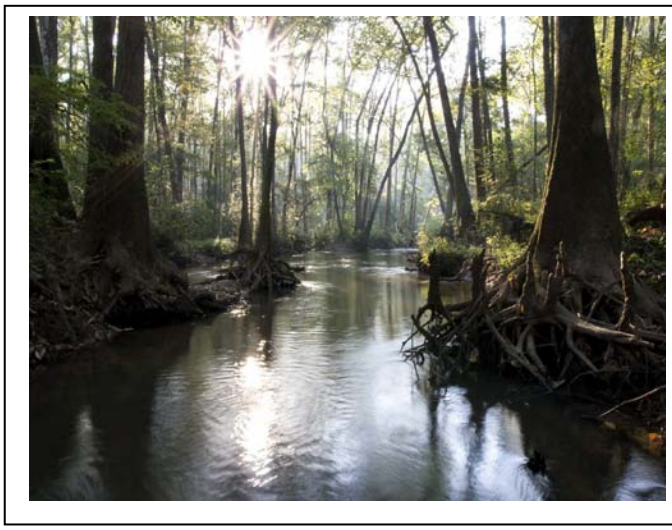
CARPENTER CREEK WATERSHED RESTORE PROPOSAL CONCEPT PAPER

Restoring Escambia County's Watershed through a Community-Based Approach



ABSTRACT

Carpenter Creek Watershed Restoration offers the potential for an integrated science, education, and economic project that will positively impact a key part of the Escambia County watershed and the region's economic resiliency.

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OVERVIEW

Through citizens and academic involvement, this project will serve to restore a biological corridor which is currently an impaired urban creek. The goals of this project include reducing pathogen and pollutant loads from entering this watershed system. This watershed is currently impaired according to the CWA 303(d) list of impaired waters.

Another goal of this project is to initiate implementation of non-point source pollution best management practices to restore the ecological function, and thus the ecological services, back into this system.

The proposed project will provide direct benefit to a 5 mile-long, meandering urban creek and the 5 mile-long urban bayou which the system feeds. The creek is fragmented by more than ten culverts and five bridges. Non-point stormwater runoff carries a mixture of nutrients, sediments, invasive species (seeds) into each fragmented section. The development along this watershed predates the current science/land development codes towards development in low lying areas and riparian zones. This project will serve to restore the natural ecosystem by identifying upland stormwater storage/detention to allow stormwater run-off pre treatment, and increasing the vegetated buffer; thus making the community along the creek and bayou more resilient to extreme events.

This project has multiple phases which will serve to provide education and stewardship of the natural environmental systems to the local and interested public. The project offers the potential to incorporate a workforce development component to grow the environmental restoration workforce in Escambia County and Northwest Florida.

THE PROBLEM

Coastal resiliency and inland riparian zones depend on vegetated buffers to mitigate and attenuate not only sea level rise, but also stabilize shorelines and creek banks through root systems. Logging efforts during the early timber days served to shift the natural landscape from upland Longleaf Pine, American Beech, Cedars, Junipers, Sweet Gum, Sweet Bay, Black Gum, Gall Berry, and Dogwood to a mixture of invasive and low quality species found today which include a mixture of opportunistic Laurel and Water Oaks, Popcorn, Privet, and Slash & Sand Pine.

Habitat loss along the entire creek and bayou waterway (i.e., resilient canopy species and emergent grasses) have contributed to habitat degradation over time which have been documented as negative impacts on fisheries, impaired biological structure, reduction of property values during the 1970s through 2005 from fish kills, and the loss of recreation in the bayou, which once held annual ski competitions and other water sports.

The tree canopy within the entire watershed has remnant rufugia of native mature species, but overall the current condition includes young trees which are not wind resistant and do not offer quality organic matter in the form of leaf matter or woody material to support vegetative energy vital in the support of food webs in the system. The value of the food web function has been diminished through the loss of native broadleaf wetland and riparian species. Restoring

this riparian canopy, while also developing an earthen berm planted with resilient native species would serve to sequester carbon, shade the watershed, and minimize non-point source storm waters from entering the watershed. Increasing by widening the vegetated buffer between upland and water will not only be cheaper in cost, this approach will allow the system to repair itself in the future when the next major weather event occurs, and will serve to implement natural approaches for improving water quality in the entire system.

THE SOLUTION

Water Quality Improvement

The redevelopment of a vegetated berm above the flood plain would serve the impaired watersheds capacity to slowly attenuate some nutrients, storm water runoff and any metals which originate from the roads which intersect this watershed throughout its entire reach.

Water quality improvement occurs when the buffer is reestablished and water conveyances are diverted away from the creek. Many of the water quality issues along the creek include nutrients, fecal coliform, mercury (atmospheric?) and sedimentation. Phase I data will serve to identify the constituents entering the system, measure riparian buffers (composition, width, and overall health) and slope of banks. Various plants are known have increased up take abilities (eg. Ferns have been known to take up metals, specifically arsenic; sunflowers are known to take up lead).

As contaminants are identified and isolated, species known to intercept these contaminants can be planted in the vicinity to intercept and slow the contaminants from entering the aquatic system (i.e., phytoremediation mitigation).

Habitat Restoration

This project when completed would improve water quality, fishery habitat, carbon sequestration and carbon storage, vegetation diversity, and restore natural hydrological function. The headwaters of the creek to the mouth of the bayou are fragmented by culverts and bridges. Many of the culverts and bridges have been reinforced by adding the equivalent of rock weirs to protect infrastructure, thus making any fish passages impossible. The system requires a watershed wide approach with the intent of reconnecting the hydraulic, as well as the hydrology to the ecosystem; ultimately this level of restoration would serve to tie the creek back into the flood plain.

In rural areas with dirt roads, counties often grade these road networks and develop turn-outs for water to leave the road bed before entering a low lying wetland or creek system. Equipment operators may grade a system monthly or bi-weekly depending on rainfall and usage. This approach may serve urban situations well if property is available for use and upland storm water can be diverted as a holding system. These holding systems should be planted swales for habitat, and not the retention/detention fenced areas seen too often in Escambia County.

