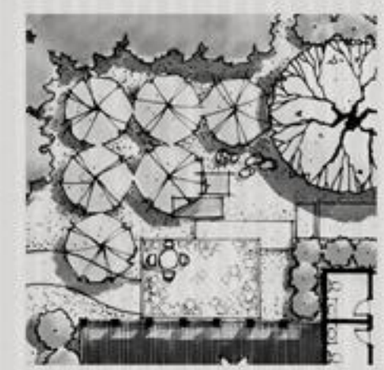
SANDPIPER PARK

Timber Lane Utility District



Yan Long MLA 2006

Dr. Jon Rodiek

Dr. Chang-shan Huang

Prof. Ward Wells

Site Research

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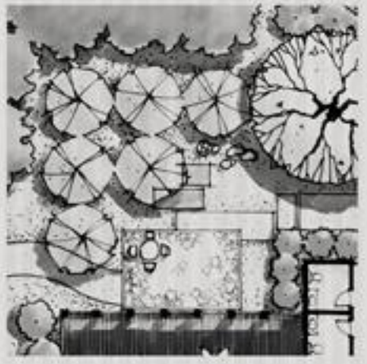
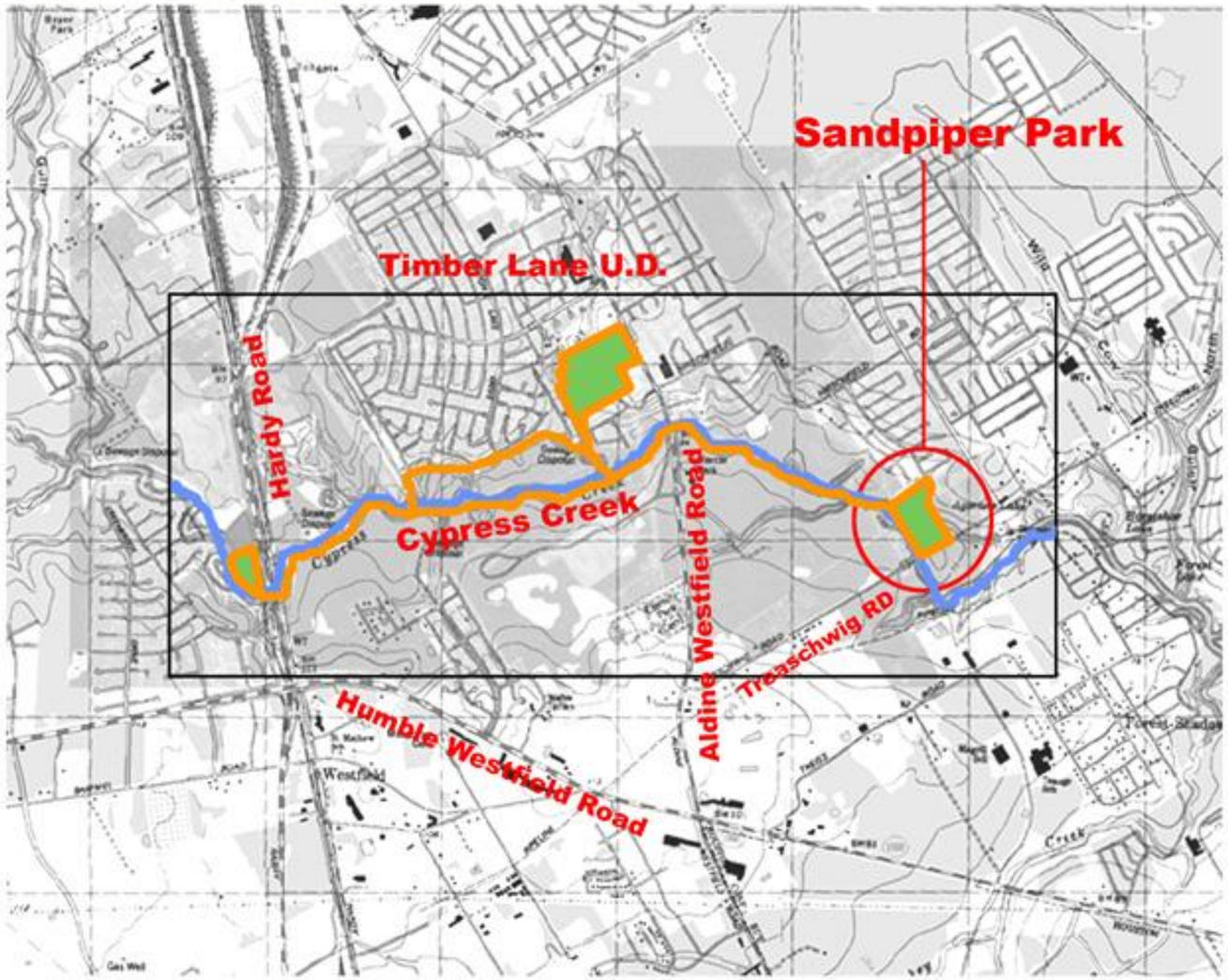


Sandpiper Park is at the Southeastern end of the trail system of Timber Lane Utility District, along the Cypress Creek.
From Houston to TLUD: 22.9 mile, 31 mins drive time
Major traffic to Sandpiper Park is from Treaschwig Road, which is on the south-east side of the site.

Texas County Map

Reference:
Texas General Land Office, http://www.db.glo.state.tx.us/gisdata/

Location of Sandpiper Park in TIMBER LANE U.D.



Location of Timber Lane U.D. in Harris County

Reference:
Texas Education Agency, http://penick.tea.state.tx.us/SchoolDistrictLocator/counties/r6/walker.asp

The Requirements From the Clients:

1. Hike and Bike Trail System
2. Attractive Park Design
3. Boat Ramp to the Cypress Creek and Parking

Sandpiper Park
Timber Lane Utility District

Landscape Architecture & Urban Planning Department
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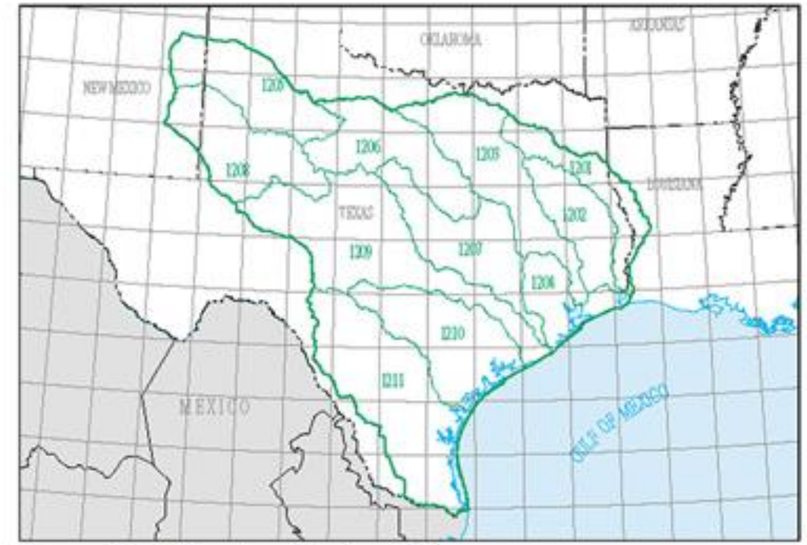
TLUD Master Plan

Sheet 02

Texas County Map

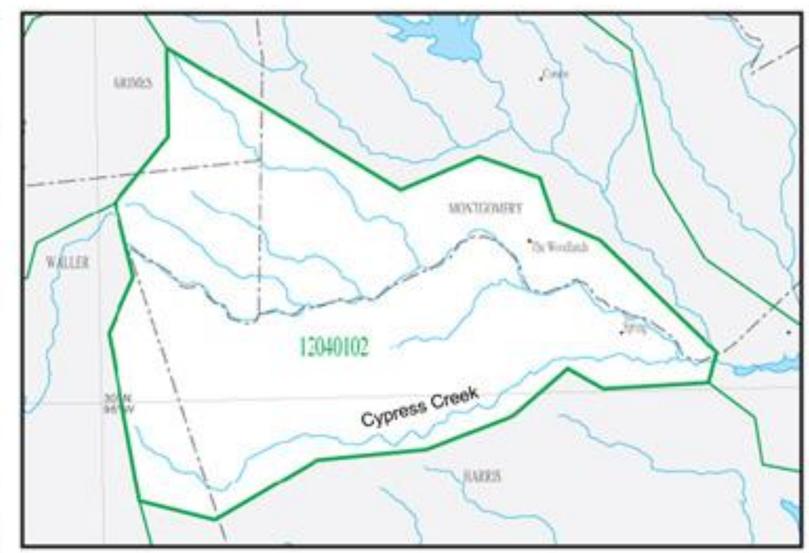
Water Resources Regions of the United States



Texas Gulf Region Region 12

Subregion 12

Accounting Unit 120401



Cataloging Unit 12040102

Watersheds & Drainage for the Region

Sandpiper Park
Timber Lane Utility District

Landscape Architecture & Urban Planning Department
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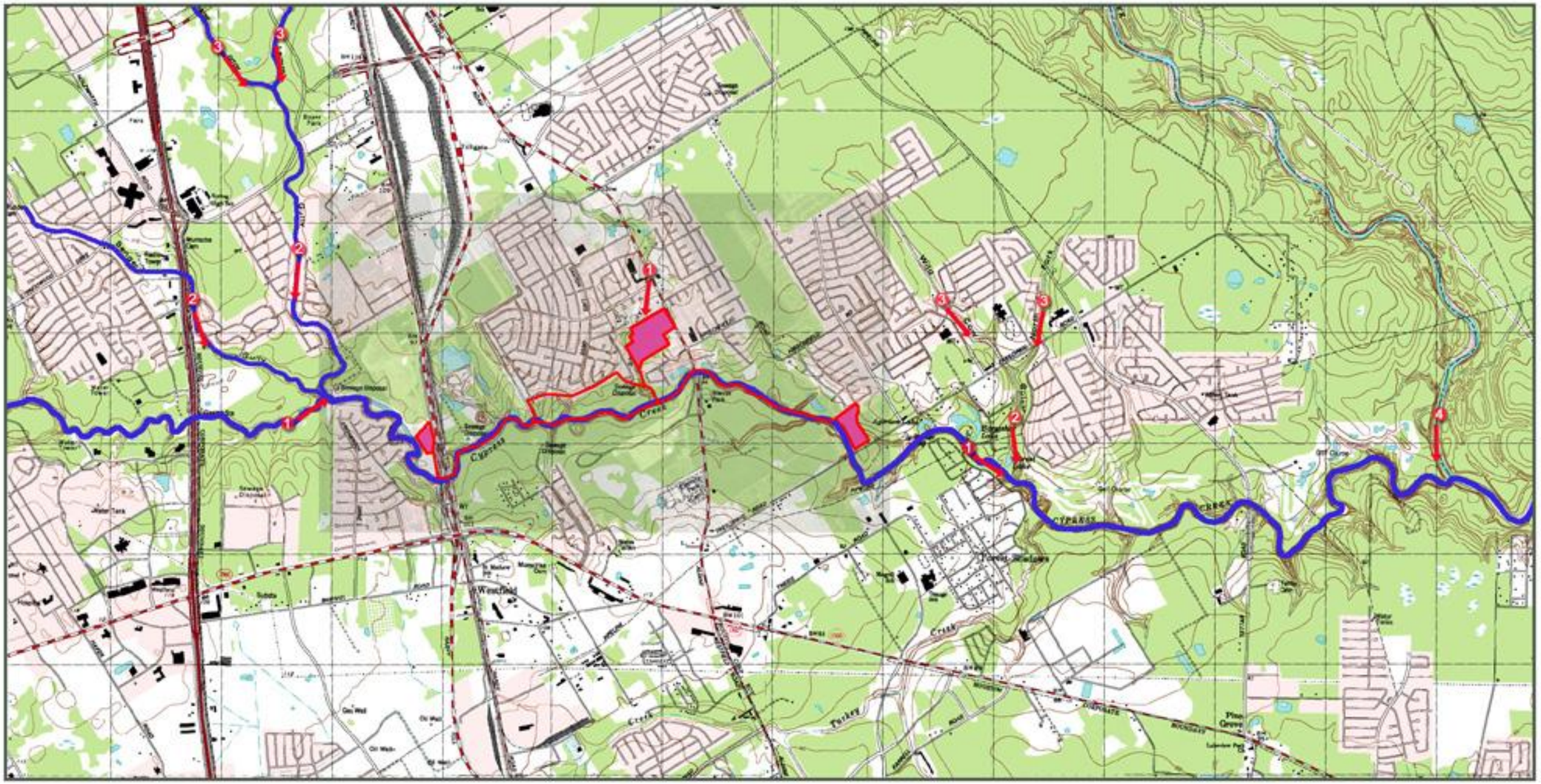

Legend

- Timber Lane Utility District Property
- Timber Lane Utility District Trail System
- 1 Cypress Creek
- 2 First Order Tributary of Cypress Creek
- 3 Second Order Tributary of Cypress Creek
- 4 Spring Creek

