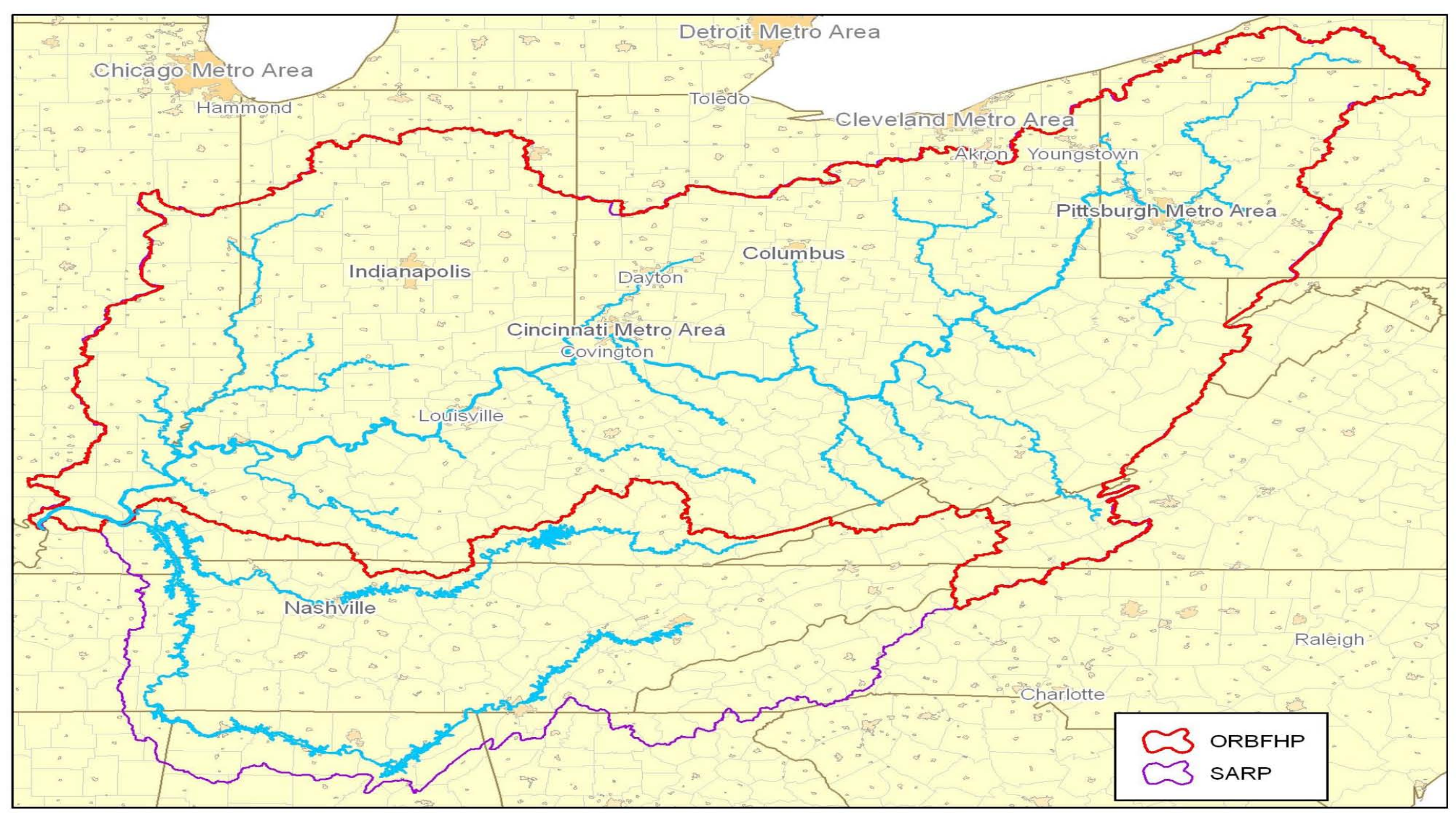




Ohio River Basin
FISH HABITAT PARTNERSHIP



Chicago Metro Area

Hammond

Detroit Metro Area

Toledo

Cleveland Metro Area

Akron

Youngstown

Pittsburgh Metro Area

Indianapolis

Dayton

Columbus

Cincinnati Metro Area

Covington

Louisville

Nashville

Charlotte

Raleigh

	ORBFHP
	SARP

WHY FISH HABITAT?

- There are approximately 1,200 recognized fish species that occur in inland waters of North America – 40% are imperiled or presumed extinct (and that is increasing).

ORB Fishes - 300 species (14 federally listed)

ORB Mussels - 130 species (38 federally listed)



- Fresh water constitutes only about 1% of the Earth's surface area and less than 0.01% of its water by volume. (5 million people get their drinking water from the Ohio River)



- Areas recognized as very high risk of current aquatic habitat degradation include Illinois, Indiana, and Ohio



Multipurpose Restoration

Economic
Industrial
Recreation
Social
Safety
..and much more





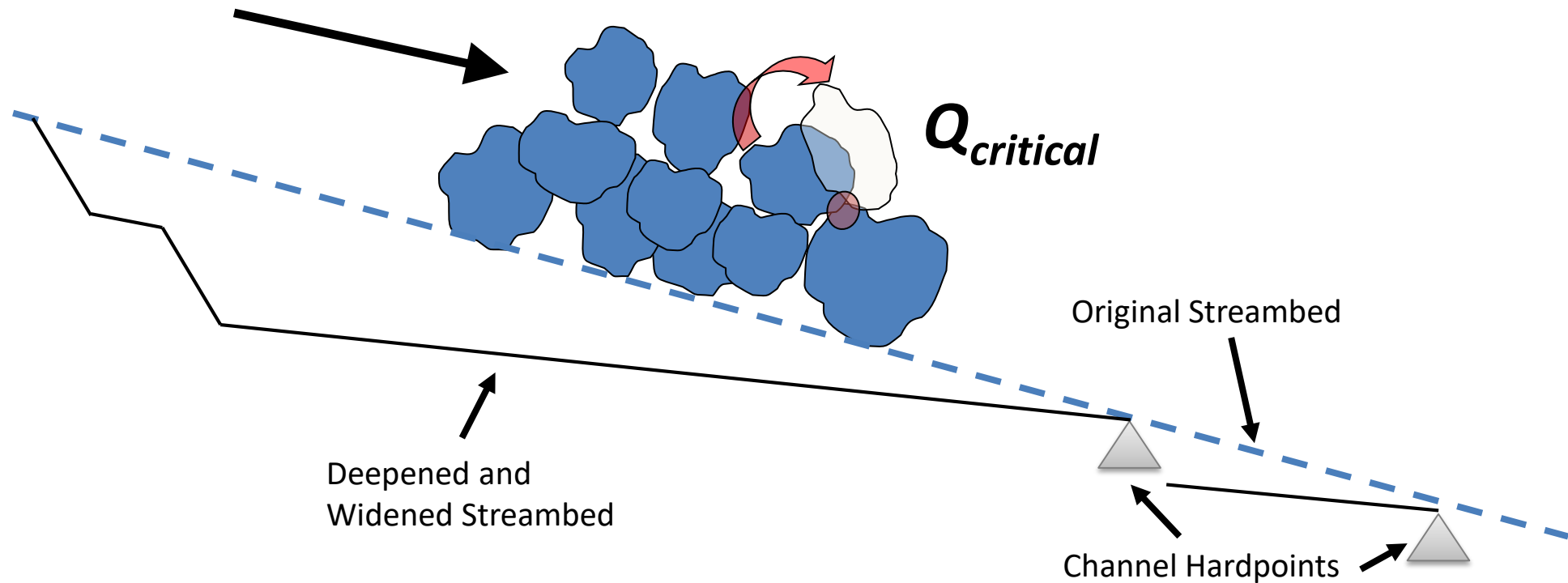
Energy Impacts

- Incision
- Widening
- Sedimentation
- Bed Movement
- Benthic
Community
- Carbon loss
- Flooding
- Infrastructure
- Inheritance



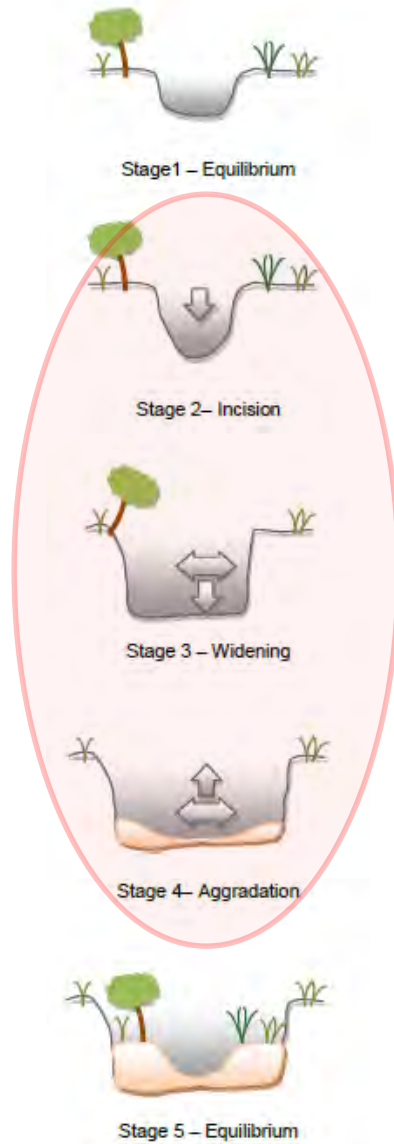
Excess Streambed Erosion Can Lead to:

- Stream Deepening & Widening
- Property & Tree Loss
- Water Quality Impacts



Geomorphic Function Requires Hydrologic Function

0.45 inches in 2 hours



100 acres

Historical Valley

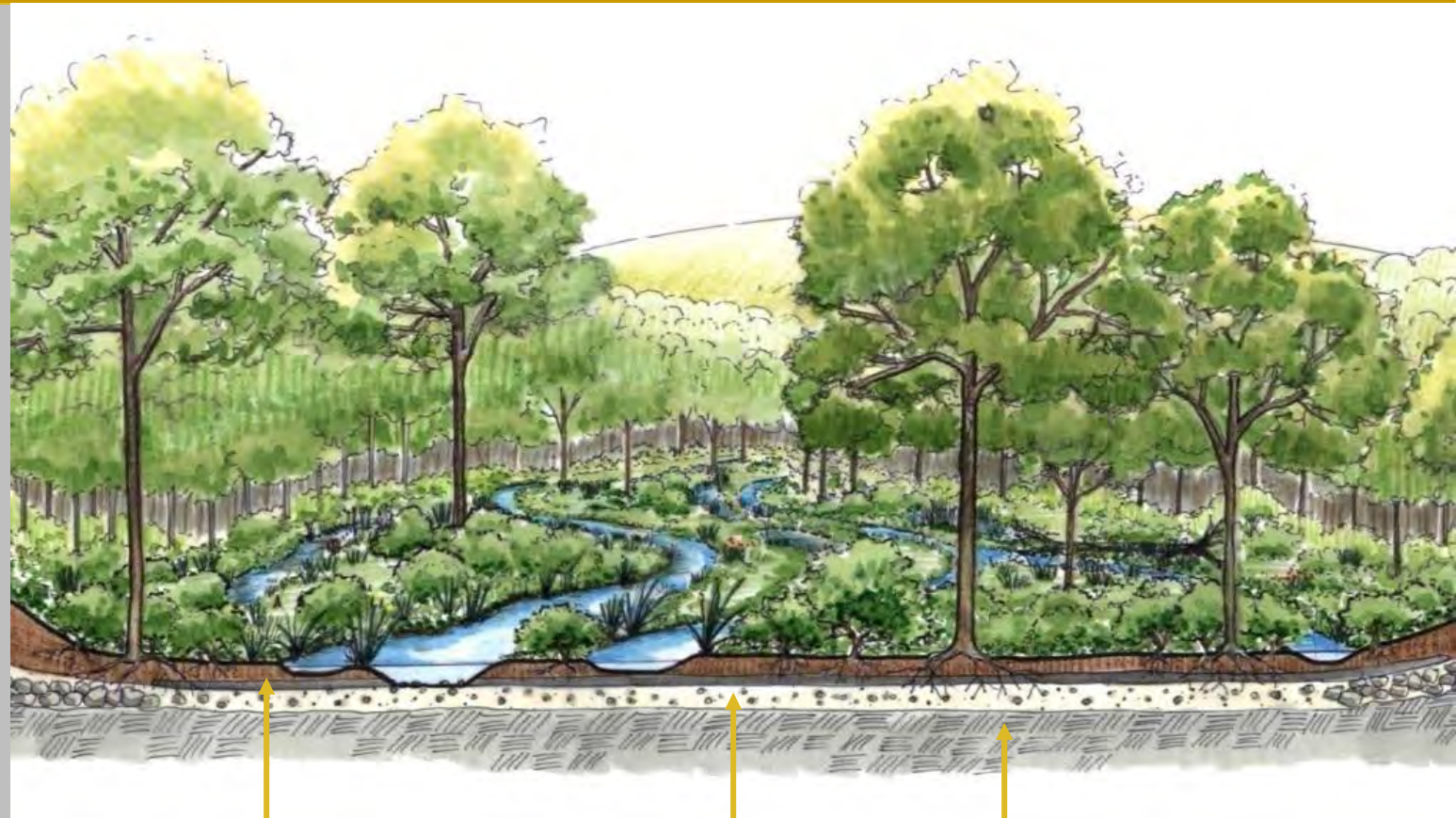
Very low bank height

Frequently inundated area

Multiple channels set in or on valley gravel aquifer

Tree root access to gravel aquifer

Gravel and LWD form stable epifaunal substrate



**Floodplain Soils –
Peaty, Organic, Porous**

**Cobble/
Gravel
Layer**

Bedrock

Contemporary Valley

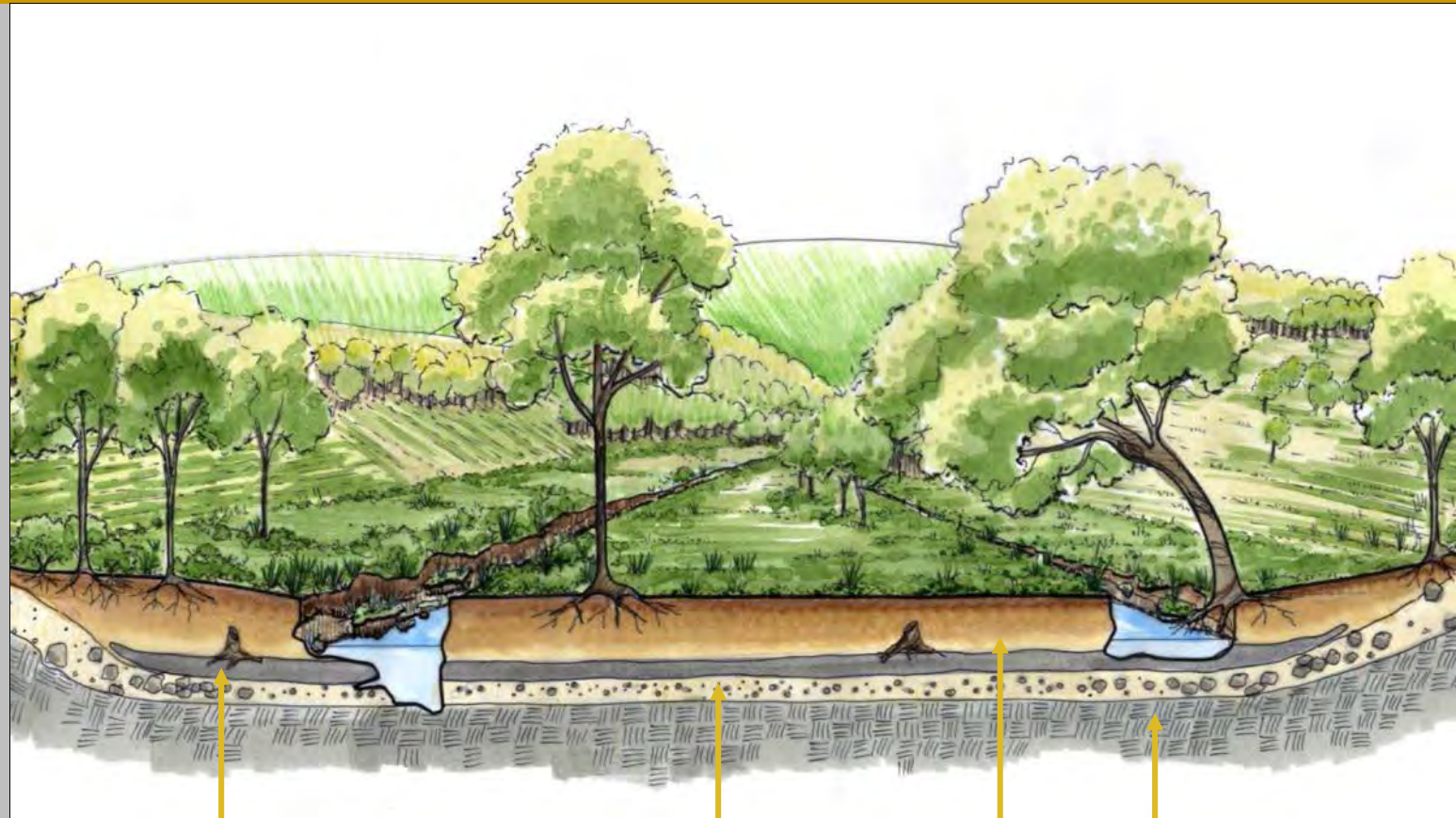
High bank height

Infrequently inundated area

Channel incised through or perched above gravel aquifer

Tree roots do not have access to gravel aquifer

