BOARD OF COUNTY COMMISSIONERS
SARPY COUNTY, NEBRASKA

RESOLUTION RATIFYING THE SIGNING AND SUBMISSION OF THE 2011 ANNUAL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT REPORT

WHEREAS, pursuant to Neb. Rev. Stat. §23-104(6) (Reissue 2007), the County has the power to do all acts in relation to the concerns of the County necessary to the exercise of its corporate powers; and,

WHEREAS, pursuant to Neb. Rev. Stat. §23-103 (Reissue 2007), the powers of the County as a body are exercised by the County Board; and,

WHEREAS, the County of Sarpy has obtained an NPDES-MS4 Permit concerning storm water runoff in the Papio Creek Basin pursuant to the National Pollutant Discharge Elimination System, Phase II storm water regulations; and,

WHEREAS, the permit requires the approval and submission of an Annual Report and attachments to the Nebraska Department of Environmental Quality.

NOW, THEREFORE, BE IT RESOLVED, By the Sarpy County Board of Commissioners that the signing and submission of the 2011 Annual Report as required by the National Pollutant Discharge Elimination System, (NPDES) Phase II storm water regulations, as presented to this Board, is hereby ratified.

BE IT FURTHER RESOLVED that the County Administrator, is hereby designated the Cognizant Official for the purposes of said documents, and is hereby authorized to sign said documents on behalf of Sarpy County, Nebraska

The above Resolution was approved by a vote of the Sarpy County Board of Commissioners at a Public Meeting duly held in accordance with applicable law on the 3rd day of April 2012.

ATTEST: SEAL

DEBRA J. HOUGHTALING, COUNTY CLERK
SARPY COUNTY, NEBRASKA

Sarpy County Board Chairman

Sarpy County Clerk

NPDES PERMIT (NER210000) FOR SMALL MUNICIPAL STORM SEWER DISCHARGES TO WATERS OF THE STATE LOCATED IN DOUGLAS, SARPY, AND WASHINGTON COUNTIES OF NEBRASKA

NPDES PERMIT NUMBER NER210000 for Sarpy County
MS4#NER210007

2011 ANNUAL REPORT

Submitted by:

Sarpy County, 1210 Golden Gate Drive, Papillion, NE 68046
March 28, 2012

Report of 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 gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the 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 known violations. See 18 U.S.C. 1001 and 33 U.S.C 1319, and Neb. Rev. Stat. 81-1508 thru 81-1508.02."

	March 28, 2012
Signature of Authorized Representative or Cognizant Official	Date
Mark Wayne	Sarpy County Administrator
Printed Name	Title

A. BACKGROUND

On October 1, 2009 the Nebraska Department of Environmental Quality (NDEQ) issued a National Pollutant Discharge Elimination System (NPDES) permit NER210000 for Small Municipal Storm Sewer discharges to waters of the state located in Douglas, Sarpy, and Washington Counties of Nebraska. The co-permittees of the Papillion Creek Watershed Partnership (PCWP) currently authorized to discharge municipal storm water under this permit are Bellevue, Boys Town, La Vista, Papillion, Ralston and Sarpy County.

The NPDES permit requires that the co-permittees submit by April 1 each year an Annual Report documenting the status of all the general programs and individual tasks contained in the Storm Water Management Plan (SWMP). This document is being submitted by Sarpy County to meet that requirement and covers the period from January 1-December 31, 2011 of permit year two.

B. COOPERATIVE AGREEMENT

The co-permittees entered into an inter-local agreement in 2001 and a continuation agreement in 2004 and again in 2009 that established a framework for meeting the permit requirements. The 2009 agreement was approved by the following entities Bellevue, Boys Town, La Vista, Papillion, Ralston, Sarpy County, Gretna, the Papio Missouri Natural Resources District and City of Omaha. That agreement identified the lead organization and the participating partners for each SWMP element and also established a basis for cost-sharing to meet the Phase II permit requirements of the co-permittees.

C. PERMITTEE COORDINATION

In 2001, the PCWP began as a planning committee to assist the Phase II communities in addressing their permit application requirements. The focus of the continuation agreement reached in 2004 was on the implementation of the SWMP as incorporated in the general NPDES permit. The 2009 agreement focused on an overall watershed plan which addresses water quality and water quantity for the participating members as well as a renewal of the NPDES permit and implementation of the updated SWMP.

The PCWP has held monthly meetings since August 2001. The meetings help to coordinate activities, and identify needs consistent with the goals of the PCWP, and implement the NPDES permit's SWMP.

1. Public Education and Outreach

1.A. Distribute informational brochures on the proper disposal of household hazardous waste and the availability of the Household Hazardous Waste Facility. Year 1-5: Print and distribute brochures.

The Douglas-Sarpy County regional household hazardous waste (HHW) facility, UndertheSink opened in June 1, 2005. Brochures are available at the facility for distribution, and can be

printed from the website www.underthesink.org. Brochures contain information about the site, materials accepted and not accepted, hours of operation, and alternative use products. 16 tours were conducted of the facility in 2011.

Keep Omaha Beautiful assisted the PCWP with distribution of 9 different types of brochures and informational cards throughout 2011 about illegal dumping, involvement opportunities, OmaGro, pesticides, herbicides and fertilizer use, UnderTheSink, Storm drain fact sheets, storm drains and water pollution, sustainability, and using lawn chemicals wisely. They were present at events/meetings/booths where the cards and brochures were available. Attachment A contains detailed information on the activities for this task. Informational stands at the point of purchase were placed throughout the region in the commercial outlets listed below:

Ace Hardware, 50th & Center
Early May, 90th & Center
Sunrise Nursery
Ace Hardware, 144th & Center
Autozone, North 30th St. and 72nd St & Redick, 24th & Vinton, and 49th & Center
O'Reilly Autoparts, 30th St and 50th & L Streets
Tractor Supply, 81st & L
Lowes, 72nd & Dodge
Sherwin Williams, 74th & Cass
Pittsburgh Paints, 72nd & L
Diamond Vogel Paint, 78 & L
Builders Supply, 72nd & Main

Brochures were also distributed at companies to inform employees and visitors. The locations are as follows:

Union Pacific – 75 brochures
Gallup – 150 brochures
Creighton University – 50 brochures
Lauritzen Gardens – 150 brochures
ConAgra – 60 brochures

Overall 6,150 brochures were distributed in 2011.

In the 2011 calendar year, UnderTheSink, had a total of 12,703 drop offs resulting in a total 884,909 lbs of material, an average of 4,425 lbs/day (of days accepting waste). A total weight of 195,858 lbs of HHW was shipped offsite by the disposal contractor. Those drop-offs and that total weight can be further broken down into:

Recycling Totals in 2011:

Steel from paint and aerosol cans: 69,480 lbs
Latex paint used with Posi-Shell at Sarpy County Landfill: 17,985 gal
Oil-based paint and flammable liquids used as industrial fuel: 13,353 gal

Antifreeze recycled: 1,100 gal
Automotive batteries: 12,712 lbs
Fluorescent bulbs: 5,380 bulbs

Oil Totals in 2011:

Collected approximately 9,200 gal
Sold a total of 1,551 gal during the summer to Tri-States Oil Reclaimers, Inc.
The remaining oil, was/is being burned in the waste-oil boiler

ReStore Totals in 2011:

People who took free useable items for their own use: 7,986 persons
Weight of non-paint items taken: 120,774 lbs
Gallons of free paint taken: 18,347 gal

This permit requirement has been met.

1.B. Issue public service announcements related to stormwater protection on local TV, radio or print outlet. Year 1-5: A summary of the activities will be included in the Annual Report.

In addition to the distribution of educational brochures at public outreach events, public service announcements were aired on KFAB radio station for topics regarding Don't Litter-cigarette butts, household hazardous waste disposal of oil, composting and announcing the World O Water event. The summary of radio advertisements is included in Attachment A.

Additional efforts were made for the pet waste campaign which was promoted at a Humane Society walk, advertised in local newspapers and as an insert in public trash cans. Newspaper articles on the pet waste program ran in the Omaha World Herald, the Shout Weekly and the Reader. These activities are summarized in Attachment A.

This permit requirement has been met.

1.C. Continue existing drain marking program to improve public awareness concerning illegal dumping utilizing volunteer services (e.g. Boy Scouts) which will address TMDL pollutants of concern. Year 1-5: Mark approximately 1,000 inlets annually and include a summary in the annual report.

KOB continues to utilize a GIS tracking system to better direct the volunteers to areas that do not have storm drains marked. The City has approximately 110,000 storm drains, using the GIS system should make tracking those inlets which have been marked or need marking easier to manage. This year 1,131 inlets were marked. A summary of storm drain marking activities is detailed in Attachment A.

This permit requirement has been met.

1.D. Hold a Sediment and Erosion Control Seminar for the developers, builders, engineers, vendors and graders which will address TMDL pollutants of concern. Year 1-5: Hold annual

Sediment and Erosion Control Seminar. Include a summary of the approximate number of participants in the Annual Report.

The annual Sediment and Erosion Control Seminar was held on February 2, 2011 at the CoCo Key Convention Center in Omaha. The seminar provided engineers, developers, and graders information on NPDES Phase II regulations, the PCWP's grading permit program and sediment and erosion control BMPs. The seminar had 180 attendees.

This permit requirement has been met.

1.E. Work collaboratively with other community organizations to develop a campaign aimed at picking up pet waste which will address TMDL pollutants of concern. Year 1: Develop outreach material and partnerships. Year 2-5: Distribute information.

A significant effort began in 2010 and continued in 2011 on the pet waste campaign. Along with the earlier mentioned public service announcements on the radio, pamphlets, and newspaper articles, the campaign was featured at the Nebraska Humane Society's annual Walk for the Animals. This outreach event was intended to increase the public's awareness and so information was displayed and 1,000 pet waste bag dispensers were distributed. Details of the pet waste campaign can be found in Attachment A.

This permit requirement has been met.

1.F. Develop materials and displays associated with BMP demonstration projects installed with Stormwater Management Program Project funds from NDEQ. Year 1-5: Provide a narrative and examples of materials developed in annual report.

An outreach event on BMPs and Post construction stormwater policy were targeted at a workshop for educators held at Metropolitan Community College (20 attendees) and approximately 60 individuals received information and guidance on the rain barrel program along with a free barrel. Additionally, a study of BMP demonstration projects was completed this year and is shown in Attachment E. Additional demonstration projects will be studied and tours developed.

This permit requirement has been met.

1.G. Develop a PCWP Stormwater Program Website, including but not limited to storm water related information and provide educational information targeted for residents, children, and industries which will address TMDL pollutants of concern. Year 1-5: Develop, operate and maintain a PCWP Stormwater web site. Include narrative in the Annual Report describing the functions of the web site. Ensure that the web site is accessible from each community's web site.

The PCWP website, www.papiopartnership.org, includes but is not limited to, the contact information for PCWP representatives (including links to the respective PCWP representative's

websites) and the illegal dumping/illicit discharge report form, PCWP meeting minutes, upcoming meetings and outreach opportunities, PCWP permits, past reports, and studies are also available on-line as well as general information about the PCWP and about watersheds, best management practices, and stormwater management in general. Additional items located on the website are the current PCWP interlocal agreement, watershed management plan, implementation plan and stormwater policies. All of which were adopted by the PCWP co-permittees in 2009. These documents are attached as Attachment B. A link is also included to the City of Omaha's stormwater web site.

The City of Omaha has developed and deployed a website, www.omahastormwater.org dedicated to the City's Stormwater Management Program. From the website industries within the PCWP can access the necessary documents to apply for stormwater permits.

Residents can also access information from the City of Omaha's website as to how they can improve water quality by actions they take at home. Children's activities are also available on the website. There is also public information available on the demonstration storm water best management practices that have been implemented in areas of the city. The public can access information related to the monitoring program. Additionally, there is an online complaint or comment form available to the public.

Sarpy County links to both the City of Omaha and Papio Partnership websites to the Sarpy County Planning Department website.

This permit requirement has been met.

2. Public Participation and Involvement

2.A. Operate a stormwater hotline and web based complaint system for Watershed (general information, complaints, reports of illegal dumping, etc.). Year 1-5: Maintain system operation and include summary of received calls/emails in the Annual Report.

The City of Omaha continues to maintain a phone line, 444-3908, for handling stormwater calls. Clerks are available during regular business hours to handle calls for the City and the PCWP. The clerks answering the hotline are required to complete a form when answering the calls so that all the required information is collected. The form is tied to a database that stores all calls received and provide a mechanism for tracking calls. A representative from the City of Omaha will use the information stored in the database to direct the call to the appropriate Partnership representative or their designee.

There was one illicit discharge complaint received via the Papio Partnership website (www.papiopartnership.org) or the hotline in 2011. Public complaints can be logged into the erosion website (www.PCWPErosionControl.org).

This permit requirement has been met.

2.B. Participate in organizing and hold open houses on Papillion Creek Watershed Partnership activities. Year 1-5: A summary of activities will be included in the Annual Report.

The PCWP held monthly meetings in 2011 and the minutes for those meetings are available on the PCWP website at www.papiopartnership.org. The agenda is posted for the entire year on the website and the recordings of those meetings are available upon request.

This permit requirement has been met.

2.C. Continue to implement a Stream Clean Up Day. Utilize KOB to identify stream segments in need of cleanup and request volunteers from the local area, public groups, and representatives from local area business and developments. Year 1-5: Conduct one clean-up day each year. A summary of the clean-up day activities will be included in the Annual Report.

The PCWP partnered with Keep Omaha Beautiful, Inc. (KOB) to organize the 2011 Stream Clean-up day on September 19th. There were a total of 68 participants who collected litter during the day. Additional clean-up activities of parks, lakes and trails are included in Attachment A.

This permit requirement has been met.

2.D. Provide tours of UndertheSink, household hazardous waste facility, for schools and neighborhood organizations to learn about the proper way to manage household chemicals and about stormwater treatment systems installed at the site. Year 1-5: Provide a summary of the tours conducted on an annual basis for the annual report. Document when BMPs are installed and included in the tour.

Sixteen (16) tours were conducted in 2011 at UndertheSink. Several BMPs including a series of rain gardens have been reconstructed and are included as part of the tour.

This permit requirement has been met.

2.E. Hold World O! Water festival focused on elementary school aged children to celebrate clean water and engage in water quality related activities. Year 1-5: Hold event annually. Report estimated number of participants in Annual Report.

World O! Water was held on August 20, 2011 at Chalco Hills Recreation Area. Approximately 1200 residents attended the annual event. Attachment A includes details from the World O! Water event.

This permit requirement has been met.

2.F. Participate in community organizations, conferences, workshops and web casts related to water quality and stormwater management. Year 1-5: Report number of staff attending, dates, location and description of events.

A summary of events is listed in Attachment A. A Sediment and Erosion Control seminar was held on February 2, 2011 with 180 attendees. Several special interest group meetings were conducted in 2011 on topics regarding stormwater awareness education, pollution prevention and water conservation. This effort reached a number of school students and other individuals. Webcasts are offered throughout the year to PCWP members on a variety of topics from software training on NPDES permit tracking, Center of Watershed Protection webcasts, and EPA webcasts.

This permit requirement has been met.

3. Illicit Discharge Detection and Elimination

3.A. Dry-weather inspections including Physical Characteristics Examinations of storm water outfalls 72" or greater and any outfalls with documented complaints. Year 1-5: Inspect and record observations. Include a count of outfalls inspected in the Annual Report.

Sarpy County Public Works has hired a consultant to develop a stream asset inventory consisting of the following information:

- Stream alignments and confluences
- Mapped channel gradient and pattern
- Property boundaries and jurisdictions
- Watershed boundaries and land use
- Road crossings, bridge and culverts
- Potential stream access points.

This permit requirement has been met.

3.B. Investigate and seek resolution concerning any dry weather discharges by notifying the source that they must discontinue discharging, and initiate enforcement action consistent with adopted ordinance which will also address any TMDL pollutants of concern. Any source that the applicant feels constitutes an immediate health or safety threat will be reported immediately to the NDEQ. Year 1-5: The following information will be included in the Annual Report; the number of process or potentially polluted wastewater sources found; the number of above resolved at local level; and the identity of any referred and/or unresolved discharge sources.

Sarpy County enforces the Storm Water Regulations and tracks violations as necessary.

This permit requirement has been met.

3.C. The applicant will perform dry weather inspection of storm water outfalls, including smaller outlets and those that discharge to lesser tributaries or other storm conduits, in

response to suspect conditions and/or complaints. Year 1-5: Inspect and record observations. Included a count for outfalls inspected in the Annual Report.

No suspect conditions and/or complaints were documented or reported. Sarpy County has requested dry weather inspections be performed on storm water outfalls and those that discharge to lesser tributaries and storm conduits.

Sarpy County hired WLA to develop a GIS stream inventory in order to have a count on streams and tributaries.

This permit requirement has been met.

3.D. Enforce existing ordinances/regulations prohibiting illicit discharge connections to storm sewers. Year 1-5: Summarize code violations and enforcement actions taken in Annual Report.

Dry weather discharges identified, as the outfalls are inspected will be investigated with respect to the source of the discharge. The Physical Characteristics Examination (PCE) will be completed as part of the inspection process and, if there is reason to believe that the discharge is allowable under the stormwater ordinance/regulation, the investigation will be terminated. If the PCE indicates that there may be an illicit connection, a more comprehensive investigation will be undertaken that may involve sampling the discharge, tracing the line upstream to identify potential sources, and questioning potential dischargers. If a potential source is identified, information will be provided regarding the impact to human health and the environment to resolve the problem.

This permit requirement has been met.

3.E. Maintain and prevent instances of sanitary sewer leakage into MS4 or waters of the state. Year 1-5: Summarize investigations of leakage and actions taken in Annual Report.

Perform annual inspections on county interceptors and outfalls including those adjacent to creeks. Perform routine maintenance on sanitary lines if necessary.

This permit requirement has been met.

3.F. Maintain and update a sewer map of major storm water outfalls and identify the names of respective receiving waters. Year 1-5: Map will be maintained electronically on City or County GIS.

Each community in the PCWP sends information to the Douglas or Sarpy County GIS departments where the outfall maps are maintained. The websites for Douglas and Sarpy Counties are http://www.dcgis.org/dogis/ and http://maps.sarpy.com/sims20/ respectively.

This permit requirement has been met.

3.G. Prevent, contain and respond to spills in the MS4. Review, as necessary, interdepartmental SOPs with respect to spills dumping and illegal disposal that impacts the MS4. Year 1-5: Summarize number of reports of spills and actions taken in Annual Report. Identify respective Department SOP and review date in Annual Report.

Sarpy County's policy for responding to prevent, contain and respond to spills is as follows:
Step 1: Gathering of facts. Who, What, Where, When, Why and How
Step 2: Determine party to respond. Whose line is it? If it is the County's line, do we have the resources to take care of it? If not, we should contact an engineering firm such as TD2.
Step 3: Contact the appropriate party or parties.
Step 4: Follow up to make sure the appropriate repairs are made.

This permit requirement has been met.

4. Construction Site Runoff Control

4.A. Maintain the PCWP construction site inspection and reporting web site and continue to make enhancements. Year 1-5: Include a narrative in the annual report about major web site upgrades and the date implemented.

Currently the web site is being upgraded for easier use and to be able to merge information for grading and post construction permit information for the projects in the PCWP jurisdictions. The old web site is still functional for project inspections and reporting. The Permix website which is the updated site to combine permit projects is still undergoing construction and will be available as soon as possible.

This permit requirement has been met.

4.B. Maintain a construction site inspection program that includes procedures for reporting, resolving deficiencies, and taking appropriate enforcement action consistent with adopted ordinances. Years 1-5: The Annual Report will contain the following information relative to this commitment: 1) the number of inspections conducted in each of the following size categories: < 5 acres and > 5 acres; and 2) the number of sites receiving enforcement actions.

Grading permits are required for all developments in the Papillion Creek Watershed and are tracked electronically on the PCWP's web based system (www.PCWPErosionControl.org) which is currently being improved on. Omaha inspectors will review weekly site inspection reports from the permittees, make periodic inspections to verify the permittee reports, notify the permittees when deficiencies are noted, and notify the permitting authority when enforcement is necessary. Priority sites are determined by the construction phase, with the initial site work being the highest priority. The goal of the construction site inspection program is to achieve

voluntary compliance, but referrals will be made to NDEQ for non-complying sites not responding to local enforcement actions.

Violations processed in 2011 are referenced in Attachment C. The table below summarizes PCWP construction inspections for 2011.

	City Inspection Reports	Private Inspection Reports
Phase I Sites (>5 acres)	574	4357
Phase II Sites (<5 acres)	511	3322
Total	1085	7679

This permit requirement has been met.

4.C. Maintain regulations and design specifications for controlling erosion, sediment loss, and other TMDL pollutants of concern from construction sites that disturb areas of 1 acre or more. Year 1 -5: Provide a narrative description of any changes implemented in sediment and erosion control regulations or design specifications in the annual report.

Chapters dealing with the post construction BMPs (Chapter 8) and Erosion and Sediment Control (Chapter 9) are being updated in the Omaha Regional Stormwater Manual which is adopted by all members of the PCWP. The update of these chapters provides more detailed information on selection of BMPs for both post construction and erosion and sediment control. Also additional BMPs have been added to the chapters to include newer technology and different practices. Several open houses have been held inviting the public and specifically the engineering community to participate in the revisions to Chapters 8 and 9 of the Omaha Regional Stormwater Manual.

This permit requirement has been met.

4.D. Maintain a program for performing review of Grading Permit applications to ensure compliance with applicable regulations and design specifications. Year 1 -5: Summarize the number of grading permit issued on an annual basis.

In 2011, there were 43 Phase I grading permits and 76 Phase 2 grading permits issued in the PCWP communities.

This permit requirement has been met.

5.0 Post-Construction Runoff Control

5.A. Develop a guidance document for Post-Construction Stormwater Management Plan. Year 1: Revise ordinances as necessary to institute authority to require the use of post-construction stormwater controls. Year 2: Develop guidance document for Post Construction Storm water Management Plan Year 2-5: Revise as necessary.

Omaha has developed guidance documents and inspection forms for BMPs that are available to the PCWP members and are located on the PCWP website (www.papiopartnership.org). The post construction stormwater management web site is currently up and running and makes the review process easier as well as provide a single location for plans, inspections, maintenance forms, etc. As mentioned earlier, the chapters of the Omaha Regional Stormwater Manual are currently being updated to provide a more comprehensive list of BMP details and specifications. The updates to the Omaha Regional Stormwater Manual are nearly complete and will be finalized by Summer 2012. Guidance documents and the Stormwater Manual will continue to be analyzed and updated.

This permit requirement has been met.

5.B. Develop a database of existing structural BMPs (private and public) that reduce the impact of urbanization on storm water run-off and improve water quality and enhance other amenities and activities such as green space, parks and recreation, urban planning, aesthetics, and public safety. Year 2: Coordinate with engineering firms and the NRD to identify existing BMPs and their location. Year 3: Develop a database and GIS map of BMPs.

In 2010, the PCWP purchased CBI software to assist with the tracking of NPDES permits activities. The use of this software was delayed due to issues with hosting and although a resolution was found, the system was not in place long enough for the majority of the Phase II communities to utilize it to its potential. The PCWP Phase II communities are in the process of loading information in to this software and it will provide an opportunity to track BMPs for each member of the PCWP when completed.