Reference: http://topozone.com

Scale

Watersheds & Drainage for 40 sq. mi. Area

Sandpiper Park
Timber Lane Utility District

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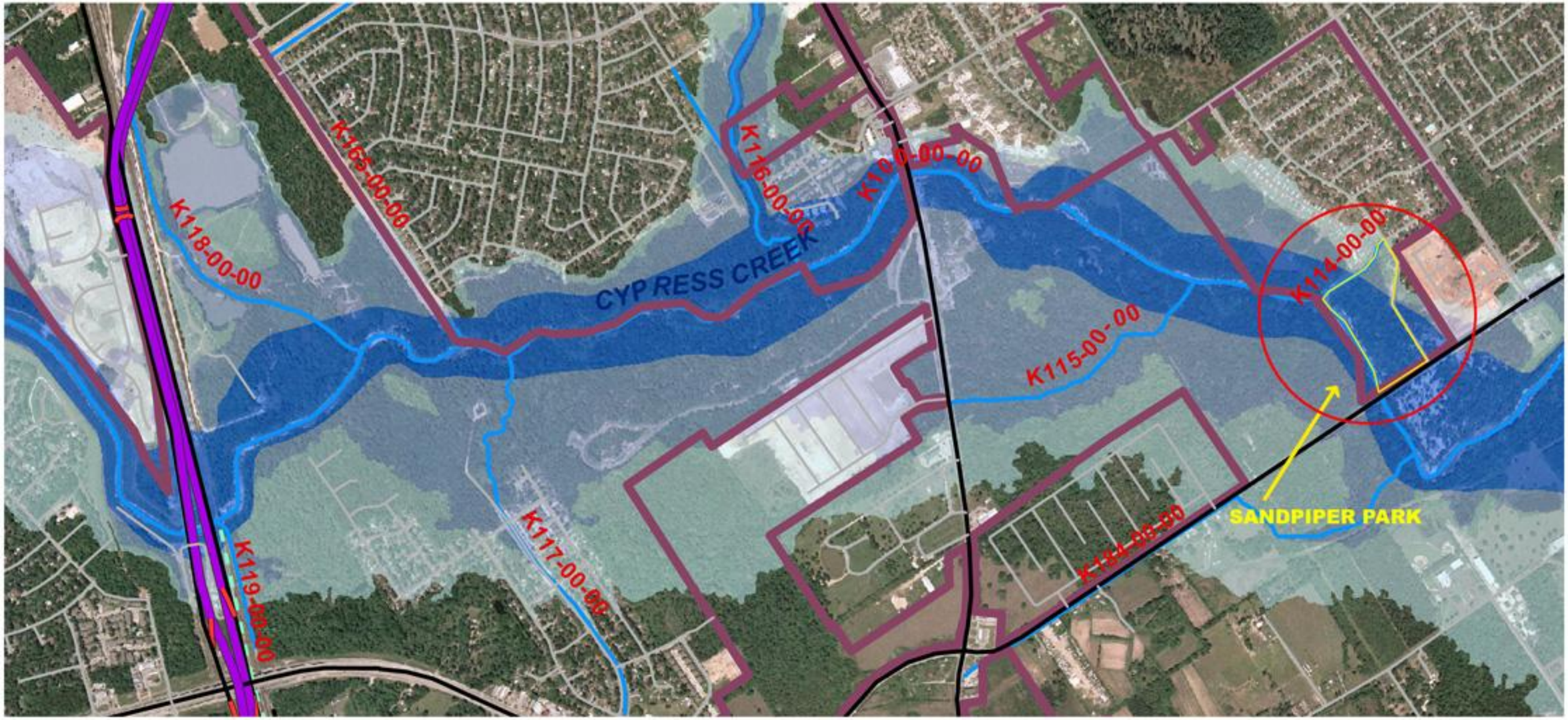

N.T.S. Map Created by IMS/CivilTech Engineering, Inc. 2005

Legend

- District Boundary
- Open Channel
- Historical
- Storm Sewer
- X, NULL
- ZONE X, 0.2% FLOODPLAIN
- ZONE AO, 1% FLOODPLAIN
- ZONE A, 1% FLOODPLAIN
- ZONE AE, 1% FLOODPLAIN
- ZONE VE, 1% FLOODPLAIN
- ZONE AE, FLOODWAY

THUD Flood Plain

Sandpiper Park
Timber Lane Utility District

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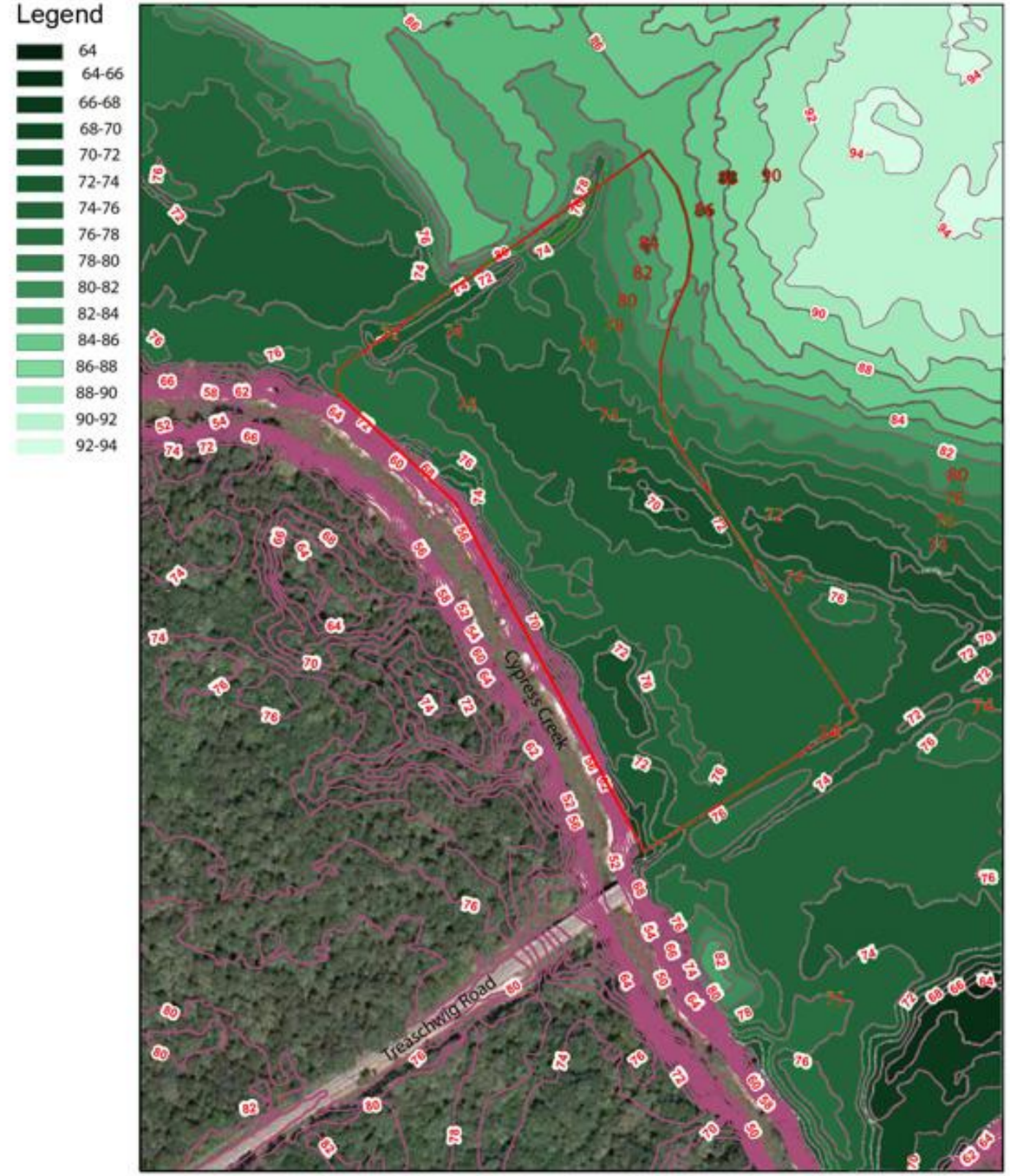
Sheet 05

Index Map N.T.S.

Most part of Sandpiper Park is gently sloping. But there are very steep slopes on the cypress creek shore; from the bottom of the slope to the top there is over 10 feet height difference.

Drainage Analysis N.T.S.



Elevation Analysis N.T.S. Map Created by IMS/CivilTech Engineering, Inc.2005

Topography & Drainage at Site Level

Sandpiper Park
Timber Lane Utility District

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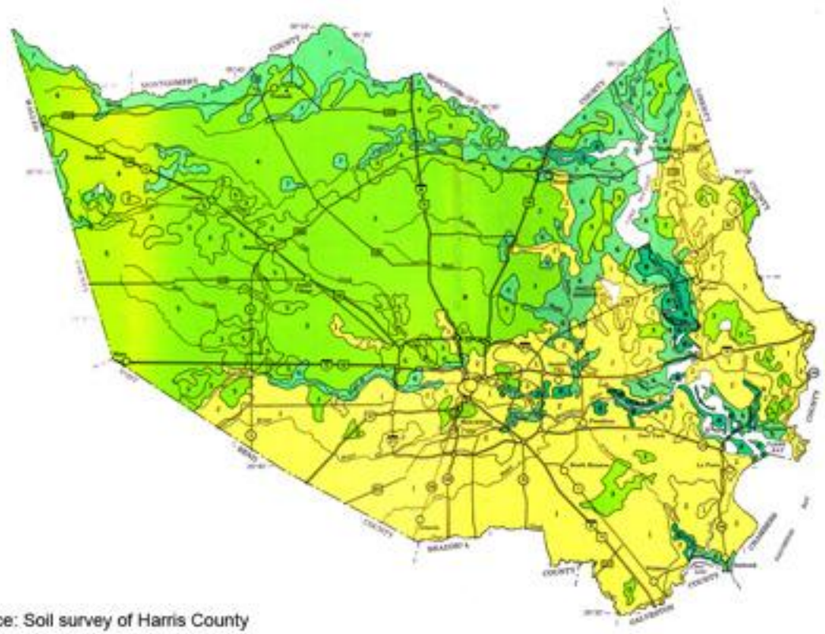
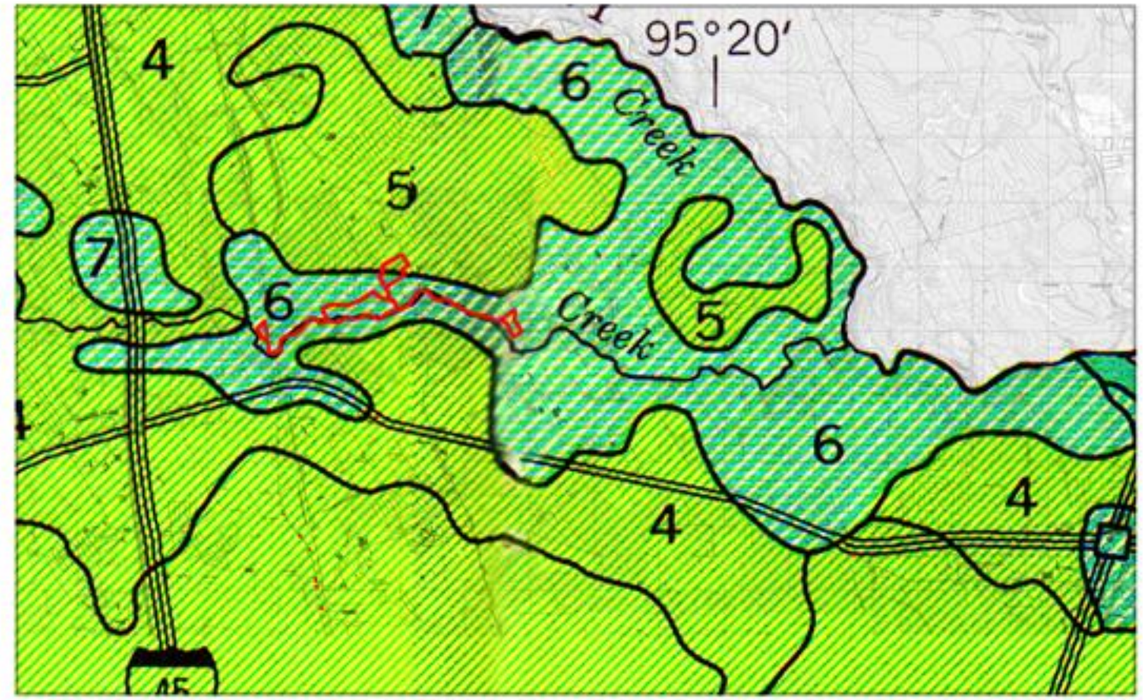
Texas County Map N.T.S.

Reference: Texas General Land Office, http://www.db.glo.state.tx.us/gisdata

Soil Types for Harris County



N.T.S.
Reference: Soil survey of Harris County



4 Wockley-Gessner association: Somewhat poorly drained and poorly drained, moderately slowly permeable and moderately permeable soils

5 Katy-Aris association: Somewhat poorly drained and poorly drained, very slowly permeable soils

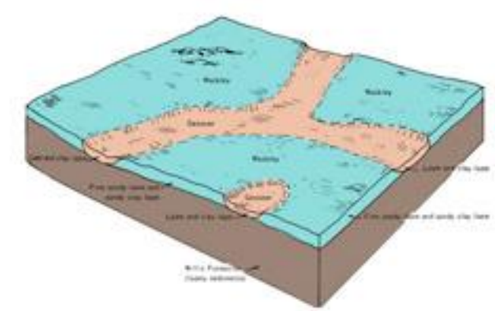
NEARLY LEVEL TO GENTLY SLOPING, LOAMY, FORESTED SOILS

6 Aldine-Ozan association: Somewhat poorly drained and poorly drained, very slowly permeable and slowly permeable soils

7 Segno-Hockley association: Moderately well drained, moderately slowly permeable soils

NEARLY LEVEL, FORESTED, BOTTOM LAND SOILS

Soil Types for Timber Lane U.D.