The development of a well planted berm will serve to slow water entering a creek and potentially redirect runoff through vegetation thus capturing sediments and nutrients (and trash) before it enters the waterway. The berm-planted vegetation known to have strong roots and provide beneficial leaf matter (for ex, American Beech and Tulip Poplar) will serve to enhance soil composition over time, act as a wind shade, and develop rich soil composition. Recognizing the species composition of the riparian zone is equally important in attracting native insects, which in turn support birds, reptiles & amphibians, and small mammals.

Habitat Conservation, Wildlife Corridors and Ecological Restoration

The entire Carpenter Creek/Bayou Texar Watershed is impaired for fecal coliform and mercury in fish tissue, according to the FDEP NW FL Regional Monitoring Program (FDEP 2015). The decline in water quality can be directly correlated to the continued uncoordinated development within this watershed landscape.

The I-110 expansion, which lasted several years between 2004 and 2010, doubled the size of the north/south feeder arm to the main interstate system and created plumes in Pensacola Bay which were conveyed to that system through the Carpenter Creek Watershed. Although additional stormwater ponds were mandated and added due to the expansion, many of the ponds were located in low lying wetland areas, which if left in their natural condition would have benefitted the uptake of water through respiration, cooled the area through condensation, aided groundwater through infiltration, benefitted air quality by CO_2 uptake and O_2 release, and Carbon Sequestration.

These low lying areas were converted from natural vegetated systems into stormwater holding ponds (retention and detention) which have never functioned as well as the natural system. Additionally, the trees planted in the holding ponds directly adjacent to the I-110 interstate are not functioning as intended, as many are dead or their growth stunted.

- **For the wetland, creek, and bayou to flourish as a healthy ecosystem, a diverse vegetated buffer must be re-established to stabilize the banks, reduce nutrient run off, and perhaps provide wildlife corridors for native fauna that are year-round residents, or migrate through the area at specified times of the year.**

- **The upland tree canopy should be re-established by individuals (ecologists, citizens involved with the Native Plant Society and academia) who understand the biological food web function and seasonal nuances in our region.**

Natural System Resiliency

The Carpenter Creek/Bayou Texar Watershed cannot function as intended because of the multiple fragmentations which have occurred throughout the system over the past six decades, thus compromising the integrity and ability of this watersheds ecological function. Healthy riparian buffers have the ability to slow water before it enters the stream channel. In addition, as science and research have advanced, ecologists and biologists better understand the impacts that land use changes have inflicted on aquatic ecosystems. Storm water and sedimentation

have contributed to the demise of water quality. Losses of riparian habitat and species composition have also impacted the biodiversity of many fauna, which have contributed to the impairment of the food web ecosystems ability to function.

The following figures provide aerial overviews of the entire watershed and visually illustrate the land use today. The head waters of Carpenter Creek were considered rural in 1960. The interstate (I-10) and south feeder (I-110) were built in early 1970's and fragmented the upper tributaries from the main channel. The University of West Florida opened in 1970, which also contributed to the shift from a rural to suburban landscape along the watershed through the mid 1980's. The development of University Mall, the expansion of Davis Hwy, addition of West Florida Hospital and the numerous subdivisions which popped up to accommodate growth were originally on septic systems. The headwaters of Carpenter Creek on Olive Road were also the site of a hog farm and slaughterhouse which contributed nutrients to the groundwater through the 1980s and still influences the surface water quality today with high nitrates.

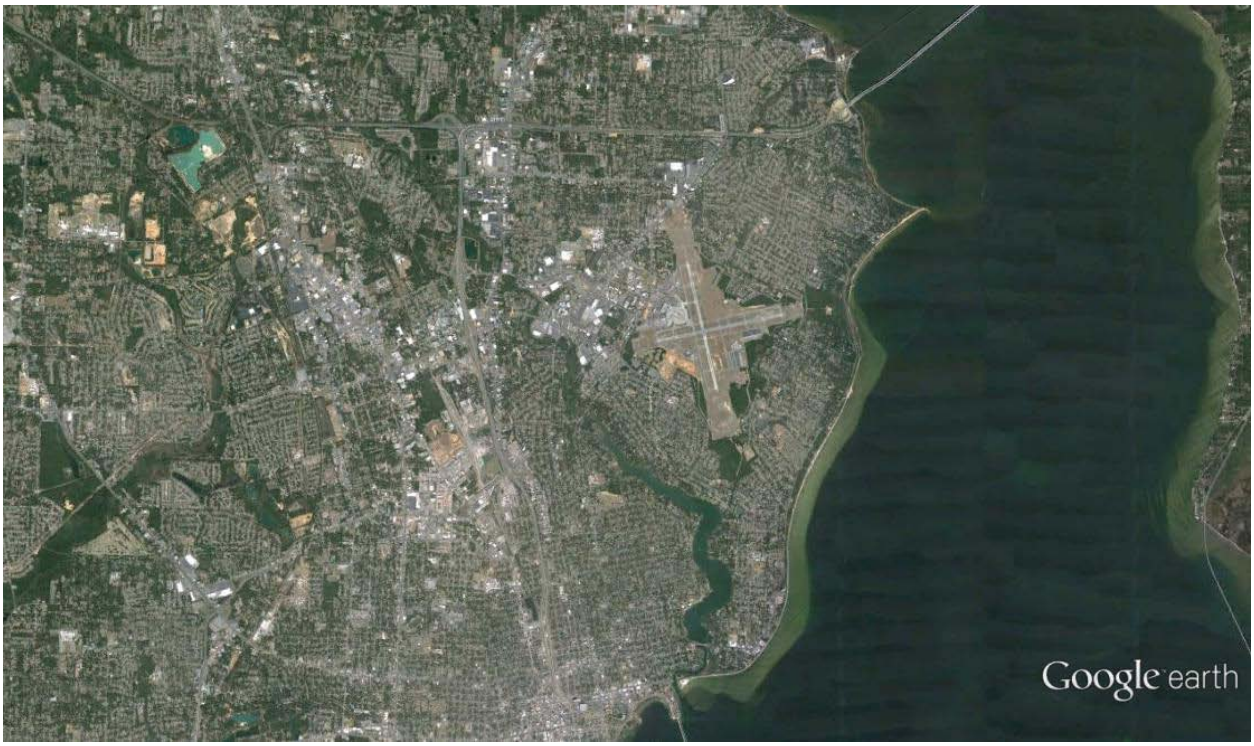

Figure 1. Aerial view of the Carpenter Creek/Bayou Texar Watershed. Note the airport is located within this watershed.

