PRELIMINARY ECOLOGICAL ASSESSMENT OF WALLER CREEK

for

The City of Austin, Texas
The Comprehensive Drainage Plan and Study
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1.0 INTRODUCTION

In the Austin area, many of the most ecologically valuable natural or semi-natural areas are associated with the major creek systems. Most of these areas exist in as yet undeveloped regions with a few remnants persisting in urbanized areas. Urban expansion as well as the maintenance and improvement operations associated with existing urban developments threatens to seriously modify or destroy many of these ecologically valuable areas. In undeveloped areas, urbanization can produce drastic, short-term changes associated with clearing and construction activities as well as long-term changes in both the quality and quantity of water transported and the degree of chronic disturbance associated with proximity to man. In established urban areas remnant natural communities are threatened by changes in runoff quality and quantity, often due to development upstream, and channel modification.

The first step in preserving ecologically valuable areas is to identify and map them. A simple system for determining the relative ecological value of streamside communities has been devised and applied to several of Austin's creeks. This ecological value index system functions to alert planners and developers to the differential suitability for development of various segments of a creek. This should allow a more environmentally sound approach to the development of outlying areas and the maintenance and improvement of preexisting urban areas.

This report describes the ecological value index system and uses it, along with a general ecological discussion and plant species list, to describe the ecological condition of Waller Creek.

2.0 ECOLOGICAL VALUE INDEX

"Ecological value" is a relative term based on the comparison, between or among ecosystems, of a number of variables which are not easily quantified. Therefore, it is not possible to objectively assign indisputable quantitative ecological value scores to various areas. Ecologists and naturalists can however often make reasonable, generally agreed upon, qualitative judgements as to the relative ecological values of certain areas. In this evaluation a number of interrelated factors are subjectively taken into account, e.g., species richness and diversity, vegetation structure and successional status, types of species present, uniqueness of the biota, wildlife support capabilities, aesthetic qualities, and degrees of human impact or pollution levels.

2.1 Definition

A simple, easily applied ecological indexing system to be used in evaluating creek flood plains has been devised which combines many of the above considerations into three arbitrarily chosen ecological parameters: stream channel condition, floral community condition, and faunal community condition. For a given stretch of a stream, numbers representing the quality of each of these factors are independently assigned and combined to generate an overall ecological index. The following table lists the assignable values and the criteria for each.

	Ecological Parameter		
Value	Channel	Flora	Fauna
0	High modification, low topographic relief.	Little natural vegetation, no trees, mainly mowed grasses and bare ground; low diversity.	Pollution & man-tolerant species; low diversity.

Value	Channel	Flora	Fauna
1	Moderate modification, low relief; or high modification, high relief.	Few trees or scattered brush, mostly grasses, weed species; low diversity.	Some natural fauna but man-associated & pollution tolerant forms dominant; low diversity.
2	Little or no noticeable modification, low relief; or moderate modification, high relief.	Moderate to heavy tree cover, little or no underbrush, grasses & herbs; medium diversity.	Natural fauna dominant over man-associated fauna; medium diversity.
3	Little or no noticeable modification, high relief.	Natural woody streamside vegetation, well developed over- & understories; high diversity.	Natural fauna; high diversity.

The above values are applicable to the streambed and the flood plain, considered here as an ecological unit. Flood plain is used in a general sense to denote the land adjacent to the streambed and subject to occasional flooding, thereby being influenced in its physiography and ecology by its proximity to the creek.

To obtain the ecological value index for a given creek segment, the values assigned for each of the three parameters are summed. The ten possible sums (0-9) can, for purposes of simplification, be arbitrarily lumped into five groups of two designated by Roman numerals (i.e. 0-1 = I, 2-3 = II ... 8-9 = V) which represent the five values of the ecological value index. It is convenient for easy visual interpretation to color code the index as follows: I = red, II = orange, III = yellow, IV = green, V = blue.

An additional rank (flag) is reserved for the presence of rare or endangered species as defined by the U. S. Fish and

Wildlife Service and the Texas Organization for Endangered Species (TOES). Areas containing such species or prime habitats for them are designated with a "flag" in addition to their regular index value. An ecological investigation and recommendation from a qualified, knowledgeable ecologist should be obtained for such areas before any planning decisions involving possible impact are made.

2.2 Explanation and Application

The parameter describing channel condition takes two things into consideration: the degree of channel modification and the relief associated with the banks of the streambed or the flood plain. Topographic relief is assumed to be positively correlated with ecological and aesthetic value. Canyons generally have greater aesthetic appeal than areas of low relief and often contain unusual or unique biological habitats. Using the proposed criteria, an unmodified stream channel with gradually sloping banks such as might be found on the gently rolling plains of the Blackland Prairie would have a value of 2 while an unmodified stream cutting a small cliff-lined canyon through the limestone strata to the Edwards Plateau would have a value of 3. While a modified channel with little relief along its banks might be assigned a value of 0, the same degree of modification on a stream bounded by high limestone cliffs might result in a higher value. Concrete lined channels are assigned a value of 0. This parameter provides consideration of human disturbance of the ecosystem, habitat uniqueness, and aesthetic value.

