

# Greening Kentucky's Signature Industry: Bioretention Treatment of Runoff at the Kentucky Horse Park



**Southeast Stormwater Association Annual Conference**

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Chattanooga, TN



# Introductions

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Project Manager



# Agenda

**1** Project Setting

**2** Project Goals & Funding

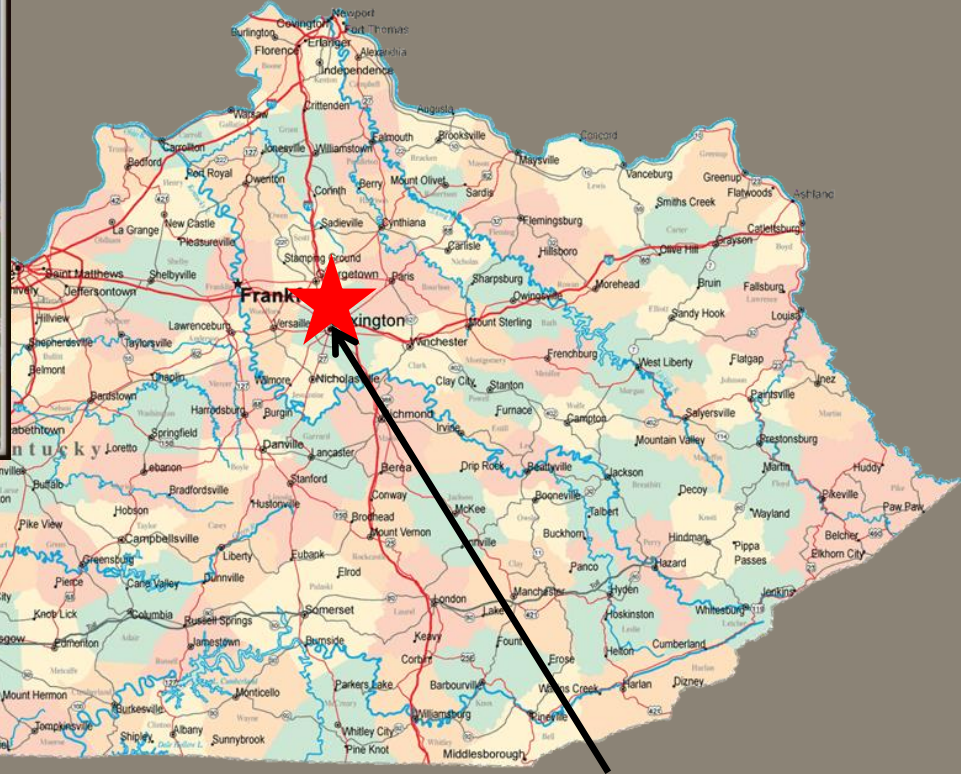
**3** BMPs Overview

**4** Bioretention System

**5** Lessons Learned

**6** Questions

# 1 Project Setting



Kentucky Horse Park

# Project Setting

## About the Horse Park:

- 1,200 Acres in Fayette/Scott Cos.
- Working Horse Farm
- Equine Theme Park
- Educational Exhibits
- Horse Shows
  - 2 Covered Arenas
  - Stadium Jumping Complex
  - Dressage Complex
- Nearly 1M visitors per year (human)
- Over 18,000 horse visitors annually

# 2 Project Goals & Funding

Work performed by UK  
as part of the *Cane  
Run and Royal Spring  
Watershed-Based Plan*

**Cane Run and Royal  
Spring Watershed-Based  
Plan Implementation  
Project: Final Report**

**Submitted By:**

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**Grant Number:**  
C9994861-06