Figure 2. An Overview of the entire watershed visually orients the reader to the remnants of the upper fragmented watershed and the roadways which intersect the system. Each road acts as a conveyance of storm water during rain events and serves to carry anthropomorphic pollutants, trash, and invasive plant species seeds to the water body. In each instance, sediment is also carried towards the water by the velocity of storm water runoff. The remaining riparian zone buffer and plant species are not the quality once known to the creek, and as such species diversity of plants and animals have been compromised.

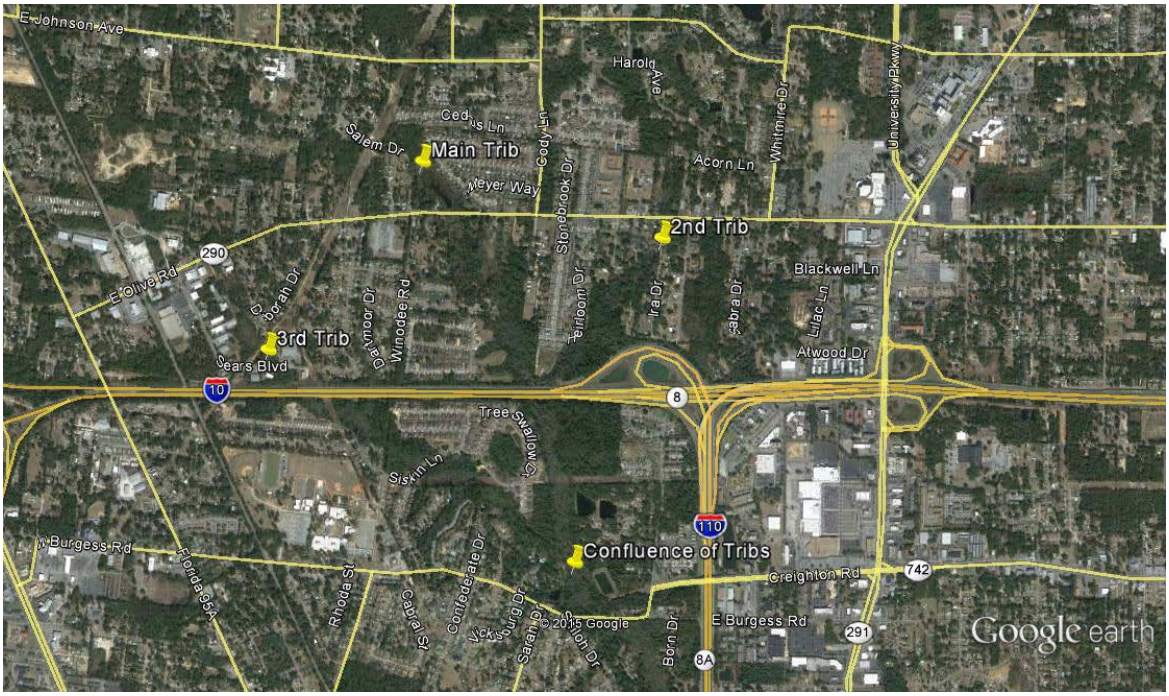

Figure 2. The upper creek head and tributaries as seen in a Google Earth image 2015. Note I-10, I-110 and other major corridors can be observed in gold.

Figure 3. Provides a bird's eye view of the journey this creek takes through an urban setting. In Figure 4, the creek has many commercial neighbors including apartment complexes, small nursing homes, doctor's offices, restaurants, strip malls, and several sizeable box stores. These facilities all contain large parking lots which contribute to the overall impairment of the creek during each rain event. A rain event consisting of a 1" rain on a 1-acre parking lot will produce 27,000 gal of water. Many of these box stores and larger businesses including Sacred Heart Hospital and Cordova Mall have been grandfathered in to past land development codes and are not required to capture, detain, or treat storm water from their property.

The creek runs through several areas with elevated topographic features, which in their natural state would have been vegetated ravines. Today these areas are parking lots or roads and have lost their continuity and stability, as well as vegetation to slow waters from entering these systems.

