



*The Canals of Jefferson Parish*  
A NEW DESIGN VOCABULARY

## Concept Statement



When the system of drainage canals in Jefferson Parish was established in the early twentieth century, it is doubtful engineers and planners could have predicted how development would impact the region a hundred years into the future. The draining of the swamps and marshlands of Jefferson Parish has left the Parish with a small water 'footprint,' relying on massive pumping capacities to drain the small-storage canals during and following heavy rainfall events. An unfortunate byproduct of the canal system's design, whether intended or not, is that stormwater has become viewed as an undesirable element to be collected and disposed of rather than as a valued resource. Because the drainage system has always been treated strictly as a flood control operation, the physical environment has often suffered. Our design concepts seek to introduce a human element to the drainage system, one which enhances aesthetics, improves environmental quality and creates wildlife habitat.

This design proposal calls for enhancements to be situated within the canal's right-of-way. Barring a dramatic redesign of the Parish's drainage infrastructure, our design team is working within the context of the drainage system as it exists in the 21st Century. While some proposals may advocate converting additional

off-line land resources to serve as water retention and detention to increase the water storage within the Parish with less reliance on pumping, we recognize that these ideas are above and beyond the scope of this competition. Thus, we are assuming a fixed area in which to recommend improvements – within the present ROWs of the canals. Improvements may go beyond beautification; indeed, enhancements proposed in this proposal will establish a legible 'vocabulary' amongst typical elements that make up the canal corridors. Proposed enhancements may also help to reestablish varied wildlife habitats, reduce erosion and improve water quality, provide opportunities for recreation, and give prominence to art in the landscape. It is our hope that these amenities will be implemented, in turn, making the drainage canals an attraction that will become a vital part of our physical environment. While the geographic focus is Canal #2 between Lake Avenue and Causeway Boulevard, concepts presented within this design proposal may be applied to any number of canals within Jefferson Parish.

Jefferson Parish's canal system offers an opportunity to create a unique amenity for the people of the parish to enjoy. Our team believes that it is critically important to transform the drainage canals into sustainable and beautiful corridors that will lead to a healthier community and environment.



## Table of Contents

- 1 Existing Conditions - The Problems
- 2 Design Treatments
- 3 Master Plan
- 4 Plant Palette
- 5 General Costs

# 1 Existing Conditions – The Problems



As was mentioned in the concept statement, the only real current function of the canals and additional land within the ROWs is to facilitate drainage towards the Lake Pontchartrain pump stations at the outfall canals. A survey of existing conditions along Feeder Canal #2 reflects this singular purpose in many ways. Numerous exposed drainage outfall pipes, usually extending far from the canal embankments, are frequently cited as being eyesores by those in the community. Not as numerous, yet equally unsightly, are the utility crossings spanning the canal. While it is necessary that potable water service, gas, and sanitary sewer lines cross over the canal into other neighborhoods, there are ways in which it can be addressed in a more context-sensitive manner. Another problem with the canal is its ragged, uneven edge character at the water line in certain areas. Also of considerable importance are the seven small bridges that span the canal within the study area.

Canal right-of-ways in Jefferson Parish north of I-10 typically range in width from about 50' to over 200'. The wetted perimeter or water footprint of the canals in this area ranges from 35 to 185 feet in width at normal water elevation. Canals are usually bounded by roads or residential or commercial land uses. Canal #2 is bounded by roads: the west and eastbound lanes of West Esplanade Boulevard.

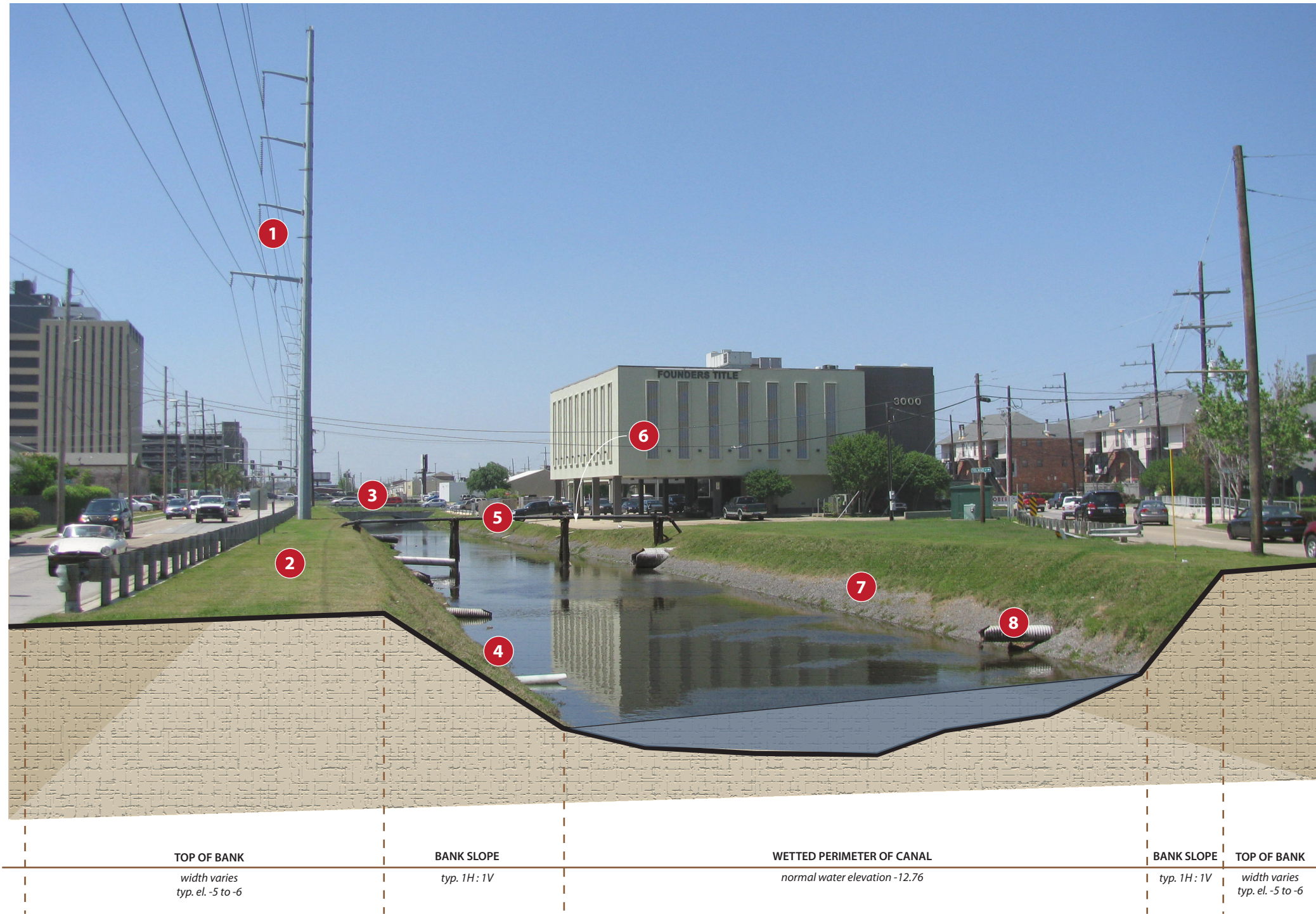
Our team has identified seven zones within the canal's right-of-way: the right and left top of bank ("TOB"), the right and left bank slopes, the right and left edge or toe, and the water profile or wetted perimeter. The water profile will generally be defined as the normal water elevation, -12.76 NGVD (+8.5 Cairo Datum) combined with the depth profile of the canal bottom.

