

## Why the Need for the Memorial Park Demonstration Project

1. Buffalo Bayou is no longer a natural stream. Every stream is inextricably linked to its watershed, every stream is shaped by its watershed and every stream evolves with its watershed. 95% of the Buffalo Bayou watershed below the dams has been urbanized to suburban densities; and the influx of millions of new people to the Houston metropolitan area over the next several decades will result in on-going, gradual increases in density within the Buffalo Bayou watershed.
2. The past urbanization and the future urbanization have utterly changed the response of the watershed to a rainfall event, with rapid, flashy peak flows within a few hours after a storm event, in comparison to the pre-development response measured in days and weeks. The Addicks and Barker Dam discharges just further exacerbate the stresses placed on the bayou by human activities.
3. Buffalo Bayou will seek to establish what fluvial geomorphologists call a 'dynamic equilibrium' with the new and changing conditions in the watershed, but for this bayou, it will be a moving target for many decades to come. The bayou will work to change its horizontal and vertical geometries in response to the changes forced on it, and these might result in changes of hundreds of feet horizontally and, depending on the location, several feet vertically, as has already occurred in multiple locations along the bayou.
4. This means that the bayou will want to eat into real estate already occupied by gardens structures, houses, condominiums, bridges and utilities. The owners of those properties will fight the bayou and, as they have been doing for decades already, they will line the banks of the bayou with steel sheet piles, bags of concrete, timber walls, gabions, and giant heaps of rubble. They will do what they think they need to do to protect their property. Anyone who has taken a canoe or kayak trip down the bayou will have seen the effects of these band-aid solutions, where one property owner's solution may very likely just shift the energy of the bayou to the opposite bank or to the downstream property owners. Given time and the changing bayou, in a few years most of the bayou will be lined with band-aid solutions installed ad-hoc by property owners intent on protecting their assets, but in the end destroying the natural character of the stream.
5. The bayou is a moving column of water, full of energy, and the only way to properly address changes to the river environment is to take into consideration both banks of the bayou, to acknowledge the changes to the flows coming into the bayou from the watershed, to understand the plan-form the bayou needs to adjust to given a changing flow regime, and to understand the vertical gradient of the thalweg, or profile, of the bayou bed for at least several bends of the bayou. For a bayou the size of Buffalo Bayou downstream of the dams, any solutions to erosion reduction and property protection need to be done in the context of understanding several miles of the bayou in each direction of any single project.
6. The Memorial Park Demonstration Project is an effort initiated by and supported by the Bayou Preservation Association to attempt to apply the best scientific stream restoration practices to a short stretch of the bayou that has been changing rapidly and of which some of the banks had already been armored with steel piles and rip-rap and bio-engineered terraces, resulting in rapid changes to the opposite banks.

7. The Demonstration Project is intended to show how property can be protected with due regard and respect for the physics of river morphology. This is done by adjusting the plan shape of the stream to correspond to the overall shape that the bayou is working to get to by chewing into the banks, but making the adjustments in such a way that they don't endanger homes or other improvements along the way. By making the adjustments at one time as a construction project, the massive amounts of material that the bayou would otherwise chew out of the banks as erosion does not clog up downstream reaches of the bayou. The bed of the bayou is also adjusted to correspond to the new plan-form, with deeper pools at the outer bends and shallower riffles between the bends; this bed profile is important to match to the plan shape of the bayou; otherwise the energy in the stream will work to create a riffle/pool sequence on its own, but it might not initially match the plan shape and it might continue to try to change the plan shape, causing more erosion.
8. This kind of stream restoration work attempts to use only the natural soils already in the bed of the stream and only natural woody material along the outer bends and in the riffles, to help resist erosion right after construction, to help roughen the bend so that the higher energy fast water is moved slightly away from the soil surface of the bank, and, importantly, to enrich the riparian habitat for small fish, reptiles and benthic creatures. Native trees and riparian vegetation is planted back along the banks, tight up against the outer bends so the root systems help secure the bank and so the shade of the branches cools the pools, and further back from the banks on the sandbar side of the bend so that high flows can pass across the bar naturally.
9. The stream restoration work will be messy during construction, but if properly planted with native riparian plants, the work area quickly recovers its lush riparian qualities, and provides better habitat than is provided by a rapidly eroding and degraded stream system. This is something new for our region, and it is why we are calling it a Demonstration Project. We need to examine the project closely, and we need to make adjustments to it as it is underway if necessary, and we need to be sure that the project has adequate follow-up to measure the success of the project from all standpoints; a reduction in erosion and excessive sediment and turbidity in the bayou; re-growth of the riparian and upland native vegetation; reestablishment of wildlife habitat, and improved water quality.
10. Although there are projects in the region that have used some of the principles of fluvial geomorphology, and although they are very different projects, there are lessons from each that we should learn from.
  - a. Sometime in the mid 1990's the footbridge on the north bank of Buffalo Bayou near Glenwood Cemetery was in danger of washing out. An engineering firm replaced the wooden bridge with a steel truss bridge, and re-established the bank of the bayou upstream and downstream of the bridge using a toe of rip-rap and terraces of MSE (mechanically stabilized earth) walls. This is a system of reinforcing the soils with geo-textiles and supporting the front face with a wire mesh (not the same as gabion walls). The bayou bank looked very 'engineered' right after construction, but in a few years, after silt had covered over the terraces and self-sown Green Ash and other trees grew in the silt, and the bank looked completely natural. The lesson here is that that even with an engineered system to protect a piece of infrastructure, and even with no deliberate re-vegetation, nobody could tell that it was not a natural bank.
  - b. The Meyers Park project on Cypress Creek was the first project in the county to deliberately re-establish a fluvial geomorphologically correct flood-bench and riffle/pool sequence to reduce the heavy erosion that was occurring along the park. This project demonstrated the basic rule that coastal streams like ours need to be able to flow out onto a flood-bench at the "channel-forming