Bed stress too high for stable gravel



**Historical
Floodplain Soils**

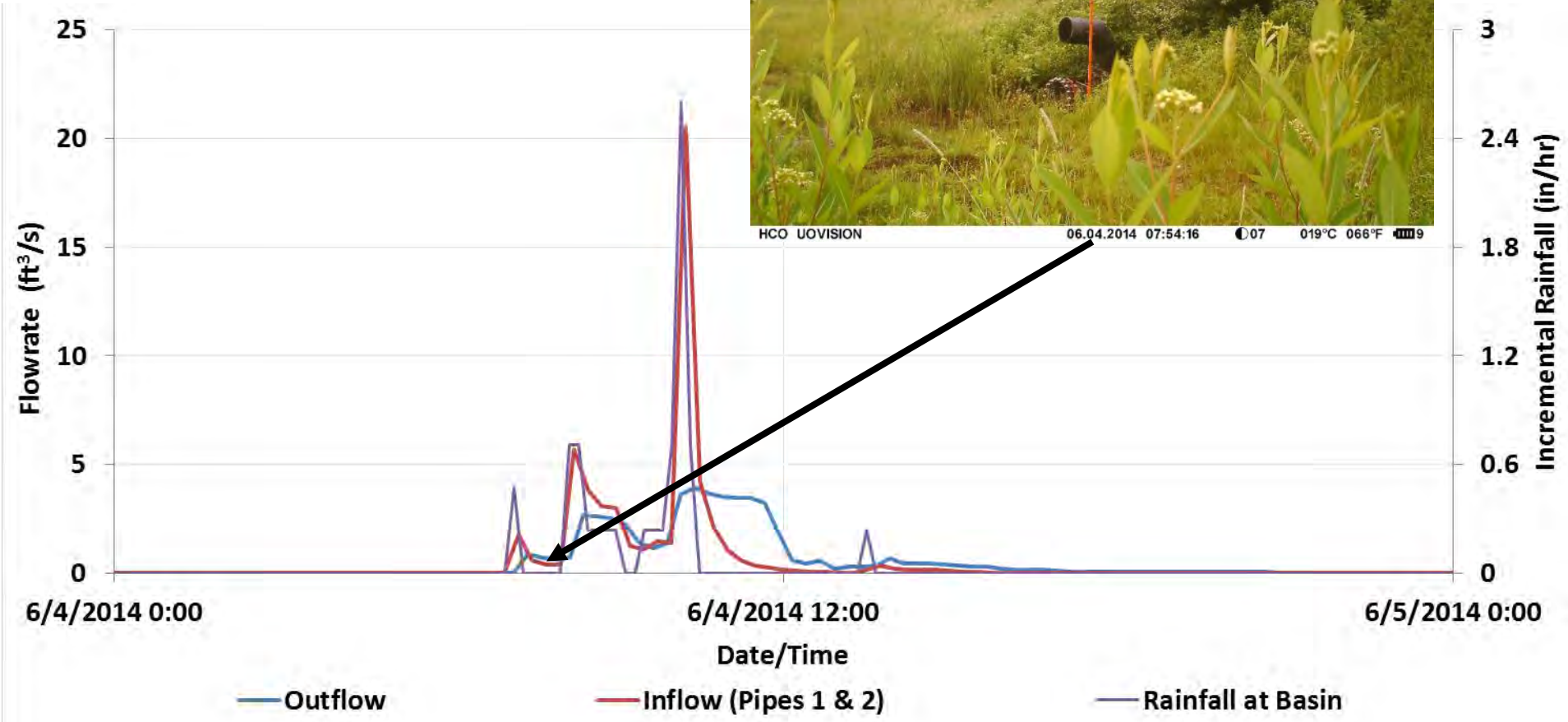
Cobble/Gravel Layer

**Legacy
Sediment**

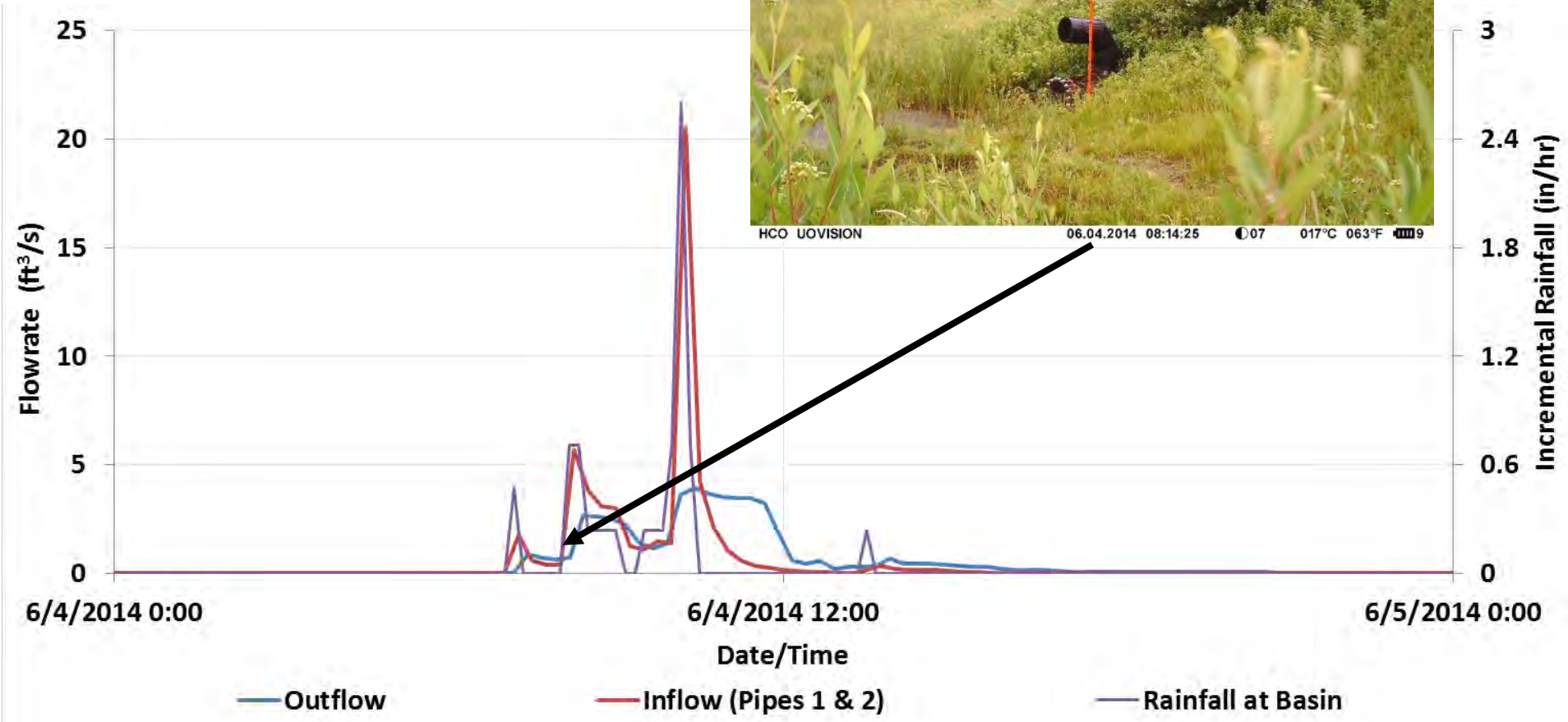
Bedrock



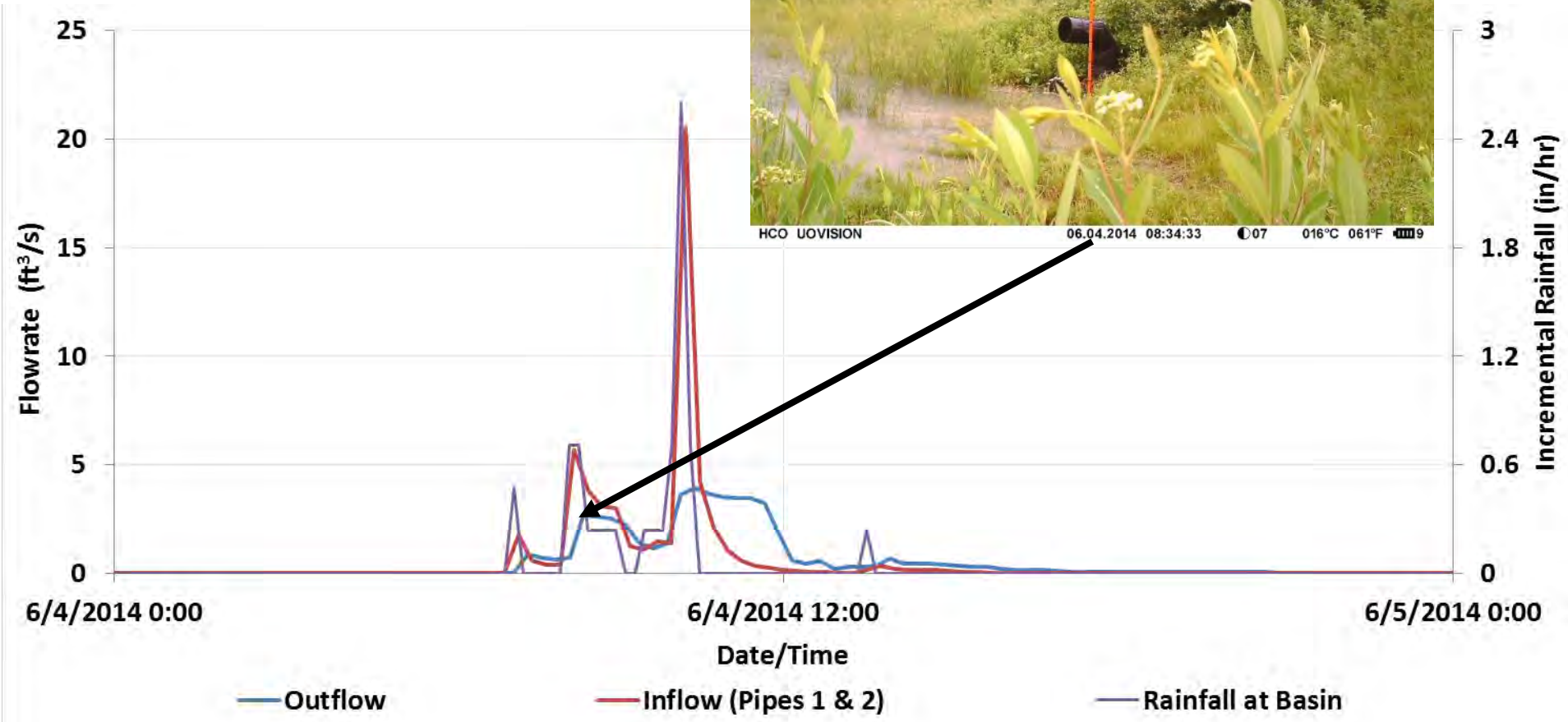
Post-retrofit



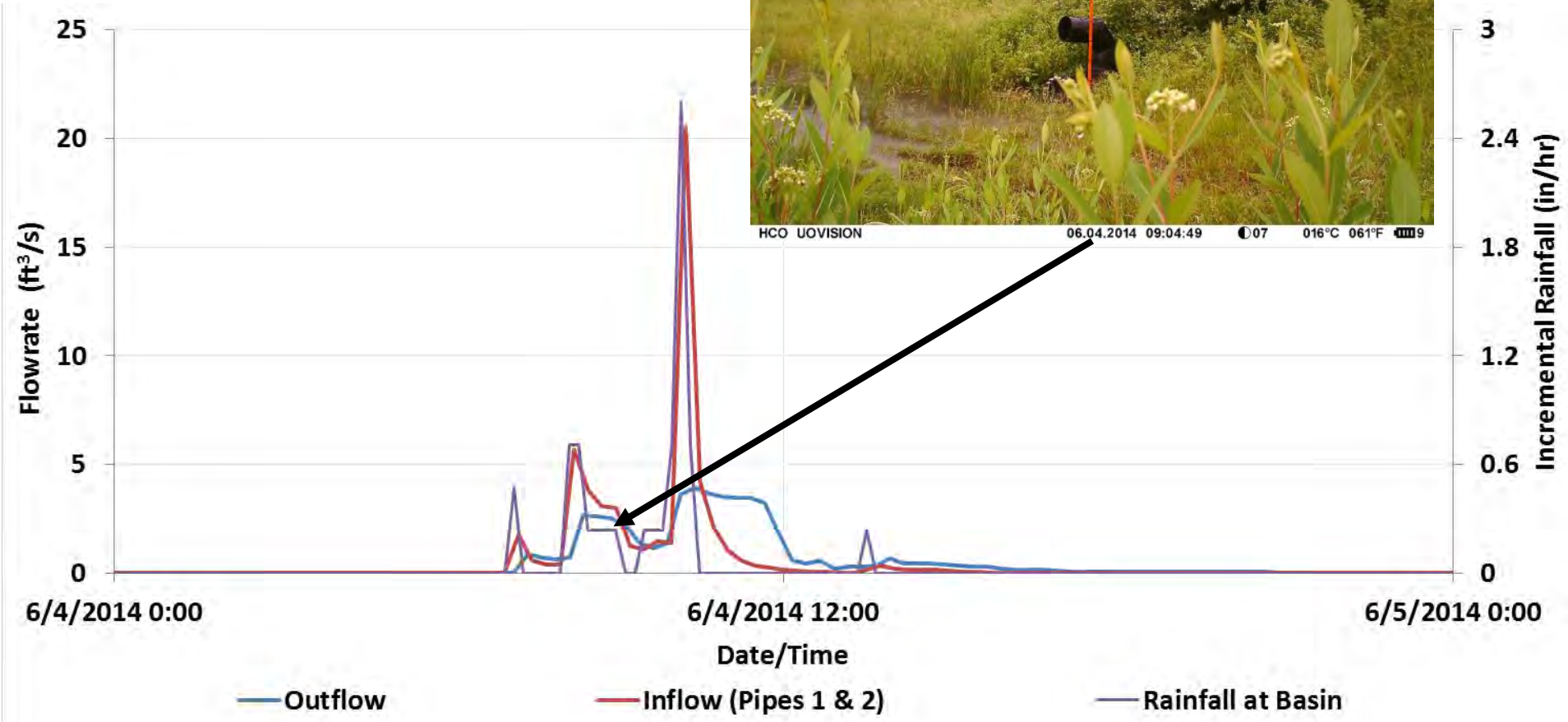
Post-retrofit



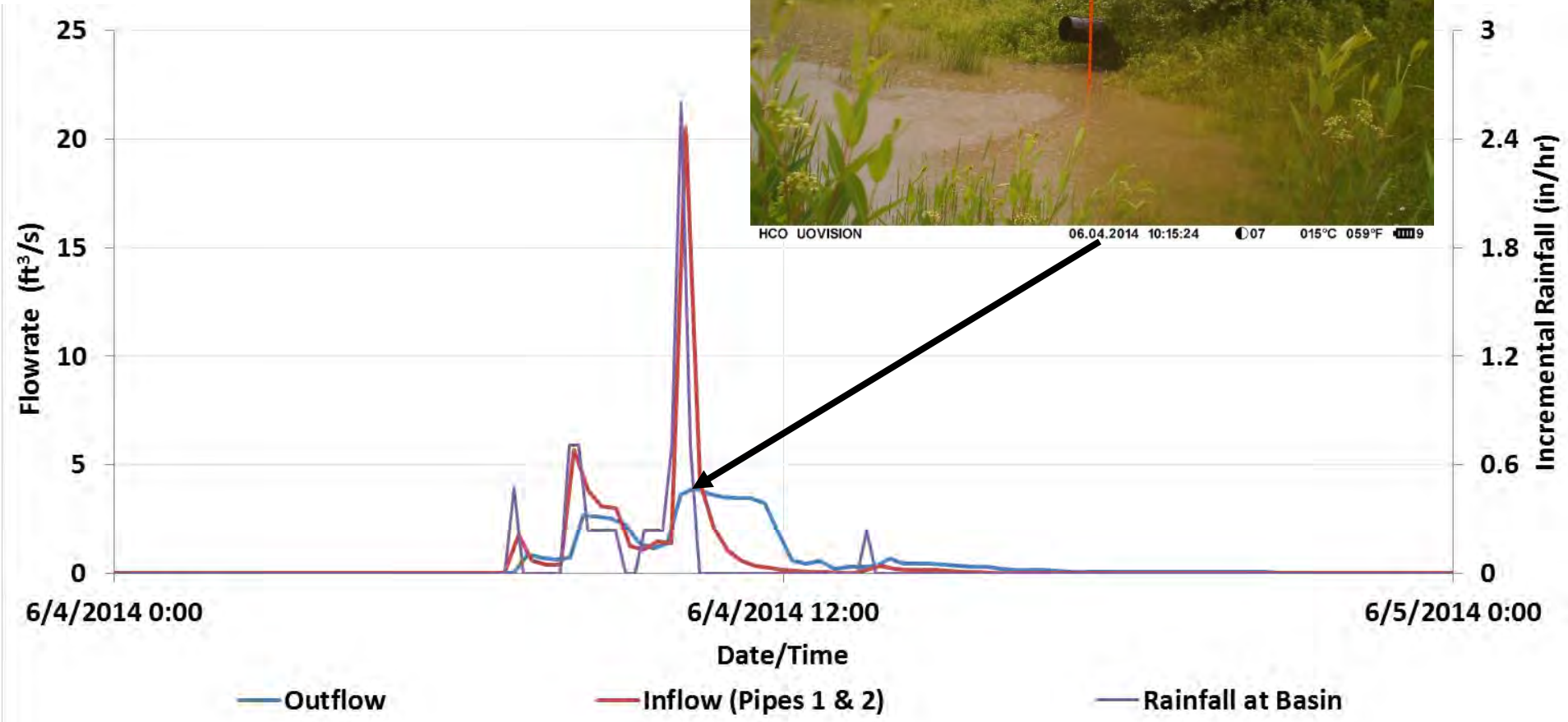
Post-retrofit



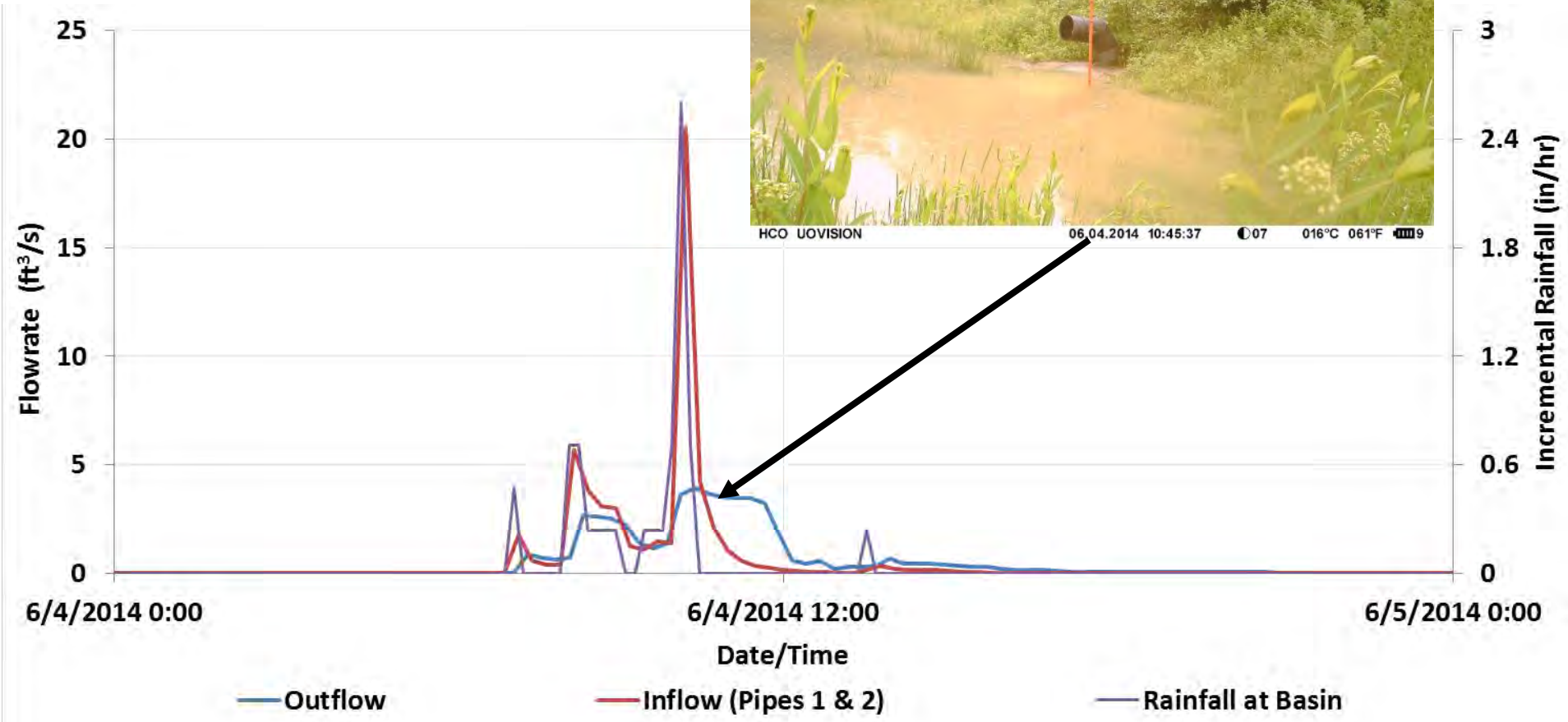
Post-retrofit



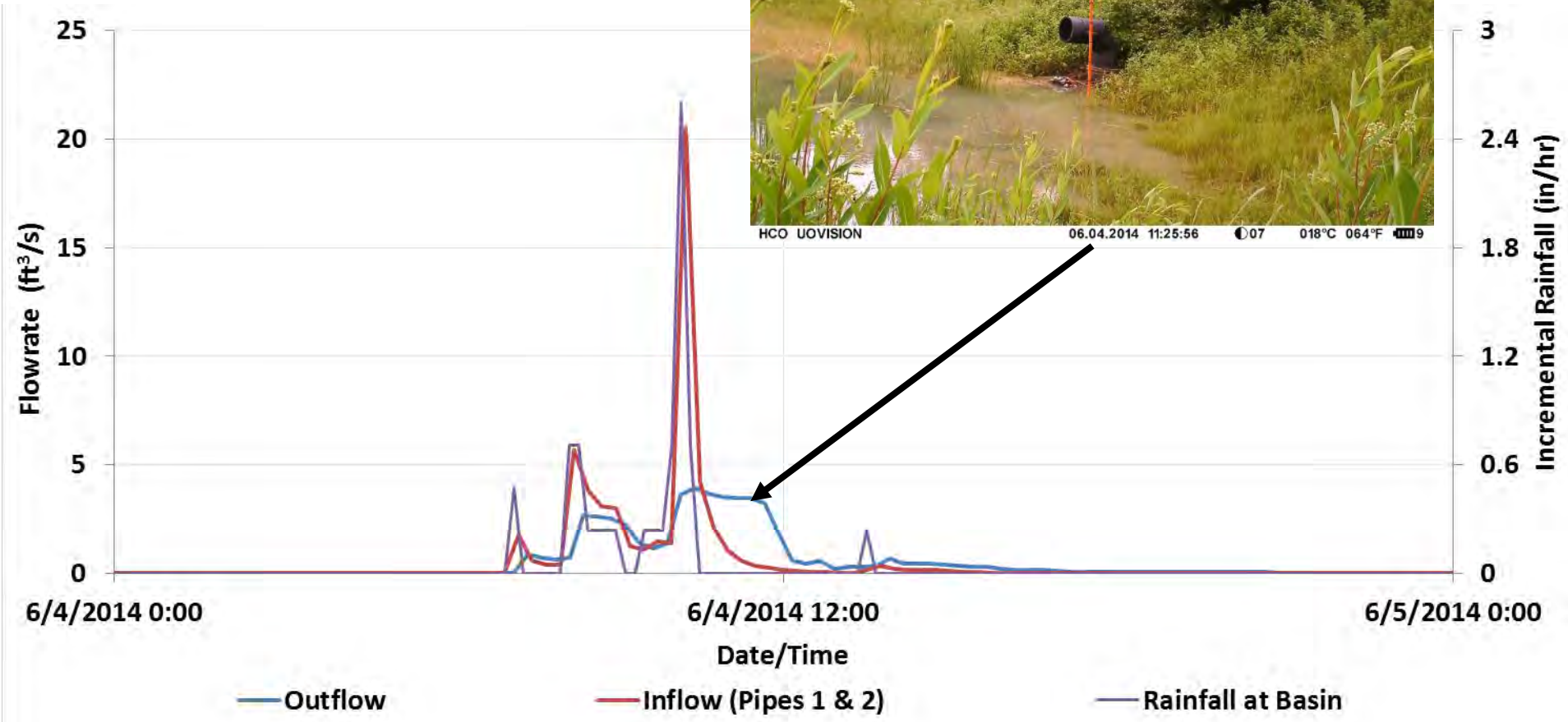
Post-retrofit



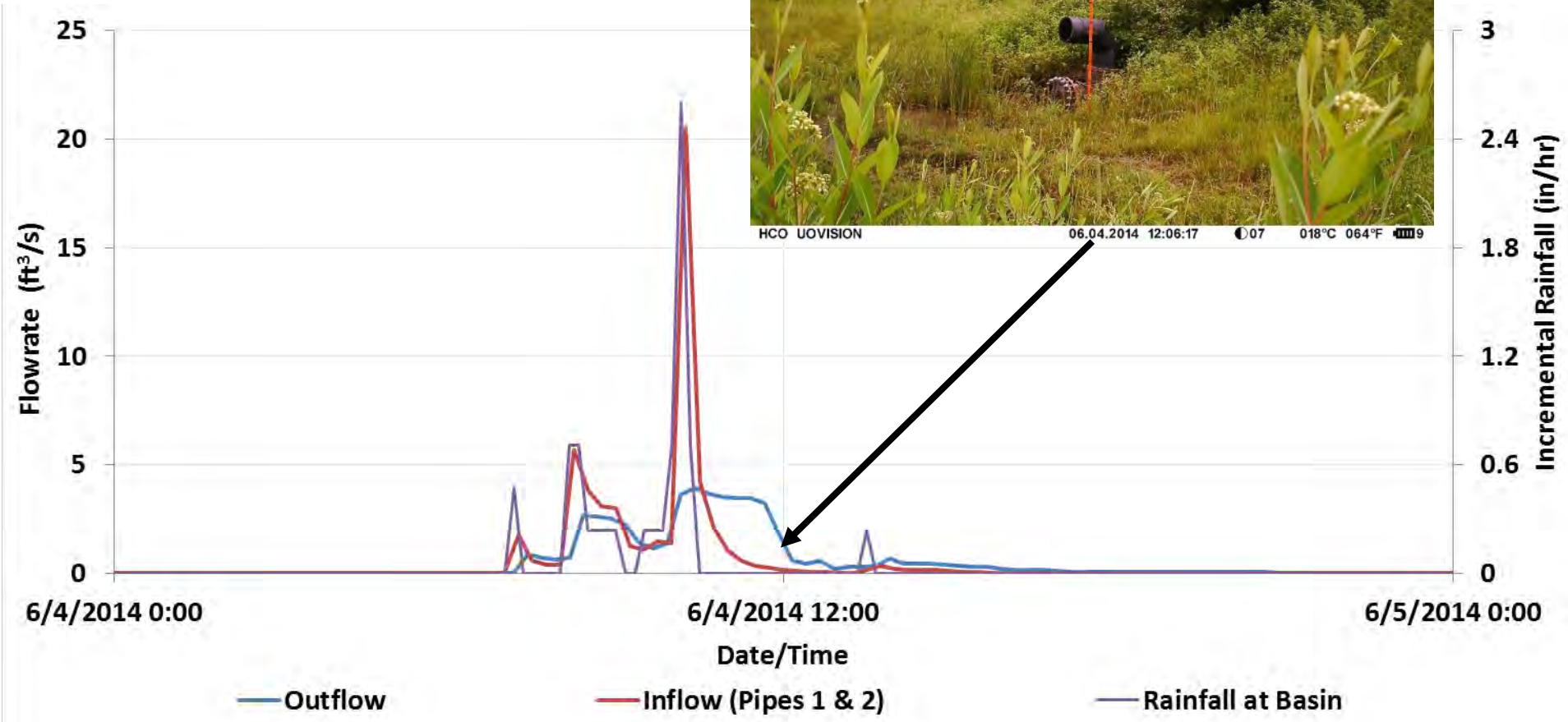
Post-retrofit



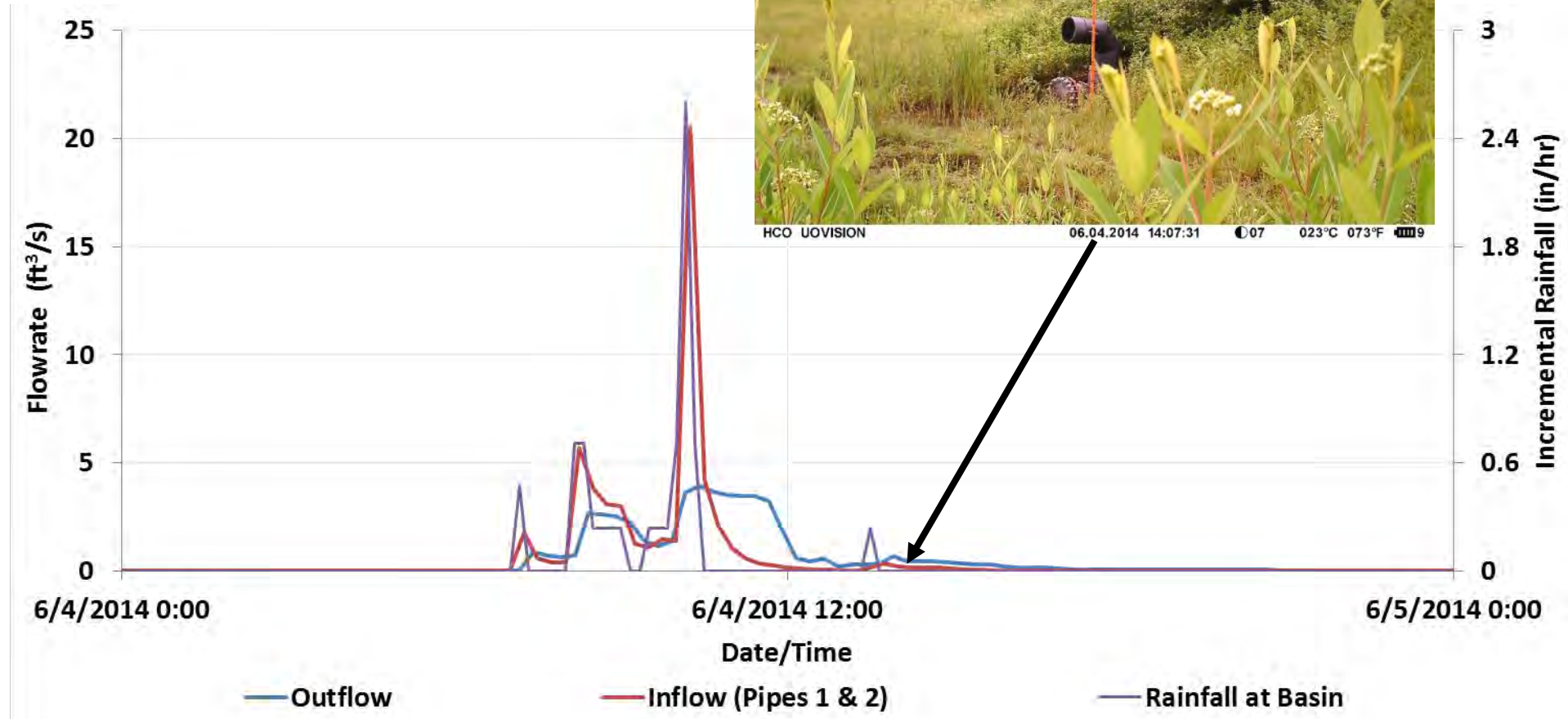
Post-retrofit



Post-retrofit



Post-retrofit



Big Creek, Cache River Southern Illinois