The TOB is the section of the canal defined as a generally level area lying between the curb along the roadway and the point where the bank begins to descend to the water's edge. Dimensionally, this is a highly variable area, ranging from virtually 0' in width in places to wide areas that may measure 70' or more. The descending banks are often grassed, dropping off to the edge typically at a 1H : 1V slope, or thereabouts. This can vary, though, with several areas having bulkheads or sheet pile forming all or part of the bank slope profile.

Our design team has grouped the canal into different segments, or zones, marked geographically according to intersecting cross streets. Because the character of the canal right of way varies in terms of widths, utility layout, and other factors, our design team thought it beneficial to classify canal segments having similar properties. Terminology of "left" and "right" is assuming viewer is facing eastward, beginning at Causeway and ending at Lake Avenue.

Segment A	Causeway - Tolmas	Segment E	Hesper - E. William David
Segment B	Tolmas - Melody	Segment F	E. William David - Focis
Segment C	Melody - Beverly Garden	Segment G	Focis - Seminole
Segment D	Beverly Garden - Hesper	Segment H	Seminole - Lake

- Segment A, Causeway Boulevard to Tolmas Drive, is open canal with a right top of bank that averages approximately 10' in width, although immediately adjacent to Causeway the right top of bank is wider at 30-35'. The right descending bank is sloped at 3H : 1V. The right canal edge is particularly ragged and irregular. The left descending bank is a grassed slope at 3H : 1V. Small sections (150+' length) of timber bulkhead are located near Causeway and near Tolmas cross street. The left top of bank along this segment is characterized by commercial parking areas that come right up to and abut the descending bank. Open concrete drains designed to convey stormwater down the bank and into the canal are in disrepair.
- Segment B, Tolmas to Melody, Street is open canal with a right top of bank averaging 13' in width. The grassed right descending bank is approximately 2H : 1V in slope. The left descending bank is a vertical timber bulkhead, for the most part. The left top of bank is 3-4' in width, except for a wider area near Melody, where the left top of bank is about 30'.
- Segment C, Melody to Beverly Garden Drive, is open canal with a right top of bank that flares from 10' to 35'. The right descending bank slopes at 3H : 1V, where it converges with a vertical sheet pile wall. The left descending bank slopes at 3H:1V. The left top of bank has an average width of 35'.
- Segment D, Beverly Garden to Hesper Avenue, represents the area where Canal #2 flows into the Bonabel Canal. Both canals have been placed underground in culverts, resulting in a wide neutral ground measuring 135' in width.
- Segment E, from Hesper to E. William David Parkway, is open canal with the right top of bank having an average width of 40-50'. The right descending bank is grassed with an approximate slope of 3H : 1V. The left descending bank is grassed and has an approximate slope of 3H : 1V. The right top of bank averages 20' in width.
- Segment F, from E. William David to Focis Street, is open canal with a narrow right top of bank that averages 4-5' and a right descending bank that is grassed with an approximate slope of 3H : 1V. The left descending bank is grassed with an approximate slope of 3H : 1V and the left top of slope averages 10' in width.
- Segment G, from Focis to Seminole Avenue, is open canal with a right top of bank that is paved, separated from the road by a guardrail. This paved area is 6' in width. The right descending bank is formed by a vertical sheet pile wall. The left descending bank is grassed with an approximate slope of 3H : 1V. A narrow strip averaging 4-5' in width characterizes the left top of bank for this segment of canal.
- Segment H, from Seminole to Lake Avenue, has a subsurface culvert that conveys stormwater, daylighting just west of Seminole cross street. As a result, there is level green space in the neutral ground averaging about 44 feet in width, flaring out to around 70 feet.
- Not mentioned in the above analysis, but of considerable design importance, are the seven vehicular bridges spanning Canal #2 along the study corridor. These vehicular nodes may be treated as special opportunities, and can provide needed repetition of design elements. The existing summary conditions on the following page show a composite of most issues along the canal.



## EXISTING CONDITIONS SUMMARY

This graphic shows a typical cross-section of Canal #2. There are a number of issues to be addressed, yet opportunities for improvements abound.

### KEY

- 1** Overhead transmission lines are typically 35 to 40' above the ground plane. Large steel supports stand on top of bank or on the bank slope.
- 2** The top of bank is sometimes a very narrow strip of land at 4 to 5', or is sometimes a relatively wide area, 50+'
- 3** Vehicular crossings are common across most canals in the parish. Several crossings span Canal #2; they can be an opportunity to provide visual continuity along the entire canal.
- 4** The toe or water's edge is ragged due to uneven growth of ground covers and grasses resulting in erosion.
- 5** Utility crossings spanning the canals are generally considered eyesores. There are opportunities for creative art or sculpture to make these interesting features or even signatures.
- 6** Paving for commercial parking abuts the bank slope, resulting in erosion problems.
- 7** Slopes are steep as a function of hydraulic necessity and width limitations. This leads to erosion problems with temporary solutions.
- 8** As this graphic shows, there are number of drain outfalls of varying sizes, lengths, and elevations that enter the canal.

