# Chautauqua Park's Green Solution to Pollution

## Regional Water Resource Agency

## and

## Commonwealth of Kentucky
Energy and Environment Cabinet
Department for Environmental Protection
Kentucky Division of Water

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Project start date February 2, 2012 to project end date December 31, 2014.

Submitted by: Bryan Henderson

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## B. Acknowledgments

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## C. Table of Contents



### 1. Table of Contents for Figures, Images, and Tables

## D. Executive Summary

Green infrastructure is a growing trend for managing and treating storm water runoff and reducing storm water inflow into combined sewer systems. It was the goal of the Regional Water Resource Agency (RWRA) to introduce a green infrastructure technology to educate and increase awareness of storm water issues in our community and use green infrastructure to address those issues.

Our selected project site is within a watershed of 3.4 acres; of that, over 1.5 acres are impervious surfaces. The runoff from the impervious surfaces was directed off the property through a single concrete flume and onto a nearby street causing localized flooding. Early soil investigations of the area indicated moderate infiltration rates in the native subsoil. The topography of the site was suitable for a bio-retention basin, and its location within a city park and beside a busy thoroughfare made it an ideal location for an educational project.

Our goal was to build as large a basin that could be built within the limitations of the site and capture the runoff from .64" rain event, which is the 80$^{th}$ percentile rain event for our area. After post construction field observations, it appears the basin is capable of capturing a sudden rain event greater than one inch, but less than 1.25". The basin will capture larger events if the rain is distributed over a longer period.

In addition to the large bio infiltration basin/ rain garden, we wanted to provide educational opportunities and other demonstration projects. With the help of our partnership with the University of Kentucky Cooperative Extension Service and EcoGro, two rain garden workshops and a rain barrel workshop were held with a total attendance of 29. During those workshops, two functional rain gardens were constructed. The rain barrel workshop educated 51 attendees on the use of rain barrels, as well as the issues of nonpoint source pollution relating to storm water runoff. 44 rain barrels were made and taken home by the participants for their use.

To reach a broader audience beyond our project site and the workshops, we created a geocache and provided 3Enviroscape non point source pollution watershed models to the Owensboro Museum of Science and History. The geocache attracted an additional 30 people to our project site. Each year the museum hosts 26,000 students for field trips and educational workshops. It is at these workshops where our models will be used as an education center.

## E. Introduction & Background

Regional Water Resource Agency (RWRA) is the sanitary sewer provider for Owensboro and Daviess County, Kentucky and the City of Owensboro (City) owns and maintains the storm sewer system within the city limits. The City, being a phase 2 MS4, and RWRA, managing a portion of its system as a combined sewer system (CSS), were hopeful of the potential of green infrastructure in reducing runoff volume and pollutants, but were unsure how those systems would perform in the soils of Owensboro. Other municipalities that have successfully adopted green infrastructure have soils other than the Loess soils that are native to the Owensboro area. The City and RWRA wanted a project to experiment and demonstrate that infiltration could work with our native soils.

Several potential sites were identified. Consultations with our partners, the University of Kentucky Cooperative Extension Service and the Natural Resource Conservation Service indicated all sites had potential for a green infiltration technology. However, it was after that we learned of the §319 grant program that we chose an area that was very visible and accessible to the public in order to create a project that would be both a demonstration area for us and anyone interested in green infrastructure, and an educational area to raise public awareness.

Runoff from our project area flowed off the property through a concrete flume. Our goal was to redirect this flow from the flume into a large rain garden. The then future storm water requirement for Owensboro and Daviess County (Owensboro Metropolitan Subdivision Regulations- Appendix A- Public Improvement Specification, Ch. 14) calls for the runoff from all rain events totaling up to .64" ($80^{th}$ percentile rain event) to be treated before leaving the property. Since then the storm water regulation has been approved.

Gaining public acceptance and providing for public education was another goal of the project. Since large rain gardens can have a wilder and more natural look, we felt the public needed to be introduced to the benefits of native plantings, and how they are important to the function of a rain garden. The high visibility of the project site lends itself to some public education, but other goals we had for outreach included producing videos, school fieldtrips, newspaper articles, meetings, and workshops.

## F. Materials & Methods

1. Chautauqua Park Rain Garden BMP

The site of our large rain garden/ bio-retention basin located at Chautauqua Park1530 McJohnson Ave, Owensboro (Figure A Image A), intercepts the runoff from a 3.4 acre watershed. Of that area, about 68,000 square feet ($ft^2$) are impervious surfaces composed of sidewalks, asphalt road and parking pavement, and roof; the remaining 80,000 $ft^2$ is manicured lawn with mature hardwood trees with canopy cover being about 20% Soil borings in the area showed that soils with limited infiltration rates (rates of .14" or less/hr) at the surface were underlain with greater infiltrating soils (infiltration rates of .28" to 7"/hr). Our basin design called for 24" of over-excavation to be filled with sand (70%), compost from bio-solids and yard waste (20%) and soil (10%) mix. This put the bottom of our basin (the bottom of the engineered fill mix) in contact with the higher infiltrating soil layers.

Total size of the basin was sized to capture the $80^{th}$ percentile rain event in Owensboro, which is a total rain event total up to .64". Using a composite runoff coefficient where we assumed 95% runoff from the impervious surfaces, and 35% runoff from the pervious surfaces, it was determined that we needed an area of 3900 $ft^2$. This square footage accounts for us ponding the runoff to a depth of 12" and a void space volume in the engineered fill at 25% of the total volume.

Native perennial forbs and grasses (Table 1) were planted within the basin. A variety of 2" plugs were planted at a spacing of 18" before the basin was "on-line". That is to say, the plants were installed in May and not exposed to the full volume of water the basin was designed to handle until the flume that carries the runoff from the parking area was cut and redirected into the basin in November. Until the flume was modified, only the runoff from about 2 acres of the site, of which .25 acres was impervious, was reaching the basin. Hardwood mulch was used as a ground cover and reclaimed sidewalk pavers were used as a border. The sloped sides of the basin were planted with a seed mix of Partridge Pea, and other native warm season grasses (Table 1).

Runoff from the 1.5 acre parking area was funneled through a concrete flume and into the adjacent street at the lower end of the project site (Image B). The side of this flume was cut out and cleats of synthetic wood decking were installed within the flowline to direct the flow into the forebay of the basin. The flume was cut and cleats installed is such a way that when the basin is filled to capacity, the excess flow is allowed to bypass the basin and flow into the street and to a storm inlet as it did before modification (Image C). Within the forebay, a ramp, tripping curb, and splash pad were constructed to receive the rushing flow and de-energize it before it entered the basin. A row of gabion baskets containing 12" rip-rap ends the forebay and serves to further slow the water entering the basin and to capture trash and contain it within the forebay.

