision

Project Lead: Massachusetts Department of Conservation and Recreation
Project Funding: U.S. Environmental Protection Agency
Project Partner/Developer: The Martins Companies
Project Design/Engineering: Meridian Associates
Data Collection and Analysis: Geosyntec Consultants

Partridgeberry Place is a new residential development in Ipswich, Massachusetts, which showcases many important LID design principles, providing an opportunity to study the impact of these design features on stormwater runoff. Using a design by Meridian Associates, the Martins Companies built Partridgeberry Place as a "cluster development" on a 38-acre parcel.

Clustering refers to setting aside a portion of a buildable parcel – using deed restrictions or other legal measures – to ensure that it remains undeveloped, in exchange for increasing the density of the layout of the buildings and roads on the rest of the parcel. This often saves money by reducing the total cost of land clearing, site grading, and road infrastructure and provides aesthetic and environmental benefits associated with protecting natural areas.

At Partridgeberry Place, twenty houses are clustered on 0.2-acre lots around a small wooded hill, and 28 acres of woods behind the houses were left undeveloped and protected as conservation land. In addition to the cluster design, these LID features were included in the original design:

- Front, side, and rear setbacks to property lines are 10 ft., 10 ft., and 5 ft., respectively – much less than in the original one-acre zoning.
- All 20 homes share a common septic system, eliminating the need for septic fields on each lot.
- Pavement is minimized by the cluster design and by using narrow roads (18 ft.) and very short driveways (approximately 20 ft.).
- All rooftop stormwater drains to drywells, and from there infiltrates directly into the ground, rather than becoming surface runoff.

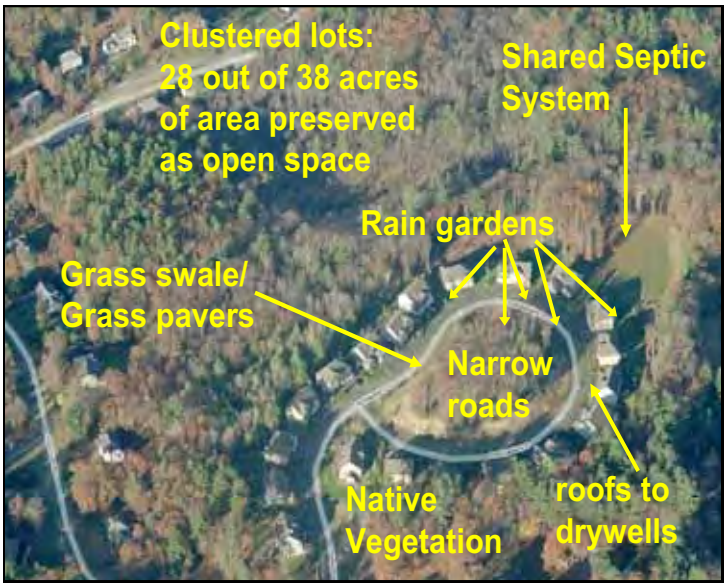
Lots in Partridgeberry Place are clustered to maximize open space.

During construction, DCR contracted with the Martins Companies to include these additional LID strategies:

A "grass paver" swale was installed along one side of the street. Grass pavers are a plastic matrix imbedded in the soil that prevents it from becoming compacted and impermeable to stormwater by heavy foot traffic or vehicles. (Note: Since the completion of the monitoring study, this practice has been replaced with a cobble road edge.)

A large raingarden was installed to capture any runoff from the grass swale that does not infiltrate through the grass pavers, providing another opportunity for this stormwater to infiltrate, before overflowing into a detention pond.

Three lots in Partridgeberry Place include rain gardens to collect and absorb rain falling on the driveway.



LID Features at Partridgeberry Place. (Note: Since the completion of the monitoring study, the grass pavers have been replaced with a cobble road edge.)

Monitoring and Modeling

DCR contracted with Geosyntec Consultants to study surface runoff at the site, a process that involved taking physical measurements and using a computer model to evaluate runoff patterns. To measure the volume and rate of stormwater runoff, flow gauges were placed at the inflow and outflow points in all the major stormwater management features around the property. Additionally, a flow gauge was installed in a forested part of the property to measure stormwater flow in the undisturbed or "predevelopment watershed" condition. Lastly, a rain gauge was installed on site to track all rainfall during the study period. Data were collected for 44 storms of various sizes during the summer of 2008.

Using the data collected from the site, Geosyntec Consultants developed a computer model that could simulate and compare how much runoff would be produced from the following four conditions:

- **The Pre-developed Condition:** The whole 38-acres is fully-forested.
- **The LID Subdivision:** Partridgeberry Place as it was built, with cluster design and LID features.
- **A Cluster-Only Subdivision:** A 20-house subdivision with clustering identical to Partridgeberry Place, but with conventional stormwater management features, such as curbs and catch basins, instead of LID features (i.e., no roof drywells, swales, or rain gardens).
- **A Conventional Subdivision:** A 20-house subdivision with 1-acre lots for every house and conventional stormwater management features (e.g. curbs and catch basins). No clustering or LID.

For these four conditions, the total volume and peak rate of stormwater runoff were compared for a range of increasingly large storm sizes: 2-year, 10-year, 25-year, 50-year, and 100-year storms (these are storms that occur, on average, every 2 years, 10 years, 25 years, 50 years, and 100 years). By predicting the runoff patterns that each site design would produce, the study characterized how effective the LID features and clustering designs were at reducing runoff compared to conventional development and how well they served to mimic the undeveloped condition.

Water was measured as it passed through V-notched weirs (pictured) and other structures.

Partridgeberry Place Key Findings

How do the runoff volumes and peak runoff rates for the four development alternatives differ?

Not surprisingly, the pre-developed condition generated the least amount of total runoff and the lowest peak rate of runoff for all storm sizes. This means that a fully forested site would allow the most rainwater to either be taken up by plants or infiltrate into the ground, instead of running off after a storm. In fact, researchers observed that the forest was so effective at capturing and infiltrating stormwater, that for storms less than ¼-inch (which represented 2/3 of the 44 storms during the study period), all the rainfall either infiltrated or evaporated. In other words, no runoff was generated by the forest during most storms.