# 2 Design Treatments



## A. Top of Bank

The top of bank (TOB) is the section of the canal defined as a generally level area lying between the curb along the roadway and the point where the bank begins to descend to the water's edge. Dimensionally, this is a highly variable area, ranging from virtually 0' in width in places to fairly wide areas that may measure 70' or more.

The width of TOB will dictate, in large part, the types and combinations of enhancements that could be implemented in this zone.

### TOP OF BANK OPPORTUNITIES



#### A-1 SHADE TREES

Opportunities exist for the planting of shade trees along segments having ample TOB widths. Establishing a mature tree canopy when possible will provide environmental and aesthetic benefits.

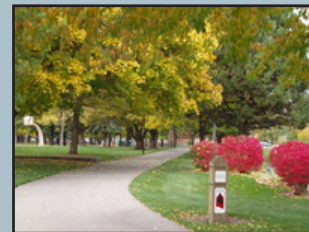


#### A-5 OPEN MEADOWS

Meadows possess a more wild, natural character than turf areas. They are typified by native grasses, forbs, wildflowers, and other herbaceous plants. These areas are managed, but not necessarily mown or manicured with any frequency.

#### A-2 SHRUBS AND UNDERSTORY PLANTINGS

Planting areas represented by small understory trees and shrubs can screen undesirable views, provide buffers, give scale, focus view corridors, as well as provide habitat and other environmental benefits.



#### A-6 ACCESSIBLE PATHWAYS

Being near water is a universal human desire. Affording people of varying ages and abilities the opportunity to walk along the water's edge in safety is something that should be considered where conditions for pathway development are favorable.

#### A-3 GROUND COVER

Where TOB is 5' or less in width, ground covers (<2' height) may be planted instead of turfgrass. Once established, ground cover vegetation may require less maintenance than turfgrass, and may spread down the bank slope to aid in bank stabilization.

Minimum TOB width for pathway construction is 25' for a typical concrete 5' width walkway to allow for adequate separation from the road, to allow space for trees to grow, and for maintenance access to the canal.

#### A-4 TURFGRASS AREAS

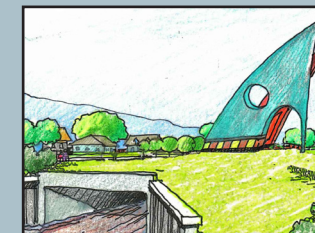
Bermudagrass and other species of turf is and will continue to be an important ground covering on the TOB. Other hardy, drought-tolerant varieties, such as buffalo grass, should be considered. A major constraint is the high acidity present in the drained, organic soils in this part of the parish.

Other factors, such as pedestrian safety at intersections and crossings, should be taken into account when planning pedestrian infrastructure within the canal ROW.

#### A-7 CONTEXT-SENSITIVE PARKING

Commercial parking areas on the TOB near Causeway about the descending bank. Open concrete drains designed to convey stormwater down the bank and into the canal are in disrepair.

To reduce erosion and allow filtration of stormwater, retrofits of parking within 20' of the descending bank are encouraged. Permeable concrete, asphalt, or pavers are an alternative to traditional paving.



#### A-8 SPECIAL DESIGN AREAS

Vehicular crossings, termini designs at the beginning and ends of canal segments or at key nodes, and greenspace design are areas of special emphasis. Jefferson Parish should strive to create a vocabulary among these elements throughout all canal corridors. These are key locations that could benefit through the use of repeatable, structured hierarchy of plant materials, hardscape elements, sculpture, signage, and so forth. The repetition of elements will create a unified corridor, and each corridor could be unique and have its own special character through design.



#### A-9 BOLLARDS

42" bollards should be installed when TOB is less than 5 feet in width. This will provide a sense of safety and provide a visual cue or delineation between the curb and TOB.

## B. Bank Slope

We recommend that Jefferson Parish consider treating the bank slopes in a more consistent fashion. Existing conditions observed in the field reflect a hodge podge of various treatments, resulting in an appearance that is neither consistent nor aesthetically appealing. Bank slopes are covered with an assortment of steel sheet pile, timber bulkheads, grassed slopes, and rip-rapped areas.

The most common bank slope seen along Canal #2 is a 1H : 1V slope stabilized with primarily bermudagrass. It is understood that this slope is required in order to move stormwater most effectively toward the pump station. However, the way in which bank slopes are handled from a design standpoint can significantly influence the overall aesthetics of the corridor as well as provide functional erosion control.

## C. Toe/Edge

Our team recommends installing a gabion edge along the length of the canal. This will provide a clean, uniform edge and will prevent erosion from occurring.

## D. Drainage Pipes and Utility Crossings

From a visual standpoint, the most frequently occurring eyesore along the canal is the array of drainage outfall pipes extending out and over the wetted perimeter of the canal. The pipes, made up of an assortment of materials and sizes, and lying at varying elevations and angles, suggest an environment that is little-cared for. Addressing these pipes is critical.

Water, wastewater, and gas utilities which frequently span the canal are another haphazard-looking result of little to no standardization relating to design. A coherent system of cross-canal utility pipes could create a repetition of attractive elements in the landscape.

## BANK SLOPE TREATMENTS



### B-1 SEGMENTAL RETAINING WALLS

Presently there are no SRWs along Canal#2. Replacement of aging wood and sheet pile wall systems with SRWs would, if done in a consistent way, enhance and modernize the appearance of the canal's banks.

### B-2 WOOD BULKHEADS AND SHEET PILE

There are several existing areas along the canal bank where the soil is retained by wood bulkheads or by vinyl or steel sheet pile. Some are in good condition, others are in need of replacement. Since the life of wood is less than that of steel or segmental retaining wall blocks, we recommend that wood be replaced with one of these materials when the time comes to replace. Where conditions indicate installation of new sheet pile walls, we recommend a continuous concrete cap at the top of the wall. Jefferson Parish may want to consider use of a more highly articulated, "decorative" sheet pile and use planter boxes that can be affixed to the concrete cap for overhanging garden displays.