This permit requirement is on schedule for completion.

5.C. Inspect annually and maintain (as necessary) the MS4 owned storm water BMP structures. Year 1 -5: List BMPs inspected and summarize maintenance activity in Annual Report.

No further work has been completed on this by Sarpy County Public Works or Planning. We have talked with a consultant about doing sustainability standards for Sarpy County's road network and developing a suburban park plan but this is not in the current budget. We are seeking funding in FY2013.

This permit requirement is on schedule for completion.

5.D. *Revise stormwater BMP maintenance and inspection plan as needed. Year 1-5: Review maintenance plan annually and include new structures. Make revisions as necessary. Report revisions and new structures in Annual Report.*

Stormwater BMP maintenance and inspections are underway in PCWP communities. A website is in place to help the review process with post construction stormwater management in all the PCWP communities. This website provides a place to store documentation on the maintenance

and inspections of the BMPs. The process continues to be monitored and any revisions will be reported.

This permit requirement is on schedule for completion.

5.E. Implement strategies, which include a combination of structural and or non-structural BMPs appropriate for the watershed, which will address potential TMDL pollutants of concern. Non-structural BMP's, including improved planning and site design, shall be a priority. Evaluate these strategies and implement changes as necessary to improve water quality and address potential TMDL pollutants of concern. Year 1 -5: Summarize strategies in the Annual Report.

The communities of the PCWP have adopted ordinances requiring the first half inch of runoff be controlled on site and that the 2 year peak flow be maintained on new development. These local ordinances are intended to address water quality in the watershed. Adopting these ordinances along with the Watershed Management Plan and Implementation Plan will address potential TMDL pollutants of concern. Stormwater policies adopted by the PCWP members also address these strategies for improving water quality. The Watershed Management Plan, Implementation Plan and Stormwater policies are attached as Attachment B. In addition, the PCWP has applied for an EPA grant to help with a Natural Resources Inventory to assess the condition of streams and wetlands within the watershed. The Natural Resources inventory is intended to be a tool to help the PCWP communities identify areas for preservation and priority areas for stream restoration.

This permit requirement has been met.

6. Pollution Prevention/Good Housekeeping for Municipal Operations

6.A. Maintain Runoff Control Plans for all the MS4's maintenance facilities to identify BMPs implemented. Review Plan annually and update as necessary. Inspect all facilities annually. Year 1 -2: Develop Runoff Control Plan for maintenance facilities. Year 3-5: Review and Revise Runoff Control Plan. Summarize efforts in Annual Report.

Evaluation documents for Facility Runoff Control Plans (FRCP) have been developed and templates shared with the members of the PCWP. These templates include a photo checklist, site questionnaire, facility profile sheet, hot spot checklist, photo log and a facility recommended BMP checklist. A training meeting is being scheduled in Spring 2012 to train managers from PCWP communities on FRCP and duties associated with them so that they will be able to train other members of their staff who are in charge at each facility. After the training session FRCPs will be developed for the necessary facilities in each jurisdiction.

Sarpy County has developed Good Housekeeping Plans for all necessary municipal facilities.

This permit requirement is behind schedule but will be caught up by end of permit year three.

6.B. Inspect storm sewer conduits, channels and catch basins and remove and properly dispose of sediment and debris as needed to maintain an efficient system within permitted area. Year 1 - 5: Report maintenance activities in the Annual Report

Type	Number Inspected (est.)	Number Cleaned (est.)
Conduits	3	3
Channels	6	4
Catch Basins	215	8
Storm drain inlets	13	9
Erosion Inspections/Maintenance	567	33
Storm Sewer System Maintenance	1	2
Flared End Sections	37	0
Outlets	3	0
Curb Inlets	551	0
Area Inlets	38	0
Manholes	106	0
Headwalls	15	0
Junction Boxes	5	0
Grate Inlets	85	0
Box Culvert	1	0
Other -New System Construction	1	1
2011 expenditures (all types – inspections & cleaning)	$131,338.45	

This permit requirement has been met.

6.C. Provide training for employees to prevent pollutant runoff from municipal operations at the applicant's maintenance facilities and at field operations. Years 1 – 5: Provide training for employees and include summary in Annual Report of when training was held and number of attendees.

Training is planned for employees in all jurisdictions of the PCWP in Spring 2012 to have the community's facility managers trained on Facility Runoff Control Plans and the implementation of those plans.

This permit requirement is on schedule for completion.

6.D. Provide for street cleaning in the following areas: Residential; Business; Major Streets; and other areas in conjunction with special projects. Year 1-5: Summarize street cleaning activities in Annual Report.

Miles of Streets Cleaned in 2011 (approximate)	2011 Expenditure	2012 Budget (proposed)
167.01	$42,458.71	$48,814.16

This permit requirement has been met.

6.E. The applicant's staff that apply pesticides will be trained in a certification program that complies with FIFRA regulations. Year 1 -5: Report total number of Staff certified each year in the Annual Report.

Sarpy County outsources lawn service to include weed control and fertilizer. The vendor is licensed, insured and maintains current applicator certifications. Sarpy County has requested a copy of the applicator certification for reference.

This permit requirement has been met.

6.F. The applicant will continue to minimize pesticide and fertilizer use on publically maintained properties. Year 1 -5: Summarize efforts in Annual Reports.

Sarpy County outsources to a vendor pesticide and fertilizer application. The vendor uses a four-step, slow release application for fertilizer and spot sprays only as needed for weeds. All applications are restricted to inner most areas of the property.

Step 1: March
Step 2: May
Step 3: July
Step 4: October

This permit requirement has been met.

8. Storm Water Monitoring Plan

8.A. Conduct in-stream water quality monitoring of named creeks in the Papillion Creek Watershed. Collect samples from at least 4 sites located in the Papillion Creek Watershed. Samples will be collected from May through August one day a week and analyzed for the following parameters: BOD5, TSS, ammonia nitrogen, nitrate-nitrogen, total nitrogen, soluble and total phosphorus, turbidity, pH, E coli, and Physical Characteristic Examinations. The purpose of the monitoring will be to evaluate the effectiveness of storm water management practices in the Papillion Creek watershed as they relate to potential TMDL pollutants of concern.

List of potential sites:
170 and Highway 36 (Big Papio)
77th and L Street (Big Papio)
66th and L Street (Little Papio)
Ft. Crook Road – USGS station (Papillion Creek) Year 1- 5: Conduct monitoring
The following information shall be included in the Annual Activity Report:

- *The monitoring data;*
- *A summary report on the findings relative to SWMP efforts;*
- *Any modifications of monitoring locations or procedures.*
  Year 1- 5: Conduct monitoring

The City of Omaha has taken the lead role for the stormwater monitoring elements 8.A and 8.B. The City sampled four sites in the Papillion Creek Watershed in conjunction with NDEQ's Basin Rotation Monitoring Program. Samples were collected one day a week from May 11 through August 17, 2011. Samples were analyzed for the following parameters: fecal coliform, e coli, nitrate / nitrite nitrogen, Kjeldahl nitrogen, nitrite nitrogen, ammonia nitrogen, total phosphorus, dissolved phosphorus, pH, BOD, TSS, TDS, temperature, DO, specific conductivity, and turbidity. Quality control/quality assurance measures were followed as described in the Sampling and Analysis Plan (submitted to NDEQ April 1, 2005). Sample results are presented in Attachment D. Data qualifiers follow NDEQ's recommended practices.

With only a limited set of data at this time (two years), it is difficult to draw any conclusions regarding the implementation of the Watershed Management Plan's impact on water quality. The Partnership will continue to monitor and gather a database which could be used to help analyze the impact BMPs on water quality.

This permit requirement has been met.

8.B. Develop an assessment monitoring plan for demonstration BMPs. Evaluate the effectiveness of the selected BMPs to treat storm water for the TMDL pollutants of concern and other water quality benefits. Consider implementation of refinements to the BMPs, which would improve their effectiveness. One aspect of the monitoring plan will include the collection stream samples on the segment that runs through Orchard Park to establish baseline conditions for BMP assessment purposes.

Additionally, the plan will address how the applicant proposed to use stream samples collected in dry weather and wet weather, as described in 8.A above, to estimate the pollutant masses discharged on an event basis and an annual basis.

Year 1 – 2: Visually document and monitor the installation of the demonstration BMPs. Installation is expected to be complete by the end of Year 2. Provide a narrative to report progress in Annual Report.

Year 2: Develop the BMP assessment monitoring plan and submit to NDEQ for approval as an attachment to the Annual Report.
Years 3 - 5: Conduct monitoring.
The following information shall be included in the Annual Activity Report:

1) *the location of the monitoring site*
2) *the intensity and duration of the storm event monitored;*
3) *the timing of sampling in comparison to the occurrence of the storm event and to the discharge of peak storm water flows;*
4) *the monitoring data; and a summary report on the findings of the removal rates of the constituents monitored for the BMPs.*

BMP assessment and testing was completed in 2011, the report titled, "Performance Assessment of Two Stormwater Best Management Practices for Infiltration, Water Quality, and Vegetative Growth", is enclosed as Attachment E. The purpose of this report was to analyze the infiltration and water quality benefits of established demonstration BMPs. The results help the communities to improve design and function of the BMPs required in the Watershed Management Plan which would increase infiltration and water quality benefits for the watershed. The BMP assessment monitoring plan is behind schedule and will be complete in permit year three.

This permit requirement is behind schedule but will be on track for completion after permit year three.

8. Fiscal Expenditures

Sarpy County spent $7,917 in 2011 to hire a consultant for the Stream Asset Inventory. Total contract is $19,800.

Administrative	2011 Expenditures	2012 Planned
Partnership Meetings/Coordination	$1000	$1200
Planning, review, and preparation	$4500	$6000
Public Education/Outreach	$0	$500
Annual Administrative Total	$5500	$7700

Operation and Maintenance

The 2012 estimated budget figures were not available at the time of preparation of this annual report. It is anticipated that these budget figures will be included in future reports.

Operation and Maintenance	2011 Expenditures	2012 Budgeted
Sediment/Erosion Control Program	$0	
Material Disposal	$0	
Creek/Open Channel Maintenance	$0	
Street Sweeping	$1,403.78	
Street /Right of Way Cleaning	$2,381.40	
Unimproved Street Maintenance	$121,435.76	
Public Education/Outreach	$0	
MS4 Planning	$0	
Bridge Maintenance and Rehab	$0	
Sewer Maintenance	$0	
Annual O&M Total	$125,220.94	

9. Changes in MS4 Area

Several annexations were approved by Cities within Sarpy County. A current map of Sarpy County's Jurisdiction is attached.

List of Attachments

Attachment A. Listing of public outreach events. Per SWMP item 1.

Attachment B. Watershed Management Plan, Implementation Plan and Stormwater Policies

Attachment C. Violations processed in 2011. Per SWMP item 4.C.

Attachment D. In-stream monitoring of named creeks. Per SWMP item 8 .A.

Attachment E. Performance Assessment of Stormwater Best Management Practices For Infiltration, Water Quality, and Vegetative Growth.

Attachment F. Changes in MS4 area.

Attachment A

2011 Outreach Activities

CONSTRUCTION RUNOFF

EVENT

Sediment and Erosion Control

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
02/02/2011	180	Builders, Developers, and Graders	CoCo Key Convention Center	Workshop for engineers, developers and graders to educate them about NPDES Phase II regulations, Omaha's Grading Permit Program, and sediment and erosion control BMPs.

POST-CONSTRUCTION RUNOFF

EVENT

Post-Construction Management

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/26/2010	275	Engineers, Developers	Omaha Marriott	IECA's Great Plains Chapter regional workshop for engineers and developers to educate them about post construction ordinance requirements, BMPs, and stormwater management.

PUBLIC EDUCATION/OUTREACH

BILLBOARD

Pet Waste

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/04/2010		Omaha Area Residents	132nd & L	Digital Billboard, Waitt Outdoor,10/4-10/10, 10-second spots, 5040 spots/week, $500

BROCHURES/PAMPHLETS

Illegal Dumping

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Willa Cather Branch Library	50

KOB Opportunities for Involvement

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	25	Omaha Area Residents	Recycling Postcards	25, "Get a Bin"
09/30/2011	50	Omaha Area Residents	Willa Cather Branch Library	50
09/30/2011	25	Omaha Area Residents	Mockingbird Community	25
09/30/2011	25	Omaha Area Residents	Elkhorn Public Library	25
09/30/2011	50	Omaha Area Residents	Millard Branch Library	50
09/30/2011	50	Omaha Area Residents	Under the Sink	50
09/30/2011	50	Omaha Area Residents	South Branch Library	50

KOB Opportunities for Involvement (Spanish)

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS

2011 Outreach Activities

PUBLIC EDUCATION/OUTREACH

BROCHURES/PAMPHLETS

KOB Opportunities for Involvement (Spanish)

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	South Branch Library	50
09/30/2011	50	Omaha Area Residents	Our Lady of Guadalupe	50

OmaGro

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Ace Hardware 50th and Center	50 copies
09/30/2011	50	Omaha Area Residents	Elkhorn Public Library	50 copies
09/30/2011	100	Omaha Area Residents	Earl May 90th and Center	100 copies

Pesticides, Herbicides, and Fertilizer Use

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	75	Omaha Area Residents	Union Pacific	75
09/30/2011	100	Omaha Area Residents	Earth Day Omaha	100
09/30/2011	75	Omaha Area Residents	Ace Hardware (144th and	75
09/30/2011	150	Omaha Area Residents	Gallup	150
09/30/2011	50	Omaha Area Residents	Creighton University	50
09/30/2011	150	Omaha Area Residents	Lauritzen Gardens	150
09/30/2011	60	Omaha Area Residents	ConAgra	60

Prepare yourself to use UTS

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Under the Sink	50

Storm Drain Fact Sheets

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011	100	Omaha Area Residents	Papio NRD - World O! Water	100
09/30/2011	900	Omaha Area Residents	Omaha Residences	900

Storm Drains and Water Pollution

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011	100	Omaha Area Residents	Papio NRD - World O! Water	100
09/30/2011	50	Omaha Area Residents	Omaha	Give out to volunteers during drain disc placement program

Sustainability Starts at Your Sink

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011	100	Omaha Area Residents	Papio NRD - World O! Water	100

Using Lawn Chemicals Wisely

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Sunrise Nursery 84th and	50

2011 Outreach Activities

PUBLIC EDUCATION/OUTREACH

CLEAN-UP

Adopt-A-Park Program

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	795	Volunteers, Parks	City of Omaha	14 new park adopted, total is 60, 210 cleanups, 795 volunteers, 1140 bags of litter

Clean-up

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
03/01/2011		Volunteers, Dams and waterways	Lake Zorinsky	
03/01/2011		Volunteers, Dams and waterways	Standing Bear	
04/01/2011		Volunteers, Dams and waterways	Riverfront	
05/01/2011		Volunteers, Dams and waterways	Lake Zorinsky	
05/01/2011		Volunteers, Dams and waterways	Big Papio	
06/01/2011		Volunteers, Dams and waterways	Standing Bear	
09/01/2011		Volunteers, Dams and waterways	Benson Park Lagoon	
09/01/2011		Volunteers, Dams and waterways	Walnut Grove Creek	
09/01/2011		Volunteers, Dams and waterways	Gene Leahy Mall	
09/01/2011		Volunteers, Dams and waterways	Lake Cunningham	

Litter

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011		Omaha Area Residents	Omaha	101 Bag of litter collected

Storm Drain Grate Clean

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011		Omaha Area Residents	Omaha	567 Grates Cleaned

DRAIN MARKING

Storm Drain Cards

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	25	Omaha Area Residents	Our Lady of Guadalupe	25
09/30/2011	25	Omaha Area Residents	Under the Sink	25

2011 Outreach Activities

PUBLIC EDUCATION/OUTREACH

EVENT

Equipment Reservation

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011	1200	Omaha Area Residents	Papio NRD - World O! Water	1200

General Stormwater Awareness Education AND Post Construction Policy

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
03/23/2011	20	Educators	MCC - Fort Campus	Present MS4 Permit requirements to educators

Girl Scout Collaboration

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011		Omaha Area Residents	Papio NRD - World O! Water	Fliers to leaders, email blast, 200 GS participated

Hy-Vee Lunch

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011	800	Omaha Area Residents	Papio NRD - World O! Water	800 hot dog, chip, cookie lunches, "Good Guys" served lunch

Industrial Stormwater Permit

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
06/22/2011	10	Printing Industry	Common Ground Community	Industrial Permit Outreach

Kid's Art Activity

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011		Omaha Area Residents	Papio NRD - World O! Water	Watercolor wash/crayon activity staffed by volunteers

Living Green: Benson High School Rain Garden Initiative

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/12/2010	60	Benson HS and community	Benson High School	Ribbon cutting and tour of Benson High School's Rain Gardens

MORE Nature Nights

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
03/29/2011	100	Elementary School Students	Picotte Elementary	After school event promoting outdoor nature based play.
08/25/2011	100	Elementary School Students	Joslyn Elementary	After school event promoting outdoor nature based play.
09/20/2011	100	Elementary School Students	Reeder Elementary	After school event promoting outdoor nature based play.

Pet Waste

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
06/18/2011	500+	Omaha Area Residents	Benson	Pet waste and general stormwater awareness
09/25/2011	1,000+	Pet Owners	Nebraska Humane Society	NHS - Walk for the Animals: Information and 1000 pet waste bag dispenser distribution at the Walk for the Animals

Shuttle

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011		Omaha Area Residents	Papio NRD - World O! Water	3 shuttles, $687

2011 Outreach Activities

PUBLIC EDUCATION/OUTREACH

EVENT

Watershed Eductation

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011		Omaha Area Residents	Papio NRD	Annual event targeting children and families educating them in a fun atmosphere about water quality and conservation issues.

World O! Water

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011	1200	Omaha Area Residents	Papio NRD - World O! Water	estimated 1200 in attendance

MUNICIPAL OUTREACH

City of Omaha Hotline

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011		Volunteers	Omaha	Printed on materials handed out to volunteers and volunteers in the storm drain disc placement program are made aware

Omaha World Herald Promotion

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/20/2011		Omaha Area Residents	Papio NRD - World O! Water	$2805.86 for promotion

NEWSPAPER ARTICLE

Pet Waste

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/04/2010	15,000	Omaha Area Residents	Shout Weekly	1/4 Page in Shout Weekly $200
10/04/2010	19,200	Omaha Area Residents	The Reader	1/2 Page ad in The Reader $672
10/05/2010	184,000	Omaha Area Residents	OWH	6X3 ad in OWH $828
10/07/2010	184,000	Omaha Area Residents	OWH	6X3 ad in OWH $828

POSTER/SIGNAGE

Pet Waste

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/06/2010	1,000+	Omaha Area Residents	Various Trash Cans	Trash Can Inserts, 50 total, $1,250

2011 Outreach Activities

PUBLIC EDUCATION/OUTREACH

RADIO COMMERCIAL

Composting

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
05/06/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial
05/13/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial
05/20/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial

Don't Litter-Cigarette Butts

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
05/07/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial
05/14/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial
05/21/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial
05/28/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial

Household Waste Disposal - OIL

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
06/04/2011	1,000+	Omaha Area Residents	KFAB Radio	30-second radio commercial
06/11/2011	1,000+	Omaha Area Residents	KFAB Radio	30-second radio commercial
06/21/2011	1,000+	Omaha Area Residents	KFAB Radio	30-second radio commercial
06/28/2011	1,000+	Omaha Area Residents	KFAB Radio	30-second radio commercial

World O! Water

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
08/06/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial
08/13/2011	1,000+	Omaha Area Residents	KFAB Radio	15-second radio commercial

2011 Outreach Activities

PUBLIC EDUCATION/OUTREACH

RECYCLING/HHW PROMOTION

Automotive UTS

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Autozone North 30th St	50
09/30/2011	50	Omaha Area Residents	O'Reilly Autoparts 30th and	50
09/30/2011	50	Omaha Area Residents	Autozone 72nd and Redick	50

Generic UTS Cards

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Millard Branch Library	50
09/30/2011	50	Omaha Area Residents	Washington Branch Library	50
09/30/2011	75	Omaha Area Residents	South Branch Library	75

Get the Point (Medical HHW)

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	75	Omaha Area Residents	Kubat Pharmacy 48th and	75
09/30/2011	40	Omaha Area Residents	Kohll's Pharmacy 55th and L	40
09/30/2011	50	Omaha Area Residents	HyVee Pharmacy 96th and Q	50
09/30/2011	50	Omaha Area Residents	Walgreens 24th and Vinton	50
09/30/2011	50	Omaha Area Residents	Walgreens 24th and L	50

Guide to HHW

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	O'Reilly Autoparts 50th and L	50

Household Hazardous Waste

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	750	Omaha Area Residents	Various Groups	750
09/30/2011	200	Omaha Area Residents	Creighton University Earth Day	200
09/30/2011	200	Omaha Area Residents	Earth Day Omaha 2011	200
09/30/2011	200	Omaha Area Residents	Union Pacific Earth Day	200
09/30/2011	200	Omaha Area Residents	Gallup Earth Day	200
09/30/2011	200	Omaha Area Residents	ConAgra Earth Day	200

Housing Dangerous Products

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Willa Cather Branch Library	50
09/30/2011	50	Omaha Area Residents	Tractor Supply 81st and L	50

2011 Outreach Activities

PUBLIC EDUCATION/OUTREACH

RECYCLING/HHW PROMOTION

Housing Dangerous Products (Spanish)

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Our Lady of Guadalupe	50
09/30/2011	50	Omaha Area Residents	Autozone 24th and Vinton	50
09/30/2011	50	Omaha Area Residents	Willa Cather Branch Library	50

Pollution Sources Around Your House

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Ace Hardware 50th and Center	50 copies
09/30/2011	50	Omaha Area Residents	Autozone 49th and Center	50 copies

Proper Paint Disposal

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Lowes 72nd and Dodge	50
09/30/2011	50	Omaha Area Residents	Sherwin Williams 74th and Cass	50
09/30/2011	75	Omaha Area Residents	Pittsburgh Paints 72nd and L	75

Spanish Under the Sink

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Ace Hardware 50th and G	50
09/30/2011	50	Omaha Area Residents	O'Reilly Autoparts 50th and L	50
09/30/2011	50	Omaha Area Residents	AutoZone 50th and Center	50

Under the Sink (Recycling Paint)

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/30/2011	50	Omaha Area Residents	Ace Hardware 50th and Center	50 copies
09/30/2011	50	Omaha Area Residents	Willa Cather Branch Library	50 copies
09/30/2011	100	Omaha Area Residents	Westlake Hardware 50th and G	100 copies
09/30/2011	50	Omaha Area Residents	Westlake Ace Hardware	50
09/30/2011	50	Omaha Area Residents	Menards Elkhorn	50
09/30/2011	75	Omaha Area Residents	Diamond Vogel Paint 78th and	75 copies
09/30/2011	50	Omaha Area Residents	Elkhorn Public Library	50
09/30/2011	75	Omaha Area Residents	Builder's Supply 72nd and Main	75 copies

2011 Outreach Activities

PUBLIC INVOLVEMENT/PARTICIPATION

Omaha Rain Barrel Program

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
07/25/2011	60	Omaha Area Residents	Omaha Residences	Information and design guidance provided with a free barrel to be created into a rain barrel.

