

Appendix D

Creeks and Streams

The Value of Creeks and Streams in the Urban and Semi-Urban Environments

Water availability for domestic, industrial, agriculture, as well as ecological use is important from a quantity *and* quality point of view. In fact, water has become a scarce commodity which has far-reaching impacts on the future of all communities, especially in Texas. Uncontrolled land development, water overuse, and pollution continue to impact this precious and primary life supporting element. Planning on all levels should be cognizant of the effects of our actions on the future of water availability.

Communities need to realize that good stewardship of water is crucial to ensure sustainable economic growth including safety, health, and welfare to everyone. Ideally, state, county, and municipal planning should take place on a watershed scale where the source, use, and disposal of water are all integrated. The goal of such an approach is sustained availability of good quality water, effective flood management, and ecologically healthy environments, with tremendous recreational opportunities.

Specific tools to achieve effective watershed management include the protection of riparian/creek buffers and integrated storm water management.



The creek corridor that runs through the Wells Property is in a very healthy condition. Monitoring upstream development and the sensitive development of the Wells Property is crucial in order to maintain the ecological viability and natural beauty of the creek.

Buffers Along Creeks and Drainage Ways

References:

Riparian Buffer Strategies for Urban Watersheds: Metropolitan Washington Council of Governments; 1995.

Stream Corridor Restoration: The Federal Interagency Stream Restoration Working Group.

The Wylie Parks, Recreation and Open Space Master Plan recommends that riparian buffers be established along all creeks and drainage ways in the City of Wylie and its ETJ as a measure to protect the fully developed 100 year flood area as an important resource for the City. The value of such corridors is manifold and includes the following:

- Flood conveyance and management
 - Natural streams have developed over time to absorb flood waters and to release them gradually once the flood has subsided. In fact, wetlands and riparian vegetation act as sponges that take up the water, hold it and release it slowly as it drains through the vegetation. Maintaining the natural vegetation within creek corridors contributes to less intense floods, less erosion, and more stable stream banks.
- Creek morphology
 - Creeks and drainage ways are by nature dynamic which means that they change course over time as the rushing water of large floods carves its way through the landscape. A proper riparian buffer allows for this dynamic change without impacting property and structures.
 - Upstream development typically leads to higher intensity floods that increase the 100 year floodline over time. A wide riparian and creek buffer takes into account the future elevated 100 year floodline based on fully developed and build-out land use conditions in the watershed.



Well established riparian buffers add to dam safety.

- Safety
 - Structures within creek corridors including buildings, bridges, and dams are all potentially in danger of being damaged or destroyed during floods, depending on the size of the particular flood event. Where bridges and dams by their very nature are built within corridors, habitable structures should be located outside the build-out 100 year floodline as a safety precaution.

- Wide riparian corridors have a definite positive effect on dam safety ó well established riparian corridors upstream of a dam decrease the chance of dam failure: Should a dam failure occur, the resultant downstream damage will be reduced with the floodwater absorbed by the wide riparian corridor. This is a particularly important point for Wylie with the various soil conservation dams within the city limits.
- Health and water quality
 - Water quality in streams and creeks is typically a factor of the quality of water entering the system and the manner in which vegetation in the watershed öcleansö the runoff before it enters the creek. The excessive use of fertilizers and pesticides within a watershed, leads to low water quality entering the streams and creeks. In an intact system, vegetation, especially native grasses, filtrate the runoff prior to entering the creek and stream. However, it is crucial that the riparian buffer is in place to ensure such filtration.
 - Riparian buffers lead to reduced nutrient load of streams which effects water quality. This, in turn, prevents the development of algae blooms in lakes.
 - Riparian buffers prevent excessive sediment loads in streams which, in turn, decrease the possibility of sedimentation of lakes.
 - An ecologically intact creek and drainage way system has a natural predator and prey system in place whereby insects like mosquitoes are preyed upon by reptiles, birds and bats. However, habitat disturbance through excessive erosion and concrete lined channels, causes a loss in the predator species which leads to excessive insect populations. Considering the mosquito born West Nile virus it is thus important to keep the creek corridors healthy by encouraging the protection of the riparian vegetation.
- Economy
 - Economics are important in the protection of structures by their construction outside the 100 year floodline based on build-out conditions.
 - Stable stream banks preclude expensive measures to prevent or fix failing stream banks.
 - Reduced flood damage means fewer costs.
 - Property facing or adjacent to open space is more desirable and expensive which leads to increased tax income.
- Ecology and habitat preservation
 - Riparian buffers typically preserve some of the natural breeding, foraging, and resting areas of native animals and bird species.
 - Riparian vegetation adds to the diversity of life within streams, wetlands, and lakes.
 - The edges where two ecological zones meet are extremely important from a vegetation and wildlife dynamic point of view. Animals from the one zone may forage in the one while resting in the other, and plants are often adapted to that specific edge zone. The edges of creeks and other water bodies are thus important where the water and land ecosystems are supportive, enriching, and dependant on each other.
 - The variety of habitats within creek corridors leads to greater diversity of wildlife.
 - Riparian vegetation typically includes multi-layered habitats including trees, shrubs, grass, and herbaceous plant material, which increases the biomass and diversity of the landscape.
 - Riparian vegetation provides a variety of functions related to aquatic habitat including:
 - ó Providing food source for species of the aquatic food chain;
 - ó Regulating light and temperature entering the water body. Many species have a low tolerance for temperature or light change beyond the normal range;
 - ó Maintaining oxygen concentrations in water through temperature regulation;