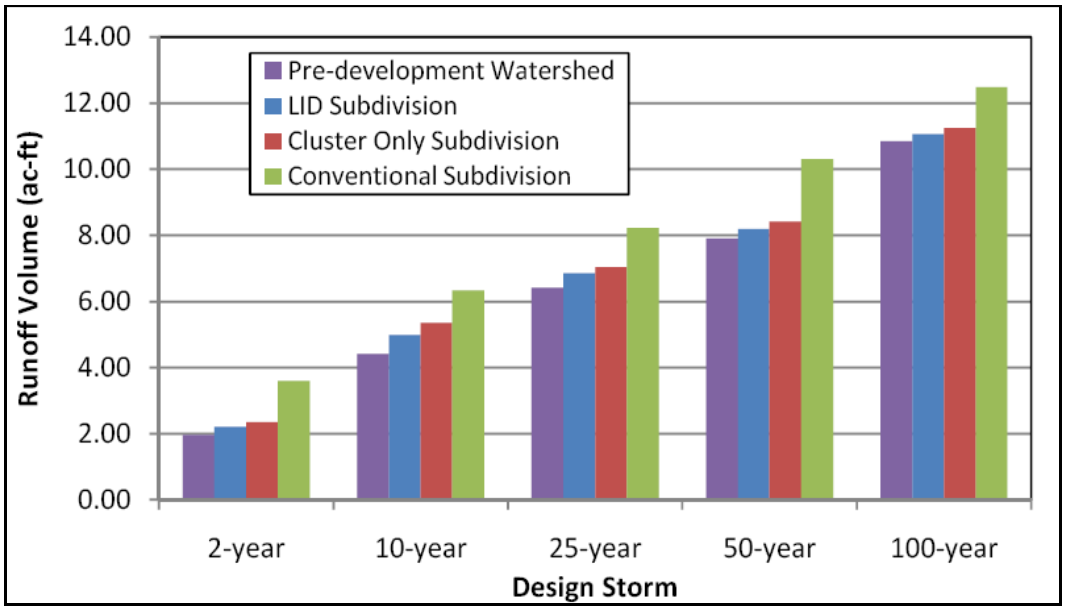
The LID Subdivision and Cluster-Only Subdivision behaved similarly to each other, producing slightly more total runoff volume and slightly higher peak rates (measured in cubic feet per second) of stormwater flow than the undeveloped condition. The LID Subdivision produced slightly less runoff and slightly lower peak rates than the Cluster-Only Subdivision for all storms, because additional LID practices, such as rain gardens, roof drywells, and a grass paver swale, were used to manage stormwater.

Central rain garden after a storm

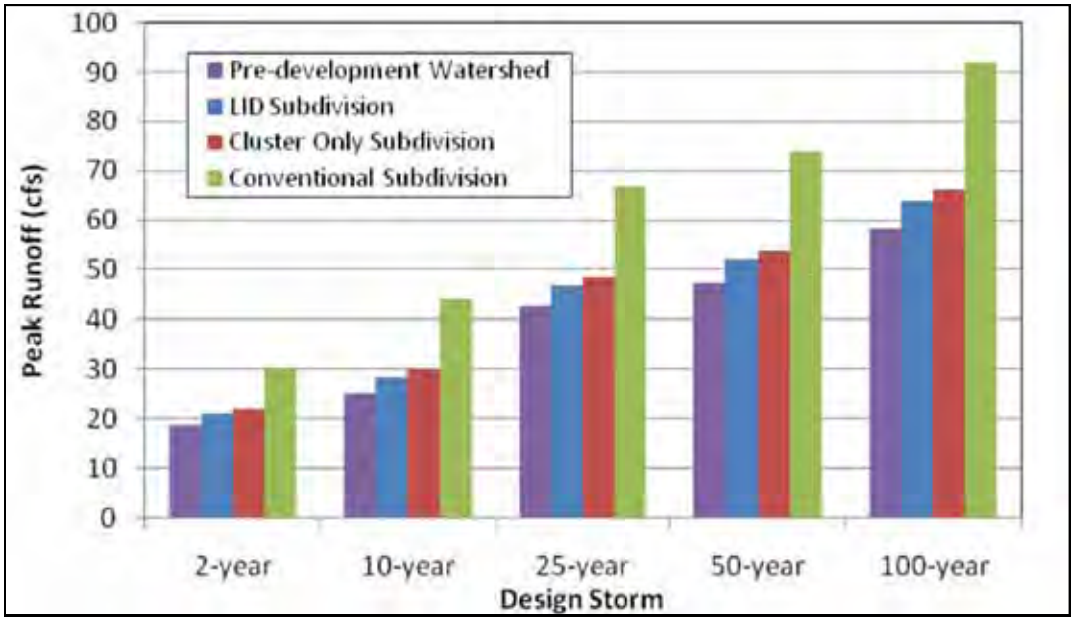
In contrast, the Conventional Subdivision produced significantly more runoff and significantly higher peak rates than all the other scenarios. The greater runoff and peak flows can be explained by the use of more pavement, more site clearing, and conventional stormwater management technologies that direct runoff from roofs, driveways, and roads directly into piped stormwater systems.

These findings suggest that clustering – preserving large areas in their natural condition and reducing areas of pavement – can go a long way toward minimizing the harmful changes to runoff patterns that can result from conventional development. Incorporating LID stormwater features into a cluster design to filter and infiltrate runoff can help even further approximate, though not replicate, the hydrology of the pre-developed site.

Total volume of runoff from modeled storms, in acre-feet



Peak rate of runoff from modeled storms, in cubic feet per second



Silver Lake Beach LID Retrofit

Project Lead: Massachusetts Department of Conservation and Recreation
Project Funding: U.S. Environmental Protection Agency
Project Partner: Town of Wilmington, MA, Department of Public Works
Project Design/Engineering: Geosyntec Consultants
Project Construction: Cali Corporation
Data Collection and Analysis: U.S. Geological Survey

The town beach at Silver Lake, a 28-acre pond in Wilmington, MA, was frequently closed due to high levels of *Escherichia coli* (*E.coli*) bacteria believed to be from polluted stormwater runoff. *E. coli* are associated with human or animal feces and can be harmful to humans upon contact. The major sources of these bacteria were thought to be from stormwater runoff, which carried feces from geese and other water fowl that browsed near the swimming area, and pet and wildlife waste from the surrounding neighborhoods. In each of the eight summers leading up to the LID renovations described here, high bacteria counts had required the town to close the beach for a week or more. In 2005, the Town of Wilmington entered into a partnership with DCR to redevelop the beach parking lot, which was badly in need of repair, incorporating the numerous LID practices described below to reduce the amount of polluted runoff entering the lake.