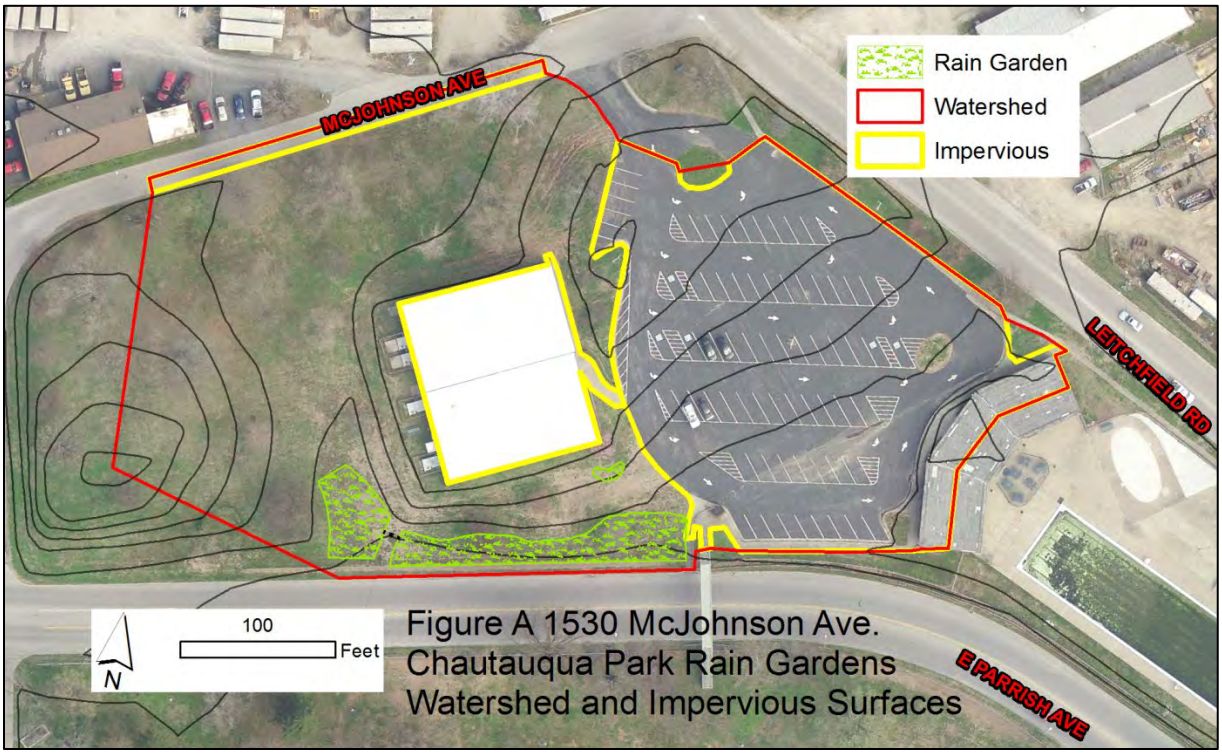


Figure A- 1530 McJohnson Ave, Owensboro

Image A- Basin from pedestrian overpass

| Complete Planting list for rain gardens | | | | |
|---|---|---|---|---|
| **Chautauqua Park Basin Plant List** | | | **Chautauqua Park workshop rain garden** | |
| *Bouteloua curtipendula* | Side-Oats Grama | | *Asclepia tuberosa* | Butterfly Milkweed (yellow var.) |
| *Chamaecrista fasciculata* | Partridge Pea | | *Baptisia australis* | False Blue Indigo |
| *Bromus kalmii* | Prairie Brome | | *Phlox divericata* | Garden Phlox (var.) |
| *Elymus virginicus* | Virginia Wild Rye | | *Sisyrinchium angustifolium* | 'Lucerne' Blue-eyed grass |
| *Carex brevior* | Plains Oval Sedge | | *Eutrocium purpureum* | Joe-Pye Weed (var.) |
| *Amsonia tabernaemontan* | Eastern Bluestar | | *Lobelia cardinalis* | Cardinal Flower |
| *Anemone virginiana* | Thimbleweed | | *Penstemon digitalis* | Foxglove Beardtongue |
| *Aster laevis* | Smooth Blue Aster | | *Echinacea purpurea* | Purple Coneflower "powwow" |
| *Aster novae-angliae* | New England Aster | | *Liatris spicata* | Liatris |
| *Baptisia australis* | False Blue Indigo | | *Coreopsis lanceolata* | Coreopsis (var.) |
| *Carex vulpinoidea* | Fox Sedge | | *Monarda sp.* | Bee Balm |
| *Chasmanthium latifolium* | River Oats | | | |
| *Echinacea purpurea* | Purple Coneflower | | **Brescia University workshop rain garden** | |
| *Eupatorium fistulosum* | Joe-Pye Weed | | *Baptisia australis* | False Blue Indigo |
| *Eupatorium perfoliatum* | Boneset | | *Phlox paniculata* | Dwarf Garden phlox "Flame White" |
| *Liatris spicata* | Dense Blazing Star | | *Phlox paniculata* | Garden Phlox "Purple Kiss" |
| *Lobelia siphilitica* | Great Blue Lobelia | | *Sisyrinchium angustifolium* | 'Lucerne' Blue-eyed grass |
| *Monarda fistulosa* | Bee Balm | | *Asclepia incarnata* | Rose Milkweed |
| *Panicum virgatum* | Switchgrass | | *Echinacea purpurea* | Purple Coneflower "powwow" |
| *Penstemon digitalis* | Foxglove Beardtongue | | *Coreopsis lanceolata* | Tickseed Coreopsis "Big Bang" |
| *Pycnanthemum tenuifoliu* | Slender Mt. Mint | | *Coreopsis lanceolata* | Tickseed Coreopsis "Li'l Bang" |
| *Rudbeckia fulgida* | Orange Coneflower | | *Schizachyrium scoparium* | Little Bluestem |
| *Schizachyrium scoparium* | Little Bluestem | | *Amsonia hubrichtii* | Bluestars |
| *Solidago nemoralis* | Gray Goldenrod | | *Juncus effusus"spiralis"* | Corkscrew Rush |
| *Sporobolus heterolepis* | Prairie Dropseed | | | |
| *Tradescantia ohiensis* | Ohio Spiderwort | | | |

Table 1 – Plant lists for rain garden BMPs

Image B - Flume before modification, flow to street.

Image C- Flume after medication, flow to basin.

2. Outreach/Education

a. Chautauqua Park rain garden workshop

Also at the Chautauqua Park site we constructed a rain garden to intercept runoff from approximately 800 $ft^2$ (Figure A, Image D). This was built as a part of rain garden workshop presented by the University of Kentucky Cooperative Extension Service. The workshop consisted of about 3 hours of classroom instruction and presentation, and then the rain garden was constructed after a break for lunch. It was constructed based on guidelines from publication HENV-205 from the Cooperative Extension Service of the University of Kentucky (UK) and planted with native or native cultivar forbs and grasses (table 1). This garden has un-amended soil, ponds water 8" deep and is approximately 160 $ft^2$. Overflow from this rain garden flows into our larger basin. A registration fee of $10 was charged to cover the cost of a catered lunch. Rough shaping was done the day before the workshop to make less work for participants. Once the sod was removed, a tiller was used break up the soil and it was raked into the final shape and a partial berm was constructed. Participants did the final raking and built the berm, planted, and mulched the rain garden.

Image D – Chautauqua Park workshop rain garden.

b. Brescia University rain garden workshop

A second rain garden workshop took place at Brescia University. This workshop was led by Russ Turpin of EcoGro in Lexington, Ky. The use of the UK Cooperative Extension Service for the workshop was unavailable since this workshop was held on a Saturday. The format of the workshop was the same with a morning presentation and information session, a lunch break, and the construction of a functioning rain garden on the campus. The rain garden was constructed at the University Alumni Center, 115 W. 7th Street (Figure B, Image E). It was constructed in accordance with publication HENV-205 from the UK Cooperative Extension Services and planted with native forbs and grasses (Table 1). The rain garden received runoff from approximately 500 $ft^2$ of rooftop, is approximately 100 $ft^2$, and ponds water to a depth of 6". The soil was amended

to a depth of 3” with peat moss to prevent a crust from forming which is common in the silty loam loess soils in our area. Cost for participants registering was $10 which was to cover the cost of a catered lunch.

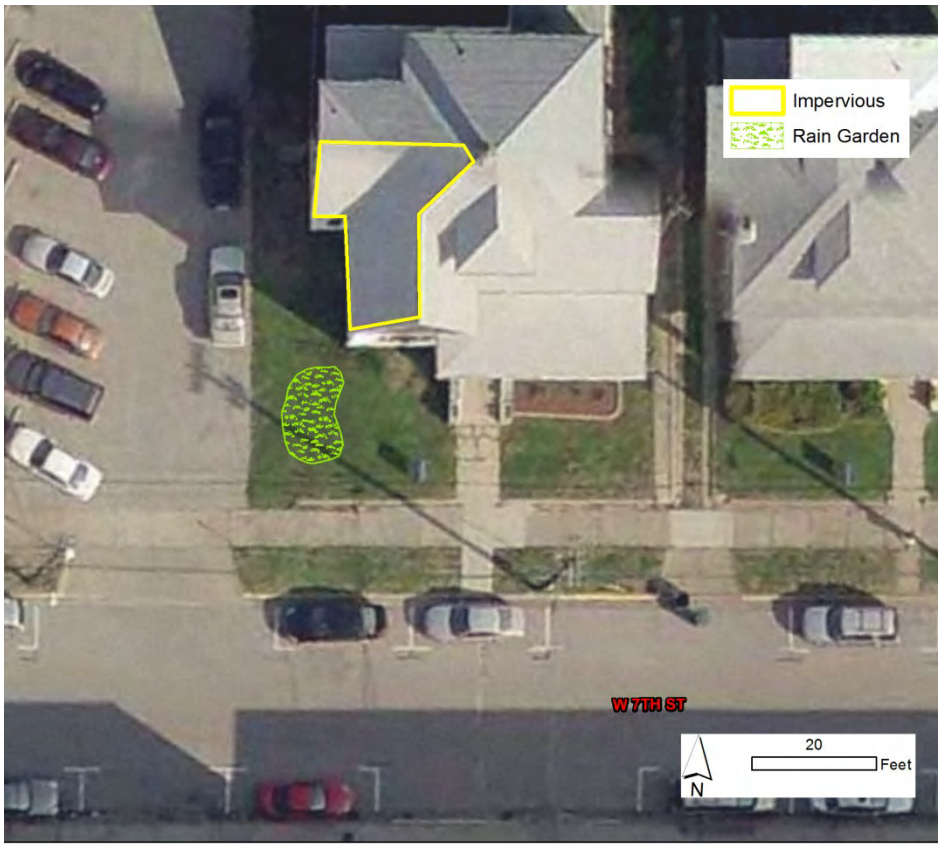


Figure B- 115 W. 7th Street, Owensboro, Ky
Brescia University workshop rain garden.