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- 6 Preventing sediment from inundating water bodies, which interferes with fish behavior and destroys benthic habitat.
- Recreation
 - Creek corridors provide visually appealing environments.
 - The linear nature of creeks and drainage ways render them ideal for hike and bike trails, both hard and soft surface trails.
 - Linear creek corridors with an associated trail system link various destinations within the City with better interaction between neighborhoods, schools, and parks.
 - The variety of wildlife found within creek corridors leads to the opportunity for wildlife viewing, including birding.
- Education
 - A myriad of natural processes is very visible along creeks and creek banks, all of which is ideal for educational purposes.
 - Students and the public may learn about the vegetation and wildlife of both terrestrial and aquatic environments, the process of natural erosion and deposition, stream morphology, and water quality.
- Utilities
 - Areas that parallel creek corridors provide the opportunity for utility corridors with permeable surfaces including water, sewer, overhead power, and telephone lines.
 - Such utilities should be located outside the 100 floodline at build-out conditions to prevent future damage that may result from floods and to limit aesthetic interference due to above ground items.
 - Measures must be taken to prevent impacts on the recreation and habitat integrity within the creek corridors. Disturbance of vegetation must be minimized during the construction phase of placing the utilities.

Riparian Buffer Criteria

The ability of a riparian/creek buffer to realize its many benefits depends on how well it is planned, designed and maintained. As development is considered for properties, the following provide some criteria in this regard.

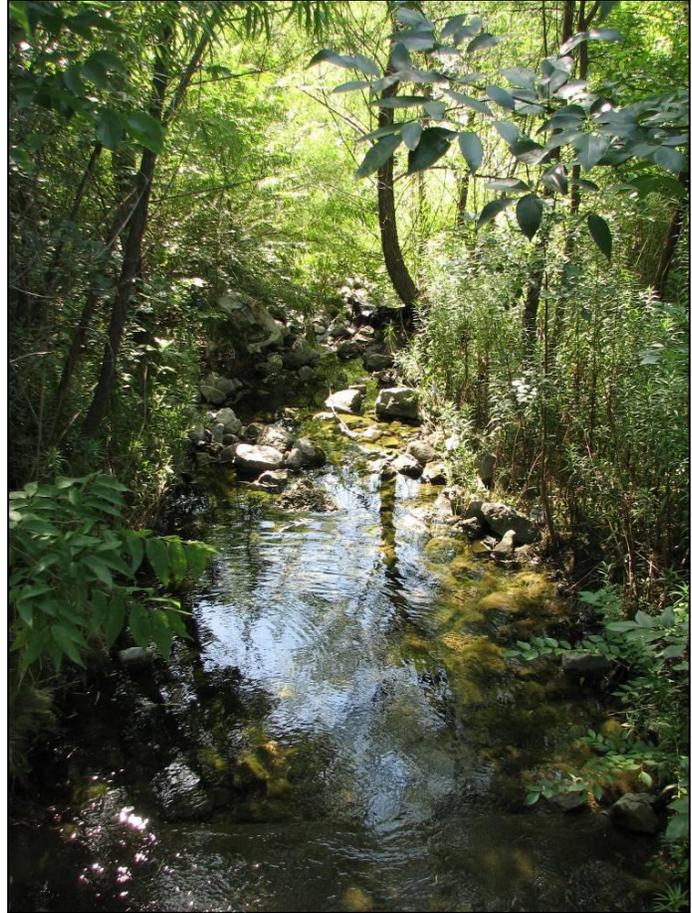
Riparian Buffer Dimension

For creek corridors, a wide riparian buffer is an essential component of any protection strategy. A network of buffers acts as the right-of-way for a creek and functions as an integral part of the creek ecosystem. The primary criteria for buffer sizing should be ecological but may also include economic and legal factors. However, the danger is that economic and legal considerations may compromise the very essence of what constitutes a healthy ecological creek corridor. With creek corridors in the City of Wylie considered a crucial natural resource all factors should be considered when establishing the riparian buffer dimension, including habitat integrity, ecological services, recreation, and aesthetics including views and vistas. Due to unique local conditions, the riparian buffer may vary as deemed appropriate.