### B-3 GABION BASKETS AND MATTRESSES

Gabion systems can be attractive, alternatives to other retaining wall systems. They may, however, have limitations as retaining walls in that the required depth and number of baskets needed to retain the earth behind may exceed the space available in certain areas.

### B-4 VEGETATED SLOPES

Slopes that are either seeded with grass or are planted with other herbaceous materials and shrub massings are cost-effective, attractive, and protective against erosion. If planted, early establishment of plant materials requires geotextile support to secure bare soils. Mulching and nylon mesh can also help to retain soils during the establishment period.

### B-5 CREATE 'FLOODPLAIN BENCHES'

These could take on many shapes and forms, but the idea is to allow provide additional stormwater capacity where ROW space allows. The benches themselves could be planted with rhizomatous plants and wetland trees such as bald cypress - plants capable of filtering stormwater runoff from drain outfalls before it reaches the canal system. This would provide cleaner water entering the Lake, provide additional capacity, and create habitat, as well as providing more visual interest.



*This photo of existing drain outfalls shows two completely different treatments. The pipe on the left is similar to how all outfall locations could be treated - trimmed back close to the bank, with gabion or rip rap underneath.*

## WATER JETS

### C-1 WATER JETS

Water jets that send up a vertical plume of water emanating from the water surface will serve to punctuate the canalscape. Located at key nodes and high visibility locations, these jets will produce a big impact as well as oxygenate the water.

## RECOMMENDED TREATMENT OF DRAIN OUTFALLS AND CROSS-CANAL UTILITIES



### D-1 STORM PIPE OUTFALL TREATMENT

Trim back drain pipe to the bank slope, beveling the edge to conform to the slope of the bank. Paint the pipes black for better concealment. Install rip rap or gabion mat beneath pipe to buffer outfall area from erosive action of stormwater.

Utility pipes crossing the canal could be jacked and bored and run underneath the canal. They also could be buried and routed around the canal, crossing underneath existing vehicular bridges, where they would again be buried until they rejoined the pipe or conduit. These solutions represent major infrastructure investments if done on a large scale.

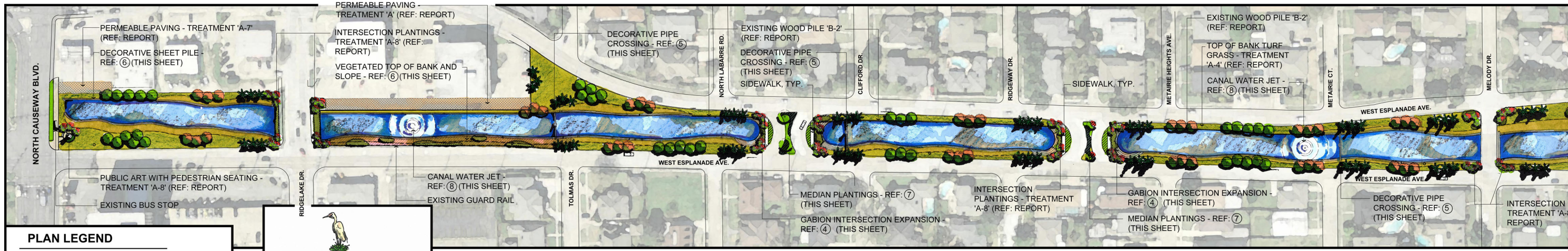


### D-2 UTILITY CROSSING TREATMENT

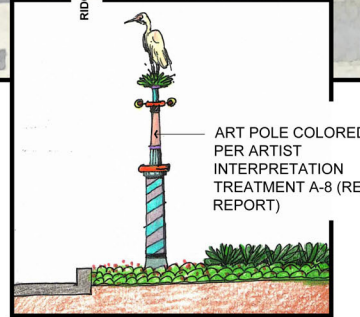
The most cost-effective option would be to keep the utility crossings in place, but address the aesthetics of the pipes and supports. All pipes and parts could be painted black, supports could be simple, using clean lines instead of clunky, heavy pilings.

Alternatively, all pipes and parts could be painted thematically, or even have sculpture mounted on the pipes. An art competition approved by governing agencies could award designs to local artists.