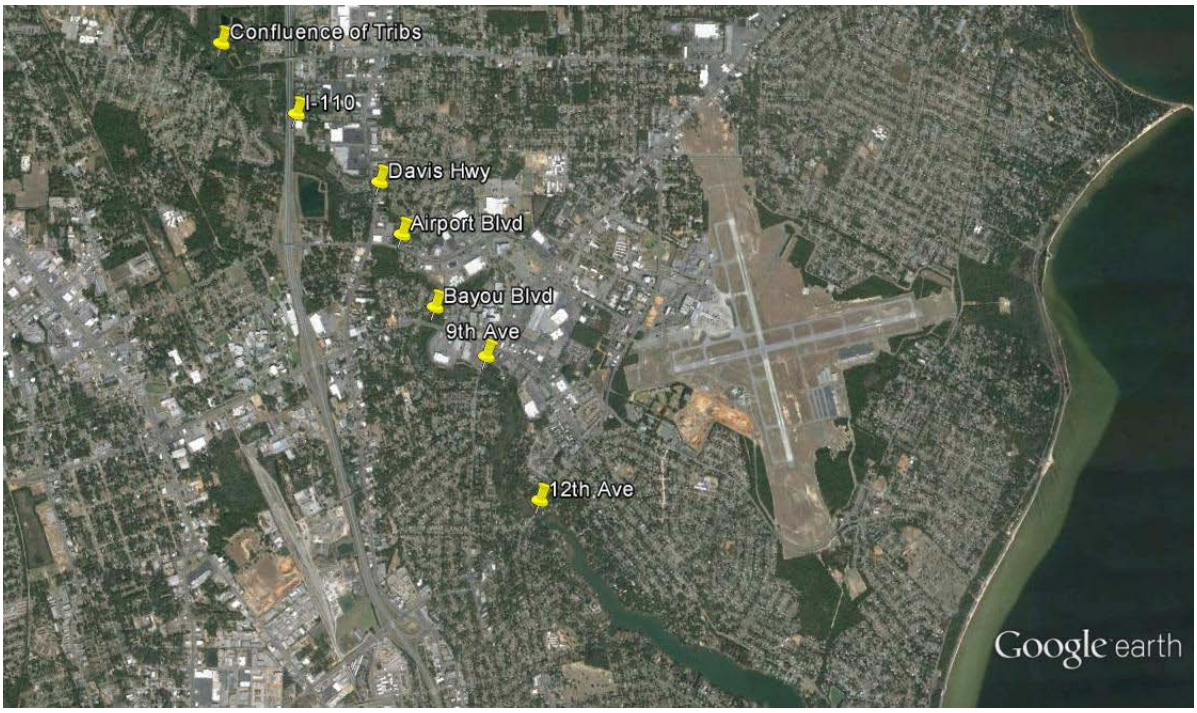

Figure 3. The urban journey of Carpenter Creek from the confluence of the three tributaries to 12th Ave, which marks the headwaters of Bayou Texar, where Carpenter Creek becomes a wider braided system.

Figure 4. Carpenter Creek from Davis Hwy to 12th Ave has many box stores as neighbors, including Lowes, portions of the Sacred Heart Hospital Complex, Rave Theater, Publix, Winn Dixie, Target, and many others.

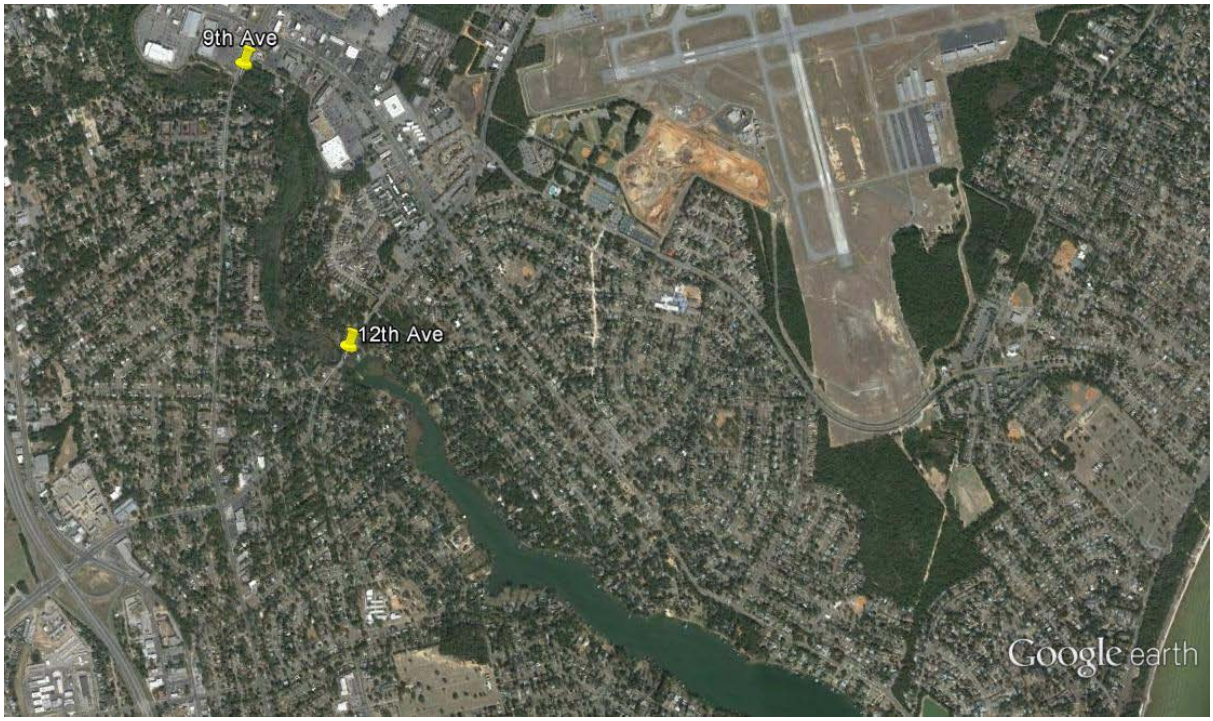

Figure 5. The lower creek and upper bayou becomes completely residential along both banks as the systems begins to widen.