Image E- Brescia University workshop rain garden

c. Rain Barrel workshop

A rain barrel workshop was conducted by RWRA and the UK Cooperative Extension Service Office. This workshop used a presentation and a manual (HENV-201) developed by the Extension Service Office. Participant were presented with 45 minutes of prepared educational material then participated in the construction of a rain barrel they could take home with them. Participants were charged a $20 registration fee. This covered the cost of the fittings and materials other than the barrel. The cost of the barrel ($15) was paid for in part by §319 monies and RWRA and the City as the local match.

d. Signage

Signage was developed for public education and outreach extensively at the Chautauqua Park site (Image F, G, H) and less so at the Brescia University rain garden (Image I). Sign concepts were developed by RWRA and revised based on review and comments from the Kentucky Division of Water (KDOW). Conceptual plans were sent to Vacker Signs, Roseville, MN and developed into proofs for further approval by KDOW. Final designs were printed on .5" thick, 18"x24" high pressure laminate (HPL) panels. The advantage of using HPL panels was that full color graphics could be used, and the thickness of the panels permitted the use of a frameless, single post mounting.

e. Museum Models

The Owensboro Museum of Science and History was supplied with 3 educational models to use in their school field trips. The hosted events present several different labs, or learning centers, for the students. We supplied three Enviroscape Non Point Source Pollution models to demonstrate to the students the effect of what is on the ground ends up in our waterways.