In 2005, the Town of Wilmington incorporated a number of LID practices to reduce the volume of polluted runoff entering the lake from the Silver Lake beach parking lot and surrounding area.

LID practices installed at Silver Lake Beach

"Daylighted" stormwater drainage pipes

Parts of two drainage pipes that carried stormwater from the parking lot and surrounding neighborhood directly into the lake were "daylighted." Daylighting refers to replacing an underground pipe or culvert with an above-ground feature. In this case, the last section of each pipe was replaced with a planted swale that filters the collected stormwater through vegetation and exposes it to sunlight. This helps break down bacteria and allows some stormwater to infiltrate into the soil before reaching the lake. One of the swales also replaced a grassy area that had served as a feeding area for geese. The steep sides of the swale and the higher vegetation discouraged geese from gathering, thereby removing a large source of fecal matter.

Swale under construction

Permeable pavement and bioretention cells

The town also replaced the conventionally paved beach parking lot, which was in need of resurfacing, with a combination of permeable pavers, porous asphalt, conventional asphalt, and bioretention cells.

Half of the original asphalt lot was replaced with a combination of permeable paving stones in the parking spaces and porous asphalt in the driving lane, all over a 12" base of crushed stone. The other half of the parking lot was repaved with conventional (impermeable) asphalt and graded so that runoff drains to the porous half of the parking lot or to bioretention areas, which were installed as traffic islands throughout the parking lot and around its periphery to collect and absorb overflow runoff.

In an overflow parking area to the side of the main parking lot, two patches of additional permeable paving materials were installed: Gravelpave™ – gravel reinforced by a plastic matrix to prevent compaction and retain permeability; and Flexi-Pave™ – a flexible porous paving material made from crushed recycled tires and stone.

The many permeable surfaces and bioretention cells allow stormwater to infiltrate into the ground, where pollutants can be broken down by natural processes.

Monitoring Study and Research Questions

DCR contracted with the U.S. Geological Survey (USGS) to monitor groundwater beneath the parking lot to make sure it would not become contaminated by the runoff infiltrating through the porous pavement. USGS installed a series of observation and sampling wells in the parking lot to assess the concentrations of chemicals commonly found in stormwater runoff from residential areas or vehicles, including phosphorus, nitrogen, dissolved metals, and petroleum hydrocarbons. Samples were collected for five months prior to the start of construction and for one year after construction was complete. During the study period, the parking lot was used heavily during the summer and sparingly in the winter. The permeable pavers and porous asphalt sections of the parking lot were cleared of snow but were neither sanded nor salted during the winter.

DCR also consulted with the Wilmington Board of Health to track its sampling for *E. coli* in the water at Silver Lake beach. The Board of Health tests water quality samples at the beach once a week during the summer and closes the beach for swimming if bacteria levels considered dangerous for human contact are detected. Lastly, Geosyntec performed infiltration tests on all the permeable paving surfaces to assess the rate at which stormwater flows through the porous materials.

Silver Lake Beach Key Findings

Do the combined effects of the LID retrofits help reduce beach closures at the swimming area?

Yes. In the five years between project completion and the time of this publication, there were no beach closures at Silver Lake due to *E. coli*, suggesting the retrofit work substantially reduced the amounts of bacteria entering the lake from the combined sources of stormwater and Canada geese. [It should be noted that the beach was closed one time following a bloom of blue-green algae, which can be toxic and is usually associated with an influx of phosphorus or nitrogen, found in fertilizers, wastewater, and in nature.]

Are the four types of permeable paving materials infiltrating as designed?

Yes. Infiltration tests were performed on all four surfaces, soon after installation and again during the following two summers, to determine the rate at which water could pass through each surface. All four permeable surfaces infiltrated as well as, or better than, designed, depending on the paving material, with infiltration rates ranging from 49 inches per hour to almost 10,000 inches per hour – all well above the rate that stormwater would build up over these surfaces.

Did installing permeable paving materials increase the risk of groundwater contamination?

No: The monitoring showed no evidence of groundwater contamination resulting from the installation of the permeable materials in the parking lot. While these results are encouraging, further study on this topic is recommended, as the present study was limited by small sample sizes and a short study period.

Silver Lake Neighborhood LID Retrofit

Project Lead: Massachusetts Department of Conservation and Recreation
Project Funding: U.S. Environmental Protection Agency
Project Partner: Town of Wilmington, MA, Department of Public Works
Project Design/Engineering: Geosyntec Consultants
Project Construction: Cali Corporation
Data Collection and Analysis: U.S. Geological Survey

Another LID retrofit project was undertaken near Silver Lake in Wilmington, across the water from the town beach, in a 3-acre residential neighborhood that borders the lake. The Town of Wilmington partnered with DCR to demonstrate practices that could help reduce the amount of stormwater entering the lake from the rooftops, driveways, and streets in this neighborhood.

Twelve rain gardens and two strips of permeable pavers were installed in front of homes, in the public right-of-way, along the two streets of the neighborhood. Stormwater from rooftops, driveways, and roads, which would otherwise flow into catch basins and discharge directly to the lake, was redirected into the rain gardens and pavers and allowed to infiltrate. Under-drains below the permeable pavers and overflow drains from the rain gardens directed excess stormwater back into the original storm drain system. In addition to reducing pollution entering Silver Lake, the rain gardens and permeable pavers were also designed to help reduce frequent street flooding that occurred in the neighborhood.

Permeable pavers along Silver Lake Ave. sit on top of stone beds that capture and filter runoff and allow it to soak into the ground.

Communication with Residents

The town-owned right-of-way where the rain gardens were located extended into the front yard of many of the homes. As a result, most of the rain gardens appeared to be part of the residents' landscaping. DCR and the Wilmington Department of Public Works sent fliers and held neighborhood meetings to inform the residents of the purpose and nature of the project, solicit their feedback during the planning stages, and request their participation as stewards of the gardens after the first three years (the project contractor, Cali Corporation, maintained the LID features for three years after installation).

Rain gardens on Silver Lake Ave. and Dexter St. collect rain water that flows off the street and allow it to slowly soak into the ground.