2011 Outreach Activities

PUBLIC INVOLVEMENT/PARTICIPATION

CLEAN-UP

Clean-up

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
04/01/2011		Volunteers	Spring Lake Park	
04/01/2011		Volunteers	Hanscom Park	
04/01/2011		Volunteers	Brown Park	
04/01/2011		Volunteers	Elmwood Park	
04/01/2011		Volunteers	Benson Park	
05/01/2011		Volunteers	Spring Lake Park	
05/01/2011		Volunteers	Highland Park	
06/01/2011		Volunteers	Keystone Park	
06/01/2011		Volunteers	Spring Lake Park	
07/01/2011		Volunteers	Kountz Park	Cleaned weekly for 6 weeks
07/01/2011		Volunteers	Benson Park	
08/01/2011		Volunteers	Hanscom Park	
08/01/2011		Volunteers	Keith Park	
08/01/2011		Volunteers	Manden Park	
08/01/2011		Volunteers	Keystone Park	
09/01/2011		Volunteers	Clarkson Park	
09/01/2011		Volunteers	Keith Park	
09/01/2011		Volunteers	Elmwood Park	

Neighborhood Clean-Up

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/21/2010	20	Omaha Area Residents	Leahy Mall	RSM McGladrey
10/23/2010	759	Omaha Youth	Omaha Area	Youth Fall Clean-up

Park Clean-Up

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/02/2010	12	Omaha Area Residents	Keystone Park	Keystone Neighborhood Association, 1 hour
10/19/2010	5	College Students	Fontenelle Park	Creighton University, 2 hours
10/23/2010	10	Omaha Area Residents	Elmwood Park	2 hours

Stream Clean Up

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
09/19/2011	68	Omaha Area Residents	Area Streams	60 volunteers from Green Coalition

Trail Clean-Up

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/08/2010	10	Omaha Area Residents	Omaha Trails	MeGroup, 2.5 hours

2011 Outreach Activities

PUBLIC INVOLVEMENT/PARTICIPATION

DRAIN MARKING

Storm Drain Markers

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
10/01/2010	1	Omaha Area Residents	Omaha Streets & Inlets	Hahn, 10 hours
10/01/2010	1	Omaha Area Residents	Omaha Streets & Inlets	Digmans, 15 hours
06/01/2011	452 (Inlets)	Omaha Area Residents	Omaha Streets & Inlets	Installed 452 drain markers
07/01/2011	237 (Inlets)	Omaha Area Residents	Omaha Streets & Inlets	Installed 237 drain markers
08/01/2011	142 (inlets)	Omaha Area Residents	Omaha Streets & Inlets	Installed 142 drain markers
09/01/2011	300 (Inlets)	Omaha Area Residents	Omaha Streets & Inlets	Installed 300 drain markers

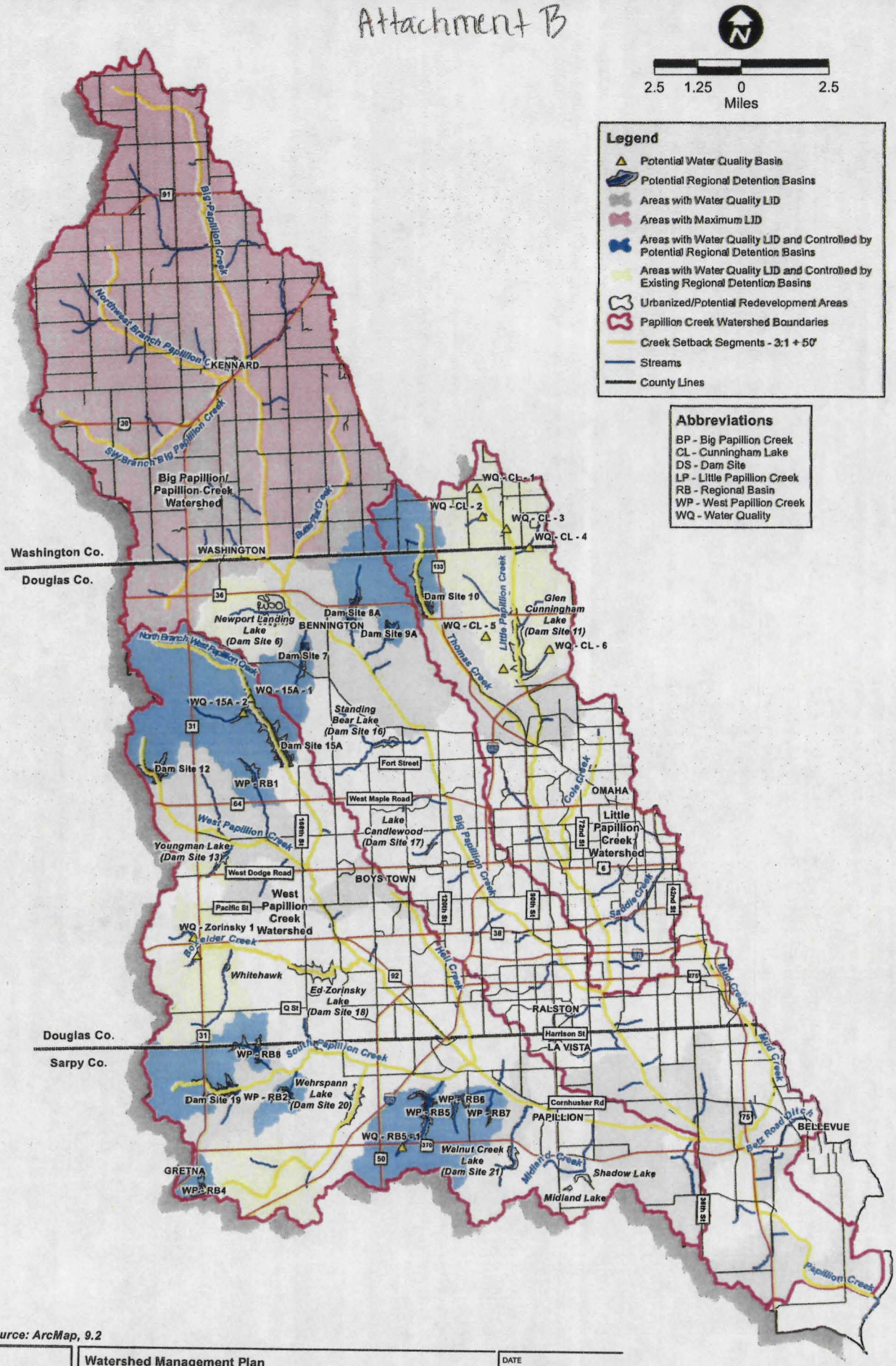
SPECIAL INTEREST GROUP MEETING

Watershed Policy

DATE	COUNT	TARGET MARKET	LOCATION	COMMENTS
11/18/2010	11	Partnership Members	Papio NRD	Partnership Meeting
01/21/2011	21	Partnership Members	Papio NRD	Partnership Meeting
02/24/2011	20	Partnership Members	Papio NRD	Partnership Meeting
03/24/2011	19	Partnership Members	Papio NRD	Partnership Meeting
04/28/2011	14	Partnership Members	Papio NRD	Partnership Meeting
05/26/2011	16	Partnership Members	Papio NRD	Partnership Meeting
08/25/2011	15	Partnership Members	Papio NRD	Partnership Meeting
09/22/2011	14	Partnership Members	Papio NRD	Partnership Meeting

Attachment B

Attachment B



Source: ArcMap, 9.2

HDR

Watershed Management Plan
Papillion Creek Watershed

Papillion Creek Watershed Partnership

Papillion Creek Watershed Plan - Stage IV
Papillion Creek Watershed Partnership

DATE
May 2009

FIGURE
1

Papillion Creek Watershed Implementation Plan (Years 2011-2013)

Program Projects Components

Water Quality

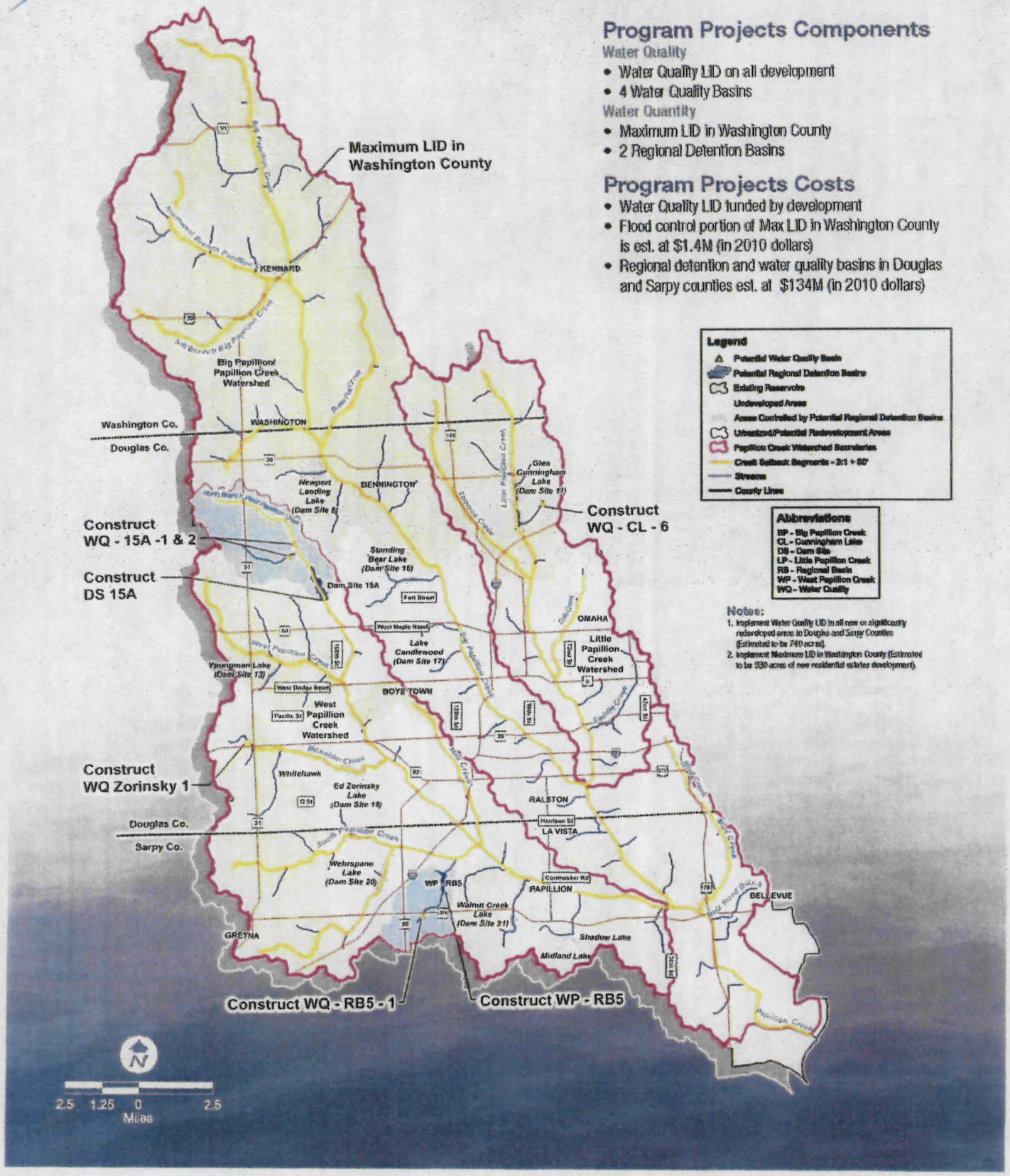
- Water Quality LID on all development
- 4 Water Quality Basins

Water Quantity

- Maximum LID in Washington County
- 2 Regional Detention Basins

Program Projects Costs

- Water Quality LID funded by development
- Flood control portion of Max LID in Washington County is est. at $1.4M (in 2010 dollars)
- Regional detention and water quality basins in Douglas and Sarpy counties est. at $134M (in 2010 dollars)



PAPILLION CREEK WATERSHED
STORMWATER MANAGEMENT POLICIES

POLICY GROUP #1: WATER QUALITY IMPROVEMENT

ISSUE: Waters of the Papillion Creek Watershed are impaired.

"ROOT" POLICY: Improve water quality from all contributing sources, including but not limited to, agricultural activities, urban stormwater, and combined sewer overflows, such that waters of the Papillion Creek Watershed and other local watersheds can meet applicable water quality standards and community-based goals, where feasible.

SUB-POLICIES:

1) Water Quality LID shall be required on all new developments and significant redevelopments.
2) Protect surface and groundwater resources from soil erosion (sheet and rill, wind erosion, gully and stream bank erosion), sedimentation, nutrient and chemical contamination. Buffer strips and riparian corridors should be established along all stream segments.
3) Preserve and protect wetland areas to the fullest extent possible to maintain natural hydrology and improve water quality by minimizing the downstream transport of sediment, nutrients, bacteria, etc. borne by surface water runoff. Reestablishment of previously existing wetlands and the creation of new wetlands should be promoted. Any impacted wetlands shall be mitigated at a 3:1 ratio.
4) Support NDEQ in an accelerated TMDL development process that addresses potential pollutant sources in a fair and reasonable manner based on sound technical data and scientific approach.
5) Implement Best Management Practices (BMPs) that reduce both urban and rural pollution sources, maintain or restore designated beneficial uses of streams and surface water impoundments, minimize soil loss, and provide sustainable production levels. Water quality basins shall be located in general conformance with an adopted Papillion Creek Watershed Management Plan.

REFERENCE INFORMATION

DEFINITIONS:

1) Low-Impact Development (LID). A land development and management approach whereby stormwater runoff is managed using design techniques that promote infiltration, filtration, storage, evaporation, and temporary detention close to its source. Management of such stormwater runoff sources may include open space, rooftops, streetscapes, parking lots, sidewalks, medians, etc.
2) Water Quality LID. A level of LID using strategies designed to provide for water quality control of the first ½ inch of stormwater runoff generated from each new development or significant redevelopment and to maintain the peak discharge rates during the 2-year storm event to baseline land use conditions, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
3) Best Management Practice (BMP). "A technique, measure or structural control that is used for a given set of conditions to manage the quantity and improve the quality of

stormwater runoff in the most cost-effective manner." *[Source: U.S. Environmental Protection Agency (EPA)]*

4) Total Maximum Daily Load (TMDL). A calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. Water quality standards are set by States, Territories, and Tribes. They identify the uses for each waterbody, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. The Clean Water Act, Section 303, establishes the water quality standards and TMDL programs, and for Nebraska such standards and programs are administered by the Nebraska Department of Environmental Quality. *[Source: EPA and Nebraska Surface Water Quality Standards, Title 117].*

PAPILLION CREEK WATERSHED
STORMWATER MANAGEMENT POLICIES

POLICY GROUP #2: PEAK FLOW REDUCTION

ISSUE

Urbanization within the Papillion Creek Watershed has and will continue to increase runoff leading to more flooding problems and diminished water quality.

ROOT POLICY

Maintain or reduce stormwater peak discharge during development and after full build-out land use conditions from that which existed under baseline land use conditions.

SUB-POLICY

1) Regional stormwater detention facilities and other structural and non-structural BMPs shall be located in general conformance with an adopted Papillion Creek Watershed Management Plan and shall be coordinated with other related master planning efforts for parks, streets, water, sewer, etc.
2) Maximum LID shall be required to reduce peak discharge rates on all new developments and significant redevelopments as identified in the Papillion Creek Watershed Management Plan.
3) All significant redevelopment shall maintain peak discharge rates during the 2, 10, and 100-year storm event under baseline land use conditions.

REFERENCE INFORMATION

DEFINITIONS

1) Low-Impact Development (LID). A land development and management approach whereby stormwater runoff is managed using design techniques that promote infiltration, filtration, storage, evaporation, and temporary detention close to its source. Management of such stormwater runoff sources may include open space, rooftops, streetscapes, parking lots, sidewalks, medians, etc.
2) Water Quality LID. A level of LID using strategies designed to provide for water quality control of the first ½ inch of stormwater runoff generated from each new development or significant redevelopment and to maintain the peak discharge rates during the 2-year storm event to baseline land use condition, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
3) Maximum LID. A level of LID using strategies, including water quality LID and on-site detention, designed not to exceed peak discharge rates of more than 0.2 cfs/acre during the 2-year storm event or 0.5 cfs/acre during the 100-year storm event based on the contributing drainage from each site, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
4) Peak Discharge or Peak Flow. The maximum instantaneous surface water discharge rate resulting from a design storm frequency event for a particular hydrologic and hydraulic analysis, as defined in the Omaha Regional Stormwater Design Manual. The measurement of the peak discharge shall be at the lower-most drainage outlet(s) from a new development or significant redevelopment.

5) Regional Stormwater Detention Facilities. Those facilities generally serving a drainage catchment area of 500 acres or more in size.
6) Baseline Land Use Conditions. That which existed for Year 2001 for Big and Little Papillion Creeks and its tributaries (excluding West Papillion Creek) and for Year 2004 for West Papillion Creek and its tributaries.
7) Full Build-Out Land Use Conditions. Fully platted developable land use conditions for the combined portions of the Papillion Creek Watershed that lie in Douglas and Sarpy Counties that are assumed to occur by the Year 2040, plus the projected 2040 land uses within the Watershed in Washington County; or as may be redefined through periodic updates to the respective County comprehensive plans.

PAPILLION CREEK WATERSHED
STORMWATER MANAGEMENT POLICIES

POLICY GROUP #3: LANDSCAPE PRESERVATION, RESTORATION, AND CONSERVATION

ISSUE: Natural areas are diminishing, and there is a need to be proactive and integrate efforts directed toward providing additional landscape and green space areas with enhanced stormwater management through restoration and conservation of stream corridors, wetlands, and other natural vegetation.

"ROOT" POLICY: Utilize landscape preservation, restoration, and conservation techniques to meet the multi-purpose objectives of enhanced aesthetics, quality of life, recreational and educational opportunities, pollutant reduction, and overall stormwater management.

SUB-POLICIES:

1) Incorporate stormwater management strategies as a part of landscape preservation, restoration, and conservation efforts where technically feasible.
2) Define natural resources for the purpose of preservation, restoration, mitigation, and/or enhancement.
3) For new development or significant redevelopment, provide a creek setback of 3:1 plus 50 feet along all streams as identified in the Papillion Creek Watershed Management Plan and a creek setback of 3:1 plus 20 feet for all other watercourses.
4) All landscape preservation features as required in this policy or other policies, including all stormwater and LID strategies, creek setbacks, existing or mitigated wetlands, etc., identified in new or significant redevelopment shall be placed into an out lot or within public right of way or otherwise approved easement.

REFERENCE INFORMATION

DEFINITIONS

1) Creek Setback. See Figure 1 below and related definitions in Policy Group #5. A setback area equal to three (3) times the channel depth plus fifty (50) feet (3:1 plus 50 feet) from the edge of low water on both sides of channel shall be required for any above or below ground structure exclusive of bank stabilization structures, poles or sign structures adjacent to any watercourse defined within the watershed drainage plan. Grading, stockpiling, and other construction activities are not allowed within the setback area and the setback area must be protected with adequate erosion controls or other Best Management Practices, (BMPs). The outer 30 feet adjacent to the creek setback limits may be credited toward meeting the landscaping buffer and pervious coverage requirements.

   A property can be exempt from the creek setback requirement upon a showing by a licensed professional engineer or licensed landscape architect that adequate bank stabilization structures or slope protection will be installed in the construction of said structure, having an estimated useful life equal to that of the structure, which will provide adequate erosion control conditions coupled with adequate lateral support so that no portion of said structure adjacent to the stream will be endangered by erosion

or lack of lateral support. In the event that the structure is adjacent to any stream which has been channelized or otherwise improved by any agency of government, then such certificate providing an exception to the creek setback requirement may take the form of a certification as to the adequacy and protection of the improvements installed by such governmental agency. If such exemption is granted, applicable rights-of-way must be provided and a minimum 20 foot corridor adjacent thereto.

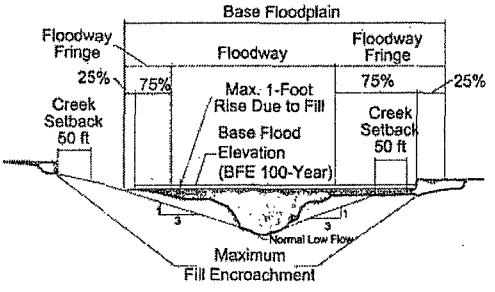


Figure 1 – Floodway Fringe Encroachment and Creek Setback Schematic

DEFINITIONS

1) Base Flood. The flood having a one percent chance of being equaled or exceeded in magnitude in any given year (commonly called a 100-year flood). *[Adapted from Chapter 31 of Nebraska Statutes]*
2) Floodway. The channel of a watercourse and the adjacent land areas that are necessary to be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. *[Adapted from Chapter 31 of Nebraska Statutes].* The Federal Emergency Management Agency (FEMA) provides further clarification that a floodway is the central portion of a riverine floodplain needed to carry the deeper, faster moving water.
3) Floodway Fringe. That portion of the floodplain of the base flood, which is outside of the floodway. *[Adapted from Chapter 31 of Nebraska Statutes]*
4) Floodplain. The area adjoining a watercourse, which has been or may be covered by flood waters. *[Adapted from Chapter 31 of Nebraska Statutes]*
5) Watercourse. Any depression two feet or more below the surrounding land which serves to give direction to a current of water at least nine months of the year and which has a bed and well-defined banks. *[Adapted from Chapter 31 of Nebraska Statutes]*
6) Low Chord Elevation. The bottom-most face elevation of horizontal support girders or similar superstructure that supports a bridge deck.
7) Updated Flood Hazard Maps. The remapping of flooding sources within the Papillion Creek Watershed where Digital Flood Insurance Rate Maps (DFIRMs) are based on 2004 or more recent conditions hydrology and full-build out conditions hydrology. West Papillion Creek and its tributaries are currently under remapping and will become regulatory in 2009. Updating flood hazard maps for Big Papillion Creek and Little Papillion Creek are planned to be completed in the future.
8) New Development. New development shall be defined as that which is undertaken to any undeveloped parcel that existed at the time of implementation of this policy.

POLICY GROUP #4: EROSION AND SEDIMENT CONTROL AND OTHER BMPs

ISSUE: Sound erosion and sediment control design and enforcement practices are needed in order to protect valuable land resources, stream and other drainage corridors, and surface water impoundments and for the parallel purpose of meeting applicable Nebraska Department of Environmental Quality regulatory requirements for construction activities that disturb greater than one acre.

"ROOT" POLICY: Promote uniform erosion and sediment control measures by implementing consistent rules for regulatory compliance pursuant to State and Federal requirements, including the adoption of the Omaha Regional Stormwater Design Manual.

SUB-POLICIES:

1) Construction site stormwater management controls shall include both erosion and sediment control measures.

2) The design and implementation of post-construction, permanent erosion and sediment controls shall be considered in conjunction with meeting the intent of other Stormwater Management Policies.

3) Sediment storage shall be incorporated with all regional detention facilities where technically feasible.

REFERENCE INFORMATION

DEFINITIONS

1) Erosion Control. Land and stormwater management practices that minimize soil loss caused by surface water movement.
2) Sediment Control. Land and stormwater management practices that minimize the transport and deposition of sediment onto adjacent properties and into receiving streams and surface water impoundments.