**Application Number:**  
06-06

**MOA Number:**  
F02 129 0900025111 2

**Project Period:**  
October 1, 2012 – December 31, 2013

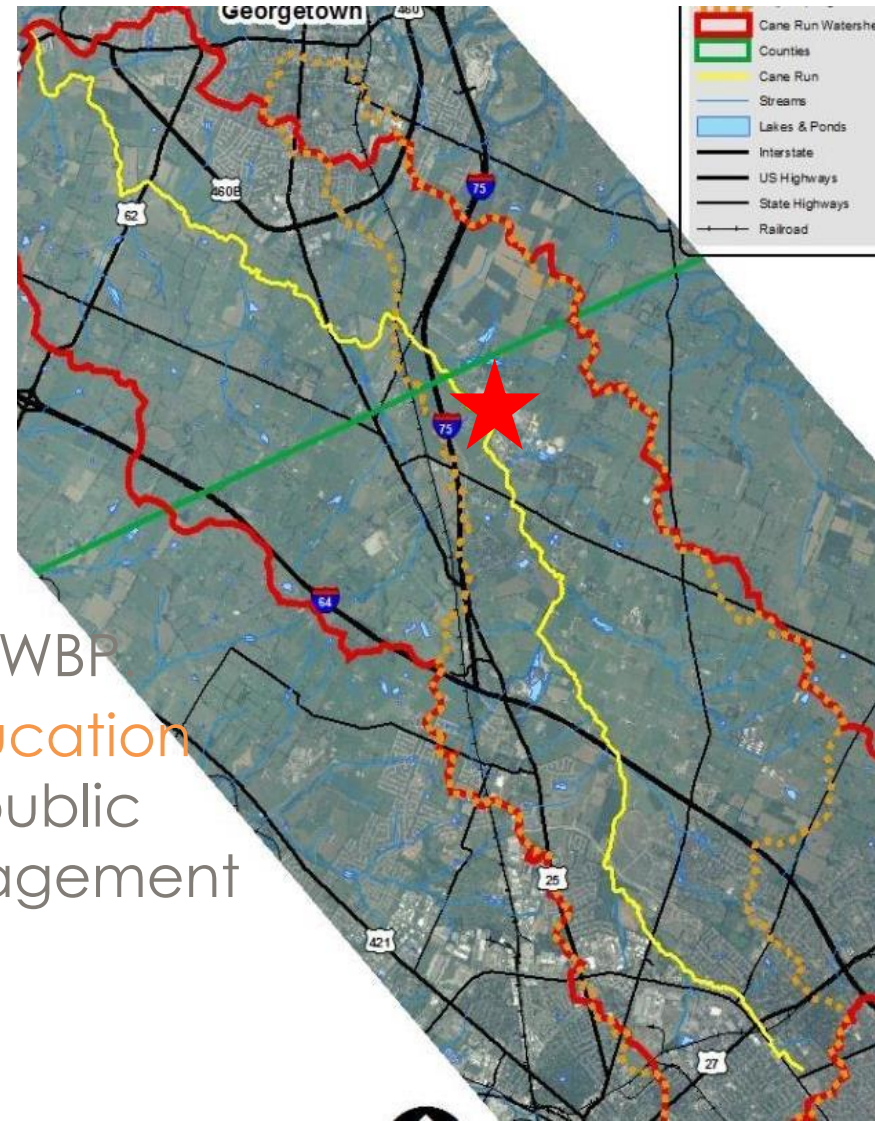
# Project Goals & Funding

## Funding:

- USEPA 319 Grant through the Kentucky Division of Water
- About \$1M

## Goals:

- Improve **water quality** by implementing management strategies as directed by the WBP
- Continue an **information/education** (I/E) component to support public participation and build management capacity related to adopted management measures.



# 3 BMPs Overview

## 30k

Cubic yards of horse muck (manure/straw mixture) is produced by the horses at the Park each year. Muck management is the no. 1 water quality priority at the Park.