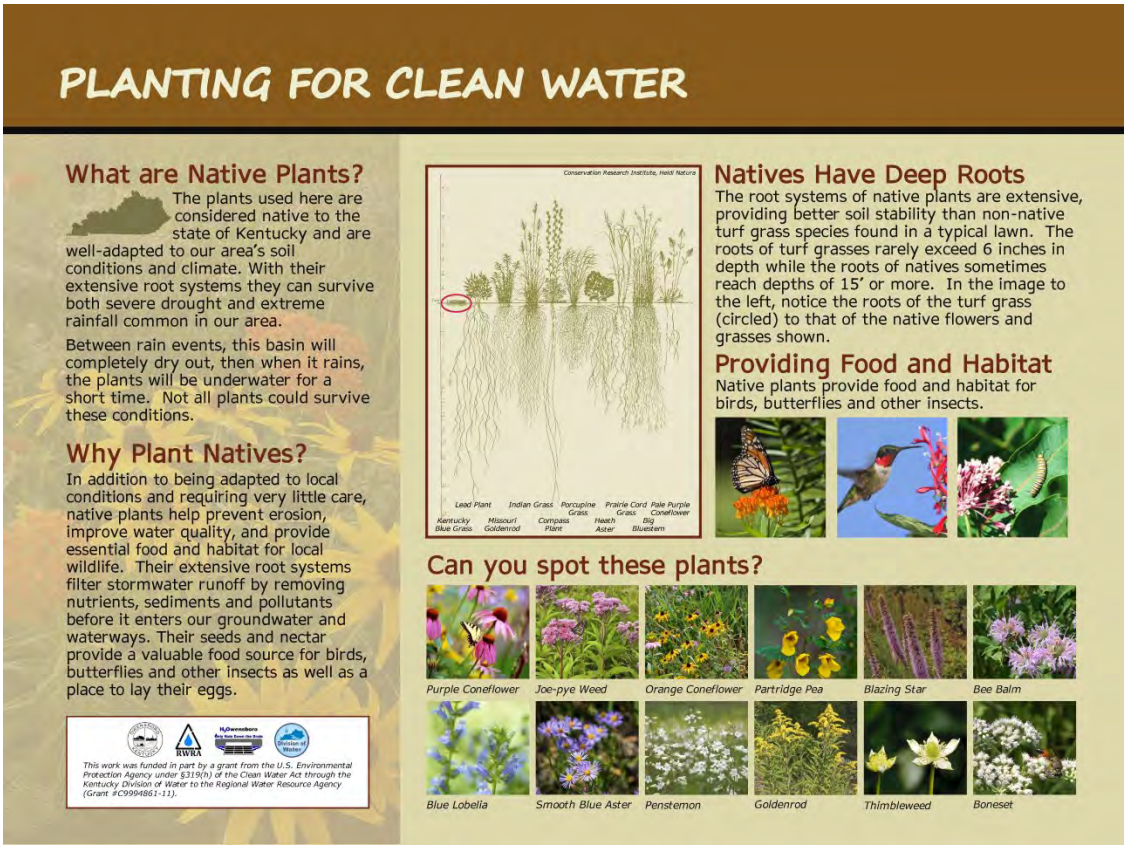


Image F- Chautauqua Park sign


Image G- Chautauqua Park sign

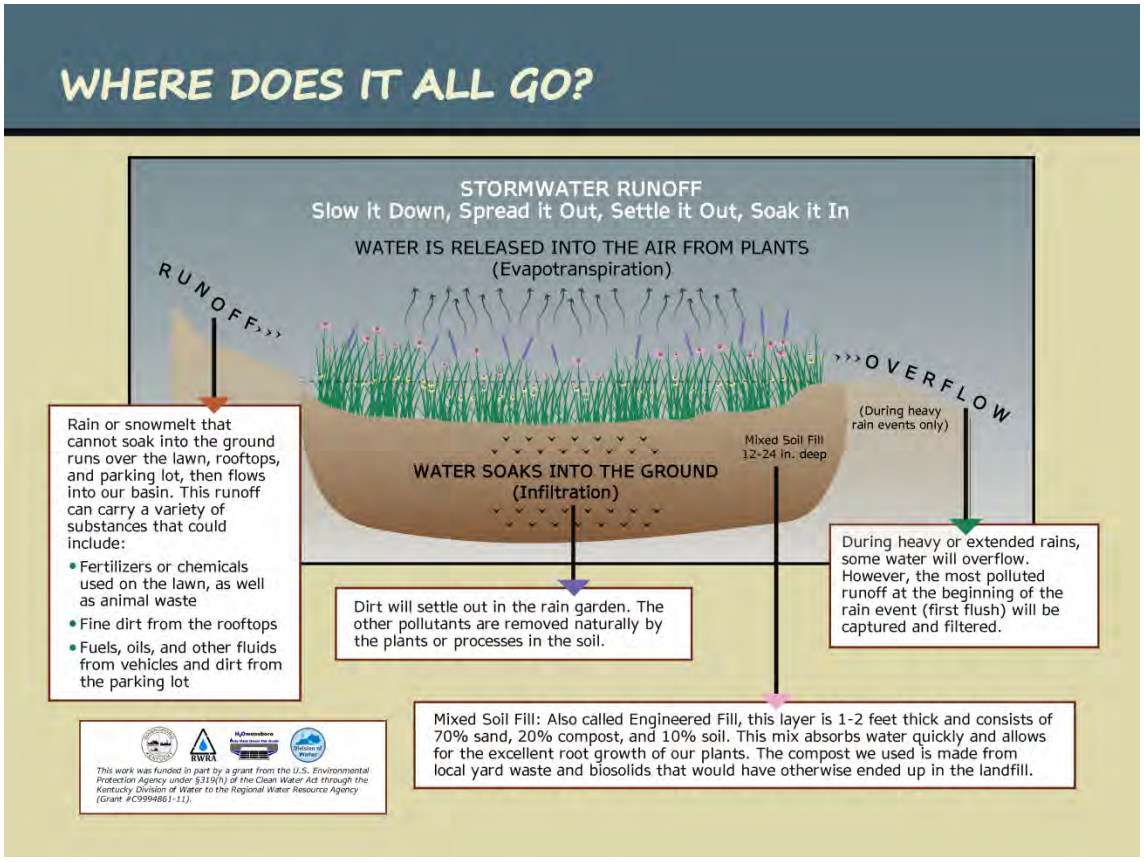


Image H- Chautauqua Park sign

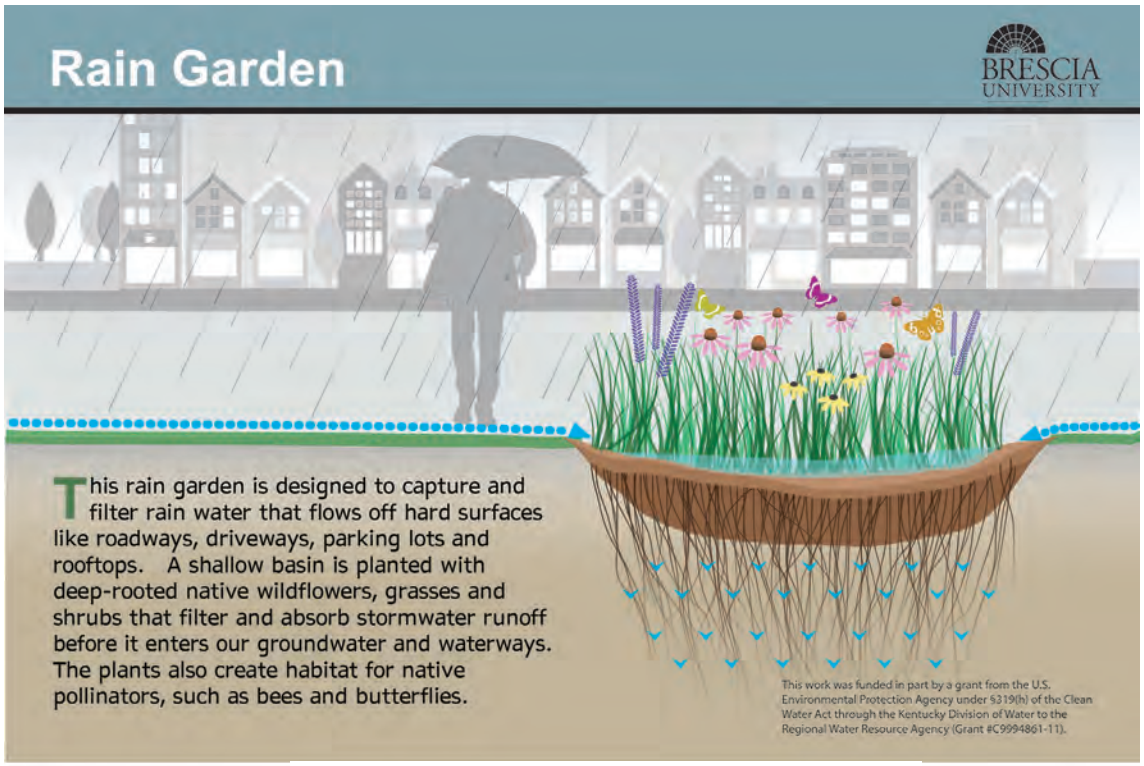


Image I- Brescia University rain garden sign

f. Geocache

As an effort to get more people at the site, a geocache was developed. The premise of the cache was that people had to read our signs to get a clue so they could locate the combination to a locked brochure box. Inside the box was a custom made geocache token (Image J) to further the NPS awareness message. Geocache location was published on www.geocaching.com.


Image J- Geocache token. Side 1 and 2

**Results & Discussion**

**1. BMP Implementation.**

a. Chautauqua Park Rain Garden BMP

As constructed our large rain garden/bio-infiltration basin located at the Chautauqua Park site has a surface storage volume of 4240 cubic feet ($ft^3$). This surface storage combined with the subsurface storage within the void space of the engineered fill, and the constant infiltration of the native soils has allowed for this basin to successfully retain runoff from a 3.12" event that spanned 36 hours. Our initial goal was to capture the runoff from the $80^{th}$ percentile (up to .64") rain event, and based upon our observations we have achieved that. Ponded water will remain in the basin up to 36 hours after the end of a rain event under normal conditions, although after one event the water remained for 72 hours. This was due to a previous rain event that occurred in the winter when the basin soils were saturated and frozen from a previous ice storm.

The first winter after the basin was in full use was very severe. Not only did we have record setting cold temperatures, but there were also frequent snow and ice events. Due to the slope of the parking lot and the employees that work in the adjacent building, the City frequently and heavily applies salt to de-ice the pavement. The following spring (2014) we experienced a significant number of plants and grasses that did not come back after dormancy. It was assumed this was due to salt damage because the pattern of plants that did not return was located at the end of the basin closest to the forebay where the water from the parking lot first enters the basin. We replanted with natives that had a either had a reputation for being more salt tolerant, or survived that first winter in the basin within that area near the forebay. To prevent a similar future outcome from salt runoff, the cleats that were placed in the flume to direct water into the basin have had a gap cut in them. During the winter months this gap allows the low volume snowmelt to bypass the basin while still catching higher volume rain events. Once the threat of

snowfall passes, the gaps are covered and the basin is then online to capture all the runoff from rain events.

Maintenance of the basin was easier than expected with the exception of having to replant after the salt damage mentioned above. Once the plants were established, the 18 inch spacing created a dense plant cover shaded the ground and helped prevent weeds from becoming established. Dominant weeds within the basin have been Cottonwood tree, Mulberry tree, and crabgrass species. An unexpected problem was the proliferation and profuse re-seeding of the Partridge Pea. This cannot be considered a weed, but may out-compete desirable native perennial plants. The area disturbed around the basin during construction was seeded with turf fescue grass. This grass seed was washed into the basin during heavy rain events. The displaced seed would grow in area where the native plants and grasses weren't established. Another unexpected weed problem came from the erosion control measures used to protect the bare slope of the basin until the seed mix could be applied. Straw mats were used on these slopes. Measuring 7'x 100' the mat was rolled out along the entire perimeter of the basin. This mat was not sterile and contained rye or wheat seeds from the straw. These seeds would germinate and although the plants are annual (they only last one growing season), they had to be trimmed and removed before seeds heads developed and they re-seeded.

b. Chautauqua Park Workshop Rain Garden

The rain garden that was constructed at the Chautauqua Park location as a part of the rain garden workshop is 160 $ft^2$ and ponds water to a depth of 8". This is enough to handle a 1.6" rain event on the 800$ft^2$ of roof that drains to this rain garden. Based on periodic observations, water in this basin will remain for up to 36 hours after the event. The Liatris planted in the basin was not successful for unknown reasons. The Butterfly Milkweed proved to be a competition for the rest of the plants. Seed production and sprouts were so prolific that it became a nuisance. Due to our experience with grass seed in surrounding areas getting washed into the basin we chose different technologies for stabilizing disturbed areas. Mats that contained fescue grass seed were used where grass was to be re-established. These mats did a good job of growing grass without allowing loose seed to get washed into the rain garden.

c. Brescia University Workshop Rain Garden

The rain garden that was constructed at the Chautauqua Park location as a part of the rain garden workshop is 100 $ft^2$ and ponds water to a depth of 6". This is enough to handle a 1.3" rain event on the 450$ft^2$ of roof that drains to this rain garden. Observations of performance are limited on this rain garden since it was installed late in the season. Due to the use and visibility of this rain garden, and the difficulty in vegetating disturbed areas at the time the rain garden was constructed, sod was chosen. The area was not very large, so sod was a cost effective option especially considering the instant appearance improvement it offered.

**2. Public Outreach / Education**

a. Workshops

i. Chautauqua Park Rain Garden Workshop

This workshop was held on Friday, May 23, 2014. There were 22 participants at this workshop. It was presented by the University of Kentucky Cooperative Extension Office. There was also a short

presentation by RWRA staff regarding improvements we are trying to make in our system and how Green Infrastructure fits in with our goals. The majority of the participants were members of the Master Gardner group which are associated with the Cooperative Extension Office. There was also representation from a few private engineering firms. The presentation was very received. After lunch the basin was constructed by participants. The work done before for the workshop was well worth the effort. This allowed the basin to be constructed quickly since there were a variety of people with different abilities attending the workshop.

ii. Brescia University Rain Garden Workshop

This workshop was held on Saturday, September 20, 2014. Since this workshop was on a weekend the Cooperative Extension Office was unable to lead the workshop. Russ Turpin of EcoGro in Lexington, Kentucky lead the workshop presentation. Since the presentation and workshop was not promoted by the Cooperative Extension Office, there was a decline in attendance. There were 7 registrants. Just as the other workshop, the majority of the rough shaping was done in the week before the workshop. The sod was removed, area tilled, and loose dirt shaped into a basin and berm. This was a wise step because of the limited participation at the workshop.

iii. Rain Barrel Workshop

This workshop was held on Thursday, October 2, 2014. This was workshop was done in conjunction with the Cooperative Extension Office. There were 51 registered participants with 44 barrels made. This workshop was very successful. The size of the workshop was limited to keep the time to just a few hours, but the presentation was well done, informative, and effective. After the presentation the participants broke up to went to different stations to complete their rain barrels. Since the class was large, some preparation work was done in the interest of time and liability. The barrels had to be washed out since our barrels still contained remnants of either pickles or peppers. Holes were drilled in the tops for the water inlet, and pipe was cut into lengths that would be needed to complete the barrel.

b. Museum Models

Museum models were provided late in the project. However, the museum hosts around 26,000 students per year.

c. Geocache

The geocache we created on geocaching.com was found by 30 people over a 6 month period. Most users finding the geocache would sign into the website and log their find. At that time I would receive a notification along with their comments. Many commented that they enjoyed the cache and learned facts about our project and NPS that they weren't aware of.

d. Fieldtrips

More fieldtrips were planned; however there was lack of interest from the local schools. On the recommendation from KDOW staff, we reached out to a local homeschool group. We hosted 2 students and their educator on a fieldtrip. This was late in the season and the instructor promised a return trip the following year and to bring more instructors and their students. Material for discussion came from the signs at the Chautauqua Park site, as well as our experience with the issue of NPS and green infrastructure.