- * By the 1970's drastic conversion of forest and wetland to crops had occurred. Issues that came from this were: altered hydrology, increase in sediment loss, stream bank instability and incision, soil erosion, water quality, and **flooding**.



Big Creek, Cache River Southern Illinois

- * Modeling process identified key water retention areas
- * 69 water retention basins installed in the upper watershed with support of the landowners
- * 5-6% of the upper watershed runs through detention basins
- * Created 396 acre feet of storage
- * Created ~200 acres of surface water



Big Creek, Cache River Southern Illinois

- * Natural Resource Benefits:
 - * Reduced sedimentation due to streambank erosion (10's of 1000's of tons)
 - * Reduced channel incision
 - * Decreased sediment deposition in Cypress Creek NWR
 - * Decrease nutrient loss/inputs
 - * Stabilized 4 headcuts
 - * Ultimately, restored stream function (stable bed, organic matter, invert stability, etc)



Big Creek, Cache River Southern Illinois

- * Economic Benefits:

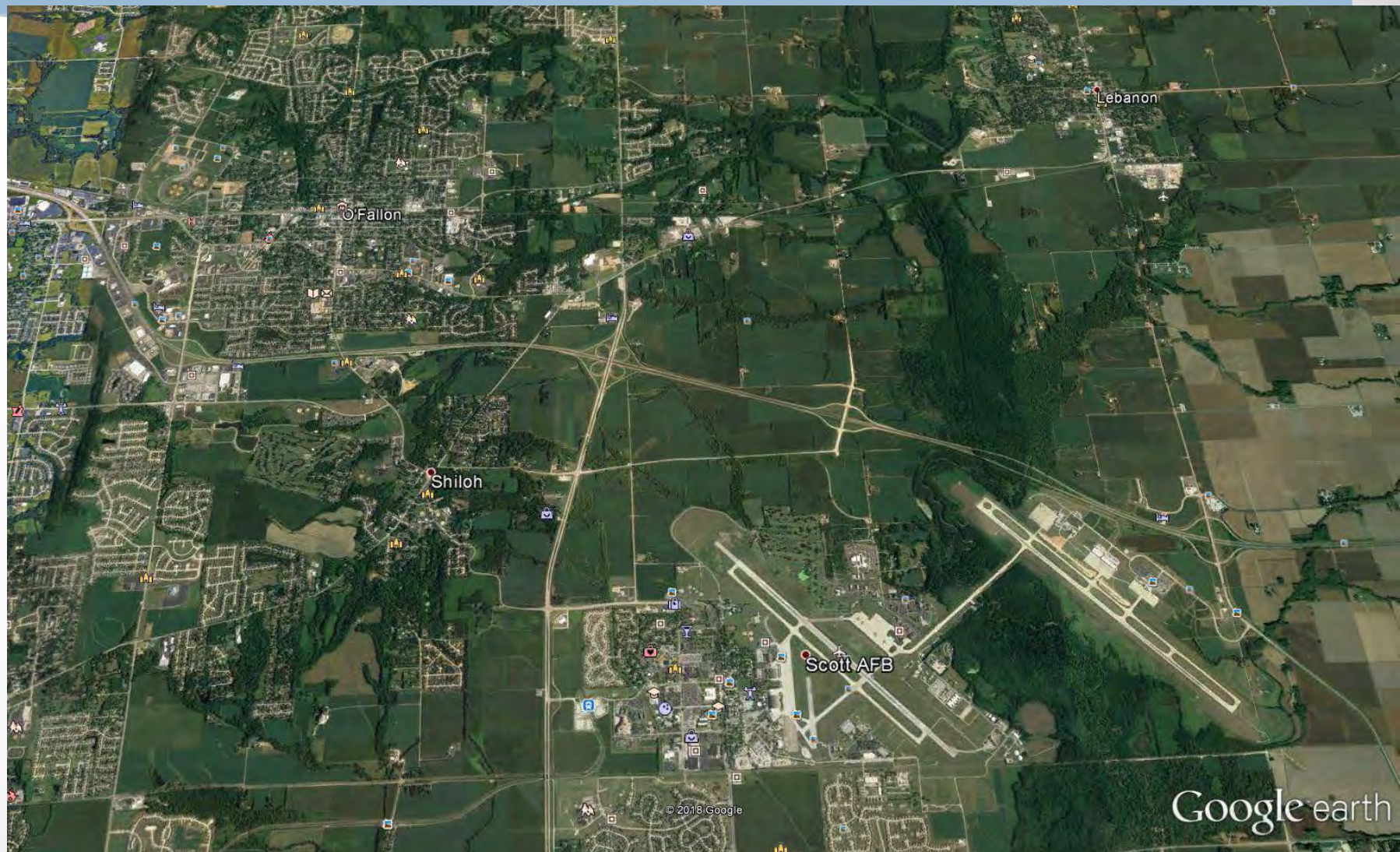
- * Before the detention basins, a 9 inch rain in 24 hours flooded 22 houses, closed two highways for 3 days, closed secondary roads for more than a week
- * After the detention basins, a 13 inch rain in 26 hours caused overbank flow but no flooding in homes and no roads or infrastructure impacted
- * AND HAS NOT FLOODED SINCE

Restoration Can Save Infrastructure Costs



Scott AFB Flooding

- ❖ Founded in 1917
- ❖ St. Louis Metro East has exploded to the east and NE
- ❖ Ag expansion to N and W
- ❖ All drain through Scott AFB
- ❖ No water retention in those areas
- ❖ Permitting for development continues
- ❖ Flooding and changing hydrology plague the base



Scott AFB Flooding

- * Restore upstream retention
- * Restore the floodplain “Sponge”
- * Minimize BASH
- * Stream and floodplain health enhanced



Great Miami River, OH

- * Municipalities striving to capitalize on their greatest asset
 - * Dayton, Middletown, Troy, Piqua, Miamisburg, Sidney, Franklin, Tipp City, etc..