flow" which is about a two year storm. The flood benches were excavated, and ephemeral wetlands were created along the benches. Riparian trees were planted along the banks and on the flood benches. The initial work appeared very 'engineered', but the first phase is now beginning to grow in, with the trees growing up and vegetation getting well established along the banks. Although the HCFCD required the use of Bermuda grass to initially stabilize the channel, the riparian vegetation has all but obliterated the Bermuda grass along the banks and the channel is appearing more 'natural' with each passing year, but is now a stable channel without the excessive use of concrete or steel.

- c. The Buffalo Bayou Park, between Sabine and Shepherd Streets, is currently under construction and the nearly completed segments where the HCFCD contractor is working are only in their initial post-construction condition. Fluvial geomorphologists were part of the Flood Control's design team and care was taken to absolutely minimize the amount of new structures in the bayou channel as they work to remove silt and to partially re-establish some of the historic bends of the bayou. Here, as along Cypress Creek, the District required the use of Bermuda grass for the initial erosion control and bank stabilization.

A large number of native riparian trees are being planted along the new banks such that there will be an almost continuous canopy of trees along the bayou again. The surface of the ground will receive additional tree and understory plantings as a part of the Buffalo Bayou Partnership part of the project, and it is the intent of the design for the immediate banks of the bayou to NOT be mowed on a regular basis (mowers will not fit between all the trees), but only to receive enough vegetation management to restrict the amount of ragweed and invasive vegetation along the banks.

Just upstream of Sabine Street, along the south bank, a pilot planting area was established a year ago, with dozens of very small Cypress, Ash, Sycamore trees were planted, along with a long list of native riparian understory vegetation. With only a year under our belt, and a very dry hot year at that, it is still too early to know what we have learned from this planting, but we hope to find out which native plants are most likely to thrive in these conditions and to provide a framework for a long-term healthy native riparian ecosystem.

11. The Memorial Park Demonstration Project wants to be different from these other projects; having learned from them that the basic principles work as predicted by the science here with our climate, soils and vegetation, we want the Demonstration Project to be a model of how to set the framework for the restoration of a natural, and "wild and woolly" stream corridor. If the project is successful once it is completed and allowed to mature, this kind of stream restoration might be an effective alternative to the often not so effective structural solutions used as band-aids for individual property owners. We will need to work with the HCFCD and their designers and contractors to build on their fluvial geomorphologic foundation and "roughen" up the finish product with the creation of habitat structures, micro topographic features, and more complex planting schemes. The BPA and the Memorial Park Conservancy might need to help design and maybe even to help fund some of these additional ecosystem features.
12. A denial of the science of fluvial geomorphology, a denial of the unbreakable link between the watershed and the bayou, a denial of the very real changes the bayou is going through right now, and a denial of the very real urges and rights of property owners and government agencies to protect their assets from losses due to an encroaching and eroding bayou.....

... will condemn the bayou to walls of concrete, bags of cement, banks of concrete rubble and steel sheet piles, each just making the problem worse for neighbors across the bayou, and for those upstream and downstream, in an ever intensifying battle against the soul and spirit of Buffalo Bayou.

We HAVE to find the right tools so a natural Buffalo Bayou can co-exist with an increasingly urban watershed and population! The Demonstration Project is just a step in that direction.