Typical pattern of soils and underlying material in association 4.

Soil Type for Timber Lane U.D.

Sandpiper Park
Timber Lane Utility District

Landscape Architecture & Urban Planning Department
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Sheet 07

AtB - Atasco fine sandy loam

This is a gently sloping soil in oblong and oval areas along ridges and natural drainageways. The surface is plane to convex. The slope ranges from 1 to 4 percent but averages about 2.5 percent.

This soil is used mainly for timber production and woodland. The native vegetation is chiefly pine, hardwoods, sedges, beaked panicum, and little bluestem. Some small open areas are used for pasture.

This soil is moderately well drained. Surface runoff is medium, and permeability is very slow.

The available water capacity is high. The lower part of the soil is saturated for 2 to 4 months in wet seasons. The hazard of erosion is slight to moderate.

Vs - Voss soils

This is a nearly level to gently sloping soil on sandbars and flood plains. The surface is plane to slightly convex and in places is dissected by channel scars and partly filled, old stream channels. Slopes range from 0 to 3 percent, but they average 1.0 percent. In the low areas this soil is frequently flooded. This flooding occours during high intensity rains and whenever the creeks rise. The soil areas are oblong and cresent shaped and have smooth boundaries.

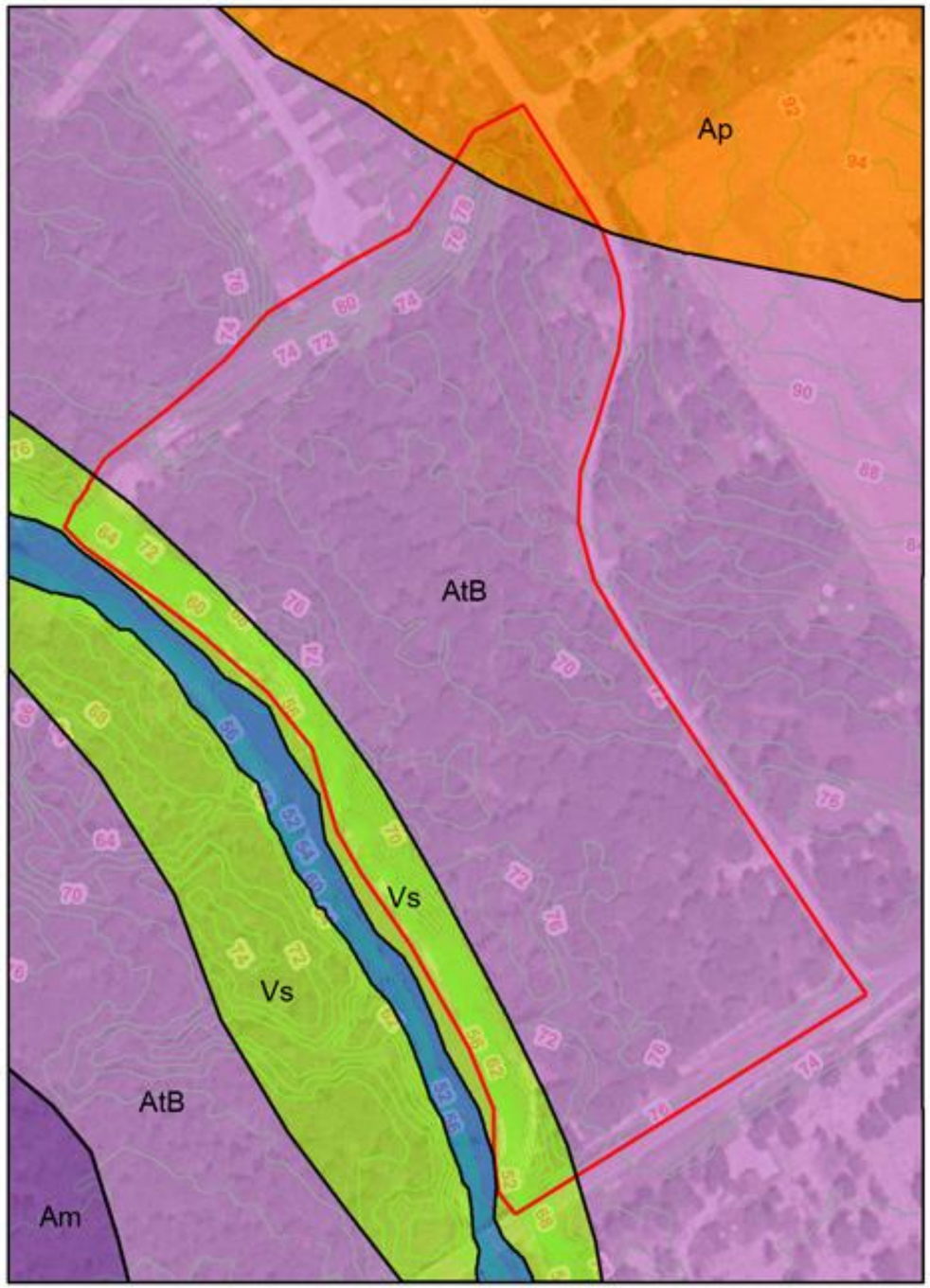
This soil is not suitable for cultivation. Some of the higher areas or protected areas have native vegetation and support such grasses as little bluestem, switchgrass, switchcane, and indiangrass. A few wooded areas along streams are good wildlife habitat. The lower area lack vegetation, except for a few annual weeds, such as bladder pod.

This soil is subject to frequent flooding, washing, and deposition of soil material. Surface runoff is slow. Permeability is rapid, and the available water capacity is very low. Internal drainage is impeded by a seasonal high water table. This soil is moderately well drained to somewhat poorly drained.

Ap - Aris fine sandy loam

This soil is used mainly for rice, native pasture, and improved pasture. The native vegetaion is chiefly longleaf uniola, beaked panicum, little bluestem, indiangrass, greenbrier, berryvines, forbs, and annual weeds.

This soil is poorly drained. Surface runoff and internal drainage are slow. Permeability is very slow. The available water capacity is medium. Poor drainage is the main limitation.



Map Created by IMS/CivilTech Engineering, Inc. 2005

Index Map

Sample 1A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
8.1 Mod. Alkaline	285 umho/cm	24 ppm Mod.	39 ppm High	395 ppm Very High	10,029 ppm Excess.	276 ppm Very High	32 ppm V. High	145 ppm Mod.

Fertilizer Recommended: **0** lbs N/1000sqf ; **0.8** lbs P2O5/1000sqft ; **0** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 1B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
6.2 Slightly Acid	105 umho/cm	4 ppm Very Low	18 ppm Mod.	58 ppm Low	851 ppm V.High	101 ppm Very High	9 ppm High	147 ppm Mod.

Fertilizer Recommended: **1** lbs N/1000sqf ; **2.5** lbs P2O5/1000sqft ; **2.6** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **10.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 2A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
6.8 Slightly Acid	148 umho/cm	3 ppm Very Low	2 ppm Very Low	47 ppm Low	2,153 ppm V.High	205 ppm Very High	10 ppm Mod.	133 ppm Mod.

Fertilizer Recommended: **1.1** lbs N/1000sqf ; **3.8** lbs P2O5/1000sqft ; **2.9** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 2B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
8.0 Mod. Alkaline	167 umho/cm	7 ppm Very Low	6 ppm Low	139 ppm High	6,163 ppm V.High	175 ppm Very High	11 ppm High	118 ppm Mod.

Fertilizer Recommended: **0.8** lbs N/1000sqf ; **3.5** lbs P2O5/1000sqft ; **0.8** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 3A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
4.9 Strongly Acid	94 umho/cm	12 ppm Low	14 ppm Mod.	45 ppm Low	645 ppm V.High	104 ppm Very High	12 ppm High	151 ppm Mod.

Fertilizer Recommended: **0.6** lbs N/1000sqf ; **2.8** lbs P2O5/1000sqft ; **2.9** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **35.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 3B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
6.3 Slightly Acid	124 umho/cm	13 ppm Low	9 ppm Low	65 ppm Mod.	1,320 ppm V.High	109 ppm Very High	10 ppm High	142 ppm Mod.

Fertilizer Recommended: **0.6** lbs N/1000sqf ; **3.2** lbs P2O5/1000sqft ; **2.5** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 4A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
7.0 Neutral	161 umho/cm	10 ppm Very Low	11 ppm Mod.	87 ppm Mod.	2,188 ppm V.High	157 ppm Very High	11 ppm High	130 ppm Mod.

Fertilizer Recommended: **0.7** lbs N/1000sqf ; **3.1** lbs P2O5/1000sqft ; **2** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 4B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
5.6 Mod. Acid	58 umho/cm	10 ppm Very Low	7 ppm Low	65 ppm Mod.	995 ppm V.High	145 ppm Very High	10 ppm High	140 ppm Mod.

Fertilizer Recommended: **0.7** lbs N/1000sqf ; **3.4** lbs P2O5/1000sqft ; **2.5** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **15.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 5A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
4.7 Strongly Acid	82 umho/cm	11 ppm Low	12 ppm Mod.	33 ppm Low	822 ppm V.High	79 ppm Very High	12 ppm High	148 ppm Mod.

Fertilizer Recommended: **0.6** lbs N/1000sqf ; **3** lbs P2O5/1000sqft ; **3.2** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **55.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 5B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
5.9 Mod. Acid	49 umho/cm	7 ppm Very Low	6 ppm Low	35 ppm Low	586 ppm V.High	56 ppm Very High	9 ppm High	165 ppm Mod.

Fertilizer Recommended: **0.9** lbs N/1000sqf ; **3.5** lbs P2O5/1000sqft ; **3.2** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **10.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 6A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
5.0 Strongly Acid	66 umho/cm	10 ppm Very Low	11 ppm Mod.	63 ppm Low	396 ppm V.High	58 ppm Very High	10 ppm High	143 ppm Mod.

Fertilizer Recommended: **0.7** lbs N/1000sqf ; **3** lbs P2O5/1000sqft ; **2.5** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **20.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample 6B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
6.0 Mod. Acid	81 umho/cm	3 ppm Very Low	4 ppm Very Low	37 ppm Low	317 ppm V.High	26 ppm Mod.	8 ppm Mod.	148 ppm Mod.

Fertilizer Recommended: **1** lbs N/1000sqf ; **3.7** lbs P2O5/1000sqft ; **3.1** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0.5** lbs Mg/1000sqft ; **0.5** lbs S/1000sqft
Limestone Requirement: **10.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample Highland A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
5.4 Mod. Acid	41 umho/cm	4 ppm Very Low	13 ppm Mod.	41 ppm Low	681 ppm V.High	82 ppm Very High	11 ppm High	167 ppm Mod.

Fertilizer Recommended: **1** lbs N/1000sqf ; **2.9** lbs P2O5/1000sqft ; **3** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **15.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample Highland B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
7.0 Neutral	234 umho/cm	11 ppm Very Low	16 ppm Mod.	69 ppm Mod.	2,339 ppm V.High	137 ppm Very High	13 ppm High	138 ppm Mod.

Fertilizer Recommended: **0.7** lbs N/1000sqf ; **2.7** lbs P2O5/1000sqft ; **2.4** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0.25** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample Sandpiper A

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
6.6 Slightly Acid	167 umho/cm	13 ppm Low	17 ppm Mod.	128 ppm High	3,010 ppm V.High	267 ppm Very High	16 ppm V.High	156 ppm Mod.

Fertilizer Recommended: **0.5** lbs N/1000sqf ; **2.6** lbs P2O5/1000sqft ; **1** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Sample Sandpiper B

pH	Conductivity	Nitrate - N	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Sodium
7.8 Mod. Alkaline	218 umho/cm	39 ppm High	40 ppm High	78 ppm Mod.	3,738 ppm V.High	168 ppm Very High	22 ppm V.High	167 ppm Mod.

Fertilizer Recommended: **0** lbs N/1000sqf ; **0.7** lbs P2O5/1000sqft ; **2.2** lbs K20/1000sqft ; **0** lbs Ca/1000sqft ; **0** lbs Mg/1000sqft ; **0** lbs S/1000sqft
Limestone Requirement: **0.00** lbs/1000sqft
Crop Grown: Landscape (Lawn, Trees, Shrubs, or Ground Cover)

Reference: *Water Analysis Report*, Soil, Water and Forage Testing Labotatory, Sep. 2005

H2O - 1

Parameter analyzed	Results	Units	Method	
Calcium(Ca)	26	ppm	ICP	Acceptable
Magnesium(Mg)	5	ppm	ICP	Acceptable
Sodium(Na)	98	ppm	ICP	Acceptable
Potassium(K)	10	ppm	ICP	Acceptable
Boron(B)	0.54	ppm	ICP	Acceptable
Carbonate(CO3)	0	ppm	Titr	Acceptable
Bicarbonate(HCO3)	184	ppm	Titr	Acceptable
Sulfate(SO4)	21	ppm	ICP	Acceptable
Chloride(Cl-)	79	ppm	Titr	Acceptable
Nitrate-N(NO3-N)	4.85	ppm	Cd-red.	Acceptable
Phosphorus(P)	1.69	ppm	ICP	Acceptable
pH	7.70		ISE	Acceptable
Conductivity	598	umhos/cm	Cond.	Acceptable
Hardness	5	grains CaCO3/gallon	Calc.	Acceptable
Hardness	86	ppm CaCO3	Calc.	Acceptable
Alkalinity	151	ppm CaCO3	Calc.	Acceptable
Total Dissolved Salts(TDS)	430	ppm	Calc.	Acceptable
SAR	4.6		Calc.	Acceptable
Charge Balance(cation/anion*100)	102		Calc.	