PAPILLION CREEK WATERSHED
STORMWATER MANAGEMENT POLICIES

POLICY GROUP #5: FLOODPLAIN MANAGEMENT

ISSUE: Continued and anticipated development within the Papillion Creek Watershed mandates that holistic floodplain management be implemented and maintained in order to protect its citizens, property, and natural resources.

"ROOT" POLICY: Participate in the FEMA National Flood Insurance Program, update FEMA floodplain mapping throughout the Papillion Creek Watershed, and enforce floodplain regulations to full build-out, base flood elevations.

SUB-POLICIES:

1) Floodplain management coordination among all jurisdictions within the Papillion Creek Watershed and the Papio-Missouri River Natural Resources District (P-MRNRD) is required.
2) Flood Insurance studies and mapping throughout the Papillion Creek Watershed shall be updated using current and full-build out conditions hydrology.
3) Encroachments for new developments or significant redevelopments within floodway fringes shall not cause any increase greater than one (1.00) foot in the height of the full build-out base flood elevation using best available data.
4) Filling of the floodway fringe associated with new development within the Papillion Creek System shall be limited to 25% of the floodway fringe in the floodplain development application project area, unless approved mitigation measures are implemented. The remaining 75% of floodway fringe within the project area shall be designated as a floodway overlay zone. For redevelopment, these provisions may be modified or waived in whole or in part by the local jurisdiction.
5) The low chord elevation for bridges crossing all watercourses within FEMA designated floodplains shall be a minimum of one (1) foot above the base flood elevation for full-build out conditions hydrology using best available data.
6) The lowest first floor elevation of buildings associated with new development or significant redevelopment that are upstream of and contiguous to regional dams within the Papillion Creek Watershed shall be a minimum of one (1) foot above the 500-year flood pool elevation.

REFERENCE INFORMATION

DEFINITIONS (See Figure 1 below and related definitions in Policy Group #3: Landscape Preservation, Restoration, and Conservation).

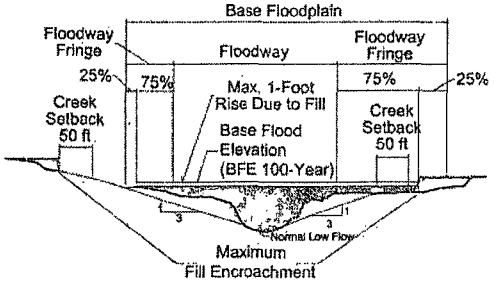


Figure 1 – Floodway Fringe Encroachment and Creek Setback Schematic

1) Base Flood. The flood having a one percent chance of being equaled or exceeded in magnitude in any given year (commonly called a 100-year flood). *[Adapted from Chapter 31 of Nebraska Statutes]*
2) Floodway. The channel of a watercourse and the adjacent land areas that are necessary to be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. *[Adapted from Chapter 31 of Nebraska Statutes].* The Federal Emergency Management Agency (FEMA) provides further clarification that a floodway is the central portion of a riverine floodplain needed to carry the deeper, faster moving water.
3) Floodway Fringe. That portion of the floodplain of the base flood, which is outside of the floodway. *[Adapted from Chapter 31 of Nebraska Statutes]*
4) Floodplain. The area adjoining a watercourse, which has been or may be covered by flood waters. *[Adapted from Chapter 31 of Nebraska Statutes]*
5) Watercourse. Any depression two feet or more below the surrounding land which serves to give direction to a current of water at least nine months of the year and which has a bed and well-defined banks. *[Adapted from Chapter 31 of Nebraska Statutes]*
6) Low Chord Elevation. The bottom-most face elevation of horizontal support girders or similar superstructure that supports a bridge deck.
7) Updated Flood Hazard Maps. The remapping of flooding sources within the Papillion Creek Watershed where Digital Flood Insurance Rate Maps (DFIRMs) are based on 2004 or more recent conditions hydrology and full-build out conditions hydrology. West Papillion Creek and its tributaries are currently under remapping and will become regulatory in 2009. Updating flood hazard maps for Big Papillion Creek and Little Papillion Creek are planned to be completed in the future.
8) New Development. New development shall be defined as that which is undertaken to any undeveloped parcel that existed at the time of implementation of this policy.

BASIC FEMA REQUIREMENTS

On March 1, 2003, FEMA became part of the U.S. Department of Homeland Security (DHS). In order for a community to participate in the FEMA National Flood Insurance Program, it must first define base flood elevations and adopt a floodway for all its major streams and tributaries. Once a community adopts its floodway, the requirements of *44 CFR 60.3(d)* must be fulfilled. The key concern is that each project in the floodway must receive an encroachment review; i.e., an analysis to determine if the project will increase flood heights or cause increased flooding downstream. Note that the FEMA regulations call for preventing any increase in flood heights. Projects, such as filling, grading or construction of a new building, must be reviewed to determine whether they will obstruct flood flows and cause an increase in flood heights upstream or adjacent to the project site. Further, projects, such as grading, large excavations, channel improvements, and bridge and culvert replacements should also be reviewed to determine whether they will remove an existing obstruction, resulting in increases in flood flows downstream. *[Adapted from Federal Emergency Management Agency guidance]*

PAPILLION CREEK WATERSHED
STORMWATER MANAGEMENT POLICIES

POLICY GROUP #6: STORMWATER MANAGEMENT FINANCING

ISSUE: Regulatory requirements for stormwater management and implementation of Stormwater Management Policies intended to accommodate new development and significant redevelopment will impose large financial demands for capital and operation and maintenance beyond existing funding resources.

"ROOT" POLICY: Dedicated, sustainable funding mechanisms shall be developed and implemented to meet capital and operation and maintenance obligations needed to implement NPDES Stormwater Management Plans, Stormwater Management Policies, and the Papillion Creek Watershed Management Plan.

SUB-POLICIES:

1) All new development and significant redevelopment will be required to fund the planning, implementation, and operation and maintenance of water quality LID.
2) A Watershed Management Fee system shall be established to equitably distribute the capital cost of implementing the Papillion Creek Watershed Management Plan among new development or significant redevelopment. Such Watershed Management Fee shall only apply to new development or significant redevelopment within the Papillion Creek Watershed and the initial framework shall consist of the following provisions:
    a. Collection of fees and public funding shall be earmarked specifically for the construction of projects called for in the Papillion Creek Watershed Management Plan, including Maximum LID costs such as on site detention, regional detention basins, and water quality basins.
    b. Multiple fee classifications shall be established which fairly and equitably distribute the cost of these projects among all undeveloped areas within the Papillion Creek Watershed.
    c. Watershed Management Fees (private) are intended to account for approximately one-third (1/3) of required capital funds and shall be paid to the applicable local zoning jurisdiction with building permit applications.
    d. Watershed Management Fee revenues shall be transferred from the applicable local zoning jurisdiction to a special P-MRNRD construction account via inter-local agreements.
    e. The P-MRNRD (public) costs are intended to account for approximately two-thirds (2/3) of required capital funds, including the cost of obtaining necessary land rights, except as further provided below; and the P-MRNRD shall be responsible for constructing regional detention structures and water quality basins using pooled accumulated funds.
    f. The P-MRNRD will seek general obligation bonding authority from the Nebraska Legislature to provide necessary construction scheduling flexibility.
    g. Financing for Papillion Creek Watershed Management Plan projects may require public-private partnership agreements between the P-MRNRD and developers/S&IDs on a case-by-case basis.
    h. On approximately three (3)-year intervals, the Papillion Creek Watershed Management Plan and Watershed Management Fee framework, rates, and construction priority schedule shall be reviewed with respect to availability of

needed funds and rate of development within the Papillion Creek Watershed by the parties involved (local zoning jurisdictions, P-MRNRD, and the development community). Subsequent changes thereto shall be formally approved by the respective local zoning jurisdictions and the P-MRNRD.

3) A Stormwater Utility Fee System shall be established to equitably distribute the costs for ongoing operation and maintenance of all stormwater BMPs and infrastructure among all existing property owners within NPDES Phase I or II municipal jurisdictions.
   a. NPDES Phase I and II cities and counties should actively seek legislation from the Nebraska Legislature to allow for the establishment of an equitable stormwater utility fee.
   b. The initial framework for the Stormwater Utility Fee System should consist of the following provisions provided Nebraska statutes allow for such a fee:
      i. A county or city shall establish by resolution user charges to be assessed against all real property within its zoning jurisdiction and may issue revenue bonds or refunding bonds payable from the proceeds of such charges, all upon terms as the county board or city council determines are reasonable.
      ii. Such charges shall be designed to be proportionate to the stormwater runoff contributed from such real property and based on sound engineering principles.
      iii. Such charges should provide credits or adjustments for stormwater quantity and quality BMPs utilized in order to encourage wise conservation and management of stormwater on each property.
      iv. Such charges shall be collected in a manner that the county or city determines as appropriate and shall not be determined to be special benefit assessments.
      v. A county or city shall establish a system for exemption from the charges for the property of the state and its governmental subdivisions to the extent that it is being used for a public purpose. The local elected body shall also provide an appeals process for aggrieved parties.
      vi. A county shall not impose these charges against real property that is being charges user charges by a city.
      vii. Any funds raised from a Stormwater Utility Fee shall be placed in a separate fund and shall not be used for any purpose other than those specified.

REFERENCE INFORMATION

DEFINITIONS

1) Stormwater Management Policies. Stormwater management policies developed by the Technical Workgroup and Policy Workgroup that were commissioned by the Papillion Creek Watershed Partnership (PCWP) subsequent to the "Green, Clean, and Safe" initiatives developed through the "Watershed by Design" public forums conducted in 2004 and 2005 and subsequently revised by the PCWP in 2009. The

following policy groups contain "root" policies and sub-policies for stormwater management that have been developed in addition to the Stormwater Management Financing Policy Group herein:

- Policy Group #1 – Water Quality Improvement
- Policy Group #2 – Peak Flow Reduction
- Policy Group #3 – Landscape Preservation, Restoration, and Conservation
- Policy Group #4 – Erosion and Sediment Control and Other BMPs
- Policy Group #5 – Floodplain Management

2) Stormwater Management Plan (SWMP). A SWMP is a required part of the NPDES Phase II Stormwater Permits issued to many of the Omaha metropolitan area Papillion Creek Watershed Partnership (PCWP) members. Development of Stormwater Management Policies is an integral part of the SWMP, and such policies are to be adopted by respective PCWP partners.
3) Comprehensive Development Plans. Existing plans developed by local jurisdictions that serve as the basis for zoning and other land use regulations and ordinances. The Stormwater Management Policies are to be incorporated into the respective Comprehensive Development Plans.
4) Policy Implementation. The implementation of the policies will be through the development of ordinances and regulations, in years 3 through 5 of the NPDES permit cycle; that is, by the year 2009. Ordinances and regulations are intended to be consistent for, and adopted by, the respective PCWP members. Such ordinances and regulations shall need to be consistent with the Comprehensive Development Plans of the respective PCWP members.
5) Low-Impact Development (LID). A land development and management approach whereby stormwater runoff is managed using design techniques that promote infiltration, filtration, storage, evaporation, and temporary detention close to its source. Management of such stormwater runoff sources may include open space, rooftops, streetscapes, parking lots, sidewalks, medians, etc.
6) Water Quality LID. A level of LID using strategies designed to provide for water quality control of the first ½ inch of stormwater runoff generated from each new development or significant redevelopment and to maintain the peak discharge rates during the 2-year storm event to baseline land use conditions, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
7) Maximum LID. A level of LID using strategies, including water quality LID and on-site detention, designed not to exceed peak discharge rates of more than 0.2 cfs/acre during the 2-year storm event or 0.5 cfs/acre during the 100-year storm event based on the contributing drainage from each site, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
8) Baseline Land Use Conditions. That which existed for Year 2001 for Big and Little Papillion Creeks and its tributaries (excluding West Papillion Creek) and for Year 2004 for West Papillion Creek and its tributaries. That which existed in 2007 for all areas not within the Papillion Creek Watershed.

BASIS FOR STORMWATER MANAGEMENT FINANCING ISSUE

1) Time is of the essence for policy development and implementation:
   a) Under the existing Phase II Stormwater Permits issued by the Nebraska Department of Environmental Quality, permitees must develop strategies, which include a combination of structural and/or non-structural best management practices and incorporate them into existing Comprehensive Development Plans by the end of 2009.
   b) The S&ID platting process is typically several years ahead of full occupation of an S&ID. Therefore, careful pre-emptive planning and program implementation is necessary in order to construct regional stormwater detention and water quality basin improvements in a timely manner to meet the purposes intended and to avoid conflicts from land use encroachments from advancing development.
2) Financing to meet capital and O&M obligations for stormwater management projects requires a comprehensive, uniformly applied approach and not a project-by-project approach.

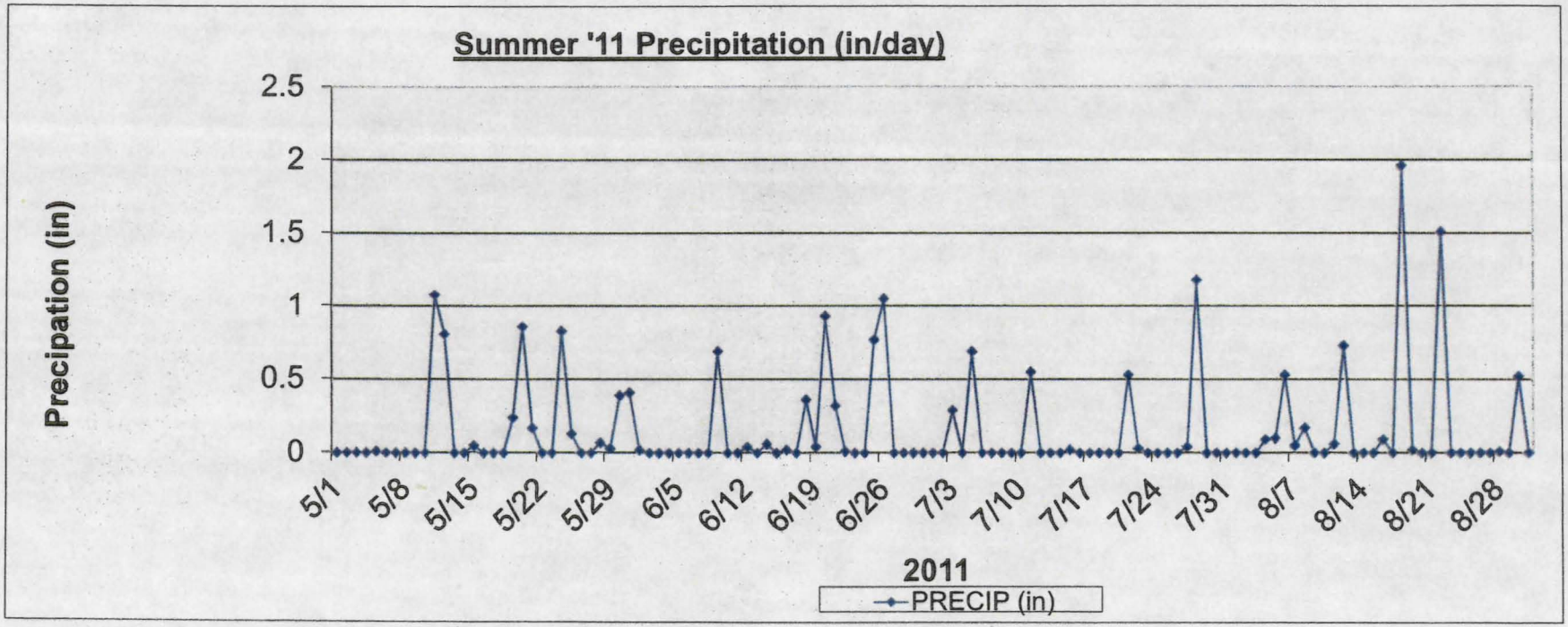
Attachment C

Attachment C

Project Name	Address	Status	Date Submitted	Action Recommended	Outcome
Black Hills Energy Building	306 Fortune Plaza Papillion NE 68046	Complete	1/4/2011	Letter of Warning	No Action Taken
Whispering Ridge West	17400 Maple Street Omaha NE 68116	Complete	1/13/2011	Notice of Violation	Request for Voluntary Compliance
Whispering Ridge West	17400 Maple Street Omaha NE 68116	Complete	1/26/2011	Notice of Violation	No Action Taken
Skyline Meadows	21805 Lacy Drive Omaha NE 68022	Complete	2/10/2011	Letter of Warning	No Action Taken
Center Springs	72nd and Oak St Omaha NE 68106	Complete	3/15/2011	Letter of Warning	No Action Taken
Pink Industrial Park 2 - Grading	120th & Roberts Road Papillion NE 68046	Complete	3/21/2011	Letter of Warning	Request for Voluntary Compliance
Hanover Fails	NW Corner of 156 & State Street Omaha NE 68154	Complete	3/26/2011	Letter of Warning	Request for Voluntary Compliance
Shadow View 2nd Addtion (lots 1-169)	Cleveland Blvd and Marinda St. Omaha NE 68154	Complete	4/14/2011	Letter of Warning	LOW Issued
Crestview Senior Living	76th & Gertrude La Vista NE 68128	Complete	5/18/2011	Letter of Warning	LOW Issued
Camden Creek Grading Plan	8410 Seward St and 8407 Decatur St Omaha NE 68114	Complete	5/27/2011	Letter of Warning	No Action Taken
MUD - Florence WTP Phase I Process Design	2710 Grebe Street Omaha NE 68112	Complete	6/3/2011	Letter of Warning	LOW Issued
OPS ELEMENTARY SCHOOL	42ND AND "X" STREETS OMAHA NE 68107	Complete	6/10/2011	Letter of Warning	Request for Voluntary Compliance
Orchards at Wildewood	75th & Gertrude La Vista NE 68128	Complete	6/21/2011	Notice of Violation	NOV Issued
Highway 370 Offsite Roadway Improvements	Hwy 370 120th - 132nd Streets Papillion NE 68046	Complete	6/22/2011	Letter of Warning	LOW Issued
Montclair Village Apartments	127th and Atwood Avenue Omaha NE 68124	Complete	7/28/2011	Letter of Warning	LOW Issued
OPWS2137 - Emile St. Relocation	40th & Emile Streets Omaha NE 68198	Complete	7/29/2011	Letter of Warning	Request for Voluntary Compliance
Big Papillion Creek Interceptor Sewer Improvements	West Dodge Road to Blondo Street Near 117th Street Omaha NE 68154	Complete	7/29/2011	Letter of Warning	NOV Issued
UNO Lot 9 Expansion	64th and Pine Streets Omaha NE 68106	Complete	7/29/2011	Letter of Warning	LOW Issued
UNMC Stanley M. Truhlsen Eye Institute	3902 Leavenworth Street Omaha NE 68105	Complete	8/18/2011	Letter of Warning	NOV Issued
Huntington Park Lots 444-465	156th & Spencer St Omaha NE 68118	Complete	8/18/2011	Letter of Warning	NOV w/ Fine
Whitetail Creek	192nd and Giles Gretna NE 68028	Complete	8/26/2011	Fines	NOV w/ Fine
Pacific Street W Lots 1-79 Inc & Outlots A-C	Highway 31 & Pacific Street Omaha NE 68154	Complete	8/30/2011	Notice of Violation	Request for Voluntary Compliance
Stoneridge	162nd Fort Omaha NE 68116	Complete	9/6/2011	Letter of Warning	No Action Taken
Double D Industrial Park	NW Corner of Sorenson Pkwy and Wenninghoff Rd Omaha NE 68134	Complete	9/16/2011	Notice of Violation	NOV w/ Fine
Manchester Ridge	NW 175th & Blondo St. Omaha NE 68116	Complete	9/26/2011	Notice of Violation	LOW Issued
Center Pointe	SE Corner of 204 & West Center Rd Omaha NE 68022	Complete	9/29/2011	Letter of Warning	LOW Issued
Altech Business Park	147th, 148th, and 149th Sts and Omaha NE 68137	Complete	10/6/2011	Letter of Warning	No Action Taken
Pacific Street W Lots 1-79 Inc & Outlots A-C	Highway 31 & Pacific Street Omaha NE 68154	Complete	10/11/2011	Notice of Violation	NOV w/ Fine
Lot 7 Wicks Southpointe	Wickersham Blvd and Stevens Pointe Cir Gretna NE 68028	Pending	10/13/2011	Letter of Warning	Pending
UNMC College of Nursing Addition	41st Street & Dewey Avenue Omaha NE 68198-7100	Complete	11/2/2011	Letter of Warning	Withdrawn
Montclair Village Apartments	127th and Atwood Avenue.Omaha NE 68124	Complete	11/8/2011	Fines	NOV w/ Fine
Huntington Park Lots 444-465	156th & Spencer St Omaha NE 68118	Complete	11/29/2011	Letter of Warning	NOV w/ Fine
John Deere	13747 Industrial Road Omaha NE 68137	Complete	12/5/2011	Letter of Warning	LOW Issued
CVS #5634	Southeast corner of 84th and Center Omaha NE 68124	Complete	12/8/2011	Fines	LOW Issued
John Deere	13747 Industrial Road Omaha NE 68137	Complete	12/20/2011	Notice of Violation	LOW Issued

Attachment D

Attachment D



2011 Precipatation Data							
DATE	PRECIP (in)	DATE	PRECIP (in)	DATE	PRECIP (in)	DATE	PRECIP (in)
5/1/2011	0.00	6/1/2011	0.02	7/1/2011	0.00	8/1/2011	0.00
5/2/2011	0.00	6/2/2011	0.00	7/2/2011	0.00	8/2/2011	0.00
5/3/2011	0.00	6/3/2011	0.00	7/3/2011	0.29	**8/3/2011**	**0.00**
5/4/2011	0.00	6/4/2011	0.00	7/4/2011	0.00	8/4/2011	0.09
5/5/2011	0.01	6/5/2011	0.00	7/5/2011	0.69	8/5/2011	0.10
5/6/2011	0.00	6/6/2011	0.00	**7/6/2011**	**0.00**	8/6/2011	0.53
5/7/2011	0.00	6/7/2011	0.00	7/7/2011	0.00	8/7/2011	0.05
5/8/2011	0.00	**6/8/2011**	**0.00**	7/8/2011	0.00	8/8/2011	0.17
5/9/2011	0.00	6/9/2011	0.69	7/9/2011	0.00	8/9/2011	0.00
5/10/2011	0.00	6/10/2011	0.00	7/10/2011	0.00	8/10/2011	0.00
5/11/2011	**1.08**	6/11/2011	0.00	7/11/2011	0.55	**8/11/2011**	**0.06**
5/12/2011	0.81	6/12/2011	0.04	7/12/2011	0.00	8/12/2011	0.73
5/13/2011	0.00	6/13/2011	0.00	**7/13/2011**	**0.00**	8/13/2011	0.00
5/14/2011	0.00	6/14/2011	0.06	7/14/2011	0.00	8/14/2011	0.00
5/15/2011	0.05	**6/15/2011**	**0.00**	7/15/2011	0.02	8/15/2011	0.00
5/16/2011	0.00	6/16/2011	0.02	7/16/2011	0.00	8/16/2011	0.09
5/17/2011	0.00	6/17/2011	0.00	7/17/2011	0.00	**8/17/2011**	**0.00**
5/18/2011	**0.00**	6/18/2011	0.36	7/18/2011	0.00	8/18/2011	1.96
5/19/2011	0.24	6/19/2011	0.04	7/19/2011	0.00	8/19/2011	0.02
5/20/2011	0.86	6/20/2011	0.93	**7/20/2011**	**0.00**	8/20/2011	0.00
5/21/2011	0.17	6/21/2011	0.32	7/21/2011	0.53	8/21/2011	0.00
5/22/2011	0.00	**6/22/2011**	**0.01**	7/22/2011	0.03	8/22/2011	1.51
5/23/2011	0.00	6/23/2011	0.00	7/23/2011	0.00	8/23/2011	0.00
5/24/2011	0.83	6/24/2011	0.00	7/24/2011	0.00	8/24/2011	0
5/25/2011	**0.13**	6/25/2011	0.77	7/25/2011	0.00	8/25/2011	0
5/26/2011	0.00	6/26/2011	1.05	7/26/2011	0.00	8/26/2011	0
5/27/2011	0.00	6/27/2011	0.00	**7/27/2011**	**0.04**	8/27/2011	0
5/28/2011	0.07	6/28/2011	0.00	7/28/2011	1.18	8/28/2011	0.01
5/29/2011	0.03	**6/29/2011**	**0.00**	7/29/2011	0.00	8/29/2011	0
5/30/2011	0.39	6/30/2011	0.00	7/30/2011	0.00	8/30/2011	0.52
5/31/2011	**0.41**			7/31/2011	0.00	8/31/2011	0