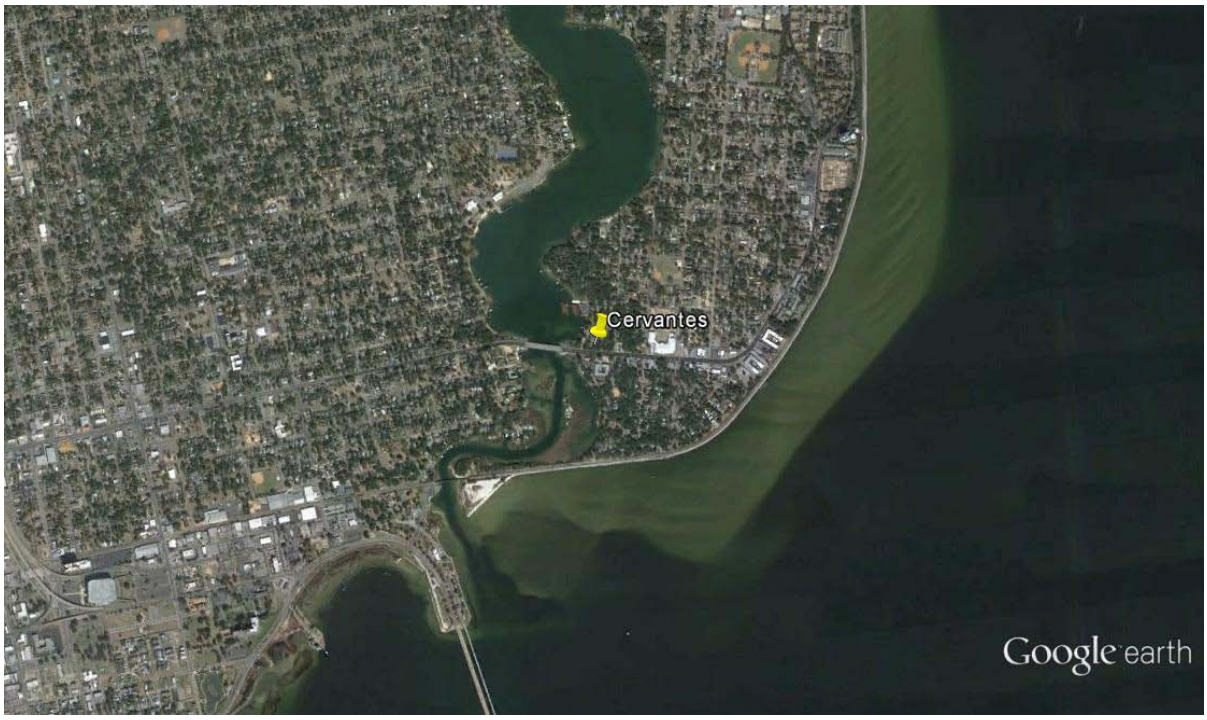

Figure 6. The lower portion of Bayou Texar which is constricted at the Cervantes Street Bridge before flowing out to Pensacola Bay. Note the channel is dredged between the bridge and the mouth and also note the sediment transport is interrupted from the north to the south by the foot/approach of the 3-mile Bridge.

The Carpenter Creek Restoration Project

This project lends itself to a multi-year *in situ* type, multi-disciplinary educational opportunity for academia, the community, research, governmental agencies, businesses, and non-governmental organizations alike.

Step I – the overall assessment of the conditions of the watershed including: habitat assessment, width of riparian zones on both banks, water depth & flow levels, amount of woody material in the system, vegetation type, sediment depth, visible conveyances (active/inactive), water quality, macro invertebrates, vertebrates, etc.

Concurrently, a study identifying upland properties located within a half mile of the watershed, their uses and ample opportunities to develop conservation easements through vacant or abandoned properties to sequester water from rain events. Perhaps develop an incentivized program to reduce taxes or reduce insurance costs.

Step II – Data interpretation from Step I can be compared to past data can be viewed (correlated) with land use changes over time (NRCS, Escambia County) to identify areas with the largest change and potential contribution. LiDAR comparisons and observed changes between 1996, 2002, and 2009 will add another line of evidence to understanding the bigger picture of source control.

Step II lends itself to opportunities for academia/engineering to develop single and complex models which correlate to nutrient loads and general buffering of the system.

The Step II data will be used in the design component of the restoration, ultimately designing the creek to have release areas where sediments can accumulate without contributing to downstream smothering, as well as diverting the pulse of stormwater entering the system to a vegetated flood plan to slow the energy and absorb the nutrients. Persistent water quality problems, septic tank leachate, stormwater pulses from major road corridors can be spot treated via a diversion if the source cannot be addressed.

In 2014, NOAA, USEPA, and USGS identified natural coastal communities as the most threatened ecosystem in Florida. Restoring the health of inland creeks through buffering and stormwater treatment will increase the productivity of the bayou which will serve to increase the productivity of the bay. Additionally, increasing the buffering capacity of the riparian zone will decrease the sediment load and help re-establish a healthy creek/floodplain habitat which could double as a wildlife corridor, serving as refugia for many species that have lost their native home.

The Escambia County Stormwater Advisory Team (SWAT which organized in Dec 2014 in response to the April 2014 Flood) has copious amounts of critical data that can be used to enhance this project regarding flooding and damaged areas within the watershed.

Step III – based on the data interpretation of Step's I & II, the construction component of this effort would be three-fold: 1) Increase vegetated buffer along all banks from headwaters with native species suited to the ecotone; 2) identify suitable areas between the Bayou Blvd and 12th Ave reach of the creek to afford access from big box stores (their associated parking lots) to a

urban creek side boardwalk (similar to Turkey Creek) [http://cityofniceville.org/turkey.php] which provides access and awareness of the creek to the public; and 3) identify areas that can be purchased or incentivize private land owners to re-establish riparian buffers. Areas identified as contributing large volumes of stormwater pulses should be re-engineered to redirect stormwater to a holding system or a wetland polishing system.

Step III of this project would kick off a large public participation component. The lower portion of Carpenter Creek is lined by 'Box Stores' from Bayou Blvd to 12th avenue. Many of these stores have been 'grandfathered in' and are not required to treat their stormwater. However, their proximity to the creek, and especially their parking areas, lend themselves to be ideal partners for access to a wide raised boardwalk which could be designed similarly to the Acadia Mill Boardwalk (UWF, Milton). In addition, there are several old water powered mill sites in the area, including one thought to be the oldest mill dam. [Dr. Benchley is reluctant to disclose the exact location – at this time, since vandalism is a concern, but she indicated that this would be a wonderful feature and attract tourism, students, and bring awareness to these systems.]

This project has the potential to become an in situ living and working laboratory utilizing and enhancing multiple disciplines. The complexity of knowledge, given the historic archaeological comprehension, the groundwater plume from the Conoco-Phillips Superfund site, and the historic uses of the upper portions of the watershed (hog farms which continue to contribute nitrates to the system) provide potential for biological and phyto-remediation.

Bayou Texar also has a vibrant history; its lower reaches were used to 'hold oysters' until they were needed as oystermen returned to Pensacola from East Bay and upper Escambia Bay. To avoid saturating the market, oystermen had 'plots' where they held them until timing was best. Today, the lower bayou, below the Cervantes Street Bridge still has small oyster bars which some believe are the descendants from earlier days.

Step IV is implementation and continual monitoring to reinforce awareness and education. Any physical work done to the creek should occur during winter months to avoid the wet season.