L~A means between Limiting and Acceptable

H2O - 2

Parameter analyzed	Results	Units	Method	
Calcium(Ca)	26	ppm	ICP	Acceptable
Magnesium(Mg)	5	ppm	ICP	Acceptable
Sodium(Na)	101	ppm	ICP	Acceptable
Potassium(K)	10	ppm	ICP	Acceptable
Boron(B)	0.52	ppm	ICP	Acceptable
Carbonate(CO3)	0	ppm	Titr	Acceptable
Bicarbonate(HCO3)	177	ppm	Titr	Acceptable
Sulfate(SO4)	24	ppm	ICP	Acceptable
Chloride(Cl-)	79	ppm	Titr	Acceptable
Nitrate-N(NO3-N)	5.04	ppm	Cd-red.	Acceptable
Phosphorus(P)	1.74	ppm	ICP	Acceptable
pH	7.50		ISE	Acceptable
Conductivity	607	umhos/cm	Cond.	Acceptable
Hardness	5	grains CaCO3/gallon	Calc.	Acceptable
Hardness	86	ppm CaCO3	Calc.	Acceptable
Alkalinity	145	ppm CaCO3	Calc.	Acceptable
Total Dissolved Salts(TDS)	430	ppm	Calc.	Acceptable
SAR	4.7		Calc.	Acceptable
Charge Balance(cation/anion*100)	105		Calc.	

L~A means between Limiting and Acceptable

Index Map

N.T.S.

H2O - 3

Parameter analyzed	Results	Units	Method	
Calcium(Ca)	27	ppm	ICP	Acceptable
Magnesium(Mg)	5	ppm	ICP	Acceptable
Sodium(Na)	105	ppm	ICP	Acceptable
Potassium(K)	11	ppm	ICP	Acceptable
Boron(B)	0.51	ppm	ICP	Acceptable
Carbonate(CO3)	0	ppm	Titr.	Acceptable
Bicarbonate(HCO3)	198	ppm	Titr.	Acceptable
Sulfate(SO4)	24	ppm	ICP	Acceptable
Chloride(Cl-)	78	ppm	Titr.	Acceptable
Nitrate-N(NO3-N)	5.12	ppm	Cd-red.	Acceptable
Phosphorus(P)	1.83	ppm	ICP	Acceptable
pH	7.60		ISE	Acceptable
Conductivity	612	umhos/cm	Cond.	Acceptable
Hardness	5	grains CaCO3/gallon	Calc.	Acceptable
Hardness	88	ppm CaCO3	Calc.	Acceptable
Alkalinity	163	ppm CaCO3	Calc.	Acceptable
Total Dissolved Salts(TDS)	456	ppm	Calc.	Acceptable
SAR	4.9		Calc.	Acceptable
Charge Balance(cation/anion*100)	104		Calc.	

L~A means between Limiting and Acceptable

H2O - 4

Parameter analyzed	Results	Units	Method	
Calcium(Ca)	14	ppm	ICP	Acceptable
Magnesium(Mg)	1	ppm	ICP	Acceptable
Sodium(Na)	11	ppm	ICP	Acceptable
Potassium(K)	3	ppm	ICP	Acceptable
Boron(B)	0.31	ppm	ICP	Acceptable
Carbonate(CO3)	0	ppm	Titr.	Acceptable
Bicarbonate(HCO3)	50	ppm	Titr.	Acceptable
Sulfate(SO4)	9	ppm	ICP	Acceptable
Chloride(Cl-)	8	ppm	Titr.	Acceptable
Nitrate-N(NO3-N)	< 0.01	ppm	Cd-red.	Acceptable
Phosphorus(P)	0.50	ppm	ICP	Acceptable
pH	6.90		ISE	Acceptable
Conductivity	125	umhos/cm	Cond.	Acceptable
Hardness	2	grains CaCO3/gallon	Calc.	Acceptable
Hardness	39	ppm CaCO3	Calc.	Acceptable
Alkalinity	41	ppm CaCO3	Calc.	Acceptable
Total Dissolved Salts(TDS)	97	ppm	Calc.	Acceptable
SAR	0.6		Calc.	Acceptable
Charge Balance(cation/anion*100)	106		Calc.	

L~A means between Limiting and Acceptable

H2O - 5

Parameter analyzed	Results	Units	Method	
Calcium(Ca)	26	ppm	ICP	Acceptable
Magnesium(Mg)	4	ppm	ICP	Acceptable
Sodium(Na)	144	ppm	ICP	Acceptable
Potassium(K)	11	ppm	ICP	Acceptable
Boron(B)	0.50	ppm	ICP	Acceptable
Carbonate(CO3)	0	ppm	Titr.	Acceptable
Bicarbonate(HCO3)	285	ppm	Titr.	Acceptable
Sulfate(SO4)	27	ppm	ICP	Acceptable
Chloride(Cl-)	81	ppm	Titr.	Acceptable
Nitrate-N(NO3-N)	1.85	ppm	Cd-red.	Acceptable
Phosphorus(P)	2.07	ppm	ICP	Acceptable
pH	7.70		ISE	Acceptable
Conductivity	758	umhos/cm	Cond.	L~A
Hardness	5	grains CaCO3/gallon	Calc.	Acceptable
Hardness	81	ppm CaCO3	Calc.	Acceptable
Alkalinity	234	ppm CaCO3	Calc.	Acceptable
Total Dissolved Salts(TDS)	583	ppm	Calc.	L~A
SAR	6.9		Calc.	Acceptable
Charge Balance(cation/anion*100)	106		Calc.	

L~A means between Limiting and Acceptable

H2O - 6

Parameter analyzed	Results	Units	Method	
Calcium(Ca)	26	ppm	ICP	Acceptable
Magnesium(Mg)	3	ppm	ICP	Acceptable
Sodium(Na)	22	ppm	ICP	Acceptable
Potassium(K)	5	ppm	ICP	Acceptable
Boron(B)	0.28	ppm	ICP	Acceptable
Carbonate(CO3)	0	ppm	Titr.	Acceptable
Bicarbonate(HCO3)	107	ppm	Titr.	Acceptable
Sulfate(SO4)	9	ppm	ICP	Acceptable
Chloride(Cl-)	18	ppm	Titr.	Acceptable
Nitrate-N(NO3-N)	< 0.01	ppm	Cd-red.	Acceptable
Phosphorus(P)	0.12	ppm	ICP	Acceptable
pH	7.20		ISE	Acceptable
Conductivity	235	umhos/cm	Cond.	Acceptable
Hardness	5	grains CaCO3/gallon	Calc.	Acceptable
Hardness	77	ppm CaCO3	Calc.	Acceptable
Alkalinity	88	ppm CaCO3	Calc.	Acceptable
Total Dissolved Salts(TDS)	191	ppm	Calc.	Acceptable
SAR	1.1		Calc.	Acceptable
Charge Balance(cation/anion*100)	106		Calc.	

L~A means between Limiting and Acceptable

Reference: *Water Analysis Report*, Soil, Water and Forage Testing Labotatory, Sep. 2005

Water Quality Analysis

Sandpiper Park
Timber Lane Utility District

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3 Bluestem Grassland

Bluestem Grassland includes: bushy bluestem, slender bluestem, little bluestem, silver bluestem, three-awn, buffalograss, bermudagrass, brownseed paspalum, single-spike paspalum, smutgrass, Gulf cordgrass, windmillgrass, southern dewberry, live oak, mesquite, huisache, baccharis, and Macartney rose.

38 Pecan-Elm Forest

Pecan-Elm Forest includes: Pecan, American elm, cedar elm, cottonwood, sycamore, black willow, live oak, green ash, bald cypress, water oak, hackberry, virgin's bower, yaupon, greenbrair, mustang grape, poison oak, Johnsongrass, Virginia wildrye, Canada wildrye, rescuegrass, frostweed, and western ragweed.

41 Young Forest/Grassland

Commonly Associated Plants: Combinations and ages of regrowth of pine and southern red oak, sweetgum, post oak, white oak, black hickory, blackgum, elm, hackberry, and water oak resulting from recent harvesting of pine or pine-hardwood forest and subsequent establishment of young pine plantation or young pine-hardwood forest. Shrubs include hawthorn, poison oak, sumac, holly, wax myrtle, blueberry, blackberry, and red bay. This type may also protray grasslands resulting from clearing of forests.
Distribution: Pineywoods.

42 Pine-Hardwood Forest

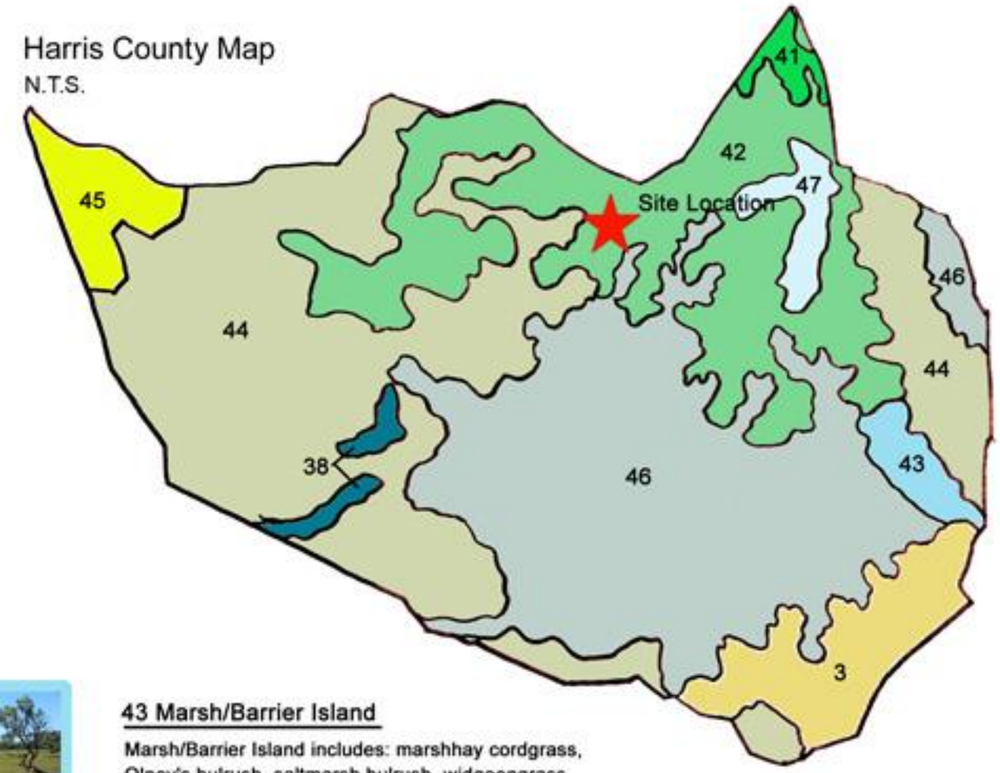
Subtype 1: Loblolly Pine-Sweetgum
Commonly Associated Plants: Shortleaf pine, water oak, white oak, southern red oak, winged elm, beech, blackgum, magnolia, American beautyberry, American hornbeam, flowering dogwood, yaupon, hwthorn, supplejack, Virginia creeper, wax myrtle, red bay, sassafras, southern arrowwood, poison oak, greenbriar, blackberry.
Distribution: Occurs throughout the Pineywoods.

Subtype 2: Shortleaf Pine-Post Oak-Southern Red Oak
Commonly Associated Plants: Loblolly pine, black hickory, sandjack oak, flowering dogwood, common persimmon, sweetgum, sassafras, greenbriar, yaupon, wax myrtle, American beautyberry, hawthorn, supplejack, winged elm, beaked panicum, sprangleglass, Indiangrass, switchgrass, three-awn, bushclover, tickclover.
Distribution: Northeast Texas counties of Bowie, Red River, Lamar, Cass, Camp, Titus, Frankilin, Marion, Harrison, Upshur, Gregg, Smith, Wood, and Morris. Extends into southeastern Pineywoods along deep sand ridges.

Subtype 3: Loblolly Pine-Post Oak
Commonly Associated Plants: Black hickory, blackjack oak, eastern redcedar, cedar elm, hackberry, greenbriar, yaupon, elbowbush, purpletop, sand lovegrass, broomsedge bluestem, little bluestem, brownseed palpalum, bushclover, tickclover, gay feather, yellow neptunia, bitter sneeseweed, velvet bundleflower.
Distribution: The "Lost Pines" in Bastrop County and westward of the pine producing region of East Texas.