Site B 168th and Hwy 36

(**Bold** text indicates that the sample result was less than the detection limit, gray background indicates probe error)

	5/11/2011		5/18/2011		5/25/2011		5/31/2011		6/8/2011		6/15/2011		6/22/2011		6/29/2011		7/6/2011		7/13/2011		7/20/2011		7/27/2011		8/3/2011		8/10/2011		8/17/2011		
Total Coliform	16501.5	A	19863.0		>24196	L	198630.0		>24196	L	24196.0		>24196	L	>24196	L	241960.0		>24196	L	>24196	L	57940.0		51720.0		24196.0		>24196	L	SM 9222 D MDL = 1 cfu / 100 mL
e coli	1100.2	A	2017.1	A	36540.0		26130.0		1108.7	A	954.4	A	>24196	L	1460.0	A	11221.0	A	>24196	L	1658.0		1878.9	A	1773.0	A	1112.1	A	4352.0		Colilert Method MDL = 1 cfu / 100 mL
Nitrate / Nitrite Nitrogen (mg/L)	6.5		8.1		8.2		6.8		9.7		9.4		11.0		10.2		8.5		9.5		9.7		9.4		9.2		9.2		9		EPA 353.2 MDL = 0.2 mg/L
Kjeldahl Nitrogen (mg/L)	0.72		0.88		4.2		4.29		0.68		**<0.50**	U	1.77		1.02		1.4		0.85		0.81		0.64		0.66		0.75		0.81		EPA 351.3 MDL = 0.5 mg/L
Nitrite Nitrogen (mg/L)	0.17		0.08		0.09		0.09		0.09		0.07		**0.05**		0.06		0.07		0.08		0.07		0.06		0.06		0.04		0.05		SM 4500-NO_2^- B MDL = 0.02 mg/L
Ammonia Nitrogen (mg/L)	**< 1**	U	**< 1**	U	1.6		**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	2.7		SM 4500-NH_3 D MDL = 1 mg/L
Total Phosphorus (mg/L)	0.33		0.4		1.49		2.23		0.51		0.34		**0.99**		0.52		0.64		0.43		0.44		0.37		0.34		0.29		0.35		SM 4500 P F MDL = 0.05 mg/L
Dissolved Phosphorus (mg/L)	0.13		0.14		0.17		0.15		0.14		0.15		**0.19**		0.16		0.14		0.18		0.16		0.16		0.18		0.16		0.16		SM 4500 P F MDL = 0.05 mg/L
pH (lab)	7.81		7.86		7.65		7.66		7.89		7.93		7.81		7.84		7.83		8.01		8.04		7.88		8.01		7.97		7.88		SM 4500-H^+ B
BOD (mg/L)	2		**< 2**	U	6		6		**< 2**	U	**< 2**	U	2		**< 2**	U	3		**< 2**	U	**< 2**	U	**< 2**	U	**< 2**	U	**< 2**	U	**< 2**	U	SM 5210 B MDL = 2 mg/L
TSS (mg/L)	137		245		1235		1905		356		166		804		382		586		192		224		194		178		141		152		SM 2540 D MDL = 1 mg/L
TDS (mg/L)	473		461		362		178		454		476		544		504		434		474		474		460		463		443		497		SM 2540 C MDL = 1 mg/L
Temp (C)	19.16	A	12.10	A	---		15.97	A	18.51	A	15.57	A	14.67	A	15.92	A	16.94	A	18.19	A	22.24	A	22.24	A	21.86	A	---		---		Field Measurment
DO (mg/L)	9.09	A	10.78	A	9.87	A	9.51	A	9.32	A	10.16	A	9.80	A	9.99	A	9.59	A	9.46	A	8.66	A	8.49	A	8.84	A	---		---		Field Measurment
SpCond (æS/cm)	678.0	A	685.2	A	560.7	A	544.2	A	676.6	A	644.8	A	669.8	A	683.8	A	640.2	A	678.1	A	687.5	A	673.8	A	686.9	A	---		---		Field Measurment
Turb (NTUs)	119.5	A	133.1	A	1064.9	A	2196.4	A	199.5	A	137.4	A	371.9	A	173.1	A	339.3	A	146.3	A	173.9	A	31.0	A	127.9	A	---		---		Field Measurment
pH	8.19	A	8.48	A	8.12	A	8.27	A	8.40	A	8.30	A	8.47	A	8.59	A	8.20	A	8.35	A	8.25	A	8.31	A	8.36	A	---		---		Field Measurment

Data quality control is done "in house" for the following tests: COD, BOD, TSS, TDS.

A = Value is an average results obtained from multiple analyses

L = The actual value is greater than the value given.

U = Value below detection limit.

X = Value exceeds instrument range.

Site S 78th and L St

(Bold text indicates that the sample result was less than the detection limit, gray background indicates probe error)

	5/11/2011		5/18/2011		5/25/2011		5/31/2011		6/8/2011		6/15/2011		6/22/2011		6/29/2011		7/6/2011		7/13/2011		7/20/2011		7/27/2011		8/3/2011		8/10/2011		8/17/2011		
Total Coliform	111990.0		19863.0		>2419.6	L	>2419.6	L	24196.0		>2419.6	L	>2419.6	L	>2419.6	L	241960.0		>2419.6	L	>2419.6	L	129970.0		46110.0		>2419.6	L	>2419.6	L	SM 9222 D MDL = 1 cfu / 100 mL
e coli	13879.5	A	1573.5	A	51720.0		7334.0	A	1553.1	A	2173.0	A	>2419.6	L	1743.2	A	61310.0		36540.0		1249.7	A	13894.5	A	11101.5	A	1183.0	A	5172.0		Colilert Method MDL = 1 cfu / 100 mL
Nitrate / Nitrite Nitrogen (mg/L)	1.2		6.1		4.5		4.7		8		7.4		8		7.1		3.5		6 3		8.1		7		7.3		7		6.8		EPA 353.2 MDL = 0.2 mg/L
Kjeldahl Nitrogen (mg/L)	6.2		0.83		4.24		1.69		0.69		0.68		2.16		1.14		7.09		2.04		0.68		1.04		0.64		0.69		0.61		EPA 351.3 MDL = 0 5 mg/L
Nitrite Nitrogen (mg/L)	0.07		0.07		0.08		0.08		0.09		0.07		0.07		0.06		0.1		0.07		0.04		0.04		0.04		0.03		0.04		SM 4500-NO_2^- B MDL = 0.02 mg/L
Ammonia Nitrogen (mg/L)	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	SM 4500-NH_3 D MDL = 1 mg/L
Total Phosphorus (mg/L)	2.45		0.34		1.29		0.93		0.42		0.38		1.17		0.46		1.89		0.76		0.38		0.39		0.28		0.26		0.27		SM 4500 P F MDL = 0 05 mg/L
Dissolved Phosphorus (mg/L)	< 0.05	U	0.12		0.11		0.12		0.14		0 14		0.15		0.13		0.06		0.15		0.16		0.15		0.16		0.15		0.15		SM 4500 P F MDL = 0.05 mg/L
pH (lab)	7.46		7.99		7.68		7.81		8.08		8.01		7.86		7.93		7.51		7.92		8.16		7.95		8.12		8.07		8		SM 4500-H^+ B
BOD (mg/L)	13		< 2	U	5		4		< 2	U	2		3		< 2	U	8		4		< 2	U	3		< 2	U	< 2	U	< 2	U	SM 5210 B MDL = 2 mg/L
TSS (mg/L)	1635		177		970		985		229		208		1098		254		3540		550		150		226		102		66		77		SM 2540 D MDL = 1 mg/L
TDS (mg/L)	483		447		378		315		456		486		421		482		< 1		404		490		446		472		472		511		SM 2540 C MDL = 1 mg/L
Temp(C)	19.27	A	14.01	A	17.03	A	19.34	A	21.96	A	17.57	A	17.24	A	19.19	A	18.83	A	20.37	A	25.00	A	25.65	A	24.99	A	21.83	A	---		Field Measurment
DO (mg/L)	7.68	A	10.22	A	9.02	A	8.41	A	8.47	A	9.45	A	9.23	A	9.14	A	8.35	A	8.80	A	8.06	A	6.43	A	8.05	A	8.82	A	---		Field Measurment
SpCond (æS/cm)	323.7	A	631.3	A	500.4	A	549.0	A	705.2	A	707.7	A	627.7	A	673.5	A	353.6	A	590.1	A	715.5	A	710.0	A	710.2	A	696.0	A	---		Field Measurment
Turb (NTUs)	2200.0	A	112.9	A	954.6	A	551.6	A	159.8	A	148.4	A	679.1	A	191.4	A	2862.6	A	797.9	A	174.0	A	--		102.5	A	--		---		Field Measurment
pH	7.75	A	8.02	A	8.00	A	7.89	A	8.29	A	8.13	A	7.95	A	8.14	A	7.68	A	8.05	A	8.18	A	7.68	A	8.24	A	8.17	A	---		Field Measurment

Data quality control is done "in house" for the following tests: COD, BOD, TSS, TDS.

A = Value is an average results obtained from multiple analyses

L = The actual value is greater than the value given.

U = Value below detection limit.

X = Value exceeds instrument range.

66th and L St

(Bold text indicates that the sample result was less than the detection limit, gray background indicates probe or analysis error)

	5/11/2011		5/18/2011		5/25/2011		5/31/2011		6/8/2011		6/15/2011		6/22/2011		6/29/2011		7/6/2011		7/13/2011		7/20/2011		7/27/2011		8/3/2011		8/10/2011		8/17/2011		
Total Coliform	241960.0		17329.0		>2419.6	L	>2419.6	L	24196.0		>2419.6	L	>2419.6	L	>24196	L	>24196	L	>24196	L	24196.0		>24196	L	19863.0		>24196	L	19863.0		SM 9222 D MDL = 1 cfu / 100 mL
e coli	22043.0	A	1784.0		18339.5	A	17609.5	A	1631.8	A	4058.7	A	8164.0		5794.0		20133.0	A	2204.3	A	316.7		24196.0		166.9	A	1185.4		595.8	A	Colilert Method MDL = 1 cfu / 100 mL
Nitrate / Nitrite Nitrogen (mg/L)	1.0		2.1		1.0		1.0		2.2		2.3		1.2		2.1		1.2		1.7		1.6		1.6		1.7		1.9		1.8		EPA 353.2 MDL = 0.2 mg/L
Kjeldahl Nitrogen (mg/L)	5.51		**< 0.50**	U	2.23		1.87		0.58		1.28		0.75		1.27		1.4		0.98		0.57		1.56		**< 0.5**	U	1.03		0.81		EPA 351.3 MDL = 0.5 mg/L
Nitrite Nitrogen (mg/L)	0.13		0.09		0.04		0.07		0.13		0.14		0.06		0.06		0.08		0.07		0.04		0.09		0.05		0.03		0.04		SM 4500-NO_2^- B MDL = 0.02 mg/L
Ammonia Nitrogen (mg/L)	**< 1**	U	**< 1**	U	**1.0**		**< 1**	U	**1.0**		**< 1**	U	**< 1**	U	**< 1**		**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	SM 4500-NH_3 D MDL = 1 mg/L
Total Phosphorus (mg/L)	1.72		0.13		0.42		0.55		0.16		0.20		0.24		0.17		0.34		0.19		0.19		0.24		0.13		0.17		0.27		SM 4500 P F MDL = 0.05 mg/L
Dissolved Phosphorus (mg/L)	**< 0.05**	U	0.07		0.08		0.08		0.07		0.09		0.09		**<0.05**	U	0.07		0.09		0.08		0.1		0.08		0.11		0.15		SM 4500 P F MDL = 0.05 mg/L
pH (lab)	7.42		7.79		7.51		7.51		7.84		7.73		7.59		7.73		7.54		7.76		7.89		7.49		7.85		7.74		7.58		SM 4500-H^+ B
BOD (mg/L)	13		**< 2**	U	6		8		**< 2**	U	4		2		2		4		**< 2**	U	**< 2**	U	7		**< 2**	U	**< 2**	U	**< 2**	U	SM 5210 B MDL = 2 mg/L
TSS (mg/L)	787		30		247		356		28		31		82		64		178		43		27		14		9		16		6		SM 2540 D MDL = 1 mg/L
TDS (mg/L)	421		478		215		252		480		503		302		486		270		439		485		454		505		460		456		SM 2540 C MDL = 1 mg/L
Temp (C)	---		14.77	A	18.08	A	18.86	A	23.32	A	19.07	A	18.62	A	20.59	A	21.98	A	22.78	A	26.02	A	24.57	A	24.95	A	22.07	A	---		Field Measurment
DO (mg/L)	6.13	A	9.81	A	8.72	A	8.20	A	7.47	A	7.87	A	8.17	A	8.66	A	7.74	A	7.90	A	7.20	A	7.81	A	8.02	A	8.27	A	---		Field Measurment
SpCond (æS/cm)	490.0	A	784.6	A	380.6	A	---		758.6	A	732.8	A	452.8	A	687.2	A	404.5	A	655.6	A	763.6	A	683.1	A	755.6	A	723.1	A	---		Field Measurment
Turb (NTUs)	898.0	A	26.6	A	240.7	A	335.2	A	21.5	A	28.9	A	102.2	A	65.3	A	212.3	A	46.4	A	106.7	A	154.2	A	0.7	A	---		---		Field Measurment
pH	7.77	A	7.96	A	7.68	A	7.67	A	8.05	A	7.83	A	7.77	A	7.95	A	7.64	A	7.78	A	7.87	A	8.13	A	7.93	A	7.81	A	---		Field Measurment
Duplicate	F		S		F		B		D		F		D		S		F		S		F		D		F		S		F		

Data quality control is done "in house" for the following tests: COD, BOD, TSS, TDS.

A = Value is an average results obtained from multiple analyses

L = The actual value is greater than the value given.

U = Value below detection limit.

X = Value exceeds instrument range.

Side D Hwy 75 and Capehart

(Bold text indicates that the sample result was less than the detection limit, gray background indicates probe error)

	5/11/2011		5/18/2011		5/25/2011		5/31/2011		6/8/2011		6/15/2011		6/22/2011		6/29/2011		7/6/2011		7/13/2011		7/20/2011		7/27/2011		8/3/2011		8/10/2011		8/17/2011		
Total Coliform	129970		12033		>2196.6	L	>2496.6	L	14136		2419.6		>2419.6	L	>2419.6	L	>2419.6	L	15531		>2419.6	L	14136		12033		>2419.6	L	6488		SM 9222 D MDL = 1 cfu / 100 mL
e coli	13700.5		954.5	A	17988.0	A	16055.5	A	317.3	A	1681.2	A	12033.0		1308.4	A	7270 0		2070.8	A	44.6	A	129.2	A	107.0	A	648.8		193.2	A	Colilert Method MDL = 1 cfu / 100 mL
Nitrate / Nitrite Nitrogen (mg/L)	0.8		4.0		1.7		1.6		5.5		5.5		2.8		3.9		2.6		4.5		4.7		4.4		4.8		3.5		4.3		EPA 353.2 MDL = 0.2 mg/L
Kjeldahl Nitrogen (mg/L)	7.08		0.59		3.44		2.2		**< 0.50**	U	**<0.50**	U	1.01		0.73		0.96		0.54		0.82		1.04		0.58		1.05		0.67		EPA 351.3 MDL = 0.5 mg/L
Nitrite Nitrogen (mg/L)	0.07		0.07		0.05		0.07		0.08		0.08		0.07		0.05		0.06		0.05		0.06		0.05		0.05		0.05		0.03		SM 4500-NO_2 B MDL = 0 02 mg/L
Ammonia Nitrogen (mg/L)	**< 1**	U	**< 1**	U	1.1		**< 1**	U	1.8		**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	1.5		**< 1**	U	**< 1**	U	**< 1**	U	**< 1**	U	2.7		SM 4500-NH_3 D MDL = 1 mg/L
Total Phosphorus (mg/L)	4.08		0.23		0.89		0.92		0.24		0.21		0.28		0.17		0.21		0.18		0.15		0.12		0.2		0.22		0.2		SM 4500 P F MDL = 0.05 mg/L
Dissolved Phosphorus (mg/L)	**< 0.05**	U	0.13		0.09		0.08		0.14		0.15		0.11		0.11		0.08		0.13		0.05		**<0.05**	U	0.14		0.15		0.15		SM 4500 P F MDL = 0.05 mg/L
pH (lab)	7.44		7.85		7.51		7.48		8.02		7.93		7.55		7.69		7.65		7.79		8.06		7.87		8.01		7.88		7.98		SM 4500-H B
BOD (mg/L)	13		**< 2**	U	7		9		**< 2**	U	3		2		**< 2**	U	3		**< 2**	U	4		4		**< 2**	U	**< 2**	U	**< 2**	U	SM 5210 B MDL = 2 mg/L
TSS (mg/L)	587		62.0		340.0		555.0		25.0		20		110		38		47		14.0		11		15		15		34		12		SM 2540 D MDL = 1 mg/L
TDS (mg/L)	233		456.0		144.0		279.0		473.0		508		302		405		337		401		447		403		503		338		532		SM 2540 C MDL = 1 mg/L
Temp (C)	19.87	A	14.52	A	18.87	A	19.66	A	25.06	A	20.10	A	19.54	A	22.26	A	23.03	A	24.26	A	29.96	A	29.68	A	27.72	A	24.53	A	---		Field Measurment
DO (mg/L)	7.84	A	10.02	A	8.78	A	7.99	A	7.80	A	9.00	A	8.09	A	8.34	A	7.80	A	7.99	A	9.84	A	9.59	A	7.97	A	7.94	A	---		Field Measurment
SpCond (æS/cm)	209.8	A	741.8	A	300.9	A	368.4	A	740.0	A	750.1	A	421.8	A	580.2	A	507.4	A	591.6	A	704.8	A	632.0	A	651.6	A	542.5	A	---		Field Measurment
Turb (NTUs)	1957.5	A	61.9	A	657.8	A	545.7	A	25.5	A	22.8	A	186.4	A	67.5	A	112.8	A	3.7	A	51.0	A	20.6	A	5.7	A	---		---		Field Measurment
pH	7.83	A	8.04	A	7.65	A	7.65	A	8.11	A	7.98	A	7.61	A	7.81	A	7.70	A	7.91	A	7.98	A	7.96	A	7.90	A	7.79	A	---		Field Measurment

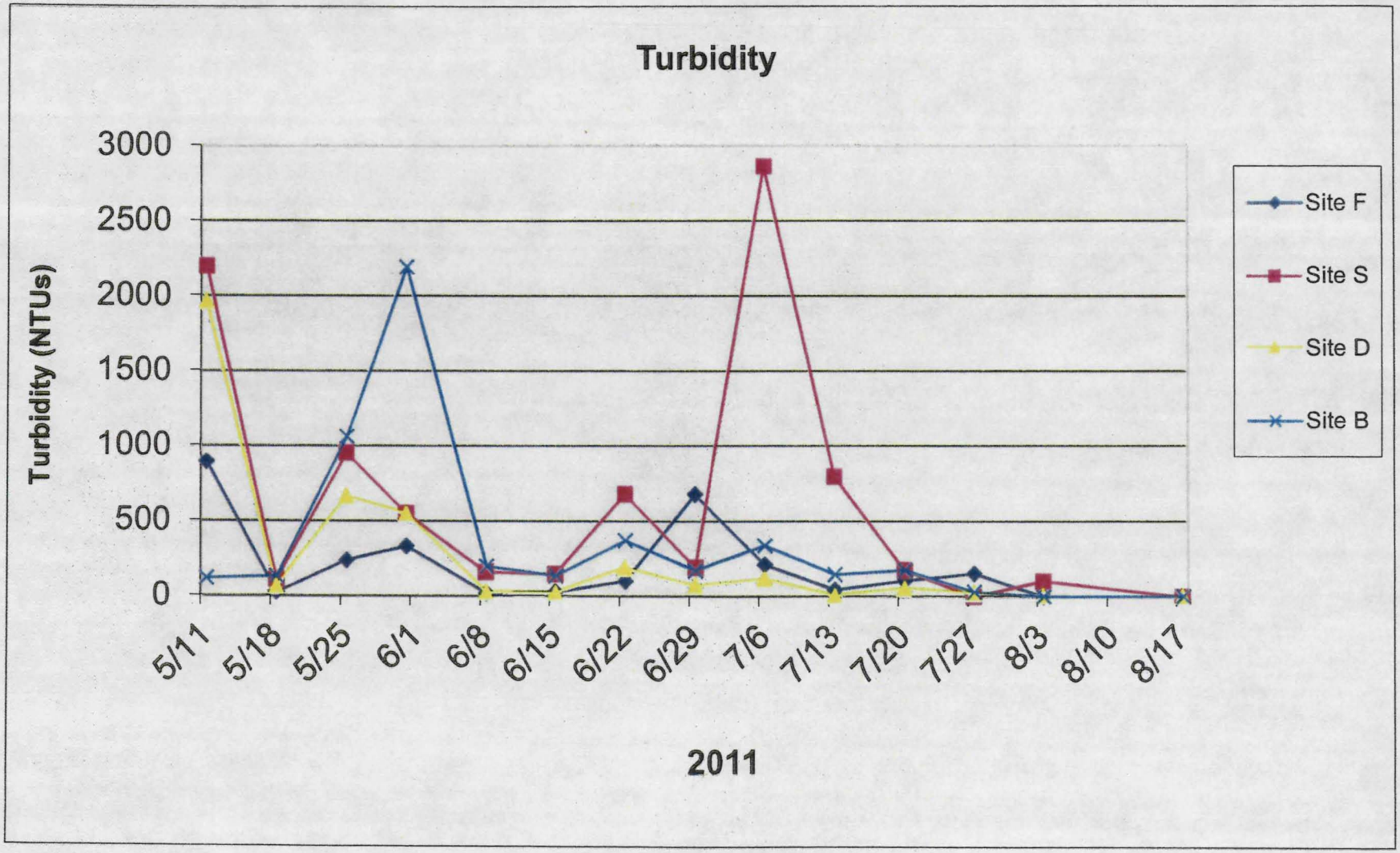
Data quality control is done "in house" for the following tests: COD, BOD, TSS, TDS.