Letters updating the residents on the status of the project were mailed at several points during the project. Residents were also invited to participate in a "Rain Garden Maintenance Party," where they were invited to pick out additional plantings to enhance the rain gardens and learn about the yearly maintenance requirements. Residents from about half the homes on the two streets participated in the day, and the gardens appeared to be well-maintained during the project's fourth summer, under the care of the neighborhood residents.

Monitoring Study and Research Questions

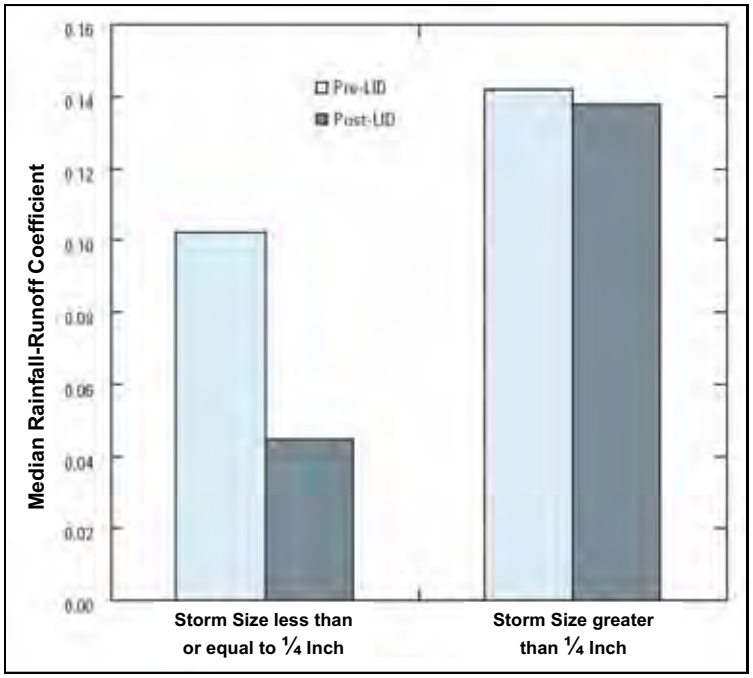
DCR contracted with the U.S. Geological Survey (USGS) to monitor the volume and quality of storm-water that was discharged from the neighborhood to the lake through a storm drain. USGS research-ers installed a rain gauge to measure the volume of rainfall, along with equipment in the storm drain to continuously monitor runoff volumes from the neighborhood. Additional equipment in the storm drain was used to capture water quality samples during the larger storms, to measure concentrations of phosphorus, nitrogen, dissolved metals, petroleum hydrocarbons, and bacteria. Monitoring was conducted for four months prior to the LID retrofit work and fourteen months after the work was completed. Similarly sized storms from before and after the retrofit work were compared to see if there were differences in runoff volume and pollutant concentrations. Researchers also calculated the percent of total rainfall during each storm that entered Silver Lake through the storm drain (the "runoff coefficient").

Location of LID features and the monitoring site in the Silver Lake neighborhood

Silver Lake Neighborhood Key Findings

Do the rain gardens and permeable pavement help reduce runoff?

The answer depends on the size of the storm. The findings suggest that the rain gardens and permeable pavers were able to measurably reduce the volume of runoff from small storms (rainfall less than or equal to 0.25 inches). Prior to the LID retrofits, all storms – even small ones – produced some runoff from the neighborhood. After the retrofits, 33% of small storms produced no runoff at all. In addition, runoff coefficients calculated for small storms were found to decrease from a median of 10% prior to the LID retrofit work to a median of 4.5% after the retrofit. Lower runoff coefficients mean less water is flushing directly into the lake and more water is soaking into the soil, where it is either taken up by plants or recharged to the groundwater. In contrast, in the larger storm categories there were no observable differences in runoff coefficients before and after the LID retrofit work. This suggests that during larger storms, much of the runoff either bypassed the LID features or overflowed from them. This could have been the result of debris blocking the inlets, sediment build-up that reduced infiltration rates, or perhaps insufficient total rain garden area. This finding underscores the importance of proper design and maintenance of LID features.



The above graph shows the percent of total rainfall during each storm that entered Silver Lake through the storm drain (the "runoff coefficient") before and after the LID features were installed.

Do the rain gardens and permeable pavement help reduce pollutants that eventually go into Silver Lake?

The answer is not clear cut. While the data show that the rain gardens and permeable pavement did not significantly reduce pollutant concentrations or loads of nutrients, metals, petroleum hydrocarbons, or fecal bacteria, this conclusion is based on a limited data set. The storms that were sampled for pollutant concentrations were generally the larger storms, because these were much more likely to produce enough runoff for sampling purposes. As a result, the study may underestimate the water quality benefits associated with reducing the runoff volume from storms up to 0.25 inches – which represented about 60% of all the storms that were monitored.

The Ipswich River Targeted Watershed Grant

In 2004, through its Targeted Watersheds Grant Program, the United States Environmental Protection Agency (EPA) provided $1 million through a cooperative agreement to the Massachusetts Department of Conservation and Recreation (DCR) to demonstrate and study practices to help conserve water, reduce storm water pollution, and increase groundwater recharge throughout the Ipswich River watershed, in northeastern Massachusetts. Under this cooperative agreement, four low impact development (LID) and five water conservation projects were undertaken by DCR in cooperation with EPA, the United States Geological Survey (USGS), eight municipalities, the Ipswich River Watershed Association, and other cooperating partners. The projects were designed to (1) implement and quantify the benefits of LID and water-conservation techniques and (2) evaluate the impact of wide-spread application of these techniques throughout the watershed, using computer modeling simulations. Additional funding for this work was provided by DCR; USGS; the Ipswich River Watershed Association; and the towns of North Reading, Reading, Topsfield, and Wilmington. In-kind support was provided by DCR; the towns of Hamilton, Ipswich, Middleton, North Reading, Reading, Topsfield, Wilmington, and the city of Peabody; AquaSave LLC; the Martins Companies; the North Shore Housing Trust (since merged with Harborlight Community Partners); and Rainwater Recovery.