- Tributary monitoring
- Land use loading rates
- Sediment load reduction
- Pollutant load reduction
- Re-establishing the riparian zone canopy
- Removal of invasive species (chemical & physical)
- Biological monitoring
- Re-introduction of beneficial native species and woody material into the system
- Quarterly outreach for XX years, followed by bi annual outreach for additional XX years
- Develop education booklet on this project and why protecting these systems is so important

- Annual symposium for the public to update the community of this large scale project

ECONOMIC BENEFITS OF THE PROJECT

Industry and Business growth

Step III of the project includes a boardwalk located behind large box stores on Bayou Blvd. This boardwalk could offer seasonal kiosks which serve light foods (eg. ice cream) or artistic wares. In addition, the potential for archeological enthusiasts would be a draw to the historic mill.

A potential opportunity for a new business would overlap with the 2020 state of FL Goals by which 75% of each of the 67 counties in the state will be required to recycle paper, plastic, and glass. Currently, the recycling market fluctuates according to worldwide needs, but a sustainable opportunity exists. TREX decking material is 100% manufactured out of recycled plastic bags (an item not currently recycled in Escambia County). Trex decking material has evolved into several different products which are weather proof, UV resilient, and have a life span of over 50 years. (www.trex.com)

Given the number of projects that will surface along our coastal region, many of which will incorporate decking material and board walks, it could behoove the county to co-locate such an enterprise in the vicinity of the new recycling center (currently ECUA & Escambia County have set aside $66M for a new recycling facility) which would serve to offer a sustainable project, provide jobs, and allow workforce development to install this product.

Transportation Network Improvements

This project offers the opportunity to expand on the potential wildlife corridor by adding a component which would allow the public access to the creek at several locations. Currently the creek is crossed by the public (pedestrian) on Olive Road, Davis Highway, Airport Blvd, 9th Ave, 12th Ave, and Cervantes Street. Olive Road and the south side of 12th Ave do not offer a pedestrian walkway.

This watershed system is an attribute to the community and offers an educational opportunity to provide overlooks with seating, educational signage and lighting for the interested public. A passive education opportunity includes signage about the ecosystem, including the plant and animal species which one may find in this habitat.

Health Concerns

Restoring water quality to the bayou would increase the opportunities for ecotourism. Currently, water quality notifications are issued after rain events indicating the waters are unsafe for recreation.

The lower bayou offers public access at Bayview Park via boat launch and pier access. In addition, plans to rebuild the older Bayview Center are underway and when finished will attract more of the public to the water. Currently the City of Pensacola allows a vendor to rent kayaks, paddle boards and other non-motorized water craft, but water quality warnings are not posted regularly after rain events. Multiple rowing groups have organized themselves and house their rowing sculls at the park.

The subsistence fishermen community uses the numerous bridge crossings and parks to fish for meals. Notification of high mercury content in fish is rarely posted at bridges or piers. A sizable component of the public relies on fish caught in coastal creeks to supplement their nutrition.

Demographics of the watershed vary from the upper head waters to the bayou area. This project begins in an older portion of town, near Olive Road – between Davis Hwy and Old Palafox Road. The creek and tributaries originate in areas known as Ferry Pass, Brent, Ensley, and flow south into East Pensacola and the City of Pensacola. Originally known as a rural area with larger tracts of land to support farming activities, the addition of the Interstate in the 1970s changed this area into a more suburban setting. Land use changes in the last decade have taken 10 and 20 acre parcels of land and transformed them into high density subdivisions made up of patio homes at 4-6 homes per acre. Many of the older tracts of land are currently trailer parks housing low income families.

The older areas may not be on sewage, as they would have been developed before sewage hook-ups were available. The upper head waters do not contain sidewalks or road side lighting, but because the area is older and a poorer demographic many of the residents supplement their diet through locally caught fish.

Flooding Improvements

This project lends itself to a whole watershed management approach. The Carpenter Creek Watershed lies in two jurisdictional areas (City of Pensacola and Escambia County). This watershed empties into the Pensacola Bay Watershed, which has been identified by on the Federal National Priorities List as an impaired body of water. (USEPA. 2010)

The Watershed Management Approach includes identifying the largest sources of nonpoint stormwater entering the system and redirecting the water to a detention or retention pond. Right of way swales are another opportunity to keep water from entering the wetland/creek/bayou system. Planting the right of way with trees known to ‘drink’ large volumes of water would offer shade on hot days, and be connected to the water table if

they were in the vicinity of the water body. Poplars and Willows are known to 'drink' up to 350 gallons of water on a hot day. In the Carpenter Creek/Bayou Texar Watershed, summer rains are known to drop 3-5" at a time, whereas winter conditions are must less; which also coincides with trees entering a dormant period.

The UWF Earth Science Dept has skilled GIS instructors and students who can play an active role with this in situ aspect of the project. The city and the county own the right of way, which would allow the use of swales and turn outs to redirect water away from the creek.

Increasing the riparian zone along the creek will also serve to mitigate flooding and stabilize the banks of the system. Incentivizing private property owners to allow additional trees to be planted on a berm would serve to decrease flooding, improve water quality, stabilize the entire system and cool water before it enters the main stem. This in turn would allow the currently impaired watershed to begin to function as a healthy ecosystem thus creating a stabilized and far more resilient system.

Workforce Development Potential

This project sets the foundation for developing curriculum in high schools, trade schools and upper academic institutions to better understand the coastal plain ecosystem and restoration efforts which blend the geographic, topographic, and biological functions to provide what is known as Coastal Plain Restoration Techniques, and to enhance ecosystem services.

- Currently there is a void of data on the negative costs of hardened infrastructure (such as bulk heads and revetments) which are now known to decrease biological diversity and increase flooding and erosion where the hardened structure ends. This principle artificially inflates the positive impacts of built up infrastructure because the negative costs are not incorporated or understood. To address this void, additional research on natural, living shorelines compared to hardened shorelines must be developed and put in the context of monetary impacts. Since insurance companies drive many of the approaches to protecting infrastructure through actuary data, there are opportunities for economic development in the transformation of hardened landscapes to softening the land and water interface.

- This project lends itself to addressing sea level rise and incorporating proactive techniques for future conditions. In addition, this project contains a Superfund Site which has not been fully investigated for attenuation opportunities in the past decade. The public is informed of its existence but uninformed and unaware of what future conditions may entail. As the technological industry continues to develop new methods for identifying contaminants and concerns, so too can those new concepts and technology be applied to this system. This contaminant plume affords new approaches to ground water attenuation in an urban watershed.