A = Value is an average results obtained from multiple analyses

L = The actual value is greater than the value given.

U = Value below detection limit.

X = Value exceeds instrument range.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Turbidity (NTUs)
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2500
2000
1500
1000
500
0
5/11
5/18
5/25
6/1
6/8
6/15
6/22
6/29
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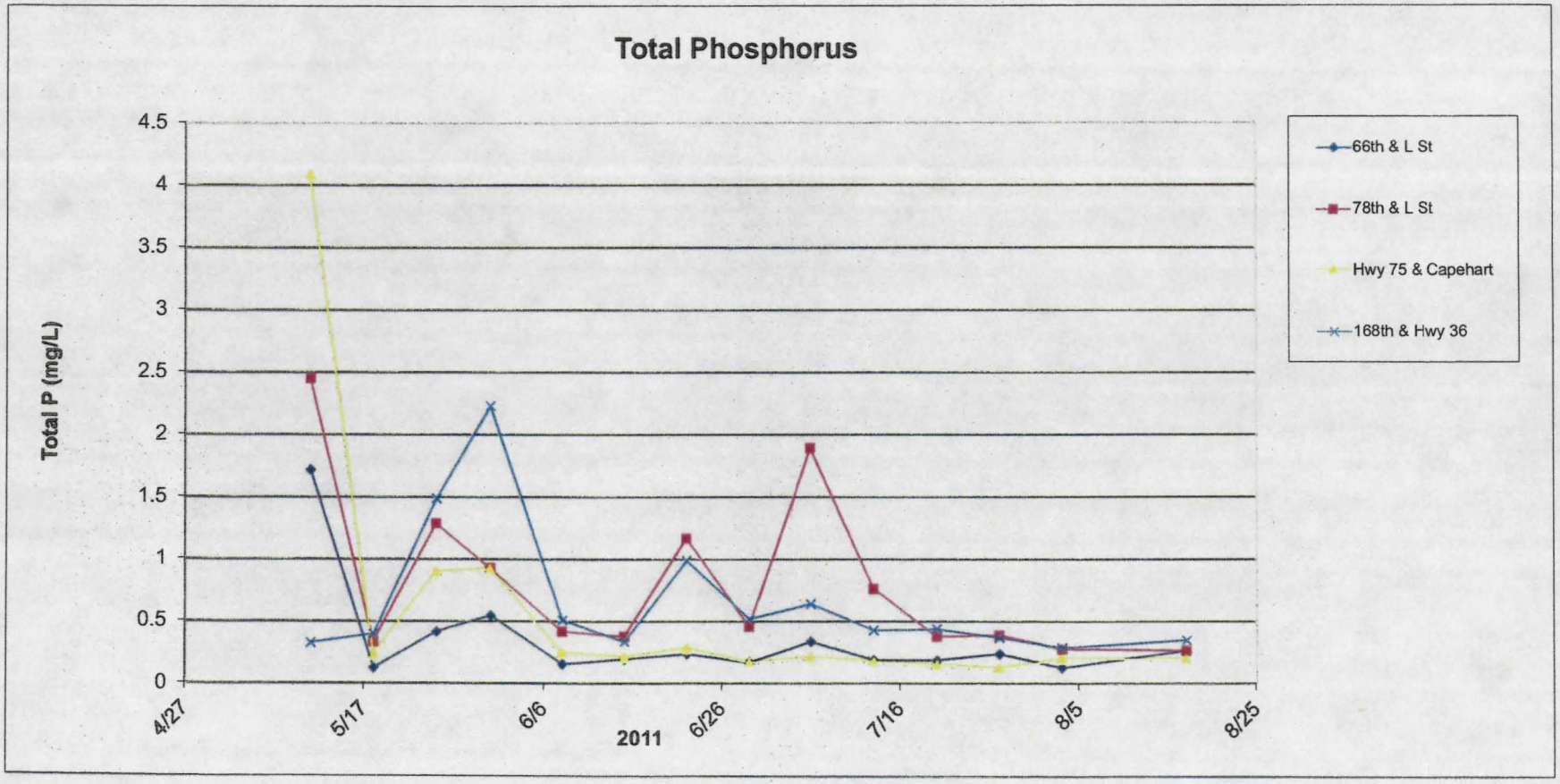
7/13
7/20
7/27
8/3
8/10
8/17
2011
Site F
Site S
Site D
Site B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Total P (mg/L)
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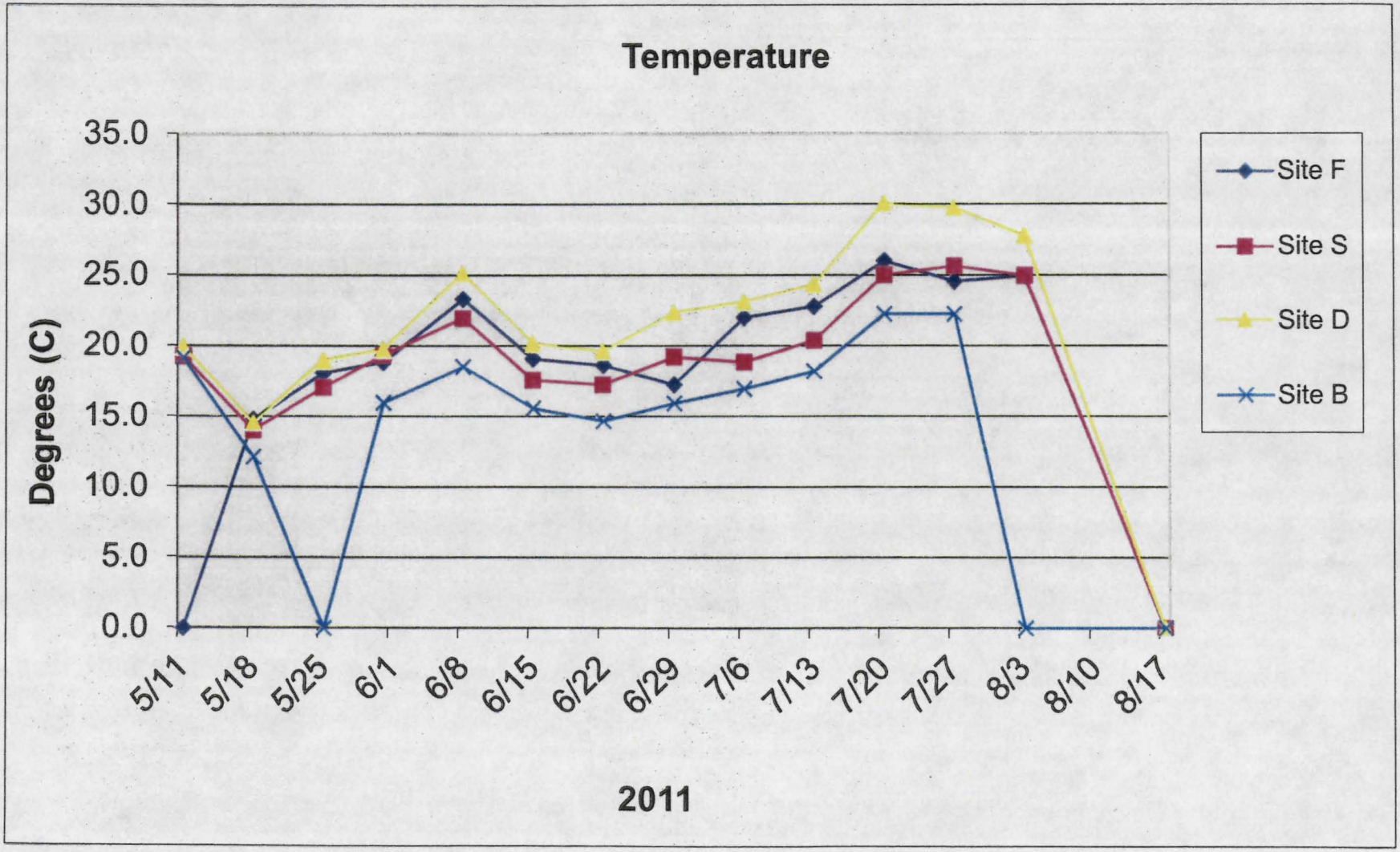
3.5
3
2.5
2
1.5
1
0.5
0
4/27
5/17
6/6
6/26
7/16
8/5
8/25
2011
66th & L St
78th & L St
Hwy 75 & Capehart
168th & Hwy 36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20.0
15.0
10.0
5.0
0.0
Degrees (C)
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6/1
6/8
6/15
6/22
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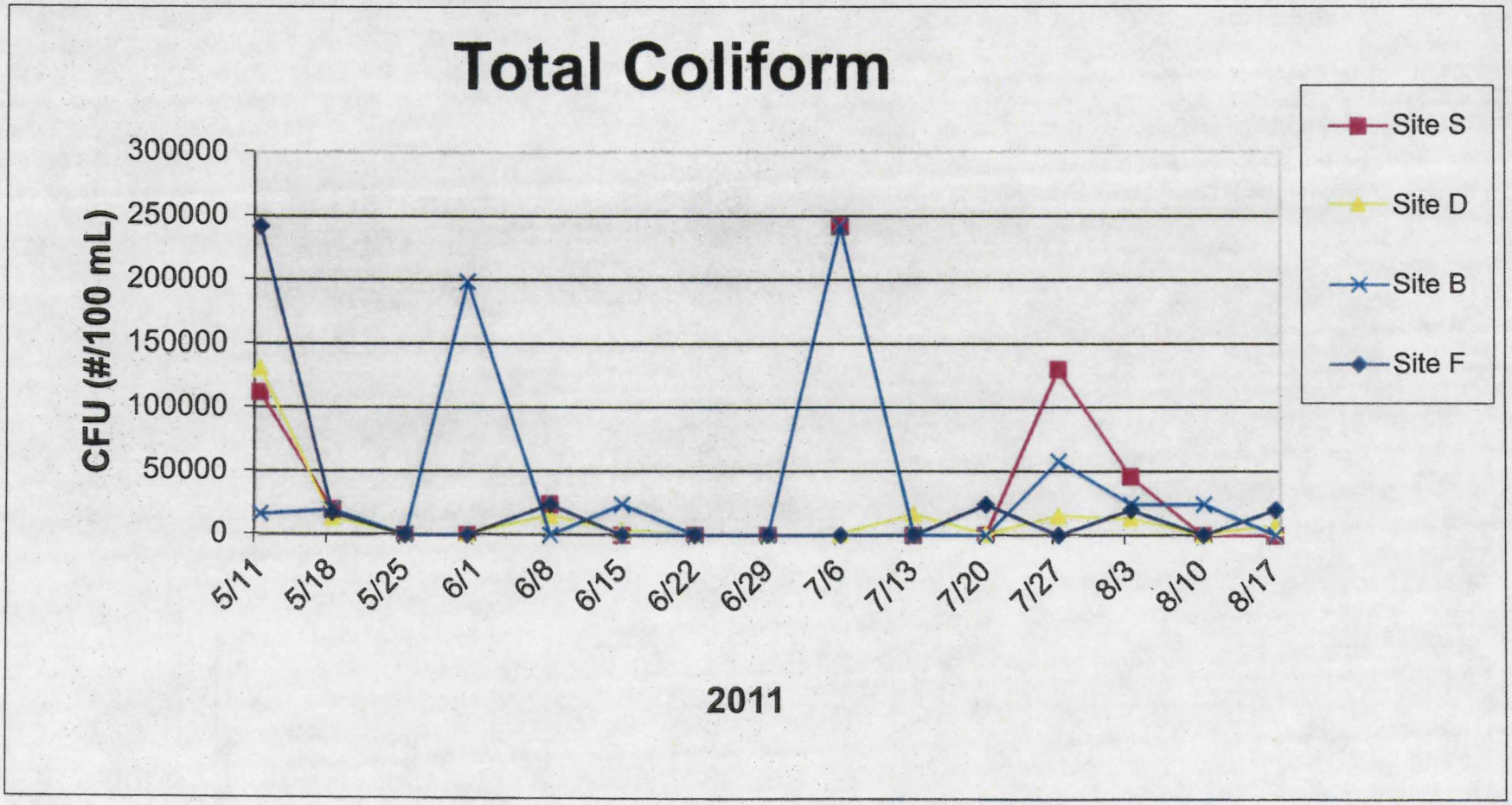
7/20
7/27
8/3
8/10
8/17
2011
Site F
Site S
Site D
Site B


Total Coliform
CFU (#/100 mL)
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250000
200000
150000
100000
50000
0
5/11
5/18
5/25
6/1
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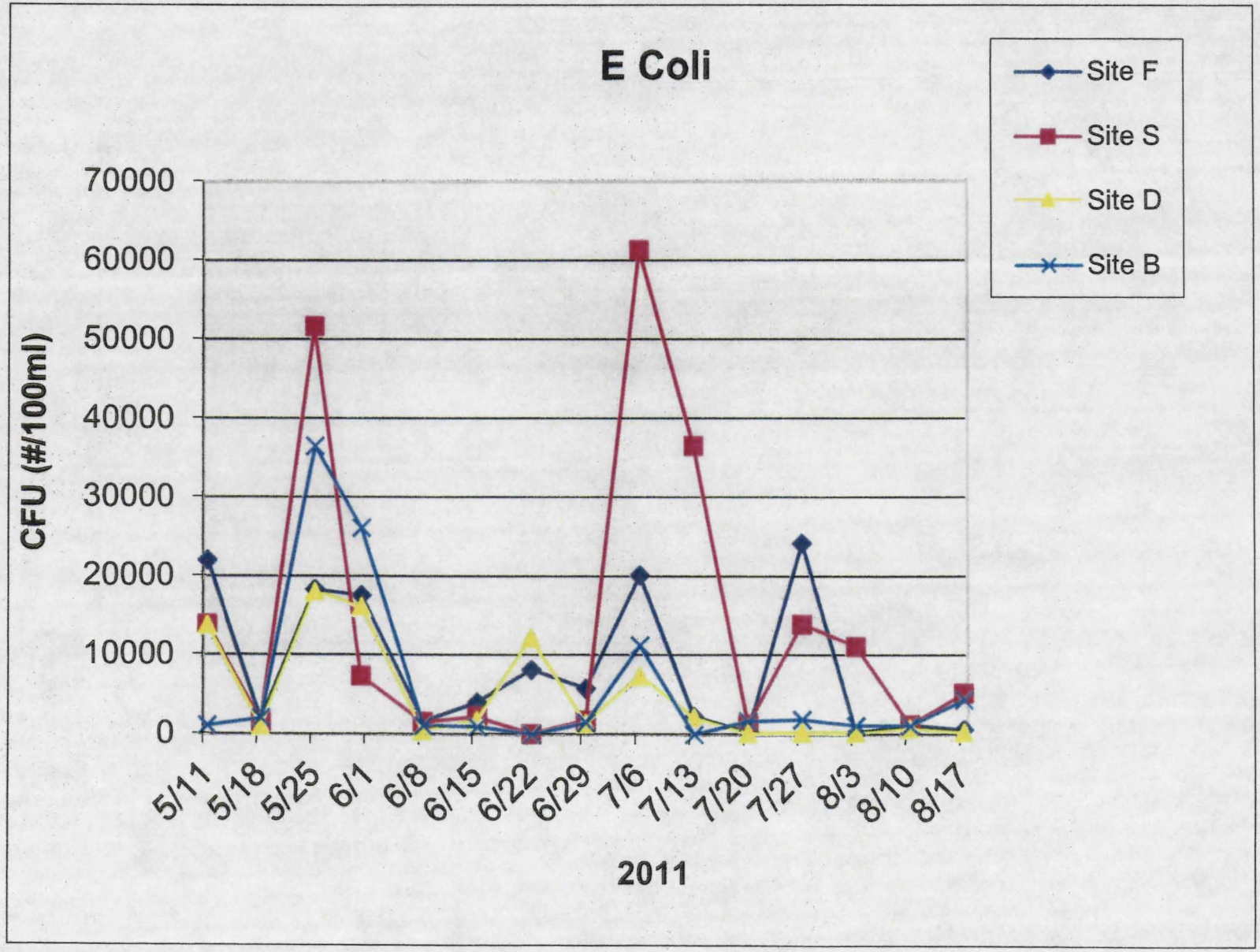
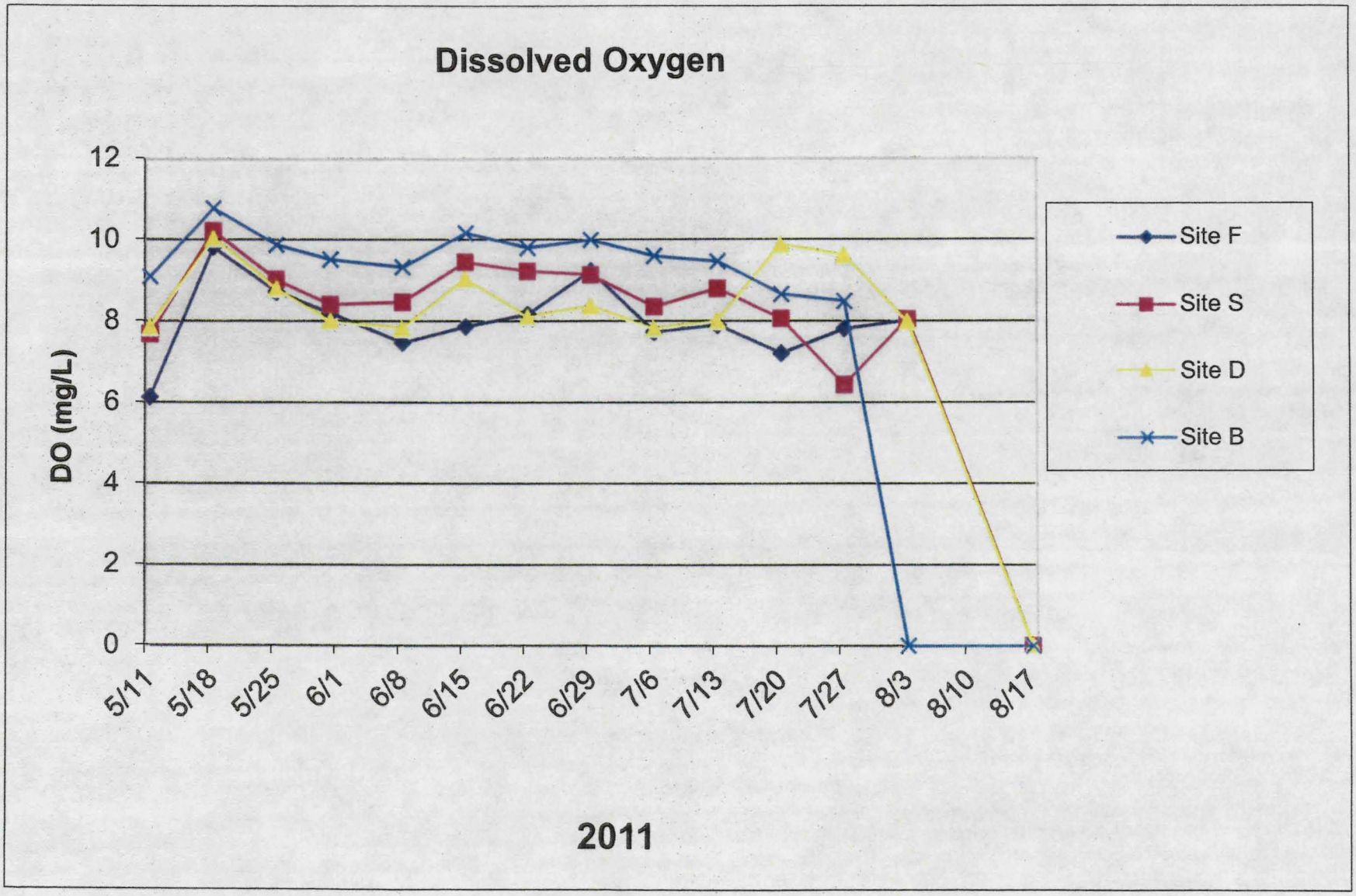
6/15
6/22
6/29
7/6
7/13
7/20
7/27
8/3
8/10
8/17
2011
Site S
Site D
Site B
Site F


E Coli
Site F
Site S
Site D
Site B
CFU (#/100ml)
70000
60000
50000
40000
30000
20000
10000
0
5/11
5/18
5/25
6/1
6/8
6/15
6/22
6/29
7/6
7/13
7/20
7/27
8/3
8/10
8/17
2011


Dissolved Oxygen
DO (mg/L)
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10
8
6
4
2
0
5/11
5/18
5/25
6/1
6/8
6/15
6/22
6/29
7/6
7/13
7/20
7/27
8/3
8/10
8/17
2011
Site F
Site S
Site D
Site B

Attachment E

Attachment C

PERFORMANCE ASSESSMENT OF TWO STORMWATER BEST MANAGEMENT PRACTICES FOR INFILTRATION, WATER QUALITY, AND VEGETATIVE GROWTH

A REPORT COMPLETED FOR THE CITY OF OMAHA, NEBRASKA

BY

TED HARTSIG, CPSS
AND
ANDY SZATKO

FEBRUARY 2012

EXECUTIVE SUMMARY

Bioretention gardens examined by the City of Omaha in 2011 demonstrated unexpected results. Infiltration rates were slower than expected in the native soils, and much more rapid than expected in the amended sand-compost soil mix used at both sites. The results of this assessment of Best Management Practice (BMP) performance indicate that changes in design parameters need to be considered closely with attention to small details that can dramatically affect their performance, and that adjustments to existing BMPs may be appropriate to improve function and performance to achieve the intended goals of stormwater control and water quality improvement.

The purpose of this assessment was to examine infiltration and percolation of stormwater in and near established BMPs during the growing season. The original intent of this assessment grew during the project time to assess overall performance of one particular bioretention garden that demonstrated initial results different from what had originally been assumed; that being that stormwater was effectively infiltrating into the native soils as well as percolating through an infiltration cell comprised of a sand-compost mix. During the course of this project, this assessment included examination of water quality improvements and vegetative growth of the garden in addition to infiltration.

Two sites were selected for the BMP assessment: a bioretention garden constructed at Orchard Park in north-central Omaha in 2009, and a series of bioretention gardens constructed at the Under the Sink facility in west Omaha in 2008. The bioretention gardens at the two sites have different designs that allowed examination of variability in bioretention garden performance. The bioretention garden at Orchard Park consisted of two gardens separated by a sidewalk, but connected by pipes extending under the sidewalk. The gardens were established in native silty clay loam soil, with 20 foot long by 5 foot wide by 2 foot deep infiltration cells filled with a sand-compost mix, and drained through perforated 4-inch PVC pipe. The bioretention gardens at the Under the Sink facility were constructed in native silty clay loam soils with a sand-compost mix filling the entire structure to a depth of 2.5 feet. Each garden is drained by flexible, perforated pipes laid in an oval shape near the perimeter of the gardens. All of the gardens are vegetated with vegetation native or adapted to the eastern Nebraska region.