**Conclusions –**

There are many ways that we achieved our goals of demonstrating to the residents in our area about use of green infrastructure to prevent NPS pollution. Our large rain garden was constructed on a busy thoroughfare. Once constructed, the large rain garden exceeded our goal of capturing the runoff from up to an 80$^{th}$ percentile rain event (.64") from the project watershed. Further demonstrating the potential of rain gardens to capture runoff and prevent NPS, we hosted 2 rain garden workshops. There was a combined attendance of 29. At both workshops, a functional rain garden was created. We also hosted a rain barrel workshop. Although this was not originally proposed, we felt that it supported the same NPS prevention message. There were a total of 51 participants at this workshop. This brings our total workshop attendance to 80, well over the 30 that we had originally proposed. As a result of the workshops, 2 rain gardens were constructed by attendees, and 44 rain barrels were distributed. An unexpected outcome of the project was a lasting partnership formed with RWRA and the UK Extension Office, as additional workshops are being planned through this partnership beyond the grant period

Our educational outreach took many forms. During and after construction we had the support of the local paper, which is distributed to over 25,000 subscribers daily and almost 28,000 on Sundays. Our project and workshops were featured in the paper a total of 7 times. In total we developed 4 educational interpretive signs at 2 different locations to explain rain gardens and their role in preventing NPS. Other educational material distributed was created by other agencies and approved by KDOW for our use in workshops and meetings. Presentations for workshops and meetings were developed by RWRA and other partner agencies, reviewed and approved by KDOW. Field trips included a group of 3 homeschooled children and their educator. A group of 5 city officials and 15 attendees from the local Storm Water Quality Advisory Committee (SWQAC) were also given a tour of the rain gardens. Our project was on the agenda of RWRA Board meeting 3 times, and a part of the agenda for the local SWQAC 25 times. These meetings were attended by up to 25 people per meeting. The museum was supplied with 3 Enviroscape NPS pollution models to feature in the field trip learning centers they host. A total of 26,000 school tour visitors every year from Western Kentucky and Southern Indiana visit the museum on these fieldtrips, additionally, the total on-site visitation for the museum is 42,000 people. The geocache created at our site drew 30 people who found the geocache and collected a custom token that features a NPS pollution message. Three videos were developed by RWRA staff and college interns to be uploaded to Youtube. Information about our project and workshops was featured on our website.

**Literature Cited –**

We have no sources to include in the literature cited.

## Appendix A. Financial and Administrative Closeout

**1. Application Outputs.**

| Milestone (Revisions approved 11/21/12) | Expected Begin | Expected Completion | Actual Begin | Actual Completion |
|---|---|---|---|---|
| 1. Submit all draft materials to the Cabinet for review and approval. | Duration | Duration | 3/30/12 | 6/25/15 |
| 2. Submit advanced written notice on all workshops, demonstrations, and/or field days to the Cabinet. | Duration | Duration | 6/14/13 | 10/2/14 |
| 3. Upon request of the Division of Water, submit Annual Report and/or participate in the Cabinet sponsored biennial NPS Conference. | Duration | Duration | 10/1/14 | 10/30/14 |
| 4. Submit BMP Implementation Plan to KDOW staff for review and approval. | Jan. 15, 2012 | Mar. 1, 2012 | 3/30/12 | 6/20/12 |
| 5. Attend LID Certification training (class schedule dependent) | Jan. 15, 2012 | Jan. 1, 2013 | 4/09/12 | 4/13/12 |
| 6. Project design | Mar.1, 2012 | March 30, 2012 | 7/1/12 | 8/23/12 |
| 7. Submit design draft to KDOW for review and approval | March 30, 2012 | Oct. 1, 2012 | 8/23/12 | 9/26/12 |
| ~~8. Bid project~~ | ~~April 15, 2012~~ | ~~June 15, 2012~~ | NA | NA |
| 9. Develop all educational and outreach material and signage, submit to KDOW as material develops. | Sept. 1, 2012 | May 1, 2013 | 12/15/12 | 12/12/14 |
| 10. Submit to KDOW newspaper articles for review and approval. | Oct. 1, 2012 | ongoing | 10/1/12 | 9/24/14 |
| 11. Submit to KDOW draft of Educational material for review and approval. | Nov. 1, 2012 | May 1, 2013 | 7/10/13 | 12/12/14 |
| 12. Submit to KDOW draft of webpages for review and approval. | Nov. 1, 2012 | Dec. 30, 2014 | 1/2/13 | 12/12/14 |
| 13. Submit to KDOW draft of video script or storyboard for community news channel for review and approval. | Nov. 1, 2012 | July 1, 2013 | 12/12/14 | 12/12/14 |
| 14. Submit to KDOW draft for signage at project site for review and approval. | Nov. 1, 2012 | May 1, 2013 | 1/2/13 | 9/17/14 |
| 15. Submit to KDOW draft for exhibit at museum for review and approval. | Nov. 1, 2012 | Feb. 1, 2013 | 4/11/14 | 12/11/14 |
| 16.Submit to KDOW design of geocache token for review and approval. | Nov. 1, 2012 | Jan. 1, 2013 | 1/15/13 | 2/18/13 |
| 17.Feature first article in newspaper after KDOW approval. | Oct. 1, 2012 | Jan. 1, 2013 | 10/1/12 | 10/1/12 |
| 18.Feature project in 6 newspaper articles after KDOW approval. | Oct. 1, 2012 | Dec. 30, 2014 | 10/1/12 | 9/24/14 |
| 19.Erect approved “Coming Soon” banner along W. Parrish Ave. | April 1, 2013 | June 1, 2013 | 5/14/13 | 11/14/13 |

| | | | | |
|---|---|---|---|---|
| 20.Submit to KDOW agenda for meetings with "technical" or officials groups for review and approval. | Nov. 1, 2012 | May 1, 2013 | 6/14/13 | 7/8/14 |
| 21.Film video 4 video segments for local news access, and online Youtube posting, submit to KDOW for review/appr. | Oct. 1, 2012 | Dec. 30, 2014 | 10/1/12 | 12/12/14 |
| 22.Generate 500 total "views" for Youtube videos | Jan. 1, 2013 | ongoing | 12/12/14 | 12/31/14 |
| 23.Begin construction of BMPs and planting after KDOW approval. | Oct. 1, 2012 | June 1, 2013 | 10/1/12 | 9/20/14 |
| 24.Order all media that has been approved by KDOW. | Jan. 1, 2013 | July 1, 2013 | 9/17/13 | 12/11/14 |
| 25.Arrange initial meetings with local officials and developers after KDOW approval. | May 1, 2013 | Aug. 1, 2013 | 2/11/13 | 2/11/13 |
| 26.Erect informational signage at project site, provide literature at site after KDOW approval. | Apr. 1, 2013 | Nov. 1, 2013 | 5/23/14 | 11/24/14 |
| 27.City crew begins to maintain beds until established | Mar. 1, 2013 | Dec. 30, 2014 | 5/28/13 | 5/23/14 |
| 28.Establish Geocache, distribute 250 tokens after KDOW approval. | April 1, 2013 | ongoing | 7/18/14 | 12/31/14 |
| 29.Develop and submit annual report with load reductions to KDOW for review. | Sept. 15, 2012 | ongoing | 10/1/14 | 10/30/14 |
| 30.Winterize plants as necessary to protect for first winter. | Nov. 15, 2013 | Dec. 1, 2013 | Jan, 2014 | Feb, 2014 |
| 31.Provide display to area museum after KDOW approval. | Jan. 1, 2013 | Mar. 1, 2013 | 12/11/14 | 12/19/14 |
| 32.Submit material to DOW for newly elected officials meeting for review and approval. | Jan. 1, 2013 | May 1, 2013 | NA | NA |
| 33.Monitor and observe BMPs during rain event to measure success. | July 15, 2013 | ongoing | 12/7/13 | 12/31/14 |
| 34.Contact local schools to arrange meetings with teachers. | Jan. 15, 2013 | Mar. 1, 2013 | 8/23/14 | 10/3/14 |
| 35.Submit agenda for school field trips to KDOW for review and approval. | Feb. 1, 2013 | Mar 1, 2013 | 10/6/14 | 10/6/14 |
| 36.Submit to KDOW agenda and manual for rain garden workshops for review and approval. | Feb. 1, 2013 | Mar. 1, 2013 | 4/21/14 | |
| 37.Distribute 1000 information brochures at site. | March 15, 2013 | ongoing | NA | NA |
| 38.Distribute 1000 information brochures at Area Museum. | March 15, 2013 | ongoing | NA | NA |
| 39.Host 3 school fields trips. | March 15, 2013 | Dec. 30, 2014 | 10/6/14 | 10/6/14 |
| 40.Host 2 open meetings, invite local engineers, architects, pertinent college classes, involved organizations after KDOW material approval | May 1, 2013 | Oct. 1, 2014 | 6/19/13 | |
| 41.Host 3 residential rain garden workshops, host 60 total attendees. | May 1, 2013 | Oct. 1, 2014 | 5/24/14 | 10/2/14 |
| 42.Arrange follow-up meetings with officials and developers. | Aug. 1, 2013 | Oct. 1, 2013 | 6/14/13 | 7/8/14 |
| 43.Submit three copies of the final report and submit | Sept. 1, | Dec. 30, | 1/23/15 | 6/23/15 |

| | | | | |
|---|---|---|---|---|
| three copies of all products produced by the project. | 2014 | 2014 | | |

1.) Q1 ’12- Began milestone with draft of BMP Implementation Plan. Other drafts to follow. Q2 12- Submitted BMP Implementation Plan. 12/31/12- Submitted BMP plan. 9/30/13 Draft of interpretive signage submitted for review. 6/31/14-Submitted rain garden workshop agenda and material. 7/1/14- Submitted information for rain garden workshop. Rain barrel workshop. 6/25/15- Draft final report sent to KDOW for review and approval.