POTENTIAL PARTNERS

The following groups (academia, business, and government) are the potential foundation for the partnerships this project could foster.

- UWF – Earth & Environmental Sciences; Center for Environmental Diagnostics & Bioremediation; Biology Dept; Computer Science Dept; Archeology Dept; and Economic Dept
- Pensacola State College
- Washington High School, Marine Science Academy
- Home School Groups
- Box Stores along the creek – Target, Michaels, Winn Dixie, Publix, Rave Theater, Mellow Mushroom
- Box Stores across the street from the creek – Cordova Mall, Gander Mountain, Barnes & Noble, and Sacred Heart Hospital
- Escambia County, FL
- City of Pensacola
- West FL Regional Planning Council
- FDEP
- Escambia County/SeaGrant, Bringing Back the Bayous
- Homeowners along the creek
- Audubon
- Bayou Texar Foundation
- Bream Fishermen Association
- East Hill Neighborhood Association
- Native Plant Society
- Six Rivers CISMA

PROJECT DETAILS

Project Steps

I. Step I

Ecological assessment of the watershed; native & invasive plant species; condition and width of the riparian zone along each bank; stream & bank condition; Stream Condition Indices; % of woody material; installation of sediment pins above & below bridges; potential sources of erosion; flow rates; and install rain gauges at several reaches (perhaps to be monitored by citizen scientists?).

Upper, middle, and lower headwaters (currently hosting a family of beavers) will include bathymetry, shoreline vegetation identification, and water quality monitoring. Upper, middle, and lower bayou will include bathymetry, water column water quality monitoring and sediment sampling for analyses (metals, nutrients, and contaminants for the Conoco Super Fund Site, PCBs, and historic EMAP data from upper Bayou Texar station TE-10)

II. Step II

Data interpretation from Phase I and application to GIS; Literature review for Carpenter Creek and Bayou Texar (Gerald Moshiri, Sneed Collard, Carl Mohrherr, BFA, EMAP, FDEP, Airport drainage, NOAA, USEPA, USGS, USFWS, FFWCC, City of Pensacola, Escambia County, and the Escambia County Stormwater Advisory Team (SWAT); etc.); NRCS for land use changes; LiDAR comparisons and changes from 1996, 2002, 2009, anything newer?); identify upland properties for water diversion up to ½ mile away; identify best places for berm design; and identify best access/egress points for boardwalk.

Identify all neighboring land owners and begin discussions of increasing the riparian zones. Meet Escambia County to discuss monetary incentives for creek side land owners to benefit from increasing riparian zones and conservation easements. Meet with FDOT and the county to discuss re-routing water from roads to nearby swales. Identify properties which can be converted into natural lands for water retention.

Invite neighboring land owners to participate in water quality sampling through hand held colorimetric kits (eg.,Hach, etc.)

Develop legal agreements with all parties (MOUs, MOAs, etc.) prior to Step III.

III. Step III

Develop and plant vegetated berm at the expanded buffering border of the riparian zone and plant with assemblage of native ecologically valuable woody and herbaceous flora which are also wind resistant. Areas which have been identified as conveyances of nutrients or other stormwater discharge should be planted with specialized flora to take up the specific contaminants. Areas that remain moist or wet should be planted with moisture loving plants and trees (cypress, willow, poplar, etc.) The Longleaf Chapter of the Native Plant Society and the Francis M. Weston Chapter of the Audubon Society will be able to assist in these areas.

Identify suitable areas between Bayou Blvd and 12th Ave that would afford access to a boardwalk along the creek. Include the FMW Audubon Chapter is the design since the creek and stormwater ponds offer many viewing opportunities.

Identify the interesting archaeological sites in this watershed and how to best introduce the public to them. The Boardwalk area will lend itself to keeping the public away from the sites and allowing areas for passive education through signage.

IV. Step IV

The next phase of the project includes monitoring and calibrating the models developed earlier in Step II. These include: Tributary monitoring; Land use loading rates; Sediment load monitoring and reporting (increase/decrease); Pollutant load monitoring (increase/reduction); Re-establishing the riparian zone canopy – vegetative monitoring & condition; Removal of invasive species (chemical & physical); Biological monitoring (both flora and fauna, bio-blitz opportunity); Re-introduction of beneficial native species and woody material into the system (increase or decrease of macro-invertebrates); Quarterly outreach for XX years, followed by bi annual outreach for additional XX years; Develop education booklet on this project and why protecting these systems is so important to the public and the surrounding community (invest

everyone); Annual symposium for the public to update the community of this large scale project (have students present their findings. Cross pollinate high school with higher level academics)

V. Step V

Step V will include the continued oversight and maintenance of the Boardwalk. This can be a employment opportunity for several individuals. Offer lecture series and field trips by various groups (Audubon, Native Plant Society, UWF Archeological Society, etc.)

Development, installation, and continual updates of information on the signage, kiosks, and website will also require a dedicated team with an overview and understanding of the project.

Community Engagement

- **Community Health**

Although many individuals living in Escambia County cross bridges daily on their way to work, school, or shopping, many don't realize the central role that rivers and creeks play in enhancing community quality of life. A healthy creek provides clean drinking water, supports a healthy fishery and wildlife habitat, allows natural protection from flooding, and can offer abundant recreational opportunities. Unfortunately, when people don't feel a connection between their community and their creek, they're less likely to care for it – which can lead to pollution, irresponsible development, and overall negligence.

Recent studies have shown that mental health issues can be reduced by access to nature. Many living in cities spend less time outside in green, natural spaces than people did several generations ago. As a result, city dwellers also have a higher risk for anxiety, depression and other mental illnesses than people living outside urban centers, studies show.

Developing sidewalks, benches, and adding trees to take up road side runoff, have the potential to benefit the entire community.

- **Neighborhood Benefits**

The Carpenter Creek/Bayou Texar Watershed is roughly ten miles in length and passes through every aspect of the community from very poor to very wealthy. A segment of the system houses retail and is well suited for a boardwalk. Enhancing the access to the creek and beautifying the area by replanting the riparian zone would serve to restore pride in many of the lower income areas.