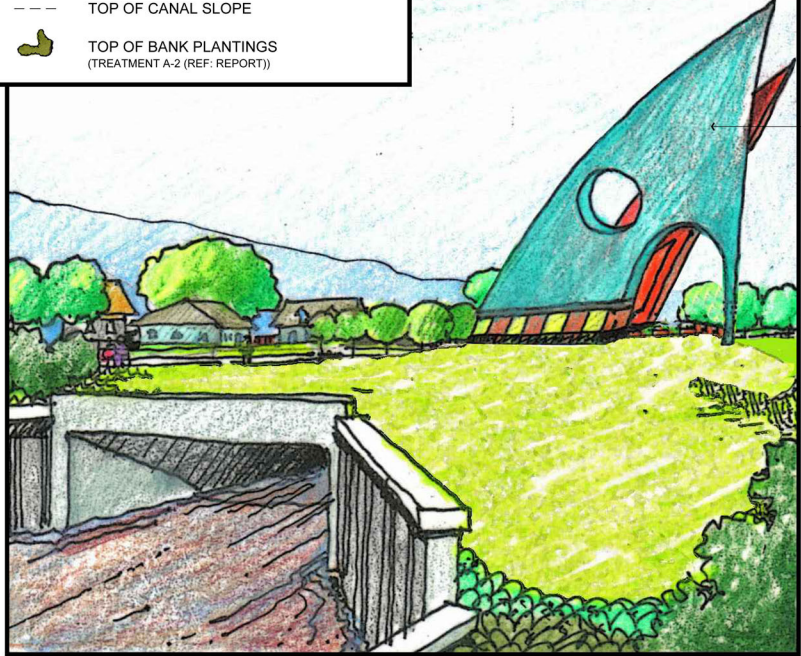
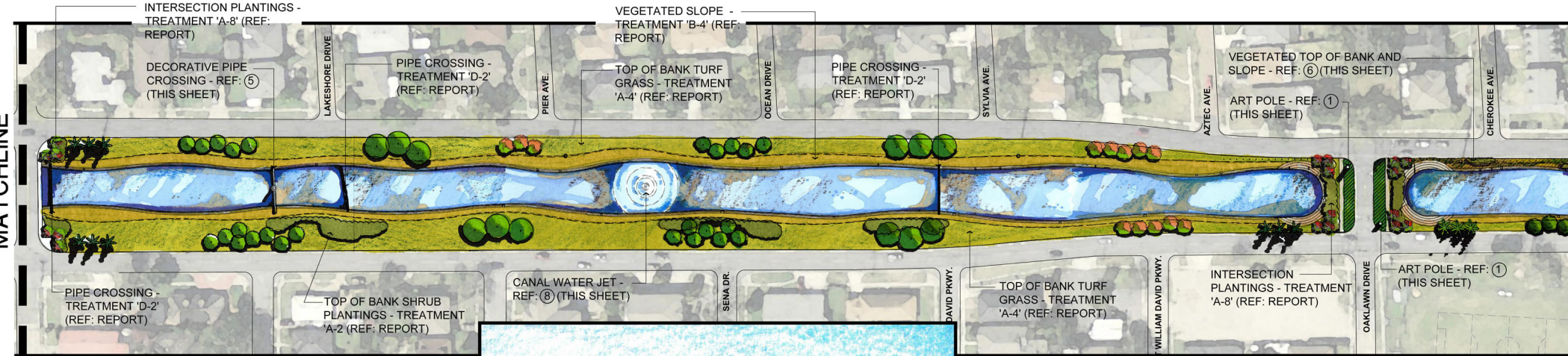
# 3 Master Plan



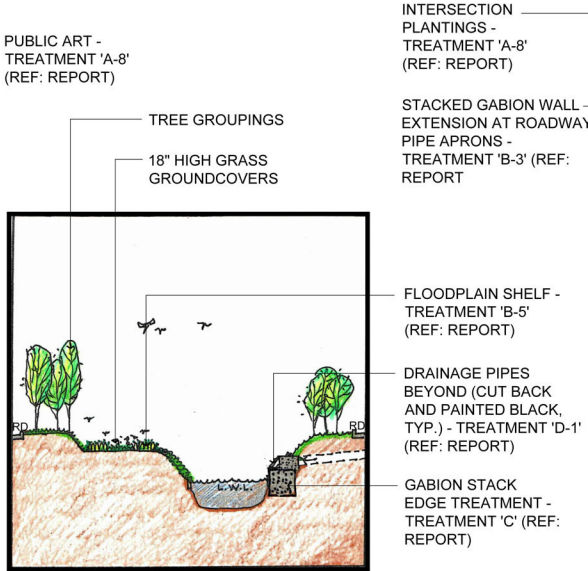
- PLAN LEGEND**
- FLOOD PLAIN BENCH GROUNDCOVERS (TREATMENT B-5 (REF: REPORT))
  - FLOOD PLAIN BENCH TREES & LARGE SHRUBS (TREATMENT B-6 (REF: REPORT))
  - INTERSECTION GROUNDCOVERS (TREATMENT A-8 (REF: REPORT))
  - PERMEABLE PAVING (TREATMENT A-7 (REF: REPORT))
  - TOP OF BANK DECIDUOUS TREE (TREATMENT A-1 (REF: REPORT))
  - TOP OF BANK PALM TREE (TREATMENT A-8 (REF: REPORT))
  - TOP OF BANK LARGE EVERGREEN TREE (TREATMENT A-1 (REF: REPORT))
  - FLOWERING TREE AT INTERSECTIONS (TREATMENT A-8 (REF: REPORT))
  - TOP OF BANK EVERGREEN TREE (TREATMENT A-1 (REF: REPORT))
  - TOP OF CANAL SLOPE
  - TOP OF BANK PLANTINGS (TREATMENT A-2 (REF: REPORT))