Three-Zone Buffer System

The primary aim of the buffer system is to protect the core of creek corridors including the stream channel, its banks, the 100 year flood area with vegetation adapted to flood conditions, as well as an upland buffer area that is crucial for the health of creek systems. Protecting the entire area below the 100 year floodline together with an upland buffer, ensures the protection of current creek conditions, as well as the anticipated changed conditions in the future. The upland buffer outside the 100 year floodline is divided into 3 lateral zones: stream side, middle zone and outer zone. Each zone performs a different function, with a different vegetative target and management scheme.

1. The stream side zone has the function to protect the physical and ecological integrity of the stream associated ecosystem. It adds visual and ecological protection through preservation of views, wildlife habitat, and noise abatement. The vegetative target is the pre-development natural condition including range land with low key recreational development including hike, bike, and equestrian trails.
2. The middle zone provides additional distance between upland development and the stream ecosystem and is available for utilities with no impervious surfaces, open space development including ball fields and golf courses, and storm water management including retention/detention basins. The vegetative target is natural pre-development conditions or unfertilized dry land cultivation and range land.
3. The outer zone is available for a parkway collector street system. Such a parkway has four major functions. First, it will serve as a buffer between development with potentially manicured landscapes and the natural creek corridor environment. Secondly, it will provide easy access for maintenance. Thirdly, the parkway will improve local traffic circulation. Fourthly, the parkway will provide a leisurely route connecting the parks, schools and neighborhoods along the creek corridor. The pleasing vistas along the creek corridor allow for scenic drives and improved neighborhoods. In fact, similar projects in other cities have enhanced property values along the route.



This stretch of Sage Creek is an example of an ecologically healthy creek with ponds and riffles, shade and moss covered stones that add to the quality of benthic (water associated) insect life.

Drainage Area

It is recommended that creek corridors and riparian buffers are applied to all creeks and streams from a point along its course where the creek or stream drains a surface area of 100 acres or greater. For any drainage area smaller than 100 acres, it is recommended that the practices as defined in the iSWM (Integrated Stormwater Management) design manuals for construction and for site development as prepared by NCTCOG (North Central Council of Governments) should be applied.

Buffer Crossings

Major objectives for riparian buffers are to maintain an unbroken corridor of riparian habitat and to allow for upstream and downstream movement of both aquatic (including a fish passage) and terrestrial wildlife along the creek corridor. Where linear forms of development such as roads, bridges, underground utilities, enclosed storm drains, or outfall channels must cross the stream or the buffer, measures must be put in place to minimize blocking the aquatic and terrestrial wildlife passageway including extended bridge spans.

Buffer Management

The general vegetation target for the land that involves the 100 year flood plain and upland buffer is pre-agricultural development/ modifications. Treated correctly, such vegetation cover requires the minimum management effort. In order for the burden to not fall on the City or individual landowner, it is recommended that management be done by one of the many Texas Land Trusts that will have an interest in such land. (see www.texaslandtrusts.org)

No Rise in Base Flood Elevation

It is recommended that the reclamation of the 100 year floodplain at fully developed conditions should be permitted only if it can be demonstrated that there will be no rise in the base flood elevation of fully developed watershed conditions. The FEMA "floodway" concept contained in the National Flood Insurance Program allows up to a one foot rise in flood elevations assuming current development conditions only. However, reclamation which allows a rise in the flood elevation could predictably create adverse impacts either upstream or downstream. Also, without due consideration of future upstream build-out conditions, which imply increased impervious surfaces with higher volumes surface runoff over shorter periods of time, areas that appear adequately protected with the "No Rise in Base Flood Elevation" may be compromised in the future.

Creek Confluences

Creek confluences typically have unique natural and visual qualities due to the increased channel length per surface areas, widened floodplain, the potential occurrence of wetlands, dense stands of trees, and increased wildlife. Such areas, also referred to as "ecological nodes", call for their special protection in the form of nature parks and nature preserves. The Wells Property is a very good example of such an ecological node where a tributary joins the Muddy Creek.

Watershed Management Plan

As much as it is important to ensure the protection of the creek and drainage way corridors and nodes, it is also vitally important to follow a watershed wide approach to stormwater management and landuse planning. Watershed management suggests measures in place that aim

to decrease the amount of hard and impervious surfaces which result in higher frequency and intensity of runoff, as well as water detention that absorbs the runoff peaks allowing it to drain slowly and over time into the creek system. Together with watershed wide measures, proper site design of each and every development is essential to obtain the best results.