2.) 6/30/13- Advanced notice given for RWRA board meeting and SWQAC meetings. 9/30/13 Tentative dates being sought for rain garden workshops in 2014. 7/8/14- Notice given of quarterly Storm Water Quality Advisory Committee meeting. Notice given for Rain Garden Workshop, and Rain Barrel Workshop. 10/2/14- Final workshop held.

3.) 10/1/14- Request for annual report was received. 10/30/14- Annual report submitted, reviewed and approved.

4.) Q1 ’12- Submitted BMP Implementation Plan. Q2 ’12- Re-submitted BMP Implementation plan with recommended changes.

5.) Q2 ’12- Attended training and completed certification requirements.

6.) 12/13/12-Designed project, submitted to KDOW for review and approval.

7.) 12/31/12- Submitted BMP design plan and engineers review for review and approval.

8.) Project was done in-house, so bidding was not necessary.

9.) 12/31/12- Began design of museum exhibit, roadside banner, and geocache token. 6/30/13- Developed and submitted Geocache design. Developed and submitted “Coming soon” banner. Began development of interpretive signage. 9/30/13- Interpretive sign concept drafts submitted and approved. 12/12/14- Videos submitted.

10.) 6/30/13- Submitted newspaper article. 12/1/12-Featured first article and follow-up front page photo and caption. Submitted to KDOW. 6/30/14- Another article was featured regarding the rain garden and our rain garden workshop. 9/8/14-9/24/14- Newspaper articles featuring the Rain Garden Workshop and Rain Barrel Workshop submitted.

11.) 6/30/13- Kentucky core content standards have been reviewed and educational material has began to be developed. 12/12/14-Videos were the last draft items submitted.

12.) 12/31/12- Created link for webpage and began design work on page. 12/12/14- Sumbitted drafts of videos for posting online.

13.) 12/31/12- Gathered footage during construction for videos. 6/30/13- Further footage is being collected as basin is still not 100% complete. Videos will be developed after all construction is complete. 9/30/13- On site video interview to be obtained upon completion flume modification. 6/30/14- Video have begun to be developed. Will be submitted to KDOW for review and approval. 12/12/14- submitted videos to KDOW review and approval.

14.) 12/31/12- Began design of roadside banner for site. 6/30/12- Draft of interpretive is being developed for review. Quotes from interpretive sign designers/maker are being sought. 9/30/13- Draft concepts submitted and approved. All material sent to Vacker Signs, Inc. for development of final sign designs, will submit final proof before printing. 12/31/13-Sign revisions sent and reviewed by KDOW. 9/17/14- Submitted for review and approval, rain garden sign for new rain garden at Brescia University.

15.) 9/30/13- KDOW staff visited with Museum staff to facilitate display design. 6/30/12- Museum staff working on exhibit design. Will submit to KDOW. 12/31/12- Began design work for museum exhibit. 12/31/13-Working with Museum personnel on design. 6/30/14- Rough draft of museum exhibit was submitted to KDOW. 12/11/15- Enviroscape models submitted and approved for the Museum.

16.) 6/30/12- Submitted design of geocache token for review and approval. 12/31/12-Began design work for Geocache token. 2/18/13- Submitted geocache design approved. 9/30/13- Geocache artwork submitted to token maker for production. 12/31/13-Ordered and received geocache token, sent samples to KDOW. 7/18/14- Geocache was active and to date 45 people have visited and collected a token.

17.) 12/31/12- First article featured, submitted to KDOW.

18.) 12/31/12-First article featured with 2nd follow-up photo and caption, submitted to KDOW. 6/30/13- 3rd time project is featured in newspaper. 6/30/14- Project and rain garden workshop featured in article. 9/8/14- Rain Garden workshop featured in article. 9/24/14- Rain Barrel Workshop featured in article.

19.) 6/30/13- “Coming soon” banner erected on fence at project site.

20.) 6/30/13- Submitted agendas for RWRA Board meeting and SWQAC meeting. 12/13/13- Submitted agenda for January SWQAC meeting. 7/8/14- Last SWQAC meeting agenda was submitted.

21.) 12/31/12-Began gathering footage for featured videos. 12/31/13- Continued gathering pictures for video. 6/30/14- Videos have begun to be developed.

22.) 12/12/14- Videos submitted to KDOW for review and approval. 12/31/14- No Youtube views available at close of project.

23.) 12/31/12- Began construction. 12/31/13- Construction completed on main cell. Demo rain garden to be constructed May, 2014 5/20/14- Rain Garden constructed as a part of Rain Garden Workshop. 9/20/14- Rain Garden constructed as a part of workshop.

24.) 9/30/13- Contact made with geocache token maker and approved artwork for token turned over to them. All approved interpretive sign material given to sign maker. 12/11/14- Enviroscape models ordered for museum.

25.) 6/30/13- New local officials presented project at RWRA orientation meeting for new local officials. 2/11/13- Last meeting with elected officials held.

26.) 9/30/13- All material sent to sign maker. Some discussion of using the sign maker to develop brochure material also. 6/30/13- Interpretive signage is in design. 12/31/13- Sign design in development. 6/30/14- Signage has been erected after KDOW approval. 9/17/14- Sign design submitted for Rain Garden built as a part of workshop at Brescia University. 11/24/14- Sign erected at Brescia University rain garden.

27.) 6/30/13- City crews began to water and weed new plant installation. 9/30/13- City crews continue to water and maintain basin. 6/30/14- Crews continue to water newly planted replacements. 9/20/14- Contract crew begins to water new Rain Garden installed as a part of the workshop.

28.) 6/30/13- Geocache design approved. Will establish Geocache when signage is in place. 9/30/13- Geocache token material submitted to token maker. 12/31/13- Geocache tokens received, samples sent to KDOW for review. 7/18/14- Geocache active, 45 finders and 45 tokens given out to date.

29.) 10/1/14- Request for Annual Report received, submitted on 10/30/14.

30.) 12/31/13- Order given to begin raking out basin and removing old vegetation as crews are available. 6/30/14- Basin was cleared and cleaned over winter.

31.) Will submit to KDOW for review. 12/31/12- Design for this exhibit underway. 6/30/13- Museum staff designing display. 9/30/13 KDOW staff met with museum staff for guidance on display design. 6/30/14- Provided rough draft to KDOW and Museum staff. 12/11/14- Received approval from KDOW for non-point source pollution models and 12/19/14- Delivered models to the museum.

32.) Material for these meeting was the design and concept of the BMP previously approved as a part of the BMP Implementation Plan.

33.) 12/31/13- Began observing basin during/after rain events. Basin fully online 12/6/13. 6/30/14- Observing before during and after rain events. 10/1/14- continuing to check on structures during and after rain events both for measured effectiveness and for general maintenance needs. 12/31/14- Monitoring is ongoing and will continue into the future.

34.) 8/23/14- Daviess County Public Schools contacted and notified that fieldtrip was available. Owensboro homeschooling organization was contacted and notified that a fieldtrip was available.

35.) 10/6/14- Tour given to home school group. Material used was existing material from approved presentations and Rain Garden Manuals.

36.) 6/30/14- Agenda and flyer submitted to KDOW. 9/25/14- Agenda for Rain Barrel workshop submitted.

37.) Brochures not developed.

38.) Brochures not developed.

39.) 10/6/14-Hosted home school group at site.

40.) 6/30/13- Hosted open SWQAC meeting. Led field trip for attendees. 10/2/14 Last open workshop held.