Infiltration was measured using double ring infiltrometers and mini-infiltrometers three times during the growing season (May, July, and September). In addition to measurement of infiltration using the double ring infiltrometers and mini-infiltrometers, the Orchard Park bioretention gardens were flooded three times during the summer to simulate actual stormwater conditions and infiltration. After the first series of infiltration measurements in May, valves were installed at Orchard Park to control the rate of discharge through the underdrain system. No alterations to the structures at the Under the Sink facility were made as these gardens already had valves on the underdrains.

The results of this assessment of BMP performance include the following:

1. The sand/compost soil mix used for BMPs – whether for the entire base of the BMP, or for individual infiltration cells – is very permeable, with infiltration rates typically more than 40 inches per hour
2. Native soils in most locations are slowly permeable and highly prone to compaction that will slow infiltration even more. Root growth in the native soils at Orchard Park varied by location within the bioretention garden, with the roots in some areas of the garden deep with strong vertical growth, while in other parts of the garden, the root growth was stunted by very dense soils.

3. Infiltration in native soils is enhanced in very close proximity to plants and their associated roots. Infiltration through vegetated native soil was found to be approximately 3.0 to 3.5 inches per hour. On soil without vegetation, even if only several inches away from vegetation, infiltration was very slow.

4. During stormwater simulations, water quality data show release of nitrogen and phosphorous with water percolating through the sand-compost soil mix of the infiltration cell with uncontrolled flow through the BMP (short retention time). This finding is consistent with other water quality measurements conducted around the U.S. and in a study conducted at the University of Minnesota. A reduction of nitrate nitrogen, total Kjeldahl nitrogen, and total phosphorous was observed in samples collected after water was resident in one BMP for 24 hours when compared to the samples collected after no retention time in the same BMP.

5. Vegetation performance of the BMPs was found to be good. Native plants at both sites showed vigorous, healthy growth. Root growth and extension into the sand-compost mixes was observed to be very good, and root growth into the native soils was also very good, with root depths to 12 inches. Even in compacted soils root growth extended to depths of near 8 inches below the ground, although the roots of plants growing in the compacted soil were not as thick as roots in the non-compacted soils.

6. The total time of inundation plays a significant role in plant performance. During the first two seasons of the Orchard Park bioretention gardens, no valve was on the underdrain systems; as a result they drained excessively and dried in a short period of time. The addition of a valve and adjustment of flow out of the garden to extend residence time to 24 hours stressed the little and big bluestem plants that were located in the frequent inundation area. Those plants above that level performed better, emphasizing the need to site plants appropriately within the garden.

7. The combination of these extremes highlights the importance of fine details in installation, limiting compaction during construction, and in design, detailing a valve assembly to control the flow out of the underdrain system.

1.0 INTRODUCTION

According to the U.S. Environmental Protection Agency, "The best way to mitigate stormwater impacts from new developments is to use practices to treat, store, and infiltrate runoff onsite before it can affect water bodies downstream." In keeping with this philosophy, the City of Omaha conducted an assessment of stormwater Best Management Practices (BMPs) performance as represented by two bioretention garden systems in 2011.

1.1 Purpose

The purpose of this study was to assess infiltration and percolation of stormwater in and near established BMPs during the growing season, and determine if improvements or adjustments in the BMPs are needed.

A primary goal of the study was to determine differences in infiltration between the established BMP and nearby (non-BMP) soil conditions, and potential changes in infiltration and percolation during the growing season. The study measurements are intended to provide data that will help designers more effectively estimate the volume of stormwater that can be treated in these BMPs. Because infield observations and measurements elucidated unexpected BMP performance issues, the original intent of this study shifted from looking at infiltration differences between BMPs and the surrounding areas, and instead became focused on infiltration management and adjustment in bioretention gardens with different design elements. Through the process of evaluating BMP performance, the project had the opportunity to examine:

- Infiltration
  - in separate native and manufactured soil types
  - in simulated conditions and manipulated drainage
- Water quality
- Vegetation performance

Data quality in this study is limited to direct measurements of observed or manipulated field conditions to test BMP performance and infiltration rates.

1.2 Background

To comply with requirements of the U.S. EPA for stormwater management, the City of Omaha requires capture and treatment of the first one-half inch of stormwater runoff to improve water quality and reduce stormwater runoff peak volumes on renovation projects and new developments. One of the best methods for accomplishing this goal is the implementation of stormwater BMPs that capture and detain rainfall runoff, promote infiltration into the soil within 24 hours, and slowly conveying excess stormwater through and out of the garden. The depth of the BMP and the infiltration rate of both the native soil and any amended soil used are intrinsically related. Shallow BMPs can function properly with slower infiltration rates, with a minimum rate of at least 0.5 inches per hour. Deeper BMPs require more rapid infiltration and drainage to assure drawdown necessary to empty the BMP above ground storage in a 24-hour period.

2.0 SITE DESCRIPTIONS

Two sites were selected for study: a bioretention garden constructed at Orchard Park in 2009, and bioretention gardens constructed at the Under the Sink (UTS) facility constructed in 2008. Orchard Park is located in north-central Omaha at North 66th Street between Sorenson Boulevard and Hartman Street, consisting of approximately 14 acres bisected by Cole Creek. Orchard Park is set in a dominantly suburban residential area, and the park is used for active and passive recreation. The Orchard Park bioretention garden investigated for this study is part of a two-cell structure that collects and treats stormwater runoff from N. 66th Street. Stormwater enters the first cell through curbcuts along the street, and overflows through pipes into the larger cell that was the focus of this assessment (Figure 2-1).

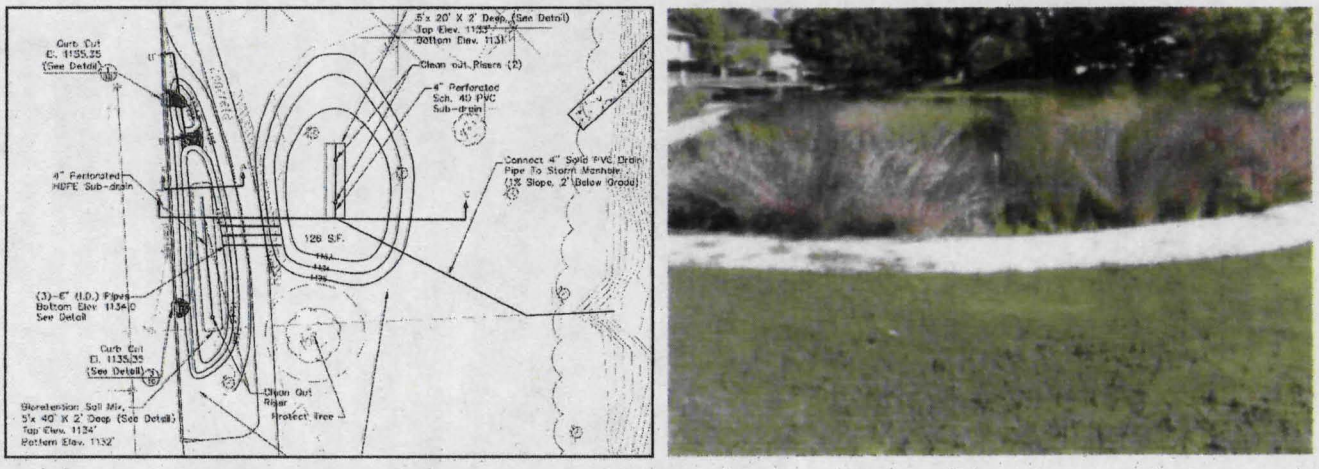


Figure 2-1: The Orchard Park Bioretention cell, with design features shown, and the primary structure showing plant growth in the third year of operation

The primary (larger) garden examined for this project averages approximately 50 feet in diameter and is approximately 30 inches deep, with a ponding depth of approximately 18 inches. Most of the garden is established in the native silty clay loam soil, with an "infiltration cell" that consists of a sand/compost soil mixture in a trench 5-feet wide, 20 feet long, and 24 inches deep, and that is drained by perforated 4-inch PVC pipe.

The Orchard Park bioretention garden exhibits very good vegetative establishment and growth. In 2011, the garden was entering its third year of growth. Grasses planted in the garden including big blue stem, switch grass, Indian grass, little blue stem, bulrush, and herbaceous plants such as black-eyed susan, liatrus, monarda, and prairie cone flower, were well-established. Little blue stem on the north and west sides of the garden does not exhibit growth vigorous as grasses on the south and east sides of the garden, and grasses in the middle of the garden, within the "infiltration cell" demonstrate excellent growth and establishment.

The Under the Sink facility is a household hazardous waste collection facility operated by the City of Omaha located at 4001 South 120th Street, occupying approximately 5.5 acres. The land has moderate slope to the west, and consists primarily of the building, parking lots, and turf lawn. A series of 15 bioretention gardens were constructed in 2008 at the site along the west and south boundaries of the property, adjacent to 120th Street (Figure 2-2).

Figure2-2: Under the Sink Bioretention Gardens (aerial photo source: Google Earth)

The bioretention gardens are generally about 20 feet in diameter, and were constructed in a silty clay loam soil. The bioretention gardens were constructed with flexible, perforated drainage pipe installed in an oval configuration at the bottom of each garden, connected with a solid four inch drainage pipe that runs to the nearest storm sewer inlet. Pea gravel was installed over the perforated pipe, geotextile laid over top of the aggregate and stapled down, and then backfilled with a compost/sand mixture. The ponding depth of each garden is approximately six inches. Vegetative growth in the bioretention gardens was observed to be good at the time of sampling, with some sparsely vegetated areas in two of the gardens. Vegetation in the gardens included **Helen's Flower, New England Aster,** Bee Balm, Spiderwort, and Golden Alexanders.

3.0 DATA COLLECTION AND RESULTS

Infiltration measurements were collected using double ring infiltrometers and mini-infiltrometers. Double ring infiltrometers have long been used by soil scientists and engineers to determine infiltration rates in soils. The device consists of two concentric rings, one inside the other, that are filled with water, with the drop of the water level in the inner ring measured with time (falling head measurement). The mini-infiltrometer is a smaller version of the double ring infiltrometer. When possible, subsoil conditions and root development of plants were examined to help understand the flow rates in the BMPs.

Infiltration and percolation measurements were conducted three times during the growing season: early **May; mid-July; and** September. Samples were initially collected within the BMP structures and from areas nearby the BMPs, but as initial data demonstrated variable characteristics within the BMPs, the subsequent measurement periods focused on the bioretention garden structures to determine if seasonal changes with plant growth or changing soil conditions might occur. Infiltration testing was initiated on May 9, with subsequent testing completed on July 12/13, and September 21, 2011. At both locations, measurements included infiltration within the gardens, and from nearby turf lawns.

In addition to measurement of infiltration using double ring infiltrometers and mini-infiltrometers, the Orchard Park bioretention garden was flooded three times during the summer season to simulate actual

storm runoff conditions. The objective was to measure the 24 hour infiltration rate of the garden from a staff gauge placed in the center of the garden. After the 24 hour infiltration readings were taken, the valves on each garden were opened one at a time to assess the rate of flow out of the garden through the underdrain system. Concurrent to the second and third simulations, water quality samples were collected and analyzed to assess the bioretention garden's performance in removing pollutants.

Vegetation condition was observed and noted during each sampling period at both sites. Along with observation of vegetation conditions, infiltration related to bioretention garden vegetation was measured twice at Orchard Park using the double ring infiltrometer in which the center ring of the infiltrometer was placed over a stalk of native grass (little bluestem both times), and measurements of infiltration rate recorded from the center ring.

4.1 Orchard Park

The original intent of infiltration measurement at Orchard Park was to measure the differences in infiltration within the bioretention garden compared to infiltration outside the garden and if infiltration would increase with plant growth through the summer. During the first testing period in May, it was observed that infiltration in most areas within the bioretention garden and outside of the infiltration cell was very slow; generally less than 0.5 inches per hour (see Section 3.0). Infiltration within the garden and within the footprint of the infiltration cell was excessively fast, measured at a rate in excess of 24 inches per hour.

4.1.1 Infiltration

Infiltration measurements were collected at Orchard Park at varying locations within the bioretention garden in approximately similar locations, or in locations to determine if amendments to soil conditions or plantings affected infiltration. Approximate testing locations are shown in Figure 4-1.
At Orchard Park, the premise that the infiltration rates for the bioretention garden may increase with new vegetative growth through the summer was a constant measurement objective. After the first

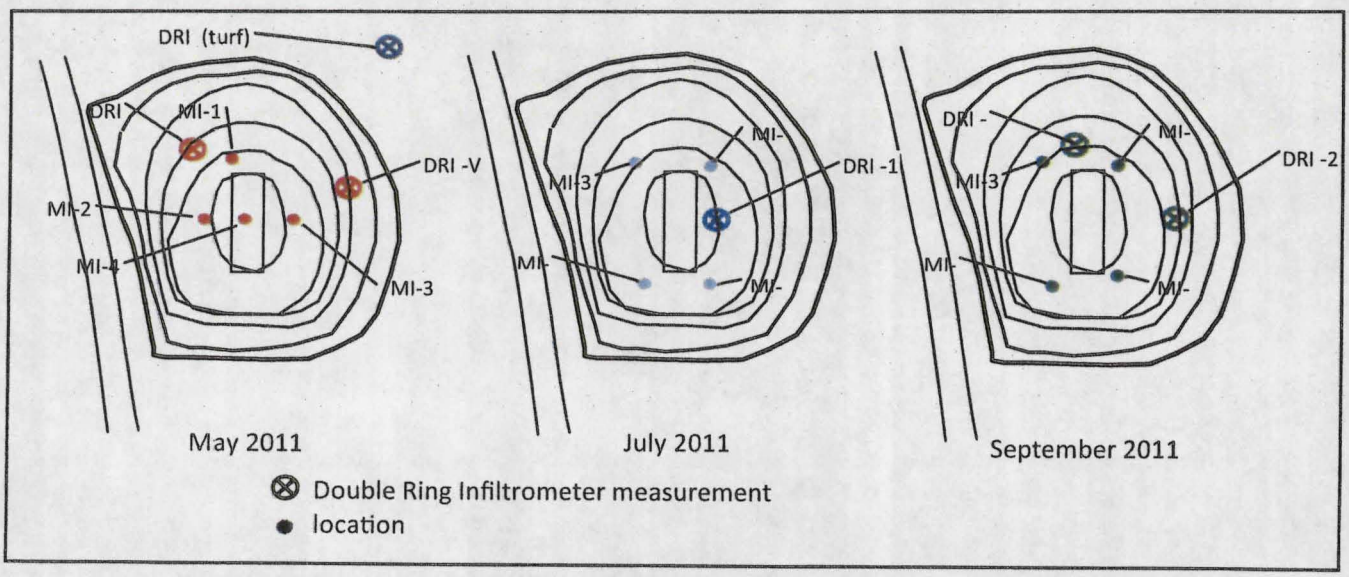


Figure 4-1: Infiltration measurement locations – Orchard Park Bioretention Garden

measurements in May the native soil condition was examined for bulk density to determine if this factor could be influencing infiltration rates. The bulk density of the bioretention garden was measure as high as 1.8 grams per cubic centimeter (g/cc) from the surface to approximately eight inches below the surface, reflecting a high degree of compaction. The project approach was amended to determine if remedial actions to break compacted, dense soils would improve infiltration.

Throughout the measurement periods, the infiltration tests using the double ring infiltrometers demonstrated very slow infiltration. Infiltration rates measured at Orchard Park are provided in Table 4-1. To determine if infiltration were equally slow near or with vegetation, infiltration was measured on soil occupied by native grass (little bluestem).

Table 4-1: Infiltration Measurement Results Orchard Park, May-July-September 2011

Measurement Location	May 9	July 12	Sept 21
DRI – Turf	0.38 in/hr	No Measure	No Measure
DRI	0.25 in/hr	<0.10 in/hr	<0.10 in/hr
DRI – Vegetation	3.00 in/hr	No Measure	3.50 in/hr
MI – 1	0.38 in/hr	0.62 in/hr	8.20 in/hr
MI – 2	0.75 in/hr	1.12 in/hr	0.13 in/hr
MI – 3	0.81 in/hr	0.18 in/hr	0.76"/hr
MI – 4	>40 in/hr *	0.00 in/hr	9.75"/hr

In general, the infiltration rates in the native soil of the Orchard Park bioretention garden ranged from 0.38 inches per hour on the north side of the infiltration cell, to 0.75 to 0.81 inches per hour on the west and east sides of the cell, and greater than 40 inches per hour within the sand/compost mix of the infiltration cell. The infiltration rate in native soil between plants averaged approximately 0.41 inches per hour, or 1.65 inches per hour including the two very rapid infiltration measurements shown in Table 4-1. The average infiltration rate excluding the two very rapid measurements is nearly equal the rate measured in the nearby park turf grass area (0.38 inches per hour). The data show that infiltration incorporating vegetation in the measurement showed a rate of 3.0 inches per hour.

The data show very slow infiltration rates, with variability in the rates of infiltration measured at different locations in the garden. Measurements from the south end of the bioretention garden had faster infiltration than readings collected on the north (0.62 – 1.12 in/hr on the south end compared to 0.00 to 0.18 in/hr on the north end in July. The garden also had typically faster infiltration on the west side (southwest and northwest corners) of the infiltration cell compared to the east side of the infiltration cell.

4.1.2 Stormwater Drainage Simulation

Valve assemblies were installed on both of the bioretention garden underdrains in May, 2011 when it was realized that drainage through the infiltration cells was too fast. To assess the infiltration of the garden as a whole, three simulated rain events were conducted by closing the underdrain valves and then flooding the garden with water from a nearby fire hydrant. These simulations took place on May

25th, June 30th, and August 17th. During the first simulation, the drop in water elevation of ponded water in the larger, primary garden was less than 3 inches over a 24-hour period. When the valve was open, the garden drained within 75 minutes, or 10.92 inches per hour, showing the affect of the infiltration cell on the performance of the bioretention garden. The second and third simulations were 12.12 and 14.64 inches per hour respectively.

During the storm event simulations, the valves were shut completely and the outfall was capped to ensure no loss of water. The 24 hour infiltration rate of water into the native soil of the primary bioretention garden was consistent for the May 25th, June 30th, and August 17th simulations, with measured infiltration rates of approximately 0.10 to 0.125 inches per hour (Table 4-2). The data indicate slight movement upward in the infiltration rate over the course of the growing season, but not significantly.

Table 4-2: Bioretention Garden Flooding Infiltration Results June and August 2011

	Water Elevation 0 hr (ft)	**Water Elevation 24 hr** (ft)	**Drop** (ft)	**Drop** (inches)	**Infiltration Rate** (in/hr)
June 30, 2011					
24 hr infiltration (ft):	1.7	1.47	0.23	2.76	0.115
August 17, 2011					
24 hr infiltration (ft):	1.465	1.22	0.245	2.94	0.123

4.1.3 Water Quality Analysis

Water samples were collected at Orchard Park during the second and third rainfall flooding simulations to provide a preliminary assessment of BMP performance for water quality improvement. Composite samples were collected for the influent entering the first curb-side garden and grab samples were collected as water first entered the larger, primary bioretention garden. Effluent grab samples were taken from both gardens independently to assess each gardens performance. Water samples were then collected from the effluent discharged from the primary garden at 0 hour, and again after 24 hours of residence time.

Samples were analyzed for nitrate/nitrite nitrogen, Total Kjeldahl Nitrogen (TKN), total phosphorous (TP), total dissolved phosphorous (TDP), heavy metals, and hydrocarbons. E coli, total suspended solids (TSS), and total solids (TS) were also tested, but due to errors in the field and lab, usable data was not obtained.

Water quality analytical results are shown in Table 4-3. The data show increases in nitrogen and phosphorous concentrations as the simulated stormwater filters through the bioretention garden. This is not unexpected, as microbial activity will free nitrogen and phosphorus from its bound form in organic matter, making it susceptible for leaching with incoming water. These results are consistent with the findings of other infiltration BMPs listed on the U.S. BMP Database maintained by the U.S. EPA in which similar BMPs show slight increases of nitrogen and phosphorous in effluent.

Table 4-3: Water Quality Analytical Results Orchard Park – June 2011					
	Nitrate/Nitrite Nitrogen	Total Kjeldahl Nitrogen	Total Phosphorous	Nitrite	Total Dis. Phosphorous
Influent (mg/l)	0.03	2.39	0.44	0	0
0-hr effluent (mg/l)	0.52	2.54	0.71	0	0.62
24-hr effluent (mg/l)	0.90	2.00	0.76	0.02	0.63
U.S. median influent (mg/l)[a]	0.59	01.80	0.25	NA	0.09
U.S. median effluent (mg/l)[a]	0.60	1.51	0.34	NA	.044
a. Median of 57 infiltration BMPs nationwide. Source: USEPA National BMP Database, May 2011					

It may be reasonable to assume that the pollutant removal capabilities of the Orchard Park and other BMPs in Omaha will show similar results for effective filtering of sediments, metals, and hydrocarbons. Bioretention gardens have been reported to effectively remove metal pollutants and hydrocarbons from stormwater under simulated conditions, while also releasing consistent concentrations of phosphorous. A study conducted at the University of Minnesota showed good uptake of cadmium, zinc, and copper by compost-amended sand in bioretention gardens, while releasing phosphorous at rates of approximately 0.29 mg/l through several hundred simulated rainfall infiltrations (Morgan, Gulliver, and Hozalski, University of Minnesota, Science and Engineering Update, Nov. 2011)

4.1.4 Vegetation

The plant material within the primary garden has performed quite well since its installation in early 2009 and has continued to perform well in 2011. Observations during the course of this study include:

- Root growth was good, with plants within the infiltration cell showing excellent root growth and structure. Plants growing in the native silty clay soil also showed very good growth, with roots found as deep as 12 inches below the ground surface. Roots of little bluestem growing in areas of the garden that have compacted soils also showed root growth to depths of 6- to 8 inches below the ground surface (bgs), demonstrating the hardiness of these plants to grow even in difficult soil conditions (Figure 4-2).

- Little bluestem grass that encompasses the majority of the north, east and south sides of the primary bioretention garden exhibited stunted growth where inundation occurred more frequently, typically toward the bottom of the garden. It is likely that while root growth was observed as deep as 8 inches bgs, high bulk density of the native soil and poor drainage contributed to stunted growth of the plant and its roots.