The manner in which development occurs in the watershed is crucial. Due consideration should be given to every component that may contribute to increased runoff volumes and intensity. Two complimentary tools that are effective to achieve watershed management are Integrated Stormwater Management and Conservation Development.

Integrated Stormwater Management

Recognizing the importance of water quantity and quality, the North Central Texas Council of Governments, developed iSWM (Integrated Stormwater Management) design manuals for construction and for site development that assist cities and counties to achieve their goals of water quality protection, streambank protection, and flood control. They also help communities meet their construction and post-construction obligations under state storm water permits, current and emerging. (see <http://iswm.nctcog.org/>)

The Integrated Storm Water Management (iSWM™) Approach

Source: <http://iswm.nctcog.org/index.asp>

Development and redevelopment by their nature increase the amount of imperviousness in our surrounding environment. This increased imperviousness translates into loss of natural areas, more sources for pollution in runoff, and heightened flooding risks. To help mitigate these impacts, more than 60 local governments are cooperating to proactively create sound storm water management guidance for the region through the integrated Storm Water Management (iSWM) program.

The iSWM design manuals for construction and for site development are cooperative initiatives that assist cities and counties to achieve their goals of water quality protection, streambank protection, and flood control by managing stormwater on a site-by-site basis throughout all phases of development.. They also help communities meet their construction and post-construction obligations under state storm water permits, current and emerging.

- The iSWM Design Manual for Construction contains a systematic methodology for creating an effective storm water pollution prevention plan for construction sites and detailed information for the design, installation, and maintenance of practices to reduce the release of sediment and other pollutants resulting from construction activities. The Design Manual for construction is also intended to assist public and private entities in compliance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit, TXR 150000, issued by the Texas Council on Environmental Quality (TCEQ).

Cities in the region are encouraged to officially adopt the Design Manual for Construction and require compliance with the provisions of the Design Manual within their jurisdictions. Adoption of the Design Manual for Construction will fulfill the major requirements of the Construction Site Storm Water Runoff Control Minimum Measure

of TPDES General Permit TXR040000 for Small Municipal Separate Storm Sewer Systems.

- The iSWMÎ Design Manual for Site Development is a step-by-step detailed instructional document to guide developers and government agencies on the control and management of storm water quality and quantity. It is a practical manual oriented to implementation in everyday practice.

It calls for the consideration of storm water issues at the conceptual stages of projects and provides tools to achieve the goals of water quality protection, streambank protection, and flood control. Its adoption in the region will simplify engineering designs, minimize local government plan review efforts, facilitate multi-jurisdictional drainage analysis, and enable regional training opportunities.

Further Studies

Reference: Linear Greenbelt Park Study: City of Allen, Texas; 1986.

For purposes of establishing an integrated riparian corridor and greenbelt system for the City of Wylie, a Creek and Linear Greenbelt Park Study is recommended. It is recommended that such a study include the following components:

1. Floodplain Delineation
The flood plains of all creeks defined and delineated as the area inundated by either the 100 year flood based on a fully developed watershed condition, or the maximum flood on record, whichever reaches the higher water elevation.
2. Environmental Inventory and Analysis
Study areas to include:
 - a. Physical features (geology, topography, soils, climate);
 - b. Biological features (vegetation and wildlife);
 - c. Man-made features (history, archaeology, streets, buildings and utilities); and
 - d. Scenic values.
3. Stream segments
Homogenous segments with similar landform, unique water features, common vegetation, wildlife habitat, scenic features, and divisions made by existing roadways.
4. Stream Corridor Delineation
Delineation of the 1% and 0.2% flood events.
5. Stream Corridor Alternatives
Flood plain and stream corridor management
6. Implementation Strategy
Supporting and additional information may include:
 - a. social, cultural, legal, and governmental influences;
 - b. land use planning along creek corridors;
 - c. funding;
 - d. public participation; and
 - e. landownership issues.

The Linear Greenbelt Park Study that was conducted for the City of Allen in 1986 is proof that early planning efforts lead to superior city development conditions. Based on this 1986 study,

the City of Allen has ordinances and regulations in place that ensure the optimal protection and use of creek corridors. The end result 24 years later is a noticeable quality of life experience for its citizens that surpasses many other cities in the region. The vision for the City of Wylie is to build on the experience of this Texas city and to incorporate exemplary and functional practices that will ensure the protection of its natural resources for the enjoyment and appreciation of future generations.



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