This is one in a series of three fact sheets that describes the work conducted under the cooperative agreement. The complete series includes:

- **Ipswich River Targeted Watershed Grant Fact Sheet: Green Roof Case Study**
- **Ipswich River Targeted Watershed Grant Fact Sheet: Water Conservation Case Studies**
- **Ipswich River Targeted Watershed Grant Fact Sheet: Three Low-Impact Development Case Studies**

For more information on the Ipswich River Targeted Watershed Grant, including links to study results and other publications, please visit:

http://www.mass.gov/dcr/watersupply/ipswichriver/index.htm.

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, and dams, whose mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources. To learn more about DCR, our facilities, and our programs, please visit www.mass.gov/dcr. Contact us at mass.parks@state.ma.us.

Commonwealth of Massachusetts
Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Executive Office of Energy and Environmental Affairs
Ian A. Bowles, Secretary
Department of Conservation and Recreation
Richard K. Sullivan, Jr., Commissioner

This publication was developed, and the work described in this publication was funded, under Cooperative Agreement No. WS – 97117501 awarded by the United States Environmental Protection Agency to the Massachusetts Department of Conservation and Recreation. EPA made comments and suggestions on this publication intended to improve its technical accuracy. EPA does not endorse any commercial product or service mentioned in this publication.

Appendix J:

Ipswich River Water Conservation Case Studies

dcr
Massachusetts

IPSWICH RIVER WATERSHED ASSOCIATION

Ipswich River Targeted Watershed Grant Fact Sheet:

Water Conservation Case Studies

Prepared by:

Massachusetts Department of Conservation and Recreation and The Ipswich River Watershed Association

Water conservation in the Ipswich River Watershed

The Ipswich River Watershed, located in Northeastern Massachusetts, refers to the 155-square-mile-area that drains into the Ipswich River. This watershed is the source of drinking water for approximately 330,000 people and businesses. Over the years, a variety of human activities, including pumping of water from the river and its shallow groundwater reserves, has contributed to extremely low flows in the river and, during some summers, sections of the river have completely dried up. These problems were so severe that, in 2003, American Rivers, a national river conservation group, designated the Ipswich as the third most endangered river in the nation.

In 2004, the Massachusetts Department of Conservation and Recreation (DCR), under a cooperative agreement with the U.S. Environmental Protection Agency, implemented five water conservation projects in the Ipswich River watershed and collaborated with researchers at Tufts University to evaluate their effectiveness at reducing water demand:

- Installation of rainwater harvesting systems that collect rain running off rooftops and store it to use for irrigation or other outdoor purposes
- Installation of weather-based irrigation controller switches (WICs), which track and use weather information to ensure that automatic sprinkler systems only deliver water when it is needed
- Incorporation of mineral amendments into the soil at a municipal athletic field to improve soil moisture retention and reduce water demand
- Free indoor water-use audits and water-saving retrofit kits
- Rebates for the replacement of conventional toilets and washing machines with water-efficient alternatives.

The irrigation controllers and soil amendment projects were designed to reduce the amount of water needed for lawn and landscape irrigation, while the rainwater harvesting systems were designed to replace a portion of the drinking water used for outdoor irrigation with rainwater. The homeowner rebate and water audit programs were focused on reducing indoor water consumption, year round.

DCR acknowledges the cooperation and contributions of the following entities in completing these demonstration projects:

- Ipswich River Watershed Association
- City of Peabody, Massachusetts
- Town of Hamilton, Massachusetts
- Town of Middleton, Massachusetts
- Town of North Reading, Massachusetts
- Town of Reading, Massachusetts
- Town of Wilmington, Massachusetts
- AquaSave, LLC
- Rainwater Recovery, Inc.
- Tufts University
- U.S. Environmental Protection Agency

Rainwater harvesting

Rainwater harvesting systems capture runoff from rooftops and store the water in barrels, tanks, or underground cisterns, to be used for purposes that do not require the same high level of treatment as drinking water. Substituting captured rainwater for activities such as lawn watering or car washing saves money and energy needed to treat and transport public water and helps reduce the use of water from the river and groundwater.

To measure the effectiveness of rainwater harvesting as a water conservation tool, DCR cooperated with homeowners at 39 residences in Wilmington, outfitting each house with a rainwater harvesting system during the spring of 2006. These residential systems consisted of a 200-gallon or 800-gallon above-ground storage tank, a pressure pump to help deliver water through a hose or sprinkler, and a water meter, which homeowners used to measure the amount of rainwater used during the 2006 and 2007 growing seasons. The rainwater was used for a variety of outdoor purposes, but primarily lawn and landscape irrigation. Participating homeowners were surveyed to evaluate how often, and for what purposes, they used the rainwater harvesting systems.

DCR also cooperated with the Wilmington Water Department to install a large underground rainwater storage vault at the Boutwell School in the spring of 2007. The underground system consisted of an 8,000 -gallon storage vault, a pressure pump, a water meter, and a mechanism to switch to public water as a backup. The school system was used to irrigate an adjacent ball field.

Key Findings

Was there a difference in how homeowners used the 200-gallon and 800-gallon systems?

- **Yes:** In both 2006 and 2007, homeowners with the 800-gallon systems used more rainwater, on average, than those with the 200-gallon systems. Even though houses with 800-gallon systems did not necessarily have larger contributing roof areas, the larger storage size enabled homeowners to capture more rain from each storm for use during dry periods. This suggests that the 800-gallon system was more appropriately sized for the frequency and volume of outdoor water used by the average participating homeowner in the study.

Did use of rainwater decrease reliance on public water?

- **Yes:** Surveys administered to the participating homeowners suggested that most of the rainwater used during the study period was a direct replacement of public water. Meters measured the amount of stored rainwater used for outdoor purposes. Homeowners with 800-gallon systems used an average of 2,600 gallons of rainwater per year; those with the 200-gallon systems used an average of 1,100 gallons per year. However, the reduction in domestic water consumption was hard to determine directly from customer water bills. Since each household used significantly more public water than rainwater, determining the actual amount of public water replaced by rainwater (a much smaller number), was very difficult to do.

200-gallon (top) and 800-gallon (bottom) rainwater harvesting systems were installed at 39 residences.

Was the large underground system at the school able to reduce reliance on public water for irrigation?