# Water Quality Improvement Projects

## 1 RIPARIAN BUFFER

Reduces erosion and filters water quality contaminants

## 2 FLOATING WETLAND

Prevents algal blooms by utilizing nutrients in the water and provides an island of wildlife habitat

## 3 RAIN GARDEN

Reduces runoff by promoting infiltration and filters water quality contaminants

## 4 STREAM RESTORATION

Prevents flooding and erosion and filters water quality contaminants

## 5 DRY LOT

Prevents mud and erosion and protects horse health

## 6 PERVIOUS WASH RACK

Reduces runoff by promoting infiltration

## 7 WATERING FACILITY

Reduces mud and erosion and protects horse health

## 8 BIOSWALE

Reduces erosion and filters water quality contaminants

## 9 HORSE EXCLUSION FROM STREAM

Prevents mud and erosion and protects horse health

## 10 VEGETATIVE TREATMENT STRIP

Reduces erosion and filters water quality contaminants

## 11 SETTLING BASIN

Collects gravels from runoff so they can be reapplied to the parking lot

## 12 BIORETENTION BASIN

Filters water quality contaminants

## 13 MUCK STORAGE STRUCTURE

Prevents muck (bedding and manure) from polluting runoff

## 14 NO-MOW ZONE

These are implemented along all streams and drainages



### DID YOU KNOW?

Nutrient (muck) management is the most important and challenging issue that the KY Horse Park faces with regard to water quality. The park is visited by up to 18,000 horses a year, generating 30,000 cubic yards of muck.

<https://kyhorsepark.com/about-us/green-khp>



HORSES ONLY

## Bioswales



## Headcut repaired with rocked bioswale



## Rain Gardens



## Repaired watering stations



## Covered Muck Storage Shed



## Streambank Stabilization



## DGA Pads for Heavy Use Areas



## Straw huts (in lieu of spreading on ground)



## Riparian Buffers



# Curbing around gravel lot/concrete forebay for gravel collection/cleanout



## DGA Dry Lot



## Pond bank stabilization



## Pond dredging



# 4 Bioretention Overview





4. Compacted Clay at Upper End of Basin with Elongated Overland Flow Path to Promote Sunlight Exposure/UV Treatment

3. Native Limestone Forebay to Collect Muck/Sediment



1. Barn Outfall (18" CPP):  
Drainage Area = 6.4 acres  
Impervious Area = 4.3 acres, 67%  
Water Quality Volume = 0.59 acre-feet  
100-yr, 24-hr Runoff Vol. = 2.3 acre-feet  
Basin Volume = 0.46 acre-feet

5. Runoff Infiltrates into the Amended Soil/Filter. A Stop-Log Structure Controls the Groundwater Level in the Basin. Runoff is Collected with 6" Perforated HDPE Underdrain Pipes. Basin is Designed to Drain in <48 hours.