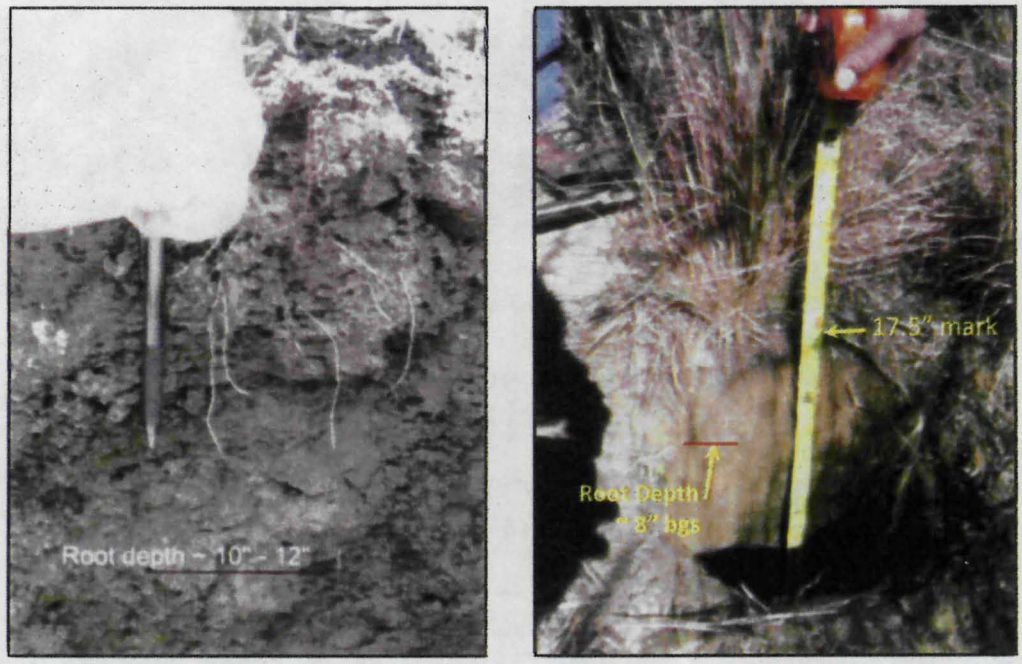


Figure 4-2: Root growth in uncompacted native soil (left) and compacted native soil (right)

- In late August, a 4- to 7-inch rainfall occurred in the Omaha area. Both gardens that comprise the bioretention structure were filled to capacity, with 12" of ponding in the first garden and 26 inches of ponding in the primary garden. The valve in the primary garden was partially closed to allow for a slow drawdown. In the bottom of the garden, Big Blue Lobelia had been performing well, but prolonged submersion during this event led to die-back of this plant. Lobelia plants that were able to stay above the ponding level remained viable and approximately two weeks after this event, new growth was noted at the base of the plants.

- New England Aster has exhibited strong colonization throughout the gardens and into the adjacent naturalized areas.

- Black-eyed susans and prairie cone flowers exhibited less vigorous growth than the first two years. This is not unusual, as the typical growth pattern of these plants is two years, followed by new growth from seed. The overall population of black-eyed susans and prairie cone flowers was lower in 2011, but improvements are expected in 2012.

- Penstemon and Prairie Blazing Star growth improved in the smaller, curb-side garden from decreases in populations in 2010 primarily the result of extensive vole damage.

The original design for the Orchard Park bioretention garden included drier, upland vegetation such as little bluestem in the bottom of the garden with the expectation of dry conditions during mid- to late-summer. The rapid drainage of the garden due to the highly permeable infiltration cell kept conditions dry and allowed the upland plants to do well. After the drain valves were installed in the garden, and

drainage slowed, the dryland vegetation such as little bluestem and great blue lobelia suffered due to the wetter conditions.

4.2 Under the Sink

Infiltration measurements were collected at the Under the Sink facility in the four bioretention gardens in the northwest corner of the property. Whereas the initial infiltration measurements at Orchard Park demonstrated very slow movement of water into the soil, infiltration into the Under the Sink bioretention garden soils was very fast. Observation of the four gardens showed that the first garden (BG-1) has a layer of silt over the top of the amended soil mix approximately 1.5 to 2 inches thick. It was determined to measure infiltration through the silt, as well as with the silt scraped aside. The remaining three gardens (BG-2, BG-3, and BG-4) were not covered with discernable silt. Measurements were collected in each garden as shown in Figure 4-3.

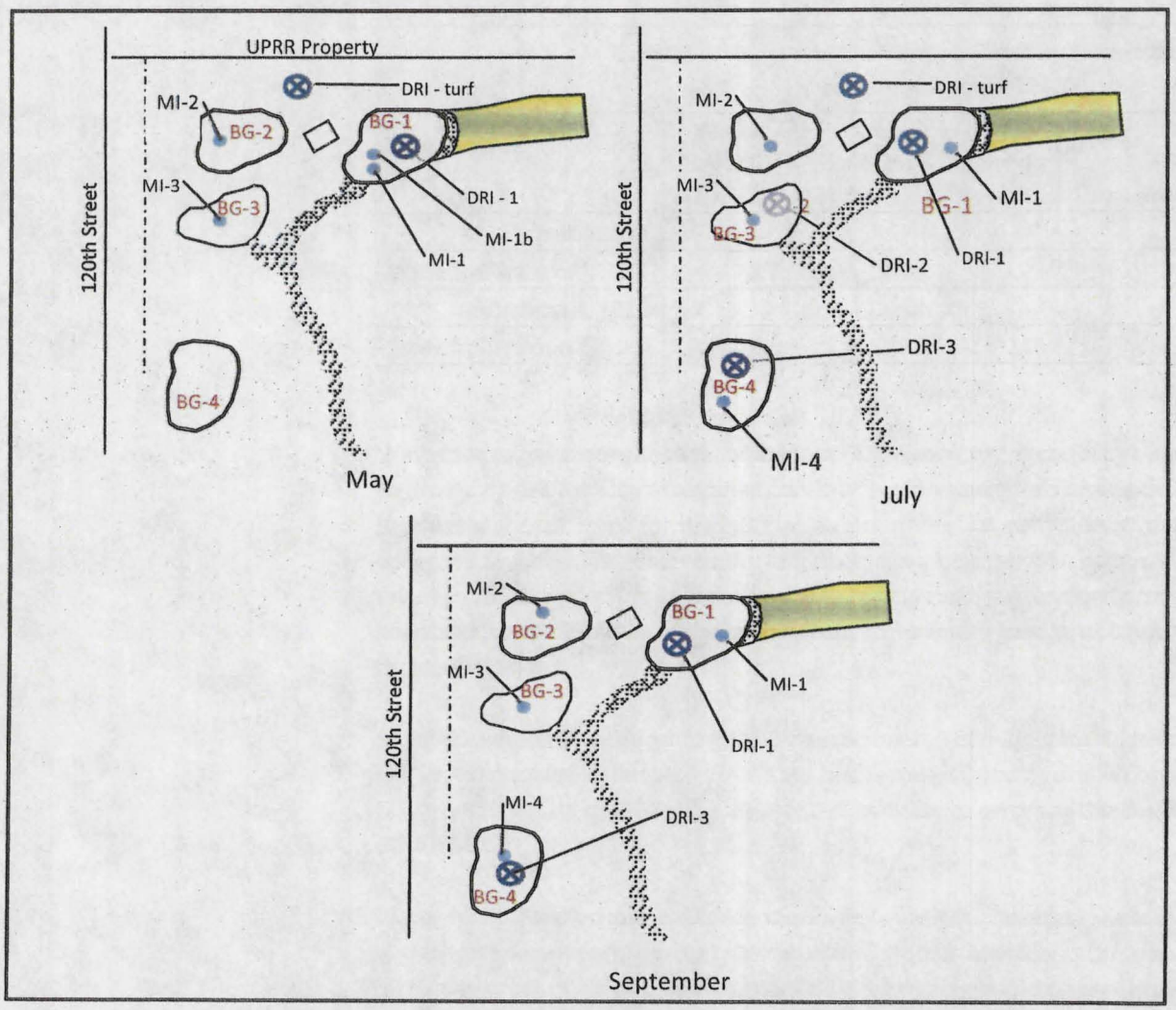


Figure 4-3: Infiltration Measurement Locations at the Under the Sink Bioretention Gardens

Because of the very porous nature of the bioretention amended soil at the Under the Sink facility, infiltration measurements from May through September were conducted to determine if there would be changes in infiltration rates with increased plant growth through the summer (including root mass) and/or possible silt deposition that could occur with rainfall runoff. Infiltration measurements were also collected in the turfgrass area near the BMPs at the Under the Sink facility. Infiltration rate measurement results are shown in Table 4-4.

Table 4-4: Infiltration Measurement Results Under the Sink, May-July-September 2011

Measurement Location	May 9	July 12	Sept 21
DRI – Turf	1.00 in/hr	0.90 in/hr	No Measure
DRI – 1	3.9 in/hr *	16.2 in/hr*	9.10 in/hr
DRI – 2	No Measure	>40 in/hr*	No Measure
DRI – 3	No Measure	>40 in/hr*	>40 in/hr*
MI – 1	2.31 in/hr	3.50 in/hr	6.50 in/hr
MI – 1b	>40 in/hr *		
MI – 2	21.5 in/hr*	28.0 in/hr*	5.50 in/hr
MI – 3	>40 in/hr *	>40 in/hr*	>40 in/hr*
MI – 4		>40 in/hr*	>40 in/hr*
*interpolated infiltration rate from last time measurement			

Infiltration measurements collected at the Under the Sink facility in May included examination of the northeast-most bioretention garden (BG-1) that had been covered with approximately 1.5 – 2 inches of silt. Infiltration measurements in this garden, collected with the silt in place, demonstrated reasonable infiltration rates (3.9 in/hr using the double ring infiltrometer, and 2.3 in/hr using the mini-infiltrometer). Infiltration rates in this same garden in July and September showed variable infiltration rates through the silt-covered material, including rates of 16.2 in/hr and 9.1 in/hr with the double ring infiltrometer, and 3.5 in/hr and 6.5 in/hr with the mini-infiltrometer. The variability in these measurements likely reflects varying thickness of the silt as well as possible edge effects from water seeping along the sides of the infiltrometer tools used. An additional measurement of infiltration into the garden with silt scraped away (MI-1b) resulted in an excessively rapid rate, greater than 40 in/hr.

Infiltration measurements collected in the two adjacent gardens, where silt had not accumulated were 21.5 in/hr in BG-2 (MI-2 in Figure 4), and greater than 40 in/hr in BG-3. Infiltration remained rapid in July and September in BG-2 (28 in/hr and 5.5 in/hr, respectively) and BG-3 (>40 in/hr in both July and September). The fourth garden (BG-4) had infiltration rates greater than 40 in/hr for both mini-infiltrometer and double ring infiltrometer measurements in July and September.

The two infiltration readings collected on the turf area at the Under the Sink facility were generally consistent between the two readings, with infiltration approximately 0.90 to 1.0 inches per hour. The data show, then, that the rapid rate of infiltration in the Under the Sink bioretention gardens is substantially greater than the existing turf, and even infiltration through the silt-covered garden was more rapid than infiltration into the existing turfgrass areas.

5.0 DATA INTERPRETATION AND DISCUSSION

When the bioretention gardens are considered as complete structures, information obtained during this assessment demonstrates that BMPs improve drainage of stormwater by diverting water away from storm sewer inlets and slowing its discharge. From this study, it was observed that variability in design and construction significantly affects the rates of stormwater infiltration and drainage in the bioretention gardens and their performance.

Infiltration rates on turf grass lawn areas near BMPs studied ranged from 0.38 inches per hour to approximately 1.0 inches per hour, based on a limited number of measurements collected. Typically, infiltration rates in the BMPs studied ranged from 0.125 inches per hour during storm event simulations at the Orchard Park primary bioretention garden, to an average of 6.9 inches per hour in the silt-covered bioretention garden at the Under the Sink facility, and to greater than 20 inches per hour in the other three gardens examined at Under the Sink.

5.1 Stormwater Infiltration at Orchard Park

While data collected at Orchard Park demonstrated increased stormwater drainage rates overall when compared to background conditions, the data does not indicate an increased rate of infiltration of stormwater into the natural soil at this location. The data showed that the sand/compost soil mix used for the infiltration cell is excessively permeable, with infiltration rates greater than 40 inches per hour based on interpolation of timed infiltration within the limits of equipment used. Infiltration in the native soil surrounding the infiltration cell averaged 1.6 inches per hour, however, two infiltration measurements were extraordinarily high (9.75 and 8.2 inches per hour) skew this average. Without these measurements, the average infiltration rate into the native soil averaged 0.4 inches per hour, with a range (excluding the two high measurements) from 0 to 1.12 inches per hour. The infiltrometer measurements were consistent with the results of a simulation in which the BMP was flooded with water from a fire hydrant. When the underdrain system was closed at the Orchard Park gardens, the 24 **hour infiltration rate into the surrounding native soils was very slow, approximately 3 inches, or 0.125"** per hour. When the underdrain valves were open, the bioretention garden completely drained in 70 minutes.

The measured variability in infiltration rates on the native soil likely reflects differences in soil density and/or proximity of the measurement to vegetation. The influence of vegetation on infiltration rates in the bioretention garden, however, was demonstrated with two measurements showing rates of 3.0 to 3.5 inches per hour. This highlights the importance vegetation plays in the overall function of bioretention gardens. It also brings notice that their influence on excessively compacted and poor soil conditions is slow to evolve, with infiltration rates between plants showing little increased infiltration as compared to those taken directly over the plant material.

5.2 Under the Sink

The 50/50 fine sand and compost mix used as the base soil of the bioretention gardens at the Under the Sink facility exhibited very high infiltration rates in all four of the gardens studied during all of the measurement periods. Only a covering of silt on BG-1 modified and slowed the infiltration into the garden. The extent of root growth in the Under the Sink bioretention gardens was not examined to

determine if the roots have extended into the native subsoil and may be promoting infiltration into the deeper soil depths.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this study did more to expose potential design and construction flaws that can occur with bioretention gardens than to observe changes or improvements in stormwater infiltration over the course of the growing season. The results of this study will contribute to improved BMP design to enhance infiltration and water quality.

Essential findings of this study include:

1. The sand/compost soil mix used for BMPs – whether for the entire base of the BMP, or for individual infiltration cells – is very permeable. The rate of measured infiltration into this soil mix is typically more than 40 inches per hour. Root growth into the sand/compost mix at Orchard Park was inspected, with plants roots within the infiltration cell showing excellent growth (approximately 24 inches or more).

2. Native soils in most locations are slowly permeable and highly prone to compaction that will exacerbate slow infiltration even more. Root growth in the native soils at Orchard Park overall was good but varied by location within the bioretention garden, with the roots in some areas of the garden deep with strong vertical growth, while in other parts of the garden, the root growth was acceptable, but stunted by very dense soils.

3. Infiltration in native soils is enhanced in very close proximity to plants and their associated roots. Infiltration on soil without vegetation, even if only several inches away from vegetation, was very slow, whereas infiltration measurements that incorporated native grasses within the infiltrometer demonstrated higher rates of infiltration.

4. Water quality data show release of nitrogen and phosphorous when water percolates through the sand-compost soil mix of the infiltration cell. This finding is consistent with other water quality measurements conducted around the U.S. and in a study conducted at the University of Minnesota. It's reasonable to assume, based on other studies conducted on bioretention gardens that other pollutants such as sediments, metals, and hydrocarbons will be removed from stormwater in bioretention gardens, but nitrogen and phosphorous will be released with water discharged from the gardens. No data was found to determine if higher concentrations of nitrogen or phosphorous in water entering the garden would be reduced in concentration in discharged water.

5. The total time of inundation plays a significant role in plant performance. During the first two seasons of the Orchard Park bioretention gardens, no valve was on the underdrain systems; as a result they drained excessively and dried in a short period of time. The addition of a valve and adjustment of flow out of the garden to extend residence time to 24 hours stressed the little

and big bluestem plants that were located in the frequent inundation area. Plants above that level performed better, emphasizing the need to site plants appropriately within the garden.

The findings of this study should be considered in the future design elements of new stormwater BMPs, as well as the management of existing BMPs in Omaha. Observations and measurements of infiltration at Orchard Park and the Under the Sink facility, combined with knowledge of the BMP structures, provides the following design and construction recommendations for BMPs:

1. Because of the high infiltration and permeability rates of the sand/compost infiltration mix, this material should be limited in application for bioretention gardens. Three strategies for design with the manufactured soil mix include:

    a. Limit the extent of sand/compost mix to areas immediately above drainage pipes. The areal extent of the sand/compost mix can be determined by calculation of the volume or column of water that can pass into and through the infiltration cell assuming an infiltration/percolation rate of at least 20 inches per hour. The BMP designer should determine the true infiltration rate of the sand/compost mix prior to conducting calculations. It must be noted that bench-scale tests of sand/compost mix infiltration rates indicated infiltration rates of approximately 3.5 inches per hour, far less than what was measured in the field.

    b. Install a valve at the discharge point of the drainage pipes of the BMP that can be open and closed as appropriate to control drainage from the BMP.

    c. Install a reducer (1-2") between the perforated and solid drainage pipes to restrict the flow out of the system if a valve is not utilized.

2. Water quality benefits are likely greater with longer residence time of water within the soil, which can be controlled with slower drainage through a valved underdrain system. The valve can be adjusted to slow or increase flow rate out of the system as needed. It can also be adjusted over time to account for increased infiltration into the native soils as a result of plant root establishment, increasing the effectiveness of the garden.

3. Manage native soils in the BMP carefully. During construction, limit access over the base of the BMP by equipment and foot traffic when and where possible. If heavy equipment must be used within the BMP area, the soils should be tilled to a depth of 8- to 12 inches (minimum) to break any compaction, and compost worked into a depth of at least 6 inches at a rate of approximately 1 cubic yard per 100 square feet. If a rototiller is utilized for blending of compost into the native soils, randomly dig holes throughout the tilled area deeper than the tilling depth. This will help to reduce the potential of an impermeable layer forming where the depths of the tines of the tiller reach to. Smearing and compacting of native soils can occur with tines striking at the same consistent depth during operation.

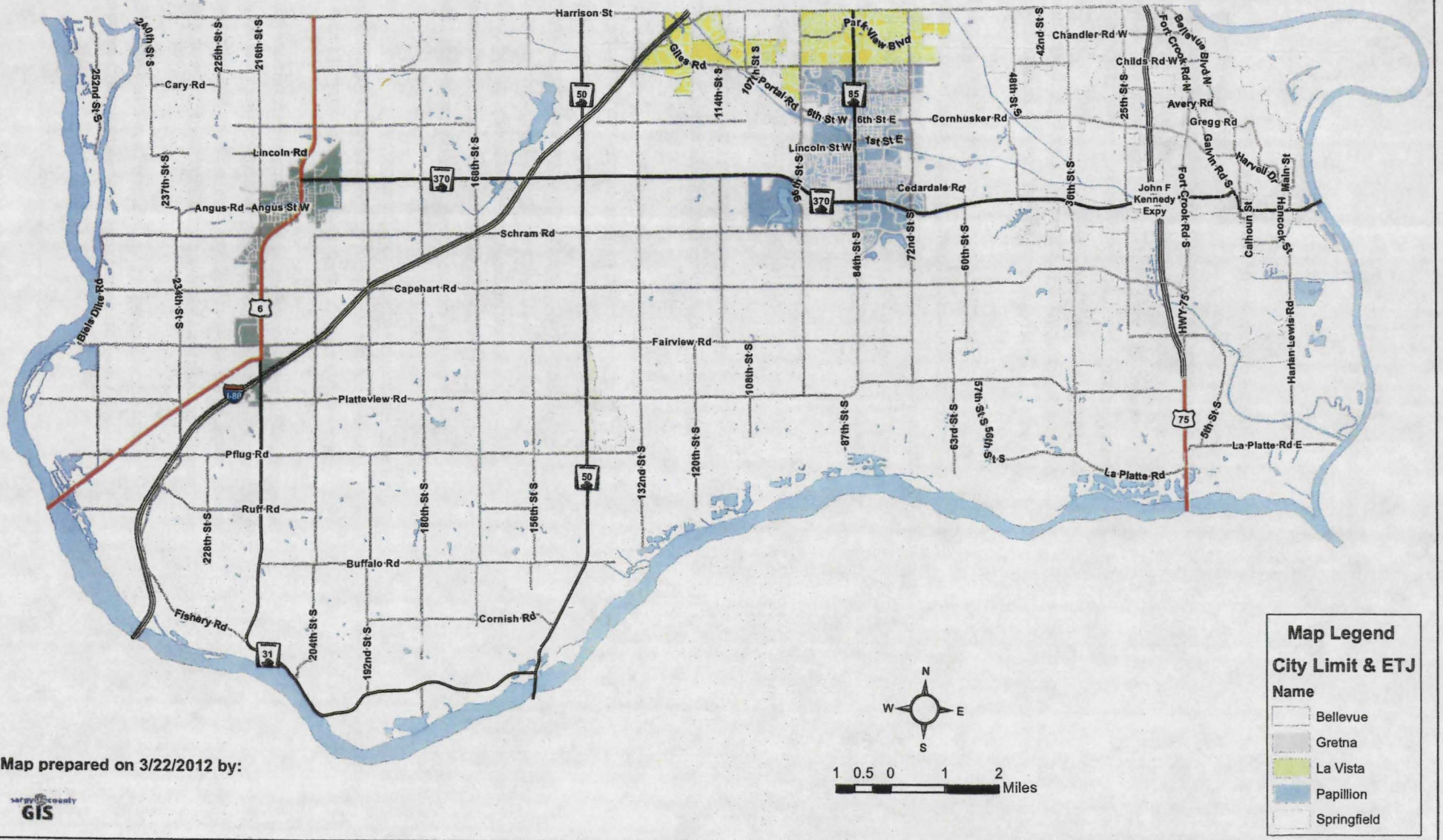
4. In existing or new BMPs, where compaction is found to be a problem, the compaction can be broken between plants using either an auger or a hand shovel to a depth of at least 12 inches, and backfill the hole with the native soil and compost mixed at a 1:1 rate. This will enable plant roots to grow more freely, and will also help to reduce the compaction of nearby soils. Compaction must be broken as much as possible in as many locations in the BMP as possible.

5. Maximize plant density. Plants and their root growth are the single most important factor in maximizing water infiltration into the soil in the BMP. Plant density should be carefully considered, however, as too high of a planting density can stunt plant growth. Not enough plants, however, will reduce the effectiveness of the BMP. Consider targeted spreading of seed from established plants within the garden. This can help to establish a full garden sooner with plants germinating in desired locations.

6. Monitor BMPs for infiltration performance regularly. If infiltration is not occurring as planned, adjustments to the BMP structure, whether by the amending soil conditions, increasing plant density, or installing a valve to control discharge can remediate problems and increase the performance and function of the BMP.

Attachment F

Attachment F



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MEMO

To: Sarpy County Board

From: Lisa A. Haire

Re: National Pollutant Discharge Elimination System (NPDES) Permit 2011 Annual Report

On April 3, 2012 the County Board will be asked to ratify the Annual Report for the 2011 National Pollutant Discharge Elimination System (NPDES) Phase II Permit concerning storm water runoff in the Papio Creek Basin.

On October 1, 2009 the Nebraska Department of Environmental Quality (NDEQ) issued a National Pollutant Discharge Elimination System (NPDES) permit NER210000 for Small Municipal Storm Sewer discharges to waters of the state located in Douglas, Sarpy, and Washington Counties. The NPDES permit requires that the co-permittees submit by April 1 each year an Annual Report documenting the status of all the general programs and individual tasks contained in the Storm Water Management Plan (SWMP).

The Papio-Missouri NRD in conjunction with U.N.O. assembles information and writes a majority of the report. The report is then sent to the various co-permittees in order for them to review and add local community information. This year, the report was not made available to Sarpy County until March 27. Due to the short timeframe, there was not enough time to present the report to the Board prior to the submission deadline of April 1. Mark Wayne signed the report and it was mailed to the NDEQ on March 28, 2012.

Do not hesitate to contact Mark Wayne or myself with any questions.

March 30, 2012

Lisa A. Haire
593-1565

cc: Mark Wayne
Scott Bovick
Brian Hanson
Denny Wilson
Bruce Fountain
Deb Houghtaling