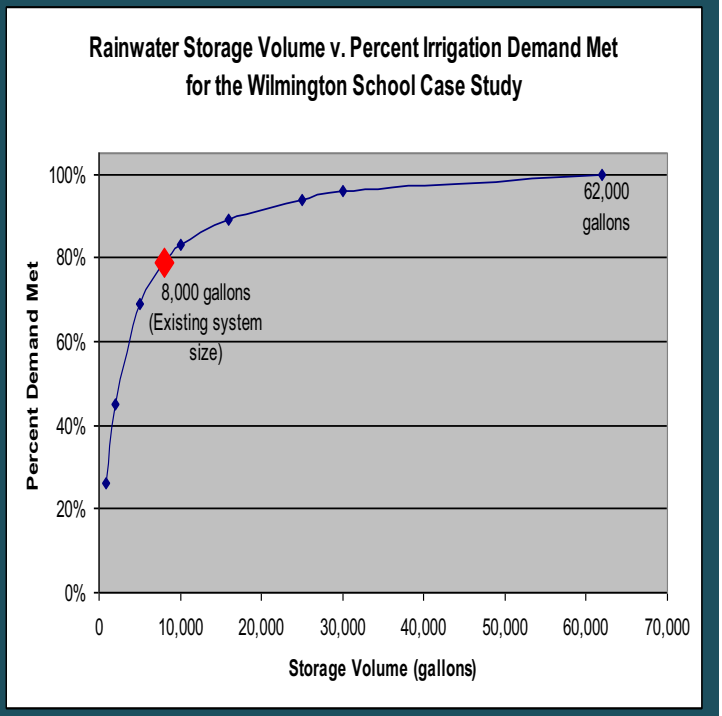
- **Yes:** To answer this question, researchers used a computer model to estimate the percentage of irrigation demand at the adjacent ball field that could be met by the rainwater system. The model used daily rainfall patterns from a seven-year period of record, the size of the building's roof, the storage capacity of the vault, and watering demands of the field. According to the model, the rainwater system should be able to provide 79% of the water needed to irrigate the adjacent athletic field .

8000-gallon vault system at the Boutwell School that captures rainwater for irrigating athletic fields.

Things to keep in mind

Generally speaking, the larger the storage capacity of a rainwater harvesting system, the more the system will cost to install. However, if a system has too little storage capacity, it may frequently overflow, and sufficient water may not be available during dry periods. To design a cost-effective rainwater harvesting system, it is useful to consider the following three factors and the relationships among them:

- **Contributing roof area:** This determines the volume of runoff generated for each storm. A large roof area will produce a lot of runoff even during a small storm.
- **Tank size:** This sets the limit of how much runoff can be captured during a storm, regardless of the size of the storm. Once a system is full, any additional runoff will be lost to overflow.
- **Watering needs and frequency of use:** These determine how quickly the stored water is used and how much room the tank will have for incoming rainwater from the next storm. If the water in the tank is not used up quickly enough, there will be less room left in the tank for additional rainwater, and the newer rainwater will be lost to overflow.



The simulation model developed for the Wilmington School harvesting system predicted that approximately 79% of the irrigation demand at the ball field could be met by rainwater. The above graph shows how this percentage would change with different storage sizes. Beyond a certain tank size, the benefit of increased storage begins to diminish quickly.

Weather-based irrigation controllers (WIC)

Watering lawns and gardens when there is sufficient rainfall or moisture in the soil only wastes water, energy, and money. Weather-based irrigation controllers (WIC) automatically control irrigation systems so they do not turn on if enough natural water is available. The WIC used in this study includes an on-site rain guage and a control unit that receives a continuous wireless data signal from a regional weather station that reports on solar radiation, temperature, relative humidity, and wind speed. The WIC device uses the regional weather data and the on-site rain guage to continually estimate moisture in the soil. When the moisture level drops below a certain threshold, the WIC device allows the automatic irrigation system to come on and deliver enough water to replenish the lost moisture. The threshold that triggers an irrigation cycle can be set individually for each system, based on type of plants, soil composition, and other factors. Until the threshold is reached, the WIC device prevents the automatic irrigation cycle from coming on, reducing unnecessary watering, such as during rain storms.

Weather-based irrigation controllers automatically control irrigation systems in response to rainfall so water is not wasted.

As a part of this study, DCR coordinated with homeowners to install WIC devices at thirteen residences in the town of Reading during the summer of 2005. DCR also partnered with municipal officials in Hamilton, Middleton, North Reading, Reading, and Peabody to install the devices at ten municipal athletic fields during the same summer.

DCR and Tufts University researchers compared the outdoor water use from the five-year period prior to WIC installation to the two-year period after installation for households that received WIC devices, and for a group of similar households with automatic sprinkler systems that did not receive the WIC devices. The latter group was used as a "control" to account for any weather differences between the two time periods that might have affected water use. The researchers also used historic weather records to simulate how much water the WIC devices would have applied at the thirteen residences and the five ball fields that had the necessary data records for analysis, during the summers of 2003 and 2004. They then compared these volumes to the water that was actually applied during this period by the conventional automatic sprinkler systems that were in place at that time.

Key Findings

Did households reduce water use after WIC devices were installed?

- On average, households using the WIC devices did reduce water use after the devices were installed, compared to households that continued to use conventional timer-based systems (the control group). However, there was so much variability in how the WIC units were operated by the different households that researchers could not conclude that the WIC units would reduce water use in all cases. For example, households that tended to have very low water demands prior to installing the WIC device actually saw an increase in demand after the WIC unit was installed. Researchers suspect that this was because the WIC devices were calibrated to keep lawns green, whereas homeowners with very low historic water demands might not have previously watered their lawns during dry periods, and instead allowed their grass to brown up.

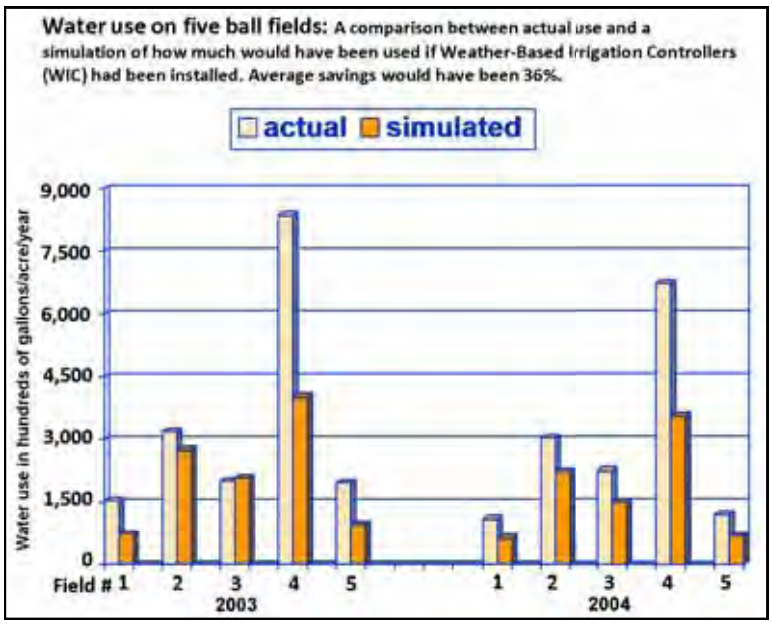
- The households with the highest water demands prior to installing the WIC device, on the other hand, showed a consistently sharp decline in water use after installation. This suggests that WIC devices are more likely to be beneficial in residences that use a lot of water for irrigation.