1 **ART POLE** : DIFFERENT LOUISIANA WILDLIFE AT ROADWAY CROSSINGS



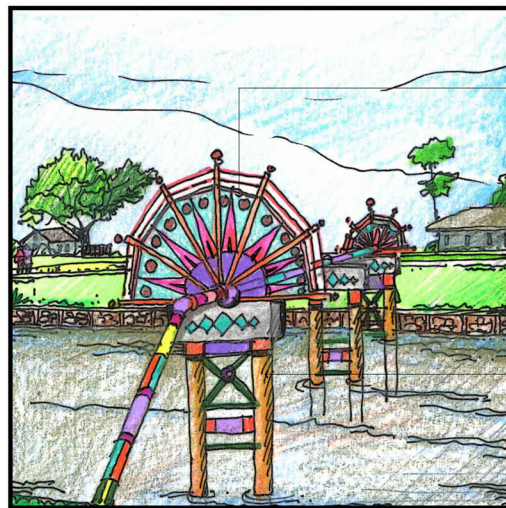
2 **PUBLIC ART** : LOCATED ON BERM WHERE OPEN SPACE PERMITS



3 **SECTION**: FLOOD PLAIN SHELF



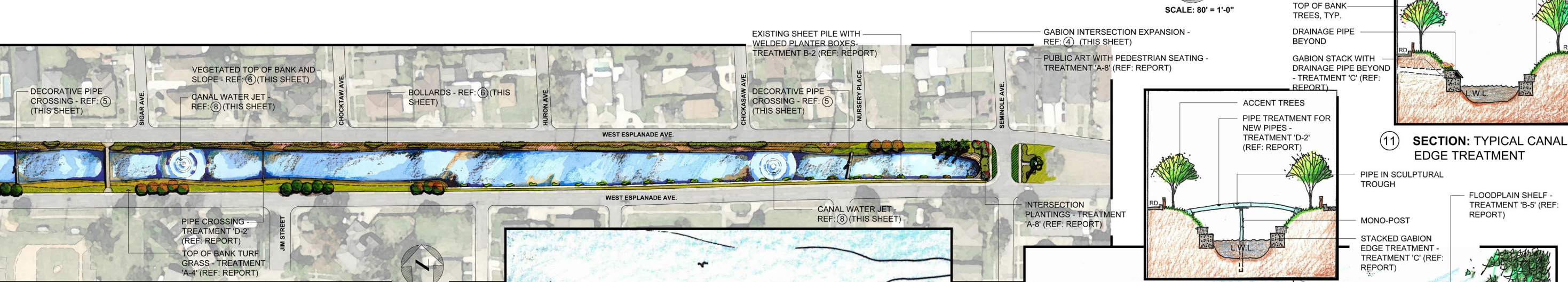
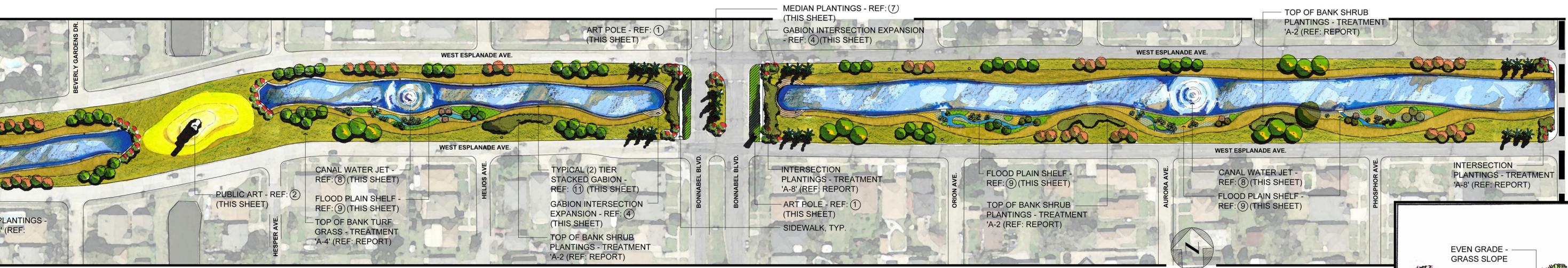
4 **TYPICAL GABION INTERSECTION EXPANSION** : AT ROADWAY CROSSINGS



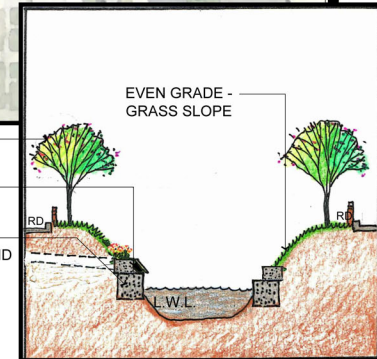
5 **DECORATIVE PIPE CROSSING** : AT SELECT LOCATIONS:

- DECORATIVE UTILITY CROSSING ART - TREATMENT 'D-2' (REF: REPORT)
- HIGHLY RIBBED AESTHETIC METAL SHEET PILING - TREATMENT 'B-2' (REF: REPORT)
- CANAL PIPE CROSSING ART TO BE DETERMINED BY CONTRACTED ARTIST - THIS IS A COLORFUL INTERPRETATION OF WHAT THE PIPE ART COULD RESEMBLE.

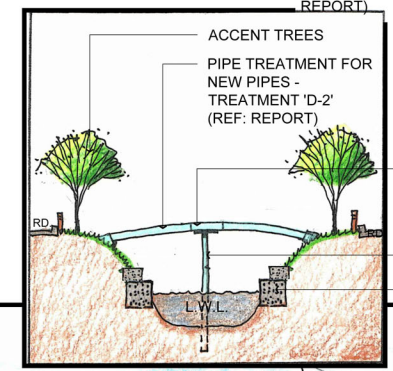




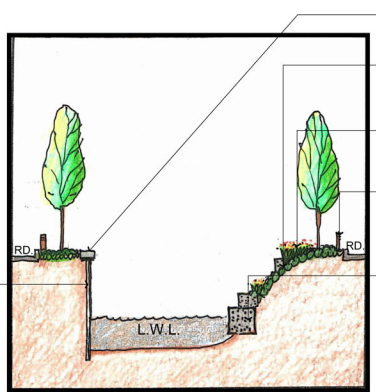
SCALE: 80' = 1'-0"



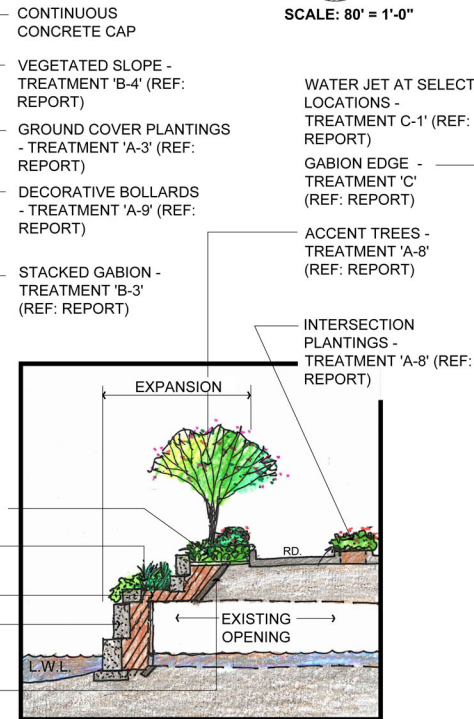
11 SECTION: TYPICAL CANAL EDGE TREATMENT