Treasure Island
Marina & Park

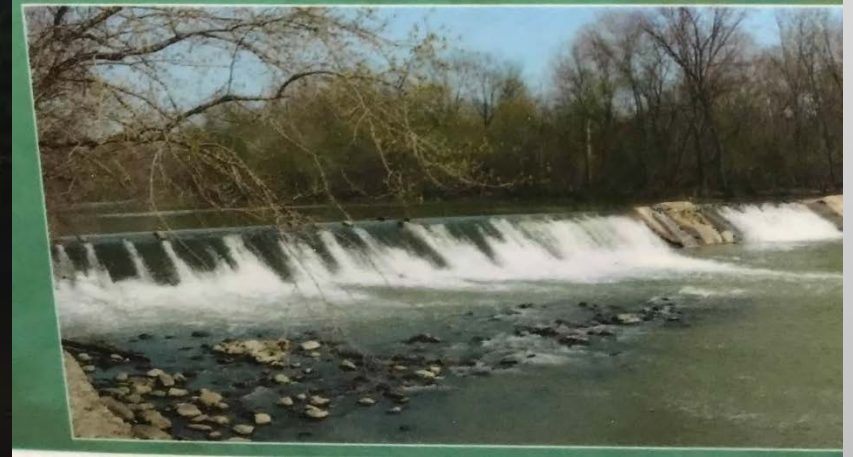
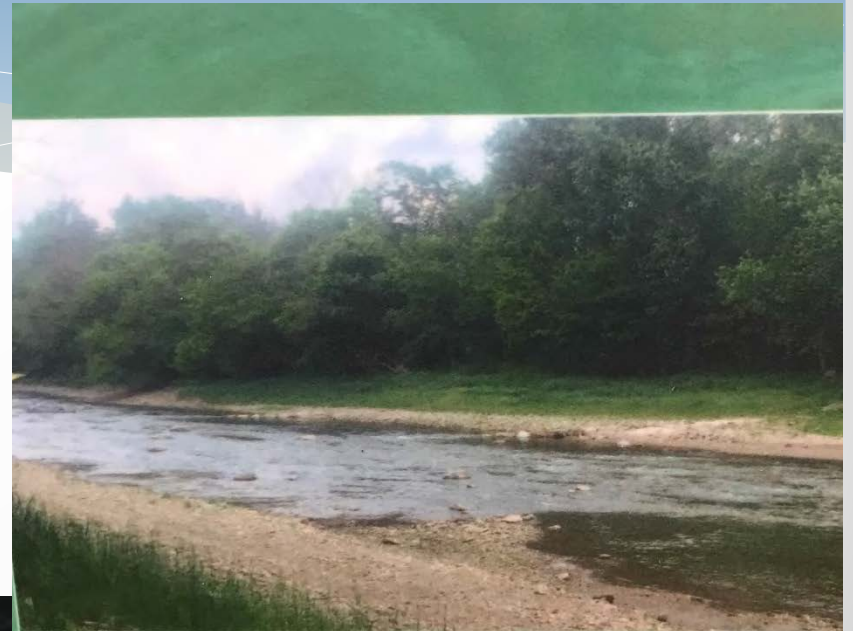
Great Miami River, OH

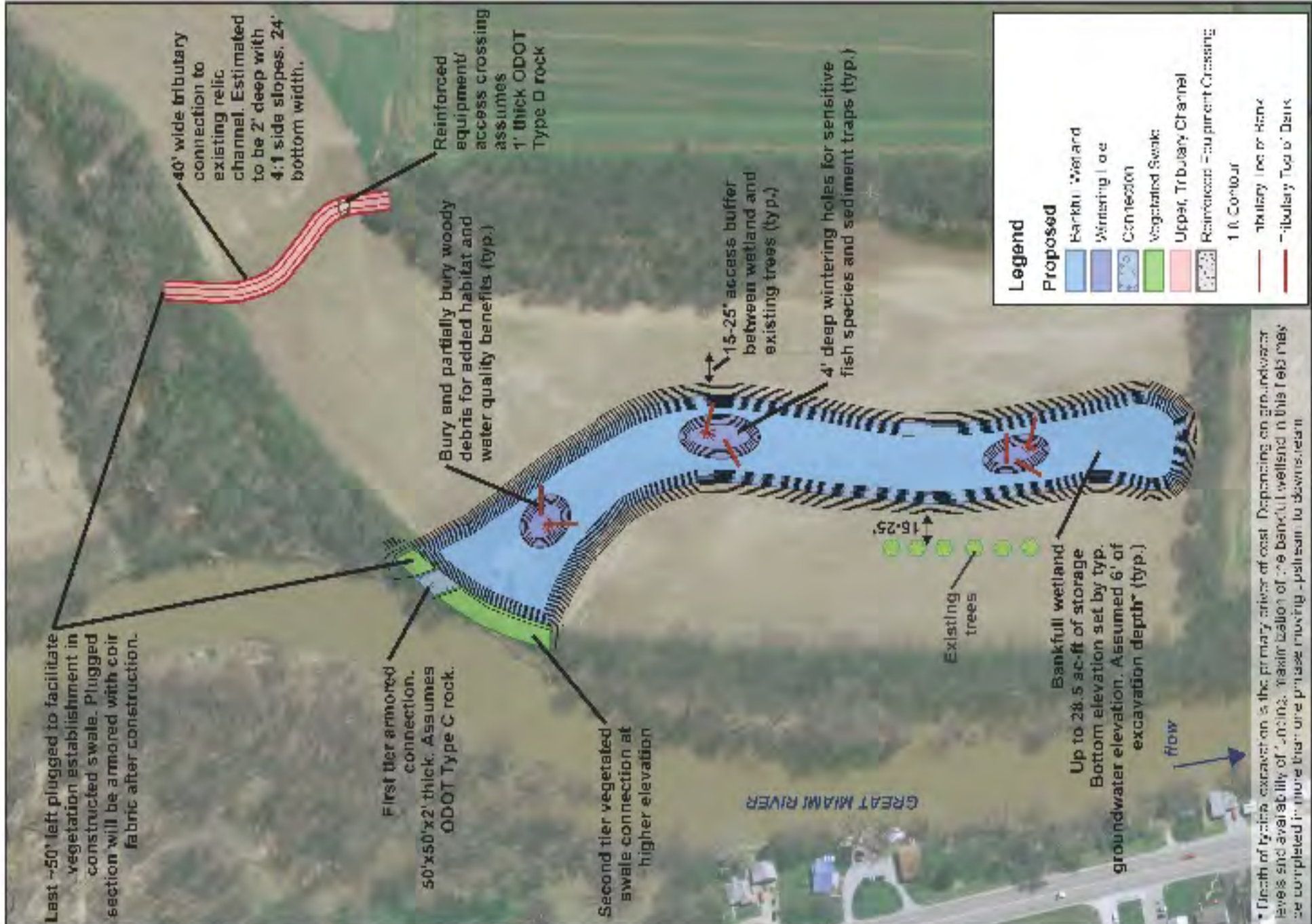
- * Obstacles to capitalizing on this asset
 - * Safety – low head dams
 - * Infrastructure
 - * Pooled reaches – little to no use, poor water quality, takes up valuable green space



Great Miami River, OH

- * Support for investing in river restoration
 - * Recreation – paddling sports are the fastest growing sport in America. Liveries and Angling guides growing
 - * Destination Location – vacations and staycations
 - * Downtown development – restaurants, bars, shops





* Depth of typical excavation is the primary driver of cost. Depending on groundwater levels and availability of lining, installation of the bankfull wetland in this field may be completed in more than one phase moving upstream to downstream.