Would households have saved water in 2003 and 2004 if they had used WIC devices?

- On average, simulations indicated that households would have used less water in 2003 and 2004 if they had been using WIC devices instead of conventional timer-based controllers. However, these results were not statistically significant, due to highly variable results among the households in the study.
- Among the highest water users, the simulation found that using the WIC units would have saved a statistically significant amount of water in 2003 and 2004. These results again suggest that WIC devices are more likely to save water for households with patterns of high water use.
- The simulation also showed that the WIC devices were most likely to save water during rainy months. This is not surprising, because the devices are designed to eliminate unnecessary irrigation, which most often occurs during wet weather.

Would ball fields have saved water in 2003 and 2004 if they had used WIC devices?

- **Yes.** For all five ball fields analyzed, the simulation described above showed that significant water savings would have occurred if the WIC devices had been installed in 2003 and 2004. For these years, the WIC units would have reduced ball field irrigation by approximately 120,000 gallons/acre/year, compared to the irrigation volumes that were applied by the conventional irrigation systems at these fields. **This represents a water savings of approximately 36%.**



Things to Keep in Mind

Weather-based irrigation control devices are designed to eliminate unnecessary irrigation. As a result, they provide the greatest water savings when installed in systems that have been watering unnecessarily. Water users that already use other mechanisms to irrigate efficiently are presumably less likely to realize savings if they convert to WIC devices.

Moisture-retaining soil amendments

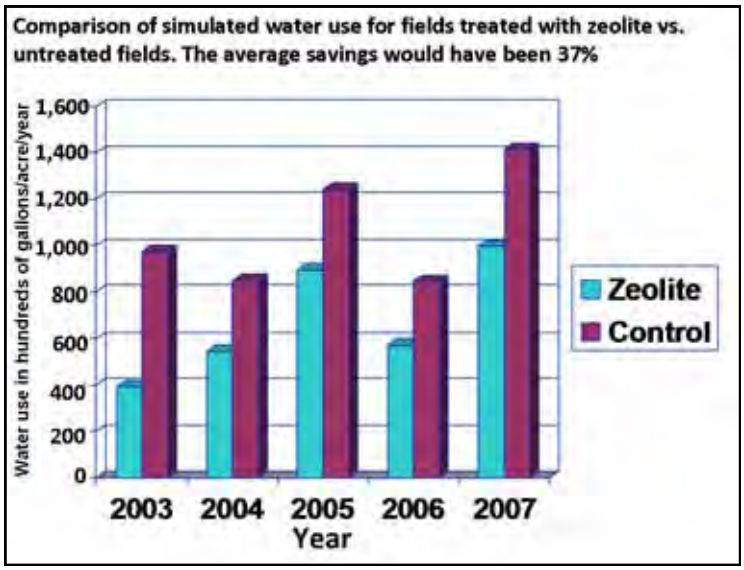
Plants draw the water they need out of the soil that surrounds their roots. Soils can be made to hold water longer with the addition of organic or mineral soil amendments. If soil can hold water for longer periods of time, the need for irrigation will be reduced, saving water that would otherwise have to be pumped out of the river or groundwater.

DCR partnered with the town of North Reading to study whether adding zeolite, a soil mineral additive that retains water, at a town athletic field would reduce the field's need for irrigation. The study compared water use at two adjacent fields. Both fields were planted with hardy, drought-resistant turf and irrigated with the weather-sensitive irrigation controllers described above. Both fields had the same original soil characteristics and were exposed to virtually the same amount of sun, wind, rain, and temperatures. One of the fields was enhanced with a zeolite additive. Because the town did not want to close the field to recreation for the season, the zeolite was applied in two doses over two summers, without removing any of the turf. A third of the zeolite was mixed with sand and introduced into the deeper layers of soil through 2½-inch and 7-inch aeration holes. The rest was applied directly to the surface and worked itself into the soil, so that by the end of the second year of application, 4% of the top inch of soil was composed of zeolite. The town progressively adjusted the settings on the weather-sensitive irrigation controller (WIC) devices for each field, and monitored the field conditions to determine the most conservative watering schedule that could be tolerated by each field, while maintaining healthy turf.

Key Findings

Did the zeolite additive reduce the watering requirements of the field?

- **Yes:** The field with the zeolite was watered less and appeared visibly healthier than the control field.
- Using historic weather records and settings on the WIC system, irrigation volumes over a 5-year period were simulated for each field; the zeolite field would have required 38,000 gallons/acre less water, per year, than the control field during the years 2003 - 2007. **This represents a savings of 37%.**
- These results imply that soil amendments can have a dramatic impact on moisture retention, and can in turn significantly reduce water demand of athletic fields and lawns.



Things to Keep in Mind

The amount of water needed to maintain healthy turf without over-watering depends on many factors, including type of turf, root depth, soil characteristics, and climate. While this study suggests that zeolite can significantly reduce irrigation demands, further studies are needed to determine the optimal amount and method of application of zeolite.