Subtype 4: Longleaf Pine-Sandjack Oak
Commonly Associated Plants: Loblolly pine, shortleaf pine, blackjack oak, sand post oak, southern red oak, flowering dogwood, sweetgum, sassafras, American beautyberry, wax myrtle, yaupon, hawthorn, yellow jessamine, slender bluestem, broomsedge bluestem, little bluestem.
Distribution: Southeastern Pineywoods.

Harris County Map
N.T.S.



43 Marsh/Barrier Island

Marsh/Barrier Island includes: marshhay cordgrass, Olney's bulrush, saltmarsh bulrush, widgeongrass, California bulrush, seashore paspalum, Gulf cordgrass, and common reed.

45 Other Native or Introduced Grasses

Commonly Associated Plants:Mixed native or introduced grasses and forbs on grassland sites or mixed herbaceous communities resulting from the clearing of woody vegetation. This type is associated with the clearing of forests in northeast and east-central Texas and may protray early stages of Type 41, Young Forest. Also occurs in the South Texas plains where brush has been cleared. Such areas are particularly subject to change due to regrowth brush.
Distribution: Principally northeast, east-central and south Texas.

44 Crops

46 Urban

47 Lakes

Reference: Texas Parks & Widlife GIS Lab Downloads of Texas Vegetation Type, http://www.tpwd.state.tx.us/gis/downloads/

Vegetation Types for Harris County

Sandpiper Park
Timber Lane Utility District

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Trees

Ash
Fraxinus L.

Pecan
Carya illinoinensis

Elm
Ulmus spp.

Black Walnut
Juglans nigra L.

Sweetgum
Liquidambar styraciflua

Pine
Pinus spp.

Black Locust
Robinia pseudoacacia L.

American Beech
Fagus grandifolia

Mulberry
Morus L.

Eastern Cottonwood
Populus deltoides

Southern Magnolia
Magnolia grandiflora L.

Oak
Quercus spp.

Shrubs

Azalea
Rhododendron spp.

Flowering Crabapple
Malus floribunda

Beautyberry
Callicarpa L.

Butterflybush
Buddleja L.

Cherry Laurel
Prunus laurocerasus L.

Silverbell
Halesia Ellis

Gardenia
Gardenia Ellis

Arizona Cypress
Cupressus arizonica

Crapemyrtle
Lagerstroemia indica L.

Huckleberry
Gaylussacia Kunth

Dogwood
Cornus L.

Japanese Privet
Ligustrum japonicum

Flowers and Ground Cover

Rosemary
Rosmarinus officinalis L.

Chinese Starjasmine
Caulis Trachelospermi

Dahlia
Dahlia Cav.

Mother of Thyme
Thymus praecox Opiz

Gladiolus
Gladiolus L.

Snapdragon
Antirrhinum L.

Hollyhock
Alcea L.

Sand Strawberry
Fragaria chiloensis

Shasta Daisy
Chrysanthemum maximum

Beach Wormwood
Artemisia pycnocephala

Sweetpea
Lathyrus odoratus L.

Vines

English ivy
Hedera helix L.

Pandorea
Pandorea pandorana

Jessamine
Cestrum L.

Bukhara Fleeceflower
Polygonum baldschuanicum.

Moonflower
Calonyction muricatum

Kudzu
Pueraria montana

Wisteria
Wisteria Nutt.

Grape
Vitis L.

Hall's Honeysuckle
Lonicera japonica 'Halliana'

Bignonia
Bignonia L.

Native Texas Plants

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Timber Lane Utility District

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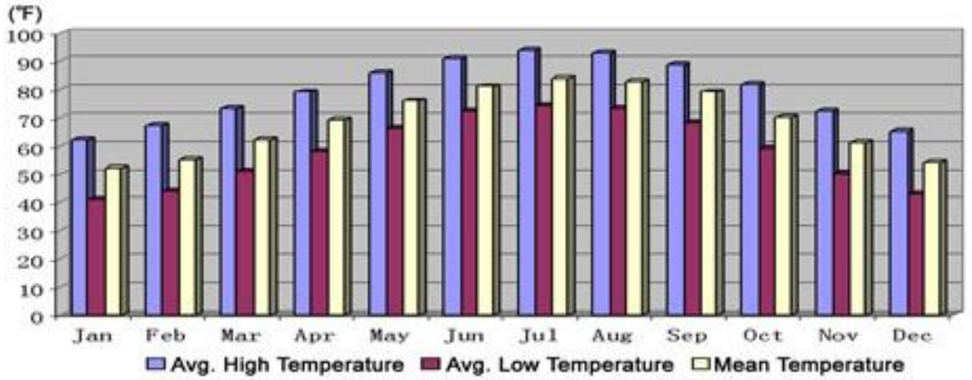
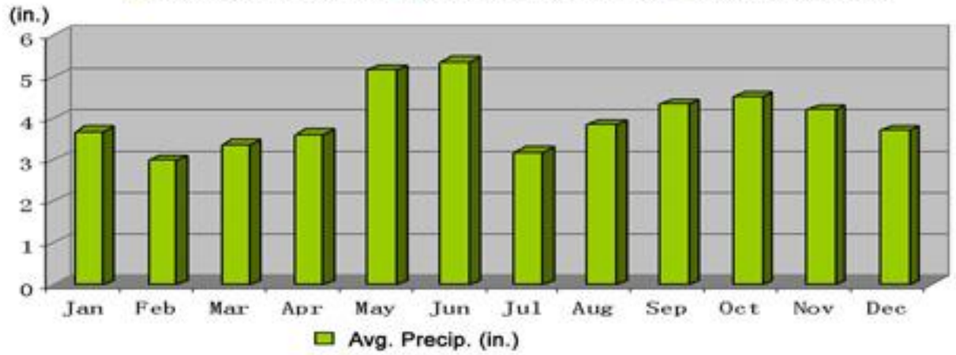
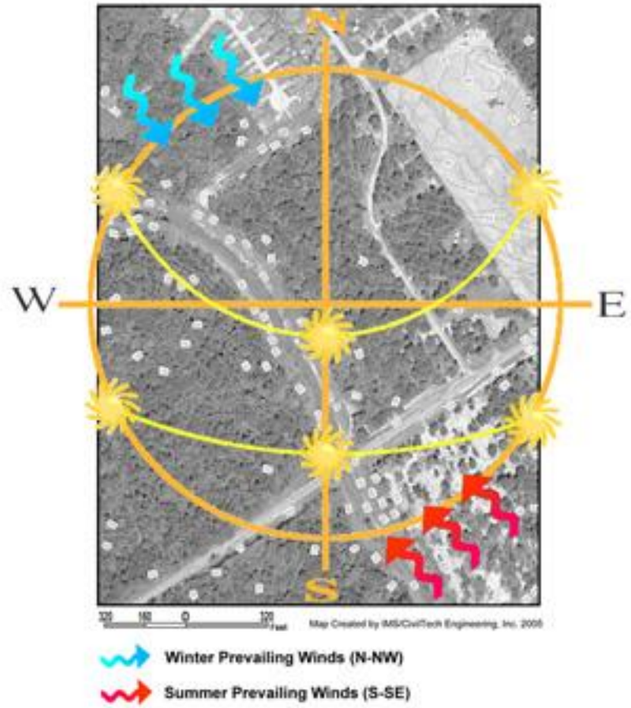
Climate Data by Month