BANKFULL WETLAND CONCEPT

UPPER WETLAND

0 100 200 400 feet

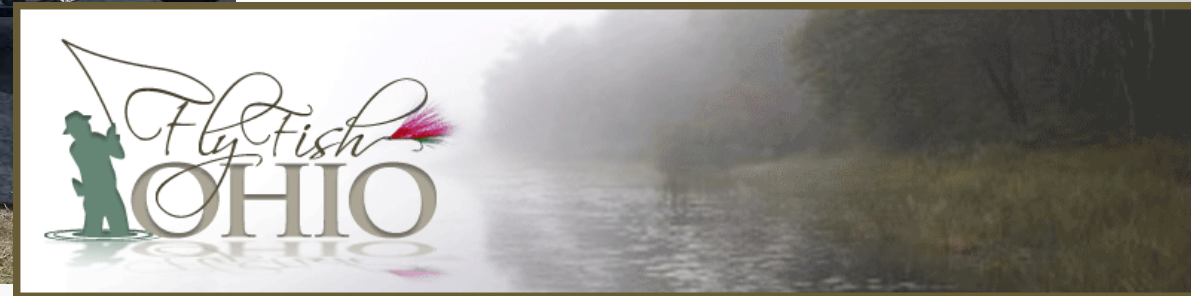
001 CHARLES WETLANDS IN 2004, 2009
002 WETLANDS AND ECOSYSTEMS / 003 / 004 / 005 / 006 / 007 / 008 / 009 / 010 / 011 / 012 / 013 / 014 / 015 / 016 / 017 / 018 / 019 / 020 / 021 / 022 / 023 / 024 / 025 / 026 / 027 / 028 / 029 / 030 / 031 / 032 / 033 / 034 / 035 / 036 / 037 / 038 / 039 / 040 / 041 / 042 / 043 / 044 / 045 / 046 / 047 / 048 / 049 / 050 / 051 / 052 / 053 / 054 / 055 / 056 / 057 / 058 / 059 / 060 / 061 / 062 / 063 / 064 / 065 / 066 / 067 / 068 / 069 / 070 / 071 / 072 / 073 / 074 / 075 / 076 / 077 / 078 / 079 / 080 / 081 / 082 / 083 / 084 / 085 / 086 / 087 / 088 / 089 / 090 / 091 / 092 / 093 / 094 / 095 / 096 / 097 / 098 / 099 / 100

001 CHARLES WETLANDS IN 2004, 2009
002 WETLANDS AND ECOSYSTEMS / 003 / 004 / 005 / 006 / 007 / 008 / 009 / 010 / 011 / 012 / 013 / 014 / 015 / 016 / 017 / 018 / 019 / 020 / 021 / 022 / 023 / 024 / 025 / 026 / 027 / 028 / 029 / 030 / 031 / 032 / 033 / 034 / 035 / 036 / 037 / 038 / 039 / 040 / 041 / 042 / 043 / 044 / 045 / 046 / 047 / 048 / 049 / 050 / 051 / 052 / 053 / 054 / 055 / 056 / 057 / 058 / 059 / 060 / 061 / 062 / 063 / 064 / 065 / 066 / 067 / 068 / 069 / 070 / 071 / 072 / 073 / 074 / 075 / 076 / 077 / 078 / 079 / 080 / 081 / 082 / 083 / 084 / 085 / 086 / 087 / 088 / 089 / 090 / 091 / 092 / 093 / 094 / 095 / 096 / 097 / 098 / 099 / 100



Great Miami River, OH

- * We want the same thing!!!!
 - * People interacting with and valuing their resource
 - * We need better packaging and better communication



Eel River Innovative Fishway

Lowhead Dam is part of a Historic Monument

Large investment in preservation and restoration of the site

Dam blocks fish passage since 1850's

Only ORB stream with Greater Redhorse



Eel River Innovative Fishway

The dam is not coming out.

Working together we found a solution!

Utility for sites where dam must stay - hydropower











About the Stockdale Mill

HISTORY

1839 Thomas Goudy received authorization from the Indiana General Assembly to construct a dam across the Eel River at this location. His dam was constructed from timbers and field stone covered by planks.

1840 Thomas Goudy built the first mill at this location. It was operational for 14 years before being washed away by a flood.

1857 The current mill structure was built by partners Daniel Baker and Samuel Rank.

1916 James Madison Deck and James Hurst Deck, father and son, improved the dam to its current form. Concrete was hand mixed on the bank and hauled by wheelbarrow to be poured in front of the original timber dam. The height of the dam was moderately increased.



1964 Commercial production of flour ceased.

2002 The mill was purchased by Dwight and Susanne Fouts who transferred ownership over to the Stockdale Mill Foundation preservation group which oversees ongoing restoration.



Mill Facts

- **14,000 Gallons per Minute** pass through the Stockdale Mill Dam
- The building itself is **Over 160 Years Old**
- The building is on the **National Register of Historic Places**
- The Stockdale Mill has always exclusively used **Water Power**
- One of the most **Photographed / Painted Vistas** in the region
- The Mill Foundation consists entirely of **Volunteers**
- **Mill Tours are available** each Saturday in May - October from noon - 4pm
- For more information, visit stockdalemill.org

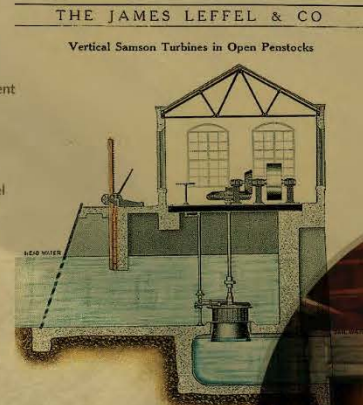
OPERATION

The Stockdale Mill Dam provides head water to power the mill. A mill race channels water to three Leffel water turbines located in a sub-basement or "penstock" underneath the mill, generating a total of 75 horsepower.

In the basement gears, shafts, pulleys, and belting distribute the power to roller mills on the main level that do the grinding.

The second level is primarily used for storage of wheat, flour, bran, and middlings. The top level has equipment for sifting as well as cleaning wheat.

Four floors of operating machinery could produce around 50 barrels of white flour per day.



LEGACY

After remaining silent since 1964, recent years have seen a rebirth of the spirit of the old mill. Standing beside the river today, one cannot help but feel wonder and admiration for the early pioneers and settlers.

The legacy of their courage, foresight and judgment remains before us to be experienced.



Tradition Meets Innovation

THE PROBLEM

The Stockdale Mill has worked well for the production of flour and corn meal since construction in 1856 however, the dam that provides waterpower to the mill turbine also hindered the ability of fish to migrate upstream. Nearly 80% of freshwater riverine fish species are migratory and rely on large stretches of river to complete their life cycle. The connectivity of stream habitat for spawning, rearing, and overwintering is critical to the health of fish populations within the Eel River ecosystem. Unfortunately, the study of fish passage as a whole has been devoted mainly to diadromous migratory fish (fish migrating between saltwater and freshwater on the Pacific and Atlantic coasts) and not to migratory freshwater fishes within Midwest streams like the Eel River. Due to the lack of research, blocked inland waterways by culverts and/or dams have been overlooked and highly misunderstood.

FISH LADDER CONSTRUCTION

The four-year effort to install this prototype fish ladder began after the Stockdale Mill Foundation gave their blessing to move forward with the project in 2013 as part of their pledge "to be good stewards of the mill, dam, and river as they educate the public on their history significance." The fish ladder would provide a way for fishes to safely cross the dam and reach areas upstream to complete their life cycle and genetically connect populations above and below the dam.

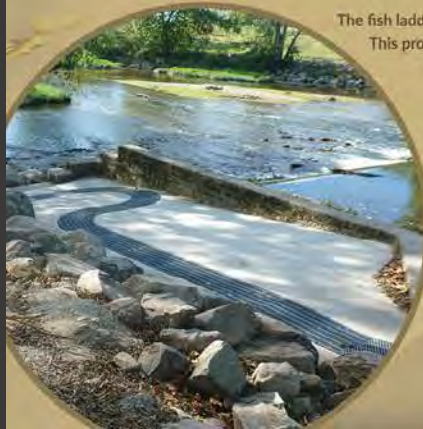
A partnership of biologists spent many years studying the fish populations in the Eel River while documenting how barriers affect fish migration. The Stockdale Mill dam provided a representative site that was the perfect location to test a one-of-a-kind fish passageway invented by B.K. Riverfish, LLC. Laboratory research and development of the fish ladder took place over a two-year period followed by a full-scale prototype constructed and delivered to the Stockdale site on August 14, 2017. An antenna system to track the movement of fish within the river and fish ladder was installed in September 2017. The ladder was officially opened in mid-November 2017.

Since the installation and opening of the fish ladder, more than 15 fish species have been observed inside of the ladder. Fish as small as three inches have been documented to move through the ladder and around the dam. The first time fish could pass around the dam in 160 years! It is estimated fish as large as two feet will be able to swim up the ladder.

The fish ladder will be monitored to evaluate the number and kinds of fish that use the ladder. This project shines a light on the problem of barriers to migratory freshwater fish as well as an innovative solution that allows fishes to pass over or around dams while preserving the history that sits at this site and other similar historic sites.



For more information on the Stockdale Mill Fish Ladder Project, visit online at: <https://www.manchester.edu/stockdaledam> or scan this QR Code with your smartphone or mobile device.

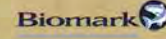
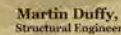
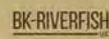
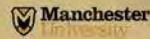


Ladder/River Facts

- It is estimated that **15 species of fish and thousands of individuals** have passed through the ladder since its opening.
- Listed as a National Fish Habitat Partnership **Top 10 Watersheds to Watch**
- American Bald Eagles** nest along the river
- The ancestral home of the **Potawatomi and Miami Indians**
- Geologic boundary** between the glacial lakes region (north) and the glacial till plain (south)
- 52 species of fish** call the Eel River home (one state endangered)
- The Eel River is about **100 miles long**
- River otters** call the Eel River home
- Home to **25 freshwater mussel species** (including two federally endangered)
- The watershed land use is **85% row-crop agriculture**
- Popular destination** for recreation (canoeing, swimming, fish, etc.)



Partnering Organizations







Two-Stage Ditch - water quality, nutrient reduction, aquatic and terrestrial benefits



Natural Resources and the Professional Development



The “20 minute project”



Multipurpose Restoration

Economic
Industrial
Recreation
Social
Safety
..and much more