Water conservation programs for homeowners: water-use audits and appliance rebates

As part of a town-wide water conservation program beginning in 2003, the town of Reading began offering water customers two opportunities to reduce their indoor water use:

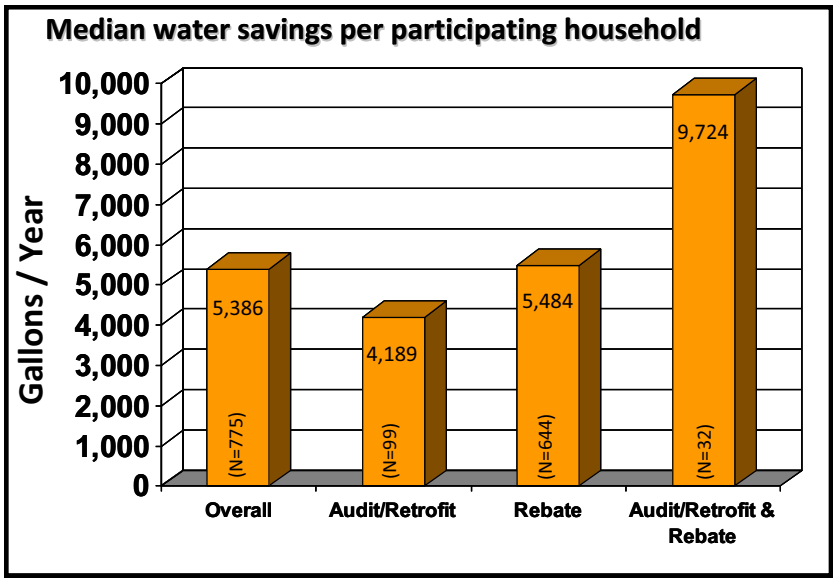
- Free indoor water-use audits and water-saving retrofit devices tailored to the results of the audits
- Rebates for eligible water-efficient washing machines and toilets.

Between 2003 and 2006, 775 households (approximately 9% of the town) participated in one or both of these voluntary programs. DCR evaluated the effectiveness of the programs on household and town-wide water use by examining customer water records from the winters of 2002 through 2007. Water records from the summer growing seasons were not examined because outdoor water uses, such as lawn irrigation, could mask the results of changes in indoor water use. For each participating household, DCR compared winter water use before and after the audit took place or before and after the installation of one or more water-saving appliance was installed.

Key Findings

Did the two water-conservation programs lead to savings in the households who chose to participate?

- **Yes:** Both programs resulted in water savings for participating households:
  - Median household reduction in water use after receiving an audit/retrofit kit was 11.5 gal/day (4,189 gal/yr)
  - Median household reduction in water use after installing one or more water-efficient appliances was 15 gal/day (5,484 gal/yr)
  - Households participating in both programs saw the highest median savings (27 gal/day; 9,724 gal/yr).



Water conservation programs for homeowners: water-use audits and appliance rebates (continued)

What were the overall water savings realized by the town from the two programs?

- As a result of the 775 households that had participated in one or both of the programs by 2006, the town-wide water savings was approximately 11,600 gal/day or 4.2 million gal/yr. This is equivalent to about two full days of water supply in Reading. Households have continued to join both programs since 2006, and the town-wide savings is presumably continuing to rise.

Things to Keep in Mind

This study evaluated the effectiveness of two water conservation programs for the average participating household and for the town, overall. The water savings varied greatly among households; some in the appliance rebate program replaced a single toilet, while others replaced three toilets and a washing machine. Similarly, an indoor water use audit in one household may have resulted in the installation of a single low-flow faucet device, while in another, several such devices may have been installed and a leaking toilet may have been identified and fixed. The findings are, therefore, most appropriate for town-wide planning; any individual households that install water-efficient appliances or retrofit devices could see water savings higher or lower than the averages reported here, depending on the number of appliances or devices they install.

Additionally, over the five-year period of the study, the town saw waves of new participation in response to various outreach efforts, including a significant spike in participation after implementation of a water conservation curriculum in third-grade classes in all of Reading's schools. It should be expected that participation in this type of water conservation program is closely related to the frequency and type of outreach.

The case studies described in this report illustrate many ways to reduce water demand in areas with critical water resources. The studies also suggest that conservation practices must be carefully planned and designed in order to achieve optimal results.

The Ipswich River Targeted Watershed Grant

In 2004, through its Targeted Watersheds Grant Program, the United States Environmental Protection Agency (EPA) provided $1 million through a cooperative agreement to the Massachusetts Department of Conservation and Recreation (DCR) to demonstrate and study practices to help conserve water, reduce storm water pollution, and increase groundwater recharge throughout the Ipswich River watershed, in northeastern Massachusetts. Under this cooperative agreement, four low impact development (LID) and five water conservation projects were undertaken by DCR in cooperation with EPA, the United States Geological Survey (USGS), eight municipalities, the Ipswich River Watershed Association, and other cooperating partners. The projects were designed to (1) implement and quantify the benefits of LID and water-conservation techniques and (2) evaluate the impact of wide-spread application of these techniques throughout the watershed, using computer modeling simulations. Additional funding for this work was provided by DCR; USGS; the Ipswich River Watershed Association; and the towns of North Reading, Reading, Topsfield, and Wilmington. In-kind support was provided by DCR; the towns of Hamilton, Ipswich, Middleton, North Reading, Reading, Topsfield, Wilmington, and the city of Peabody; AquaSave LLC; the Martins Companies; the North Shore Housing Trust (since merged with Harborlight Community Partners); and Rainwater Recovery.

This is one in a series of three fact sheets that describes the work conducted under the cooperative agreement. The complete series includes:

- **Ipswich River Targeted Watershed Grant Fact Sheet: Green Roof Case Study**
- **Ipswich River Targeted Watershed Grant Fact Sheet: Water Conservation Case Studies**
- **Ipswich River Targeted Watershed Grant Fact Sheet: Three Low-Impact Development Case Studies**

For more information on the Ipswich River Targeted Watershed Grant, including links to study results and other publications, please visit:

http://www.mass.gov/dcr/watersupply/ipswichriver/index.htm.

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, and dams, whose mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources. To learn more about DCR, our facilities, and our programs, please visit www.mass.gov/dcr. Contact us at mass.parks@state.ma.us.

Commonwealth of Massachusetts
Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Executive Office of Energy and Environmental Affairs
Ian A. Bowles, Secretary
Department of Conservation and Recreation
Richard K. Sullivan, Jr., Commissioner

This publication was developed, and the work described in this publication was funded, under Cooperative Agreement No. WS – 97117501 awarded by the United States Environmental Protection Agency to the Massachusetts Department of Conservation and Recreation. EPA made comments and suggestions on this publication intended to improve its technical accuracy. EPA does not endorse any commercial product or service mentioned in this publication.