6. Excess Ponding (>1.5' deep) is Controlled by the Principal Spillway and the 20' Wide Emergency Spillway.

Relocated Fence

Flow Towards Cane Run

12" CPP

Compacted Clay Embankment w/ 8' Crest

Gravel Parking Lot

New Concrete Curbing to Prevent Erosion into Basin

New Speed Hump

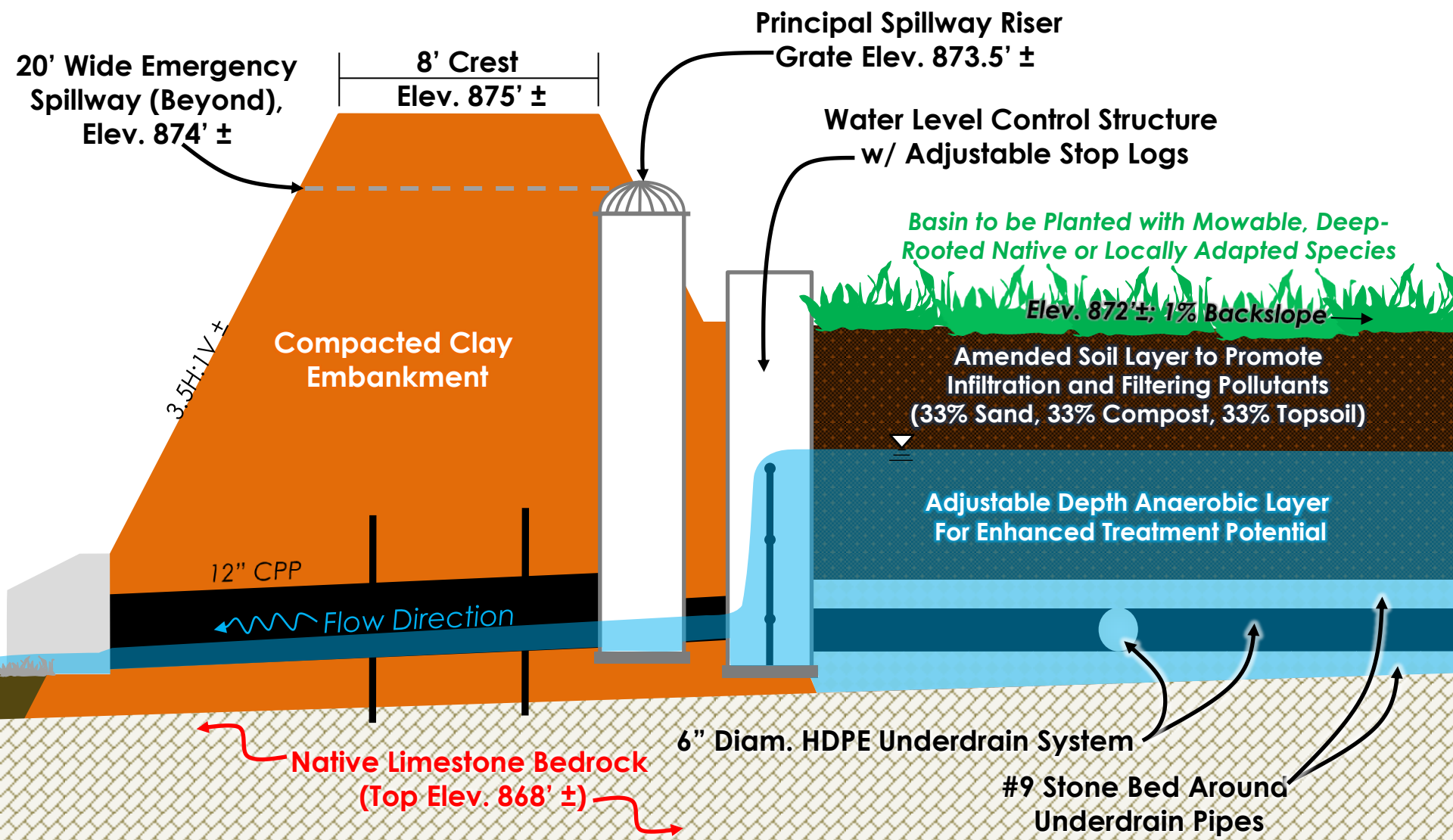
New Concrete Forebay to Collect Gravel from Parking Lot

Repaired Headcut with Native Limestone Channel

Nina Bonnie Blvd.

Bioretention Basin Plan View (Not to Scale)





Bioretention Cross Section A - A' (Not to Scale)



# 5 Lessons Learned



# Lessons Learned

## Research Findings:

- **30,000+ gpd** inflow on dry days
- *E. coli* → **96% to 99%** reduction
  - (10 events)
- Phosphate → 95% to 97% red.
  - (3 events)
- TKN → 22% to 89% reduction
  - (6 events)

## Lessons Learned:

- Effective treatment method
- Understand loading rates
  - *Flow, contaminants (e.g., detergents)*
- Understand forebay req'ts
  - *Sizing, cleaning frequency, access, etc.*



# Questions?



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