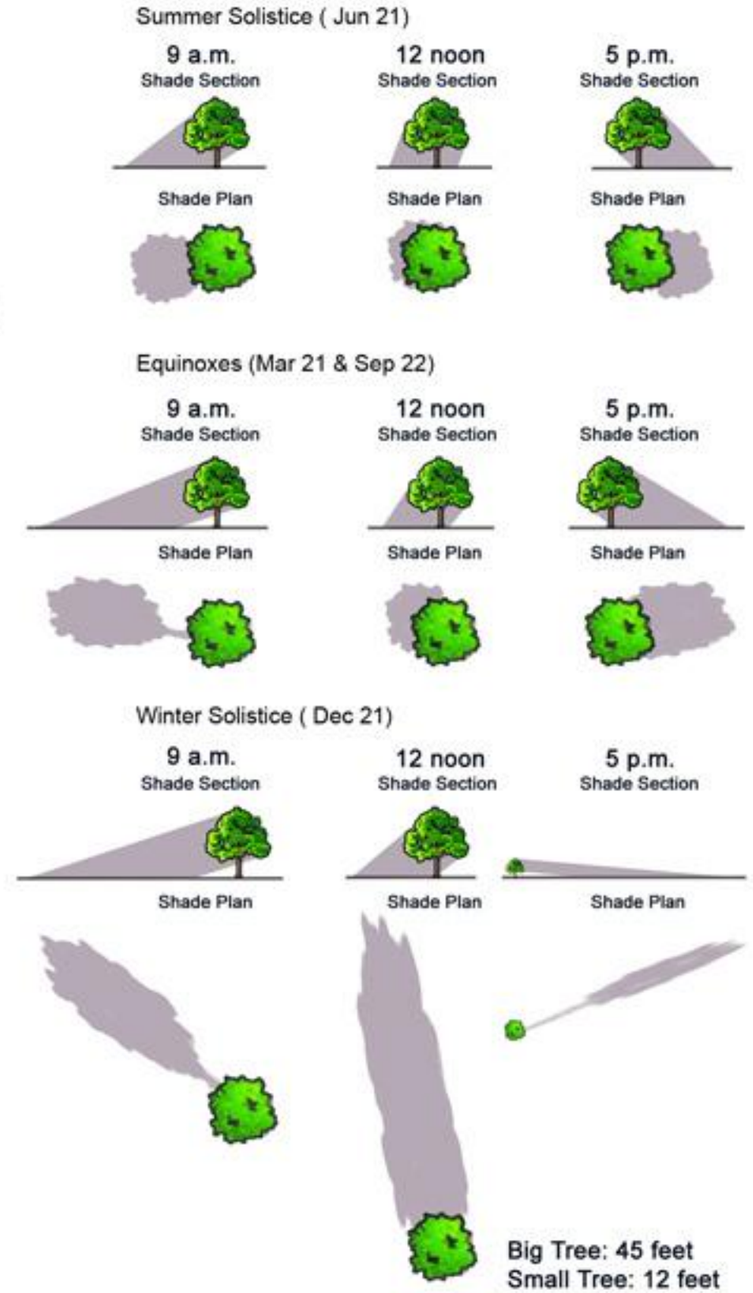




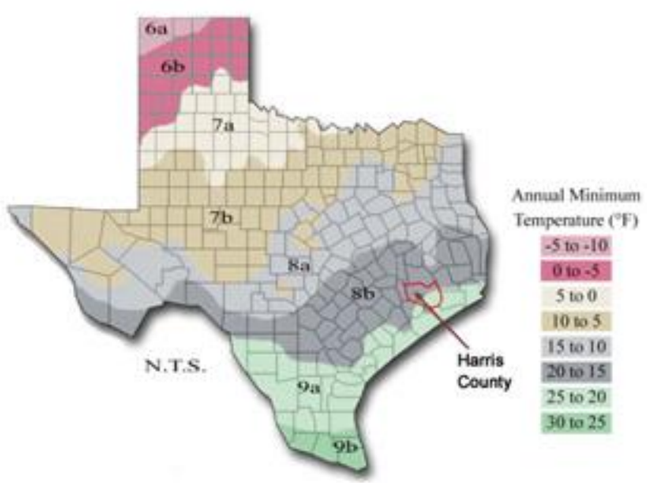
Wind Direction & Soupath



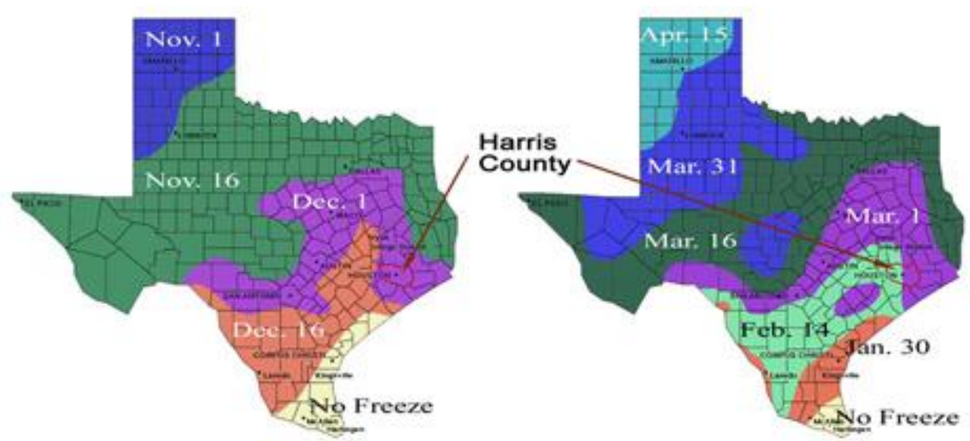
Solar Exposure Diagram



USDA Hardiness Zones

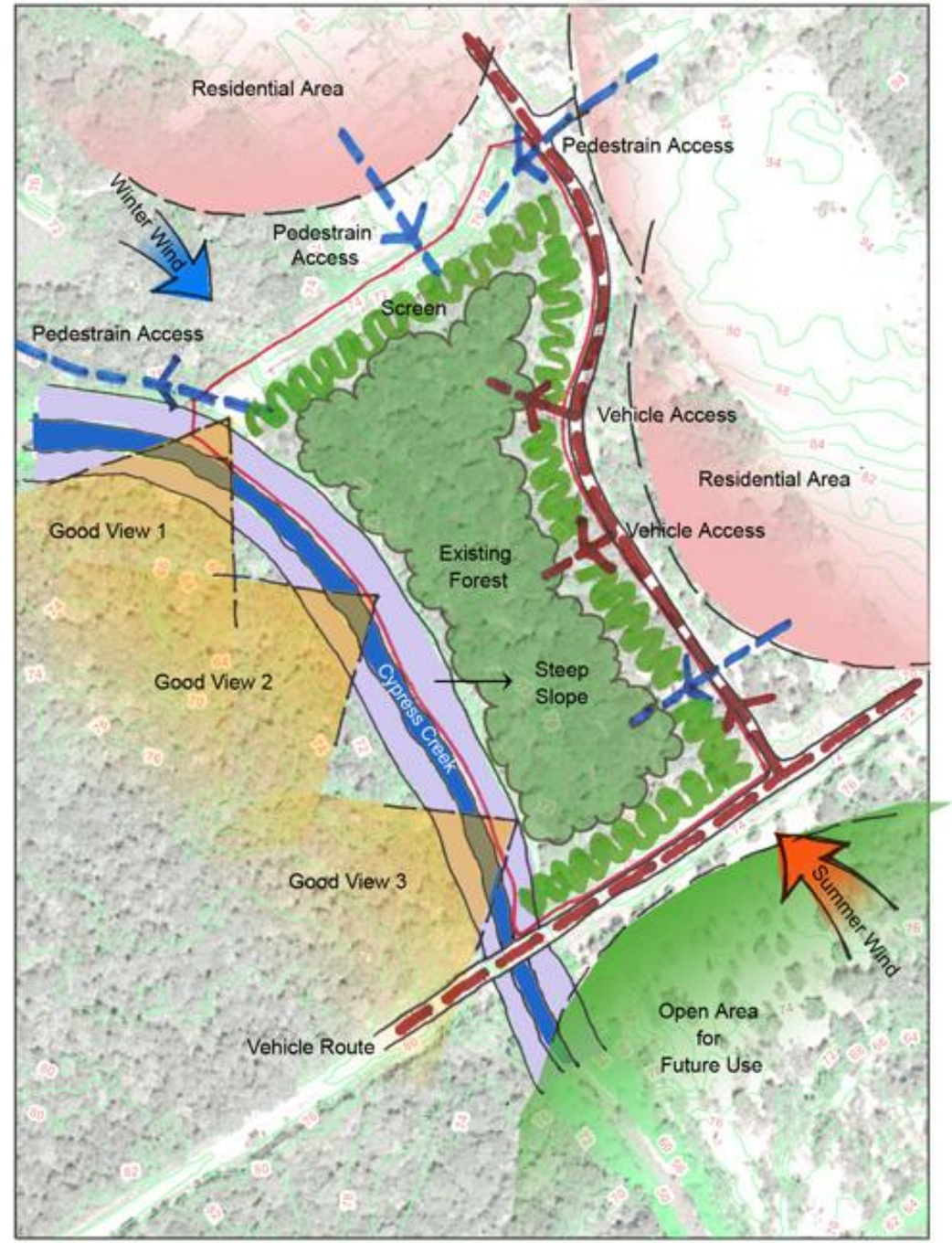


Average Frost Dates

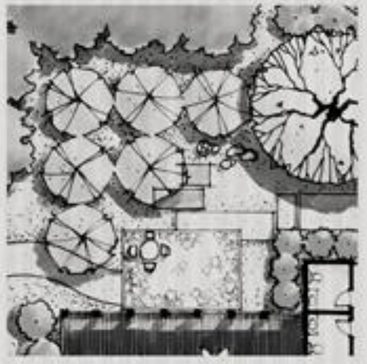


Reference: 1. www.weather.com ; 2. USDA Plant Hardiness Zone Map, USDA/ARS Publication Number 147 ; 3. www.susdesign.com

Index Map N.T.S.



Design Solution

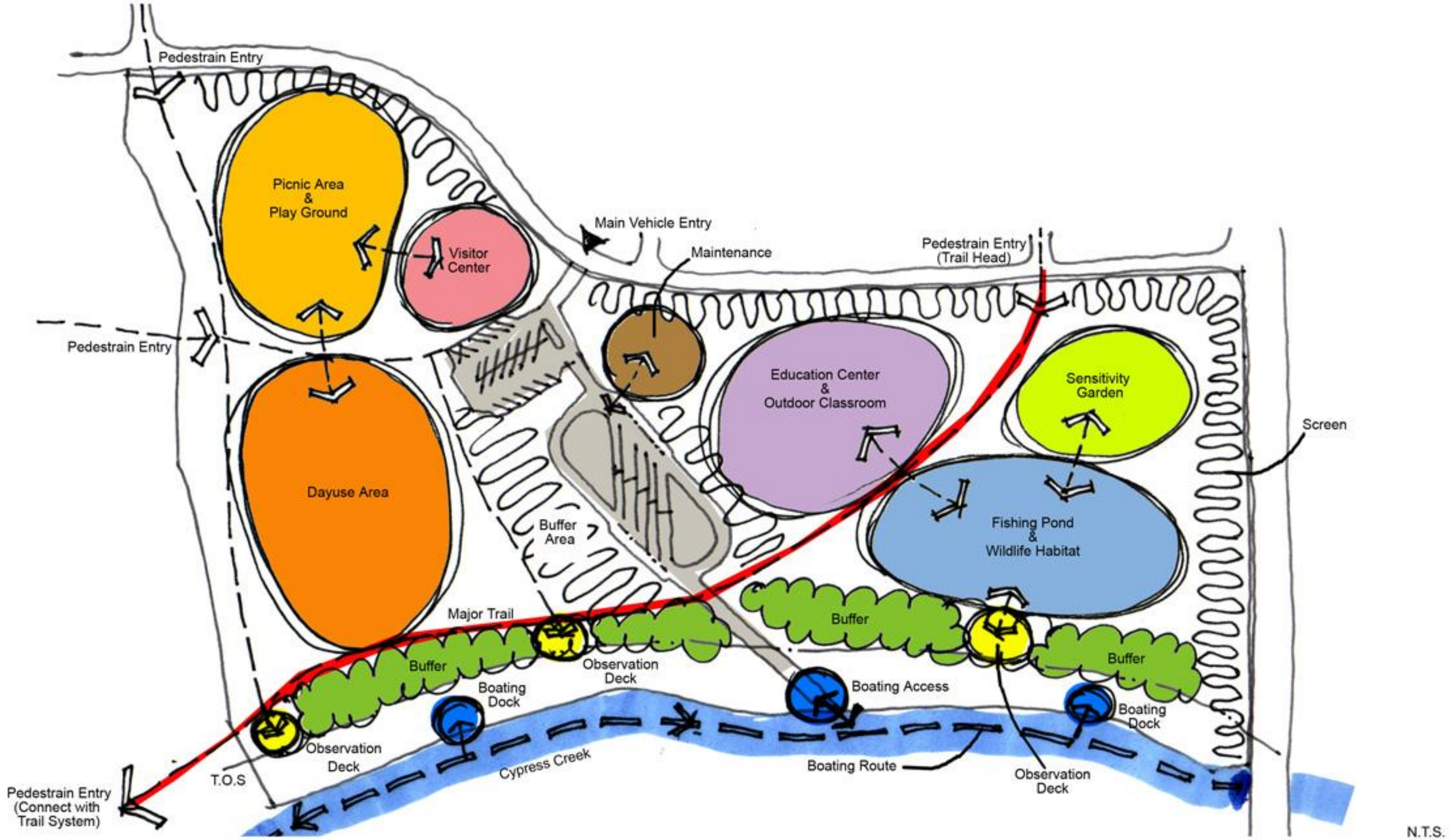


Purpose of Design

- Boat access to Cypress Creek
- Trails connect with the whole hike and bike system of TLUD
- Safe and attractive environment serve for different types of users
- Resonable circulation routes
- Use existing site condition sufficiently
- Unique character

Program

Users	Activities	Facilities
Walkers/Runners	Walking/Running/Exercise	Trail
Pet owners	Walking pets	Trail/Open space
Bikers	Biking	Trail
People with kids	Playing/Walking/Running/Biking	Play ground
Elders	Walking/Observing	Enabling garden
Fishing people	Fishing/Watching	Fishing pond/deck
Picnickers	Picnicking/Communicating	Picnick area
Canoeists	Boating	Boating access
Environment Educators	Observing/Teaching/Recording/Learning	Education center/Outdoor classroom
Watchers (for bird, wildlife, view, etc.)	Observing	Wildlife habitat/Sensitivity Garden /Rhododendron Garden
Outdoor public events	Entertainment/Communicating	Small plaza



Functional Diagram

Sandpiper Park
Timber Lane Utility District

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Sheet 16

Legend

Facilities	SQ.FT
1. Visitor Center	2635
2. Education Center	3750
3. Maintenance	700
4a.Plaza	4200
4b.Plaza	1250
5. Pavilion for fishing pond	700
6. Picnic Area	5250
7. Children Playground	1500
8. Enabling Garden	5550
9. Healing Path	1080
10.Exercise Stations	750 x 2
11.Wetland / Creek	11900 (0.27 ac)
12.Observing Deck	120 x 3
13.Boat/Kyak/Canoe Dock	160 x 3
14.Sensitivity Garden	18000 (0.41 ac)
15.Rhododendron Garden	15000 (0.34 ac)
16.Wildlife Habitat	22400 (0.51 ac)
17.Fishing Pond	17555 (0.40 ac)
18.Preserved Forest	
19a.Parking Lot:	26 car spaces 2 handicap spaces
19b.Parking Lot:	11 car spaces 1 handicap space
19c.Boat Parking:	10 spaces
Total Area:	944104 (21.67 ac)
Length of Roadway:	1531.05'
Main Trail: Hike & Bike	10'
Secondary Trail:	8'
Path:	5'

0 40 80 160

Sandpiper Park
Timber Lane Utility District

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Master Plan

Sheet 17

Legend

Phase I
1 - 2 Years

1. Visitor Center
3. Maintenance
6. Picnic Area
7. Children Playground
11. Wetland / Creek
12. Observing Deck
13. Boat/Kyak/Canoe Dock
19a. Parking Lot: 26 car spaces, 2 handicap spaces
19c. Boat Parking: 10 spaces
20. Main Trail: Hike & Bike

Phase II
3 - 4 Years

2. Education Center
4a. Plaza
4b. Plaza
5. Pavilion for fishing pond
8. Enabling Garden
9. Healing Path
10. Exercise Stations
12. Observing Deck
17. Fishing Pond
19b. Parking Lot: 11 car spaces, 1 handicap space

Phase III
5 - 6 Years

14. Sensitivity Garden
15. Rhododendron Garden
16. Wildlife Habitat

0 40 80 160

Phases Planning

Sandpiper Park
Timber Lane Utility District

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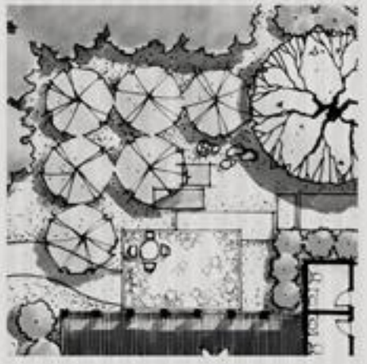
Site Details



Index Map N.T.S.

Legend

1. Visitor Center
   - 1a. Waiting Area
   - 1b. Visitor Information
   - 1c. Office
   - 1d. Kitchen
   - 1e. Restroom
   - 1f. Storeroomt
2. Conference Center
3. Patio
4. Courtyard
5. Main Entrance (Handicap Access)
6. Sculpture
7. Entry Sign
8. Preserved Forest

Building Area: 2634.95 sf.

Site Plan

Scale: 1" = 10'

Park Entrance & Visitor Conference Center

Sandpiper Park
Timber Lane Utility District

Landscape Architecture & Urban Planning Department
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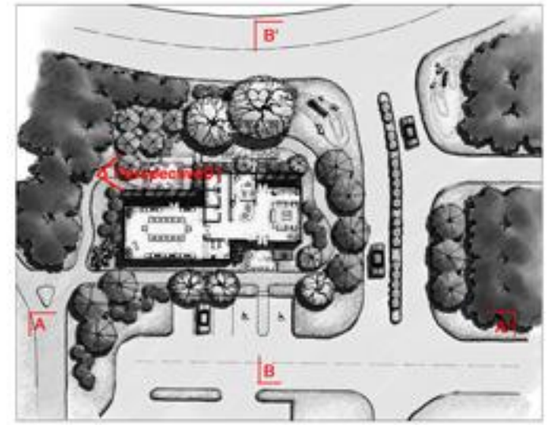
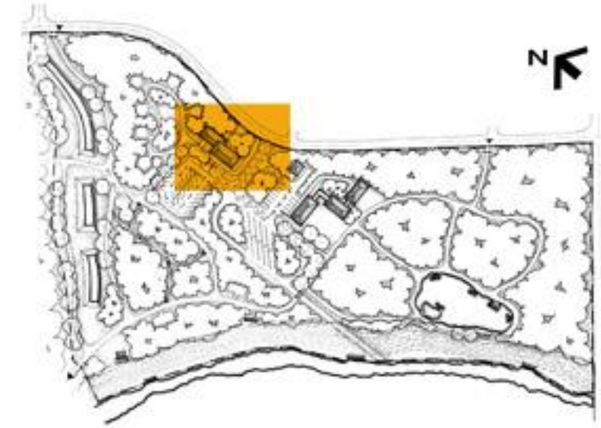
Bird's-Eye View

Perspective 01





Index Map N.T.S.