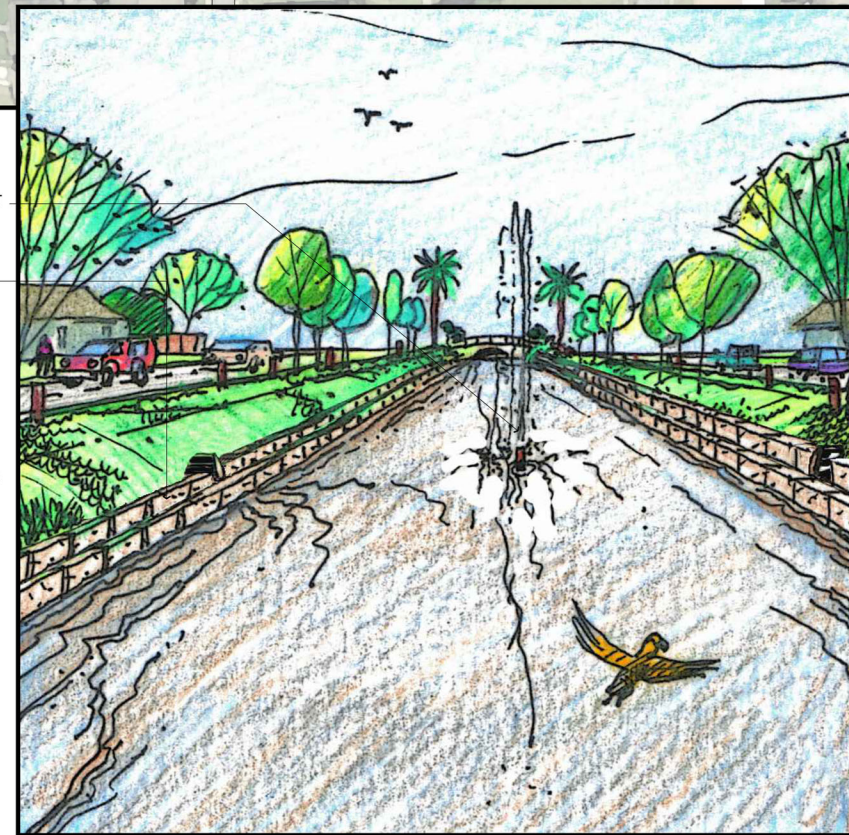
10 SECTION: FUTURE UTILITY CROSSING



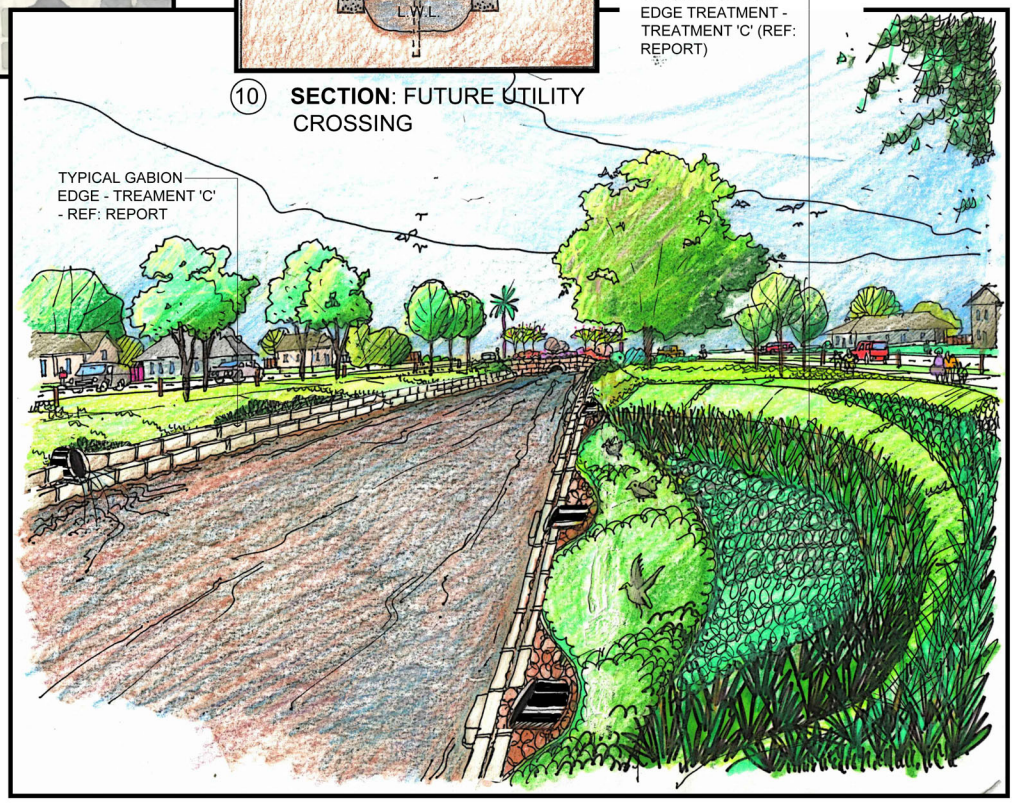
6 SECTION: TYPICAL SHEET PILING



7 SECTION: GABION AREA EXTENSION AT ROAD CROSSINGS



8 TYPICAL GABION CANAL WATER EDGE TREATMENT WITH WATER JET



9 FLOODPLAIN SHELF AT SELECTED LOCATIONS

# 4 Plant Palette



Plant materials should be appropriately sized, easy to maintain, disease-free, non-invasive, winter-hardy, and storm-hardy. Preference should be given to North American native plants, particularly those native to the Southeast and New Orleans areas.

The following list may be used as a guide to inform designers as to which trees, shrubs and groundcovers could be planted and should perform well. This is not intended to be an exhaustive list, but should serve as a template from which species could be added as conditions are shown to be favorable for their inclusion.