41.) 12/31/13- Rain garden workshop to be held Fri, May 23, 2014. Agenda and outline will be submitted to KDOW as material is developed. 6/30/14- Rain garden workshop hosted 13 attendees. 9/20/14- Rain Garden Workshop at Brescia University, 7 participants. 10/2/14- Rain Barrel workshop, 47 registrants, 55 in attendance.

42.) 6/14/13- Open SWQAC meeting featured discussion and current finding from project. 7/8/14- Final SWQAC meeting during project timeframe that featured project and discussion.

43.) 1/22/15- Draft of Final submitted.

**2. Budget Summary**

**Original detailed budget from application**

| **Detailed Budget** | | | |
|---|---|---|---|
| Budget Categories (Itemize all Categories) | §319(h) (60% of funds) | Non-Federal Match (40% of funds) | TOTAL |
| Personnel | | 34,413 | 34,413 |
| Supplies | | 11,850 | 11,850 |
| Equipment | | | |
| Travel | | 1,934 | 1,934 |
| Contractual | 93,358 | 13,442 | 106,800 |
| Operating Cost | | | |
| Other | | 600 | 600 |
| TOTAL | 93,358 | 62,239 | 155,597 |

**Revised Budget. Approved by KDOW 8/14/2012**

| **Detailed Budget** | | | |
|---|---|---|---|
| Budget Categories | §319(h) (60% of funds) | Non-Federal Match (40% of funds) | TOTAL |
| Personnel | | 34,288 | 34,288 |
| Supplies | | 11,850 | 11,850 |
| Equipment | | | |
| Travel | | 2,109 | 2,109 |
| Contractual | 93,358 | 13,442 | 106,800 |
| Operating Cost | | | |
| Other | | 550 | 550 |
| TOTAL | 93,358 | 62,239 | 155,597 |

This revision was done to increase the budget for travel expenditures in the course of gaining low-impact development (LID) certification. When the original budget was written as a part of the application process it was unknown where in the state the certification would be held since it is in a different location every year. Only after the training and all travel was completed did we know the true cost of that travel. The budget was revised to reflect that actual cost for travel. The "other" category was reduced $600 to $550 to reflect the actual cost of the certification course cost. Money from the Personnel budget was transferred to provide for the increase in Travel.

**Revised Budget. Approved by KDOW 1/13/15**

| Budget Categories | 319(h) Dollars | Match | TOTAL | Final Expenditures |
|---|---|---|---|---|
| Personnel | | 37,792.20 | 37,792.20 | 39,876.01 |
| Supplies | | 7,185.06 | 7,185.06 | 7,212.06 |
| Equipment | | | | |
| Travel | | 2,109.00 | 2,109.00 | 2,109.00 |
| Contractual | 93,358.00 | 14,602.74 | 107,960.74 | 108,008.67 |
| Operating Cost | | | | |
| Other | | 550.00 | 550.00 | 550.00 |
| TOTAL | 93,358.00 | 62,239.00 | 155,597.00 | 157,755.74* |

**Regional Water Resource Agency (RWRA) was reimbursed $93,358.00. All dollars were spent; there were no excess project funds to reallocate. This project did generate overmatch provided by RWRA. This overmatch was not posted to the Grant.*

This revision was done to transfer funds to the Contractual and Personnel categories from the Supplies category. There we increase cost in the contractual category due to our involvement in constructing one more rain garden as well as hosting the rain barrel workshop that was not in our application. The added cost for personnel was to cover the increased cost of the education and work done to present the workshops.

**Budget Narrative:**

**Personnel:**

BMP Implementation cost are those cost associated with activities related to the BMPs as a part of the project. This includes times by partner personnel associated with preparation of the workshops work required to get the vegetation established within the BMPs.

- BMP Implementation plan. Engineering Technician $50.00/hour (includes fringe) x 28 hours =$1,400.00.
- Watering, weeding, and clean-up of rain gardens by partner personnel and grounds crew including fringe =$3,856.97.
- Workshop prep work by partner personnel. This included activities related to the workshops, but were performed prior without the presence of the participants. Material gathering, cleaning, and rain garden rough-in work are some of the activities included. Includes fringe = $4669.80

Project Management costs include the partner personnel's time to administer the project. This includes invoicing, design, training, and project oversight.

- Certification class at North Carolina State University. Engineering Technicians from City of Owensboro and RWRA, 24 hours each.= $1,944 includes fringe.
- Construction inspection- Engineering Technician, $50/hour including fringe x 120 hours = $6000
- Project design and specifications development- Engineering Technician, $50/hour including fringe x 100 hours =$5,000.
- Invoice and report creation and submittal- Engineering Technician, $50/hour including fringe x 24 hours= $1,200.00 + $52.64/hour including fringe x 6 hours = $315.84. Total $1,515.84.
- Project review- Director of Engineering at $113.00 per hour including fringe x 2 hours = $226.00

Education, Training, and Outreach costs were allocated to include all work done by partner personnel during our knowledge transfer activities such as meetings, workshops, and newspaper article interviews.

- Open meetings including RWRA Board meetings and the Storm Water Quality Advisory Committee of Owensboro. Various personnel, 9.5 hours total includes fringe. = $740.42
- Newspaper article interviews. Various personnel, 4 hours total, includes fringe. = $268.28.
- Development of educational material for workshops. This includes advertising, handouts, and presentations. Various employees, 12.5 hours, includes fringe. = $640.36.
- Video creation. Done by student summer interns. Includes fringe- 112 hours x $12.95= $1450.40
- Museum exhibit development. Engineering Technician - $52.64/ hour including fringe x 15= $789.60.
- Visual material development including signs and geocache token. Engineering Technician 30 hours total, including fringe = $1510.56.
- Workshop presentations, set-up and coordination. Various employees, 77 hours total including fringe = $3,583.56.
- UK Agricultural Extension Office personnel for activities related to the presentations at our workshops. Various personnel, 136 hours = $7507.

Monitoring costs were used to pay personnel for the inspection of the BMP performance during and after rain events.

- Engineering Technician, 16 total hours, fringe included = $826.40

**Supplies:**

Education, Training, and Outreach cost are allocated to include any supplies related to educational materials to be printed and distributed. The cost of the Geocache tokens, signage, and software to design signage is also included.

- Google Sketch-up Pro = $495.00
- Signage- banner, (3) 18x24 interpretive panels, rain garden sign and mounting material = $3,713.74.
- Geocache tokens- 1000 with custom design and set-up = $190.07
- Educational materials- 75 copies each of UK Extension Office publication HENV-201 "Building a Rain Barrel", HENV-205 "Residential Rain Gardens", and Bluegrass Greensource's "Rain Garden Manual". $.17per page = $446.25
- Enviroscape NPS models for Museum. 3 at $780 each including shipping. = $2,340.00

**Equipment:**

No additional equipment is being proposed for purchase. For cost efficiency, existing video equipment, small equipment, and other supplies will used from our partners. All heavy equipment used for construction will be provided by contractor under contractual labor.

**Travel:**

Project Management cost for travel was associated with the Low Impact Design certification course at North Carolina State University in Raleigh, NC. Cost includes Air fare, per diem, and lodging for 2. = $2109.00

**Contractual:**

BMP Implementation costs are those cost for contractor material and personnel costs related to the construction of our BMPs.

- Contractual plant material. This includes the native plants that were used in and around our rain garden. This includes trees, seed, and plugs. Labor to plant is included in the other contractual cost for BMP implantation. =$4921.02
- Contractual labor and material for constructing BMPS, and includes fringe on personnel of partners that were involved directly with the construction processes. = $101,193.82

**Operating Costs:**

No proposed continual operating costs are anticipated.

**Other:**

Project Management cost for this category is from the cost of the certification course for the Low Impact Development training.

- NC State LID training $275 each x 2 = $550.

## 3. Equipment Summary

No equipment was purchased for this project.

## 4. Special Grant Conditions

There were no conditions placed on our project or grant (#C9994861-11) by USEPA.

# Appendix C – BMP Implementation Plan

The Regional Water Resource Agency (RWRA) and the City of Owensboro (City) are to construct stormwater best management practices (BMPs) as part of a section 319 grant project titled, "Chautauqua Park's Green Solution to Pollution". RWRA and the City have agreed to form a financial partnership to fund the local match for the project. Two different best management practices (BMPs) will be implemented on a property that is owned by the City. As a financial partner, the city has agreed to perform the required maintenance on the BMPs to provide an in-kind match during the grant period. After the grant has expired the City will continue to maintain the BMPs as they do all municipal flower beds and gardens for the life of the BMPs. RWRA will be acting as the lead partner organizing the construction activities and fulfilling all reporting requirements of the 319 grant.

## Technologies to be installed

This project will include a rain garden that will catch a portion of the roof runoff from the Parks Department office building. This will be situated off a front corner of the building with good visibility from the parking lot. In addition, there will be a bioswale / bioinfiltration (biocell) structure that will capture and hold runoff from the majority of the parking lot at this location, as well as roof runoff from the office building not captured by the rain garden, and the roof of the Combest Pool building. This structure will be located along East Parrish Avenue. Locations and situation of the BMPs and building and parking lots can be seen in the attached site aerial photo.