Section AA'

Park Entrance & Visitor Conference Center

Sandpiper Park
Timber Lane Utility District

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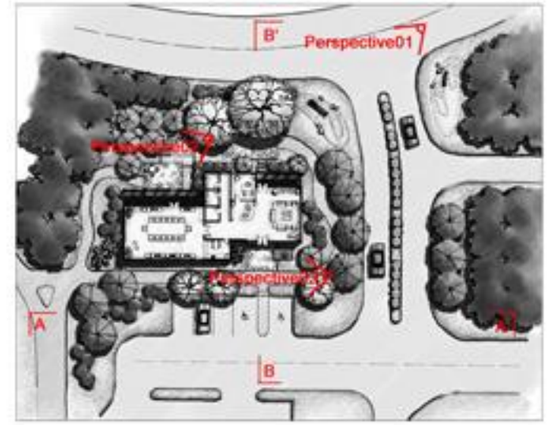
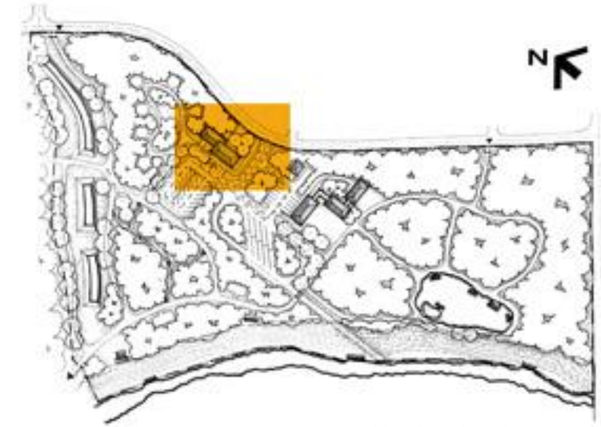
Perspective 01





Index Map N.T.S.

Perspective 02

Perspective 03

Section BB'

Park Entrance & Visitor Conference Center

Sandpiper Park
Timber Lane Utility District

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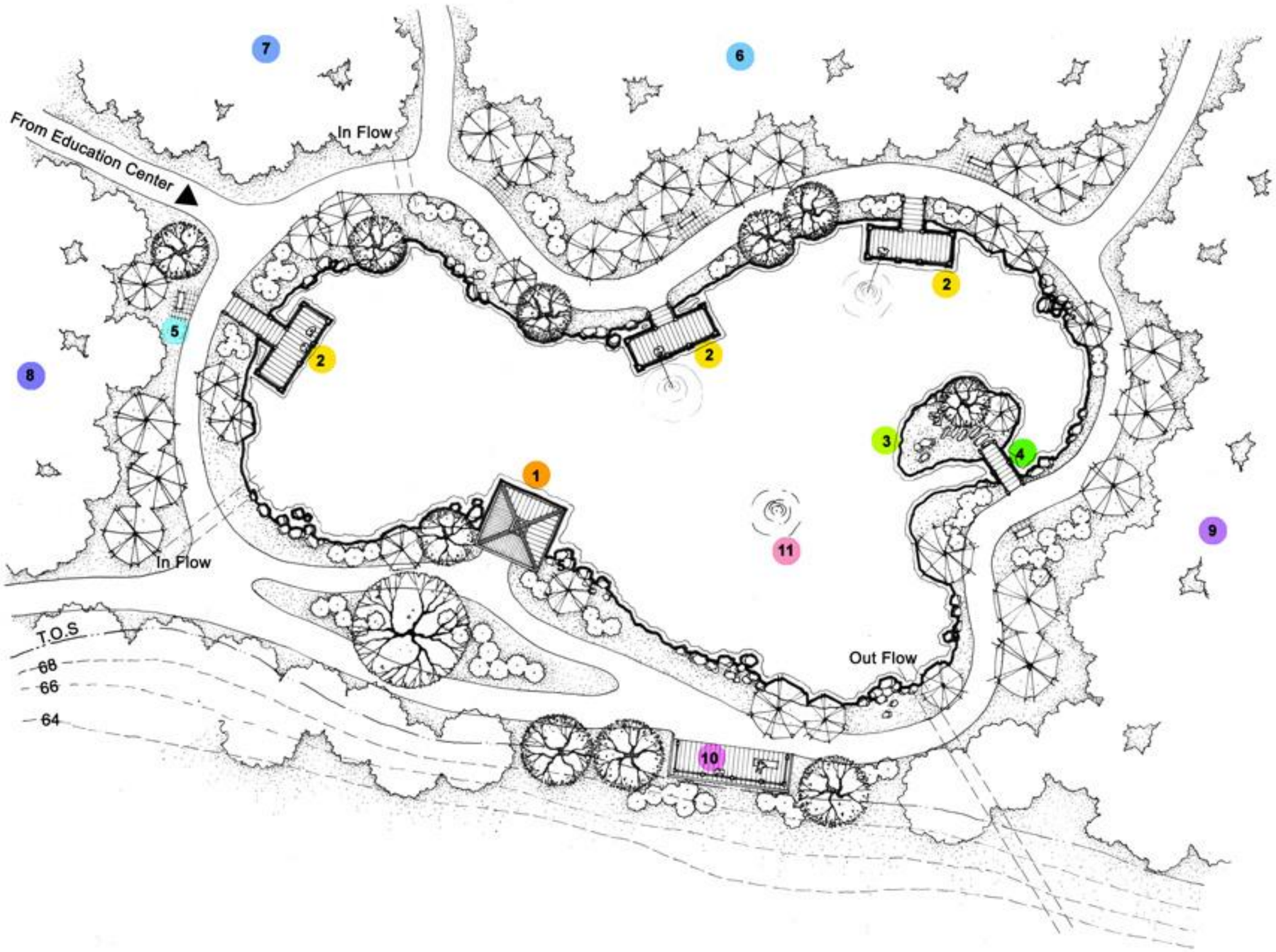
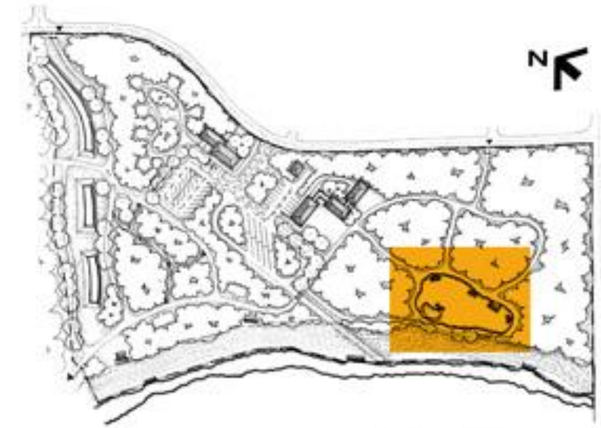




Index Map N.T.S.

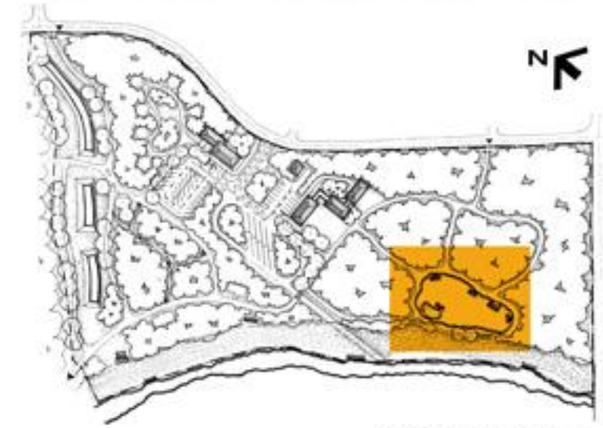
Legend

1. Pavilion
2. Fishing Deck
3. Small Island
4. Bridge
5. Sitting Area
6. Sencitivity Garden
7. Rhododendron Garden
8. Wildlife Habitat
9. Preserved Forest
10. Observation Deck
11. Fountain

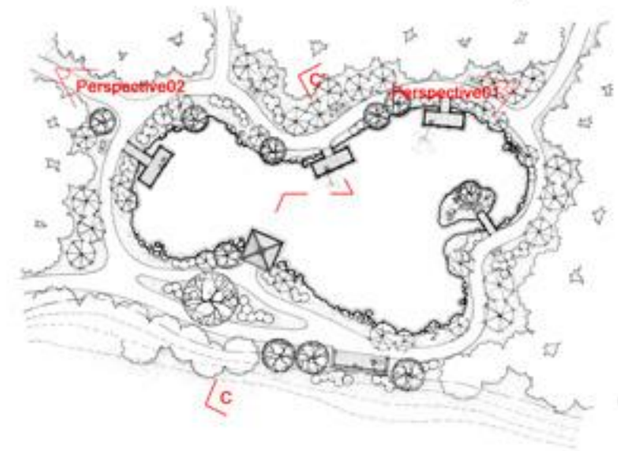
Fishing Pond Area: 17555.32 sf.(0.4 ac)

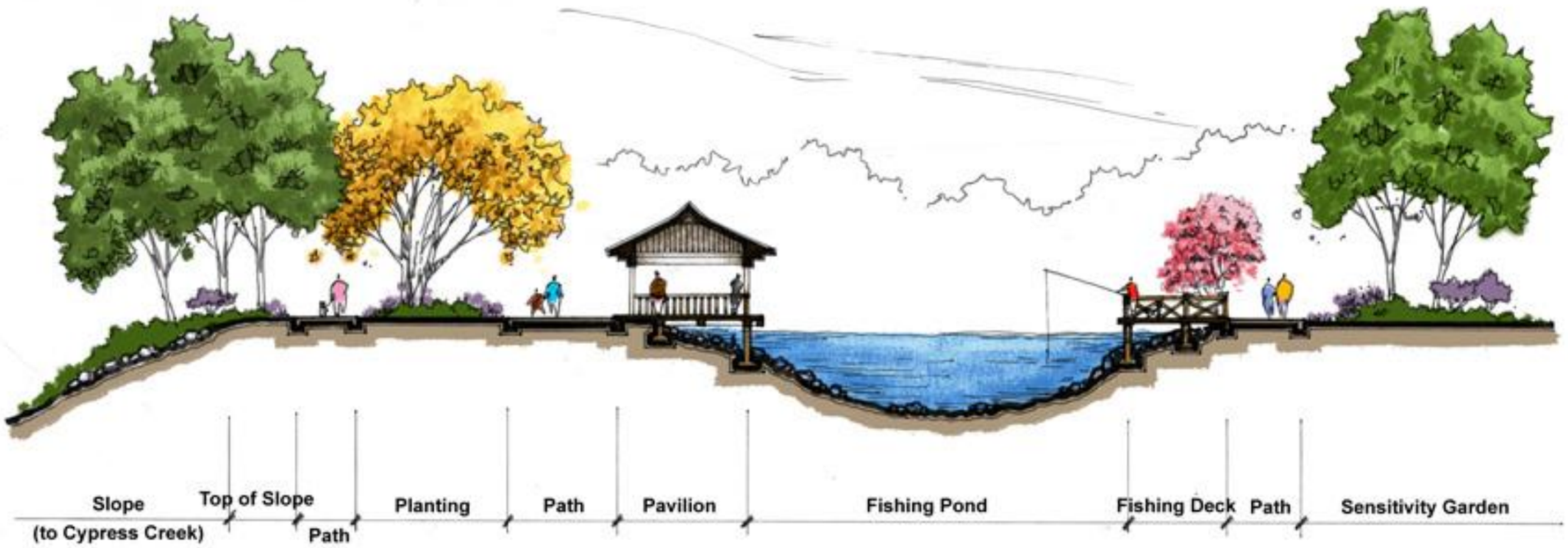
Perspective 01

Perspective 02



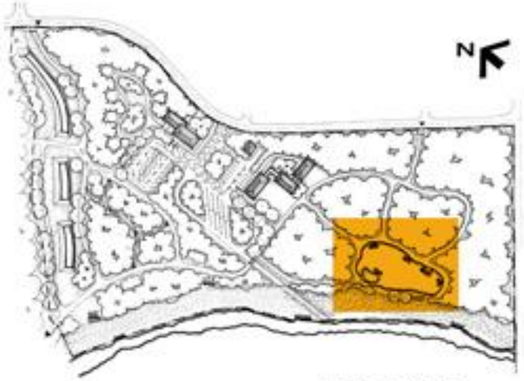
Index Map N.T.S.