Developing a continuous sidewalk/bicycle corridor would allow/encourage the public to reach many of the retail outlets without using a vehicle. Sidewalks and bicycle corridors would have to be designed such that pedestrian traffic is separated from the faster moving roadway, to assure that these corridors are safe and really used.

As the Escambia County/City of Pensacola community grow, a green corridor which encourage pedestrian and bicycle connectivity to the area will add property values and encourage healthful commutes.

- **Local Preference**

  As with all aspects of infrastructure, there is a maintenance component. This project will lend itself to maintaining the tree canopy, continual removal of invasive species, upkeep of the sidewalks, benches, and weekly garbage pickup.

  Communities that maintain their parks and pedestrian corridors raise pride and property values for the area. An educated community also attracts educated visitors.

- **Education and Awareness**

  Education and awareness can be improved with signage connecting the public to the system. The Boardwalk component of this project will be the real 'meat and potatoes' of the educational component since that aspect of the project will separate the public from the noise of city life and traffic.

  As the project develops, signs and kiosks will be an important tool to provide information. An overview of the entire watershed and the habitat restoration can be shown as an inset, followed by information at key locations as to what is being at that site; how all these aspects fit together.

  Signage along a pedestrian/bicycle corridor in the vicinity of park benches near culverts and bridge crossings will serve to bring awareness of the overall project and tie the community to the watershed. Kiosks can be installed at boardwalk access points.

  The general public is very ill informed about nature and the general services the environment performs for the community. This project lends itself to being a passive learning and educational tool to convey this knowledge.

  The opportunity to offer information in various languages is also possible by including a QRC code which links to a website and provides updates on water quality, species diversity, and project succession.

- **Environmental Outreach**

  This project will serve to enhance many senses as the riparian system is restored, it will attract more wildlife in the form of birds and insects. The creek has a good flow, albeit it is smothered by sediments in most of its length, but as the water table is reconnected with the flood zone the water depth should be able to support larger fish and turtles.

  The historic mill location will fulfill the connection to the past, and it is hoped that the system is designed to invite educators to the site to share their research with the public. Students will also have the opportunity to educate the public, thus preparing them for public speaking.

This project will also lend itself to educating younger members of the community on the importance of creeks and their role in supporting the fishery. Woody material in the form of native species will increase the diversity of species that support the biological food web. This projects lends itself to workshops where the community can be introduced to a inland, urban creek system and with educators can learn about the role of these systems and how they fit into the bigger Pensacola Bay Watershed.

- **Cultural and Historic Resources**

As previously mention, this project lends itself to both cultural and historic attributes which can be featured as an ecotourism destination.

- **Consistency with Local Plans**

Currently the entire Carpenter Creek/Bayou Texar Watershed are on the 303d list for bacterial contaminants, nutrients, and fish consumption due to elevated mercury levels. This watershed empties into the larger Pensacola Bay Watershed which has lost 95% of submerged aquatic vegetation, as well as a diverse fishery. The commercial finfish and shellfish industry harvested from the Pensacola Bay area amounted to 5.6 million pounds in 1973. The fishery had all but collapsed by 1976.

Nutrients, biological oxygen demand, sedimentation, point and non-point runoff was a contributor to demise of the system. Today, contaminated sediment pockets lie dormant in areas, seagrasses are still not making a recovery, and low dissolved oxygen levels on the bottom of the bay reveal signs of hypoxia.

The Water Management District cites many projects to improve water quality in the bay through the SWIM Plan. Escambia County, City of Pensacola, Bay Area Resource Council, FL Dept of Environmental Protection are all working in tandem to improve aspects of these smaller watersheds, but this project proposes a holistic approach and offers the community an opportunity to participate.

- **Green Design**

This project seeks to incorporate rain gardens, vegetated swales, stream enhancement, riparian zone enhancement, upland stormwater retention/detention, and landscaping with native species throughout the entire watershed. Areas with boardwalks will be encouraged to use Trex material, which is recycled and has a long lifespan when compared to traditional wooden boardwalks, given our climate.

Estimated Project Budget

Step I – See Separate Attachment

Step II - See Separate Attachment

Step III - See Separate Attachment

Step IV - See Separate Attachment

Step V - See Separate Attachment

Potential Leverage of Other Funds

List sources of state and federal funding, also foundation funding that is currently available or could be applied for as leveraged funding for the project.

1. Rockefeller Foundation: 100 Resilient City Challenge Grant - The Rockefeller Foundation has announced the third and final round of the 100 Resilient Cities Challenge. The 100 Resilient Cities Challenge seeks to find 100 cities that are ready to build resilience to the social, economic, and physical challenges that cities face in an increasingly urbanized world. The Finalists identified during 2015's 100 Resilient Cities Challenge will be eligible to receive: Funding in the form of a grant to hire a Chief Resilience Officer; Technical support to develop a holistic resilience strategy that reflects each city's distinct needs; Access to an innovative platform of services to support strategy development and implementation. Platform partners come from the private, public, and nonprofit sectors, and will offer tools in areas such as innovative finance, technology, infrastructure, land use, and community and social resilience; Membership in the 100 Resilient Cities network to share knowledge and practices with other member cities. Applications are due November 24, 2015. Contact Sustainable Strategies DC at Andrew.Seth@strategiesdc.com or (202)261-9881 for more information.

2. The Environmental Protection Agency (EPA) Office of Smart Growth will choose approximately 25 communities for the "**Local Foods, Local Places" Designation**, which will provide direct technical support to selected communities to develop action plans that use local foods to support healthy families and communities and to drive downtown and **neighborhood revitalization**. The assistance process features a community workshop that brings people together to develop shared goals and steps to achieve them. EPA encourages applications from communities that are economically challenged and in the early phases of their efforts to promote local foods and community revitalization. The deadline for applications is September 15, 2015. Contact Andrew Seth at Andrew.Seth@strategiesdc.com or (202)261-9881 for more information.

3. The NWFWMD is seeking project submittals for watershed and water quality improvements. The expansion of riparian zones along the creek was discussed and found to be a good fit. http://nwfwater.com/latest-news/2015/09/01/district-seeks-water-project-submittals/

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