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Technical Memorandum

To: Chris Warn, Doug Robison

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Re. Headwater Streams

Wood Project No. 600542

ISSUE

Approximately 75% of peninsular Florida's first and second order streams (e.g. headwater streams) have been biophysical impaired by a variety of human stressors (Kiefer et al. 2015[1]). This is a particularly troubling statistic given that about 90% of streams in west-central Florida are headwater systems.

Extensive direct alterations contribute significantly to the observed biophysical impacts. These have historically included partial to complete replacements of natural streams and wetlands by ditch and canal diversions (Kiefer et al. 2015).

Indirect impacts are also severe, and typically include hydromodification in the watershed caused by artificial drainage ditch networks and by excessive stormwater flow as part of urban runoff. In other words, streams can be severely impacted by watershed impacts even absent direct modification to the waterbody. The adverse impact of urban runoff is so globally pervasive, it is referred to as 'urban stream syndrome.' Hydromodification brings excessive fluvial forces into the receiving valley, leading to stream erosion and habitat loss. This affects a variety of unnamed headwater streams and many named mid-order streams downstream of the headwaters. In some cases the induced erosion can incise the stream channel so severely that it no longer hydrologically connects with its floodplain. The altered runoff also brings significant pollutant loads to the stream while it is simultaneously compromising the system's ability to naturally process or sequester portions of the load.

The combined result of watershed and waterbody modifications is that a once biophysically complex lotic system consisting largely of chains-of-wetlands has been homogenized into a series of straight channels that efficiently carry water to the tide without providing much of the predevelopment habitat support and water quality transformation of the flow. The water has lost much of its historic contact with wetlands and the meandering stream channels once connecting them. Not only does that hydraulic simplification represent a substantial loss in inland geodiversity and biodiversity, it is highly plausible that the altered drainage system is a major driver of increased harmful algal blooms (HAB) in coastal receiving waters. For comparison, stream restoration has become a standard best management practice and significant component of the Chesapeake Bay nutrient and sediment Total Maximum Daily Load (TMDL) (Schueler and Stack 2014[2]), which was established specifically to suppress HAB in that estuary. It stands to reason that analogous estuarine benefits could be achieved via stream restoration in Florida watersheds.

RECOMMENDATIONS

The primary proposed restoration strategy focuses on prioritizing activities in the 100-year hydraulic floodplain of named streams. Such systems typically consist of the watershed's longer, wider, and most geodiverse riparian corridors. They naturally encompass a dynamic and diverse patchwork of upland, wetland, and aquatic habitat dispersed within in the hydraulic floodplain. Thus, these systems can strongly support wildlife corridor objectives.

It is important to recognize that the hydrology and alluvial habitat surfaces of these larger complex stream valleys depend on the cumulative delivery of flow and sediment from headwater streams. Because headwater streams are in the most extensive and most direct contact with land use activities, healthy headwaters are typically required for healthy downstream rivers.

Therefore, we recommend adding headwater stream restoration as a point of emphasis for improving habitats in the Charlotte Harbor watershed. Priority locations should be selected holistically in concert with determining priority named stream corridors. Prioritization should also account for lagged responses and tipping points in fluvial geomorphic adjustments. In many cases a press disturbance exists above a critical threshold for harm, but the harm does not occur until a trigger occurs to release it. This occurs in Florida streams because the degree of vegetative resistance to erosion is substantial, and it may take an event like a hurricane to set it back and create the open wound from which the system cannot recover under an ongoing artificial flow regime. In that scenario, the adverse flow regime is not strong enough to overcome native vegetative controls, but is strong enough to prevent their subsequent recovery from a pulsed disturbance. In another common tipping point scenario, a stream may artificially incise for decades with little measurable environmental impact before it suddenly reaches a tipping point beyond which it either loses connection with its floodplain, or its banks can no longer support their own weigh and start collapsing.

Lag and tipping point effects lead to a prioritization as follows:

1. Scenario 1. Conserve named stream corridors in relatively good condition with damaged headwaters and develop a master plan to restore and conserve the headwater systems before adverse adjustments can develop in the named streams. This appears to be a somewhat common scenario, and is likely to be time sensitive.
2. Scenario 2. Restore systems with both damaged named streams and headwaters. This scenario offers conditions with the largest need and investment for recovery, but is perhaps the least time sensitive scenario for the inland stream corridors themselves. That may change in areas subject to planned urban developments in the headwaters, where permitting agencies may wish to negotiate restoration set-asides or onsite mitigation to promote headwater restoration on a timely basis that may be otherwise precluded once the development occurs and lateral encroachment prevents sufficient width of restoration activities along the drainage system. In some cases, this scenario may also represent the

most time critical needs for protecting and improving water delivery to coastal ecosystems. In general, it may make little sense to restore the downstream systems prior to achieving a critical mass of headwater restoration under this scenario, especially if hydromodification is causing erosion in the named stream, or land use is causing excessive sediment delivery.

3. Scenario 3. Restore damaged named stream corridors with intact headwater systems and simultaneously work toward conserving the intact headwater stream corridors. This is unlikely to be a common scenario, but should be prioritized where it is observed in areas subject to planned urban development in the headwaters.

In summary, headwater streams should be viewed as essential appurtenant structures of their downstream named creeks and rivers. Thus, restoration of the 100 year floodplain of named stream corridors patently includes considerations of the departures of their headwaters from a natural condition and a mechanism for addressing them.

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[1] Kiefer JH, Mossa J, Nowak KB, Wise WR, Crisman TL, and KM Portier. 2015. Peninsular Florida Stream Systems: guidance for Their Classification and Restoration. Final Report. FIPR Institute PN 05-03-154R. Bartow, FL. 696 p.

[2] Schueler T and B Stack. 2014. Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects. Approved by the Chesapeake Bay TMDL Water Quality Goal Implementation Team.