### Top of Bank Tree Options

Swamp red maple	<i>Acer rubrum drummondii</i>
Bald cypress	<i>Taxodium distichum</i>
Leyland cypress	<i>Cupressocyparis leylandii</i>
Red oak	<i>Quercus falcata</i>
Willow oak	<i>Quercus phellos</i>
Nuttall oak	<i>Quercus Nuttalli</i>
Fringe tree	<i>Chionanthus virginicus</i>
Crape myrtle	<i>Lagerstroemia indica</i>
Wax myrtle	<i>Myrica Cerifera</i>
Lacebark elm	<i>Ulmus parvifolia</i>
Cabbage palm	
Weeping willow	<i>Salix babylonica</i>
Pistachio	<i>Pistacia chinensis</i>
Parsley Hawthorn	<i>Crataegus Marshallii</i>

### Top of Bank Grass Options

Bermuda	<i>Cynodon Dactylon</i>
Buffalo grass	<i>Buchloe dactyloide</i>
Spike Rush – native – 6-9"	<i>Eleocharis montevidensis</i>
Little stem blue grass	<i>Schizachyrum scoparium</i>

### Top of Bank and Bank Slope Ground Cover Options

Asian Jasmine	<i>Trachelospermum asiaticum</i>
Iris	
Katrina Iris	Iris spp.
Part of proceeds go towards marsh restoration	
Copper Iris – native- spring	
Confederate Jasmine	<i>Trachelospermum jasminoides</i>
Purple Coneflower – Native – Spring	<i>Echinacea purpurpea</i>
White-top Sedge – Native – 6-12"	
Swamp Sun-flower	<i>Helianthus augustifolius</i>
1.5-5' – Fall color	
Wild Ageratum	<i>Eupatorium coelestium</i>
18-24" – Fall color	
Golden Aster	<i>Pityopsis graminifolia</i>
12" – Fall Color	
Redroot	<i>Lachmanthescaroliana</i>
Tolerates flooding – 12-18"	
Summer flowers	
Cattail Gayfeather	<i>Liatris pycostachya</i>
2-5' purple spikes	
Summer flowers	
Butterfly weed	<i>Asclepias tuberosa</i>
18-30 inches	
Spring flowers	
Cardinal Flower	<i>Lobelia cardinalis</i>
2-4' spike	
Summer flowers	
Passion Flower	<i>Passiflora incarnata</i>
Vine	
Summer flowers	

### Roadway Crossing Shrub And Groundcover Planting Options

Indian Hawthorn	<i>Raphiolepis Indica</i>
Knock-out Rose	<i>Rosa spp.</i>
Indian Azalea	<i>Rhododendron Indicum</i>
Agapanthus	<i>Agapanthus africanus</i>
Blue pacific juniper	<i>Juniperus conferta 'blue pacific'</i>
Liriope	<i>Liriope Muscari</i>
Little leaf Boxwood	<i>Buxus microphylla</i>
Lantana	<i>Lantana camara</i>
Loropetalum	<i>Loropetalum chinense</i>
Dwarf Loropetalum	<i>Loropetalum chinense</i>
Emerald Snow	
Pixie Pink	
Dwarf Knock-out Rose	<i>Rosa spp.</i>

\*Plus any of the top of bank groundcover options

### Roadway Crossing Flowering Tree Planting Options

Vitex	<i>Vitex Agnus-castus</i>
Lagerstromia Indica	<i>Lagerstromia Indica</i>
Oriental Magnolia	<i>Magnolia x Soulangiana</i>
Fringe Tree	<i>Chionanthus virginicus</i>

### Terminus Design Tree Planting Options

Weeping Willow	<i>Salix babylonica</i>
Locate only where enough land exists, such as either end of canal project	
Vitex	<i>Vitex Agnus-castus</i>
Crape Myrtles – Natchez White	
Oriental Magnolia	<i>Magnolia x Soulangiana</i>
Fringe Tree	<i>Chionanthus virginicus</i>

### Floodplain Bench Tree Options

Pond cypress	<i>Taxodium distichum</i>
Vitex	<i>Vitex Agnus-castus</i>
Tupelo Gum	<i>Nyssa aquatica</i>
Box elder	<i>Acer Negundo</i>
Water Elm	<i>Planera aquatica</i>
River Birch	<i>Betula nigra</i>
Titi	<i>Cyrilla racamosa</i>
Wax Myrtle	<i>Myrica cerifera</i>

### Floodplain Bench Shrub, Grass and Groundcover Options

Purple coneflower	<i>Echinacea purpurpea</i>
Spider Lily	<i>Hymernocallis liriomes</i>
Golden club	<i>Orontium aquaticum</i>
Pickelweed	<i>Pontederia cordata</i>
Water Dragon	<i>Saururus cernuus</i>
Louisiana Iris	Iris "Louisiana"
Swamp rose	<i>Rosa palustris</i>
Dwarf Palmetto	<i>Sabal minor</i>
Swamp azalea	<i>Rhododendron visconsum</i>
Redroot	<i>Lachmanthescaroliana</i>
Swamp Iris	<i>Iris nelsonii</i>

## 5 General Costs



	ITEM	COST (2011 DOLLARS)	UNIT
<b>EDGE AND BANK TREATMENTS</b>	3' x 1'-6" gabion edging (PVC coated), stacked and battered	\$75 - \$80	LF
	bulkheading / sheet pile, aluminum or steel panel sheeting, incl. concrete cap and anchor	\$200 - \$220	LF
<b>UTILITY CROSSINGS</b>	cost includes piling/support modifications, sculpture, painting	\$8,000 - \$12,000	EA
<b>STORM PIPE TREATMENT</b>	cost includes trimming back pipe, removing bracing, installing scour protection	\$700 - \$900	EA
<b>VEHICULAR CROSSINGS</b>	cost includes gabion buttressing, lighting, monumentation, decorative paving surfaces, plant materials, mobilization, design fees	\$55,000 - \$60,000	EA
<b>FLOODPLAIN SHELVES</b>	cost includes excavation, grading, planting, mobilization, demob, stormwater piping modifications	\$45,000 - \$60,000	EA
<b>SCULPTURE PARK</b>	cost includes sculpture installation, grading, design	\$70,000 - \$120,000	EA
<b>PLANT MATERIALS ALONG LENGTH OF CANAL</b>	trees - large - 12' to 14'	\$400 - \$425	EA
	trees - med - 10' - 12'	\$300 - \$325	EA
	shrubs	\$20 - \$25	EA
	ground covers	\$12 - \$18	SF
	turfgrasses	\$2 - \$3	SF
<b>ADDITIONAL EARTHWORK ALONG LENGTH OF CANAL</b>	cutting, filling, berming costs	\$2 - \$3	LF
<b>PERVIOUS PAVING RETROFITS</b>	pervious concrete, asphalt, unit pavers, includes demo costs	\$12 - \$20	SF
<b>WATER AERATOR/JET</b>		\$10,000	EA