## Selection process

With our main goal of addressing non-point source pollution (NPS) there are several BMP technologies that would have worked on this site. However, with our secondary goal being a demonstration and education project, we wanted to show landowners and residents what can be integrated on their properties and to show that a stormwater BMPs can be attractive and an asset while serving a function to help NPS pollution issues. Additionally, our site location is within a city park and easily accessible, so we wanted a BMP feature that would be highly visible and attractive. Having an attractive BMP would also make a good platform for our NPS public education. The flowering plants included in our selected BMPs will make these features both visible and attractive.

The treatment efficiency of the BMPs chosen are also effective for the pollutants that would be expected in the runoff that we will capture from the rooftops and parking lot. Metropolitan Sewer District (MSD) of Louisville, KY has published Green Management Practice Fact Sheets for the BMPs we intend to use. Since this is a similar region in regards to climate and geography, the fact sheets will be assumed to apply to our similar circumstances. The fact sheets show that both BMPs are excellent at removing sediment from the runoff as well as curbing peak flow rates. The biocell structure is also excellent at reducing nutrient and metals present in the runoff. Comparatively, the rain garden will be moderately effective at removing nutrients and metals. Both BMPs are listed as moderately effective at removing hydrocarbon pollutants. Temperature buffering of runoff is also a benefit of both features. All removal efficiencies are dependent on proper design to acquire a sufficient retention time.

Operation and maintenance required for these structures to function properly will vary over the lifespan of the structure. The first two to three years will be the most intensive times of maintenance. As the new plants are getting established, they will need to be watered during times of prolonged drought. Competition from weeds will also be greatest during these first few years and frequent hand weeding is expected. Every few years through the lifespan of the BMPs, sediment build-up will need to be removed, and the existing layer of mulch removed and replaced. The City will be performing the grounds keeping function of the BMPs as a part of their local labor match. As

a part of the project a booklet will be prepared for those that will be involved with the BMP maintenance. The guide will reference common weeds in our area, as well as show what the seedlings of the selected plants look like. At the beginning of each season the City grounds crew supervisor will meet with the crew that will be responsible for the BMPs and review the guide. A representative from RWRA will also meet on site with the crew to evaluate their work in the field.

The initial plant selection will have an impact on the long term maintenance of the BMPs. Perennials that are native to Kentucky or regions close to our area will be sought. Cultivars of regional and native Kentucky plants will also be considered. The plant selection over time may have to be altered. Plants that have not successfully established may need to be replaced with a different species. Conversely, plants that become aggressive or overtake the structure will need to be removed and replaced with a less dominant species to maintain species diversity. Replacement or alternate species will be selected from the current planting selection or will be in addition to what has already been planted. Again, native Kentucky perennials or native cultivars will be considered for these.

There is little information available regarding the lifespan of the BMPs we are using. It is expected that the interstitial space between the soil grains and aggregate will be filled over time with fine sediment. This process will affect the main functional portion of the BMPs to the point of rendering the BMPs ineffective at infiltrating stormwater and reducing flow volume. A proper sediment forebay for our biocell will extend the lifespan of this function. There is less concern for sedimentation of the Rain Garden since the runoff from the roof will contain significantly lower levels of suspended solids. If full sedimentation occurs, rehabilitation of the unit would involve removing and replacing the top layers of soils, mulch, and plant material. The time until this happens is incalculable. As well, the cost of such work could only be estimated at that time once the BMPs are evaluated to see the extent of what would need to take place to reestablish their original functionality.

Cost estimates of the (biocell) are based on several years of stormwater best management practices (BMP) building in the Cincinnati Ohio area. The cost to construct biocells such as ours in that area has been $15 - $20 per square foot. This figure was quoted by John Lyons of Stand and Associates Engineers, Inc., Cincinnati, Ohio. This cost was figured by his staff and quoted to us verbally so we have no real cost analysis to provide. There are no local projects for which we can use as a basis for our cost estimating. All costs available through online searches generally show projects in areas where these practices are currently required and routine, and contractors may be more competitive in their bidding, however, they are generally close to this range when the scope of the job is similar. We used the upper dollar amount of the range for our cost estimate since we feel we have significant variables that will affect the contractor's bidding which may already be skewed due to the lack of experience with this type of project in our area. One of our significant variables pertains to the underdrain system, which will have to be engineered both to accept infiltrated water while preventing combined sewage overflows from occurring. This will add an amount of complexity and cost to the system. Further, an extensive sediment forebay of some sort of structure is expected. The velocity and volume of water from our project site and the width of our biocell may require a more elaborate forebay and energy dissipation measures to prevent damage to the unit. Our initial estimates showed that in order capture the volume of runoff that we wanted from the parking lot and roof areas, and maintain a reasonable ponding depth within the structure, we need upwards of 4850 square feet of surface area. Therefore, using the $20 per square foot unit price, $97,000 is our initial estimate of biocell feature construction cost. It is expected that up to 20% of that cost will be for the native planting. The other large percentage cost would include the contract for the excavation of the site, the underdrain system, and the engineered fill materials, but they are in unknown proportions at this time.

When detailed engineered plans are completed, they will be submitted to the KDOW for review and approval prior to any implementation activities. Once the project is bid and the actual biocell cost is known, a detailed budget will be submitted to KDOW for review and approval. KDOW shall be notified by email no less than two weeks prior to any installation or construction activities.

The cost for rain garden was estimated using the same cost per square foot. Again, no local examples were available for a cost comparison. Online searches for rain garden cost can show lower per unit cost, however, these estimates are generally materials only assuming the homeowner or other volunteers will provide the labor. Also, with the projects bidding together and with contractor inexperience with either technology, it is expected the contactor may not differentiate the two in their bidding. Plants are expected to be the dominant material cost for the rain garden. The cost of materials, including plants, for the rain garden could approach 50% of the total rain garden unit cost, with labor taking the remainder. In trying to size this rain garden to residential rain garden standards, our initial estimate was a 150 square foot feature. At $20 per square foot the total cost estimate for the rain garden is $3,000. When detailed engineered plans are completed, they will be submitted to the KDOW for review and approval prior to any implementation activities. Once the project is bid and the actual rain garden cost is known, a detailed budget will be submitted to KDOW for review and approval. KDOW shall be notified by email no less than two weeks prior to any installation or construction activities.

There is additional work in creating a structure to divert the flow from the existing flume into the features, as well as work re-directing the downspouts of the Park Department Administration building from their existing connection to the sewer system. The total for this work and material cost was estimated to be $5000. The total cost for on-site construction is $105,000. When detailed engineered plans are completed with these details, they will be submitted to the KDOW for review and approval prior to any implementation activities. KDOW shall be notified by email no less than two weeks prior to any installation or construction activities.

Construction activities will require a cut/fill permit from the City of Owensboro. This shall be obtained 2 weeks prior to construction activities. The disturbed area of this project is anticipated to be about twice the area of the BMPs (10,000 sq.ft.), therefore we do not expect to file a NOI as a part of the NPDES permitting process.

As this is an education and demonstration project, signage will be erected to inform and educate the public of NPS pollution and the function of the BMPs on site. Included with the signage will be a brochure that visitors can take with them.

Pollutant reduction and treatment analysis will be provided as a part of our annual reports and final report. Load reduction will be derived from STEPL web tool provided by Tetra Tech, Inc. Observations on performance during rain events will also be reported annually.

Financial plan of action

RWRA and the City will share the 40% local match. This will mostly be achieved by in- kind labor. The majority of the labor match by RWRA will be accumulated during the in-house design / planning stage and during the construction phase with inspection activities. The maintenance of the project will be provided by the City and will be used as a significant portion of their match. Most construction activities are expected to be contracted out, so use of equipment and construction labor will be provided by the contractor and cost paid towards this will constitute the majority of our in kind cash contribution.

Maintenance agreement with the landowner

The City is the landowner of the project site as well as our shared financial partner. The City has agreed to provide maintenance on the BMPs during the course of the grant in order to help achieve their portion of the local fund match. As a part of this project we will develop a long-term

maintenance agreement between the City and RWRA to provide maintenance for the life of the BMPs.

KDOW notification process

Kentucky Division of Water will be notified by email prior to the implementation of any of the BMP activities. KDOW will also be notified prior to any milestone activity listed previously in grant documents already submitted to KDOW. All plans and education material will be submitted for review and approval. All presentations or other literature will be submitted for review and approval prior to meetings, publication, or dissemination.

KY Ag Water Quality Act / Forest Conservation Act

We have no agricultural or forestry BMPs, therefore we do not need to comply with the Kentucky Agriculture Water Quality Act or the Forest Conservation Act.