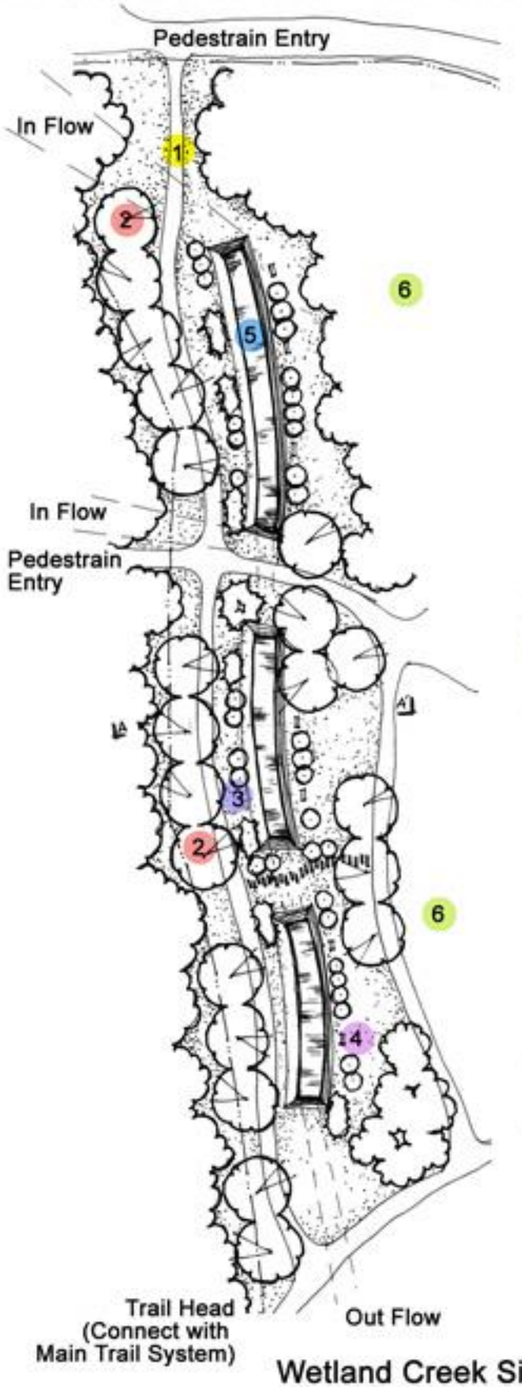


Section CC'

Bird's-Eye View



Index Map N.T.S.

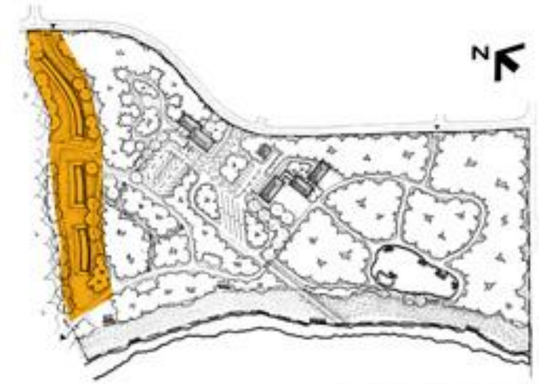


Wetland Creek Site Plan

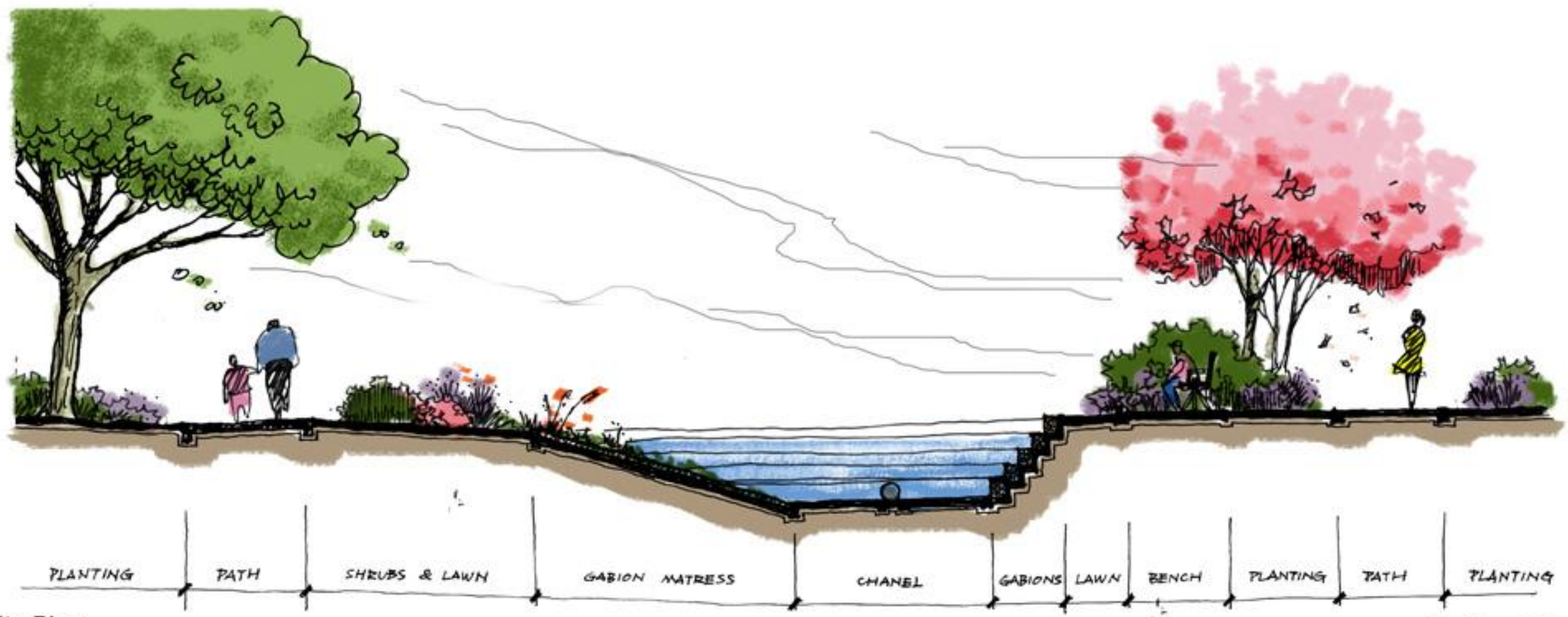
Legend

1. Path
2. Ornamental Tree
3. Shrub
4. Sitting Bench
5. Wetland Creek
6. Preserved Forest

Gabions and gabion mattresses are wire fabric containers, uniformly partitioned, of variable size, interconnected with other similar containers and filled with stone at thesite of use, to form flexible, permeable, monolithic structures. Mattresses are relatively small in height in relation to the lateral dimmension of a gabion and are generally used for channel linings.



Index Map N.T.S.



Section AA'

Wetland Plants for Use in Texas

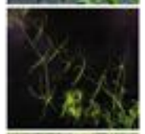
1 Vallisneria americana
Wild celery, tapegrass, eelgrass
S, Ev

2 Potamogeton nodosus
American pondweed, floating-leaf pondweed
S, T

3 Potamogeton illinoensis
Illinois pondweed
S

4 Heteranthera dubia
water star grass
S

5 Chara spp
muskgrass
S



6 Nelumbo lutea
American lotus
FL, Sh, X

7 Nuphar luteum
spatterdock, cow lily, yellow water lily
FL, Sh, X

8 Nymphaea odorata
white water lily
FL, Sh

9 Scirpus validus
Softstem bulrush
E, Dor

10 Eleocharis quadrangulata
squarestem spikerush
E, Dor

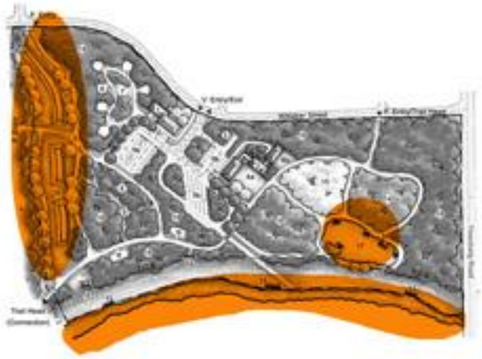
11 Eleocharis macrostachya
Flatstem spikerush
E, Ev

12 Sagittaria latifolia
Arrowhead
E, Sh, Dor

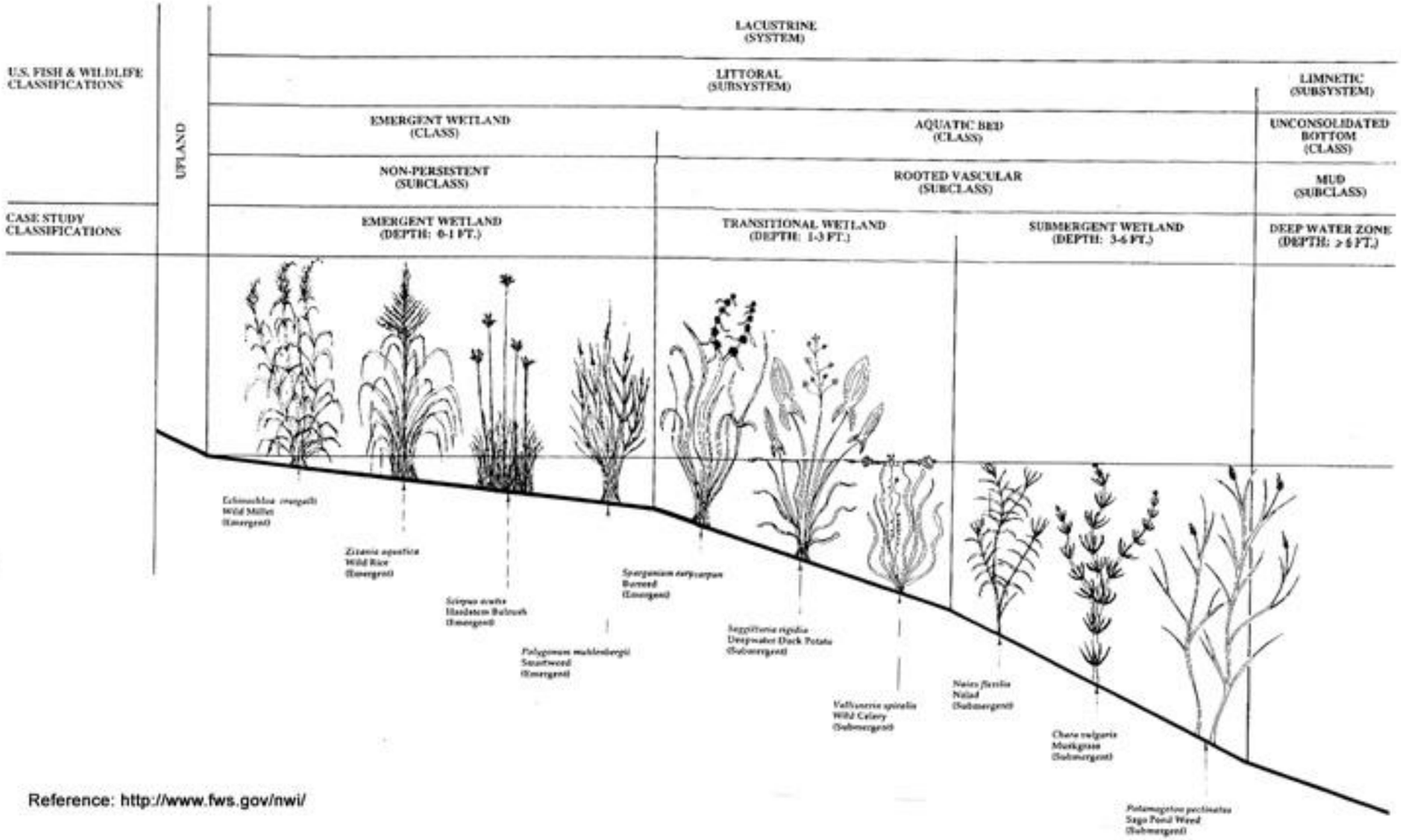
13 Sagittaria graminea
bull tongue
E, Sh, T, Dor

14 Echinodorus cordifolius
creeping burhead
E, Sh, Dor

15 Pontederia cordata
pickerel rush, pickerelweed
E, Sh, Dor



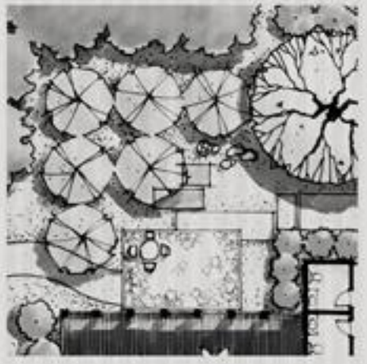
Aquatic Plants Location



S= submersed
FL= floating-leaved
E=emergent
Sh=showy flowers
X=may grow to excess
Ev=evergreen
Dor=dormant in winter
T=tubers help recovery from drawdown

Reference: http://www.fws.gov/nwi/

Appendix



Reference List

01. Texas General Land Office, http://www.db.glo.state.tx.us/gisdata/

02 Texas Education Agency, http://penick.tea.state.tx.us/SchoolDistrictLocator/counties/r6/walker.asp

03 Map Created by IMS/CivilTech Engineering, Inc. 2005

04 http://water.usgs.gov

05 Reference: http://topozone.com

06 Soil survey of Harris County

07 Soil and Water Analysis Report, *Soil, Water and Forage Testing Labotatory*, Sep. 2005

08 Texas Parks & Widlife GIS Lab Downloads of Texas Vegetation Type, http://www.tpwd.state.tx.us/gis/downloads/

09 www.weather.com

10 USDA Plant Hardiness Zone Map, USDA/ARS Publication Number 147

11 www.susdesign.com

12 http://www.gabions.net/

13 http://www.fws.gov/nwi/