The floral condition parameter is based on the structure, naturalness, and diversity of the flood plain vegetation. A stream in a residential area lined with mowed grass lawns and

containing small willows, cattails, or other weeds would receive a 0 ranking. The same stream passing through an established residential area with occasional small trees or shrubs along with mowed lawns and perhaps a few weed species in the channel would receive a 1 ranking. A stream bordered by large, mature trees, grasses and herbaceous growth would be given a 2 rating as would a young stand of native woody vegetation composed of several species with occasional undergrowth and a few weed species. A stream with a diverse, relatively natural tree, shrub, and herb layer in its flood plain would be classed as a 3. In classifying vegetation, the number of species and vegetation structure should be considered. Thus, a park with two or three species of trees providing almost total shade, although aesthetically pleasing would be ranked lower than an undeveloped streamside with several species of trees and shrubs forming a dense wooded habitat. The latter supports greater plant diversity and provides better habitat for animals. Ecologists consider the species diversity in an ecosystem to be roughly correlated with the stability and resiliency of the system. The width of the belt of vegetation along the creek is also considered. In extreme cases, variation in width may result in essentially the same type of vegetation receiving two values. For example, a wide belt of young, relatively diverse woody vegetation might receive a value of 2 while similar vegetation forming a belt only a few feet wide in another area might be valued as 1.

The faunal condition parameter is based on the naturalness and diversity of the animal assemblage. A flood plain where the major faunal elements are man-associated species such as house sparrows, grackles, starlings, domestic dogs and cats, rats, and tolerant aquatic species would receive a 0 ranking. One which supports a varied bird fauna, including spring and fall migrants and nesters, and viable populations of native mammals, reptiles

and amphibians as well as a diverse fish fauna would receive a 3 ranking.

The three parameters chosen to grossly characterize the creek environment are not independent. A high rating in one parameter is usually, although not necessarily, associated with equivalent ratings in the other parameters. High faunal ratings must normally be accompanied by high floral ratings since vegetation provides the most significant component of the habitat necessary to support animals. Conversely, high floral rankings may not be accompanied by high faunal rankings. In urbanized areas, remnant stands of native vegetation may not support a natural fauna due to the adverse impact of man's proximity (e.g., noise, physical disturbance, predation or competition by domesticated or man-associated species) on many wild species. Channel rating is usually correlated with vegetation rating. An undisturbed channel will much more likely support a natural stand of vegetation than a disturbed one. After the disturbance, associated with channel rectification, of natural streamside communities, weedy species (e.g., willow, cattails) invade the modified habitat and form a new community, simpler and less valuable ecologically than the natural one it replaced.

The ecological value index, obtained by summing the values assigned for the three parameters described above, assumes one of five values as explained previously. An example of the highest (V) rating, color-coded blue, would be a pristine, undisturbed canyon in the hill country or a natural wooded flood plain without spectacular topographic relief. A green (IV) rating might be given to the former area after it had been surrounded by low density human development the impact of which might be a reduction in the faunal diversity, slight modification of the natural vegetation, and some stream channel modification (e.g. placing sewer lines in the creek bed, etc.). Some stretches of Austin's urban creeks

illustrate this type of impact effect. A yellow (III) rating would normally be applied to well-used parkland and established, low density residential areas. Such areas are characterized by moderate to abundant tree cover, mowed lawns, an limited shrub layer and a mixing of natural and domestic species. An orange (II) rating is exemplified by residential areas of low topographic relief, little or no tree cover, no significant shrub layer, mowed grass or dirt banks, and a dominance of weed or domestic species. The lowest (I) rating, color-coded red, is applied to rectified portions of creeks dominated by weed species and having little aesthetic appeal or ecological value.

A creek in an undeveloped area does not inherently deserve a blue (V) rating. Farming or grazing land in use or abandoned and coverd with young second growth vegetation does not support the species diversity of a more mature stratified forested area and might therefore receive a green (IV) or yellow (III) rating. Likewise a stretch of creek bordered by developed land need not always receive a red (I) or orange (II) ranking. Low density residential neighborhoods where heavy tree growth and a diversity of shrubs and herbaceous species border the creek may provide a more valuable habitat than that found in some undeveloped areas.

The ecological value index is, in general, positively correlated with several qualities of the creek environment. Among these are naturalness, aesthetic appeal, species diversity and species richness, and stability and resiliency, i.e., the ability to withstand minor perturbations without undergoing major structural or functional changes. A negative correlation generally exists between the value index and human usage, amount of development and/or channel modification, and pollution levels. Exceptions to these relationships exist. Unusual, fragile natural habitats of high ecological value often lack resiliency and are

easily destroyed. Open, parklike habitats with large, widely spaced trees, mowed grasses, and little underbrush are considered by many as more aesthetically desirable than natural wooded streamsides supporting a diversity of plants and having much greater structural complexity. However, the latter, due to its greater diversity and stability, is considered the more ecologically valuable according to the system used here.

Because this system is based on the judgement of the investigator in applying arbitrarily separated, discontinuous category rankings over a continuum of ecological situations the values arrived at should not be considered definitive. For a number of reasons, different investigators may vary in their assessments. One of the foremost difficulties in assessing the naturalness of an area is in determining what the "natural condition" is or was. Most of the area in and around Austin has been modified to some degree by man's activities over the past 150 years, chiefly by farming and grazing. Therefore, investigators' independent assessments of the ecological value of an area based on their evaluations of its similarity to a hypothetical undisturbed state may vary. Nonetheless, the variance in rankings assigned by different investigators should not be great. In most cases, the value index applied to a single area by several investigators should not vary more than two rankings, i.e., a single area might vary from orange to yellow but not normally from red to yellow.

2.3 Utility

The proposed ecological index provides a general assessment of the environmental quality of the immediate environs of a waterway. The following are some of the more obvious ways in which planners can utilize this index system:

1. When considering alternative locations of development projects or alternative plans for approved developments which may impact the creek, the index allows quick identification of problem areas.

2. When channel modification is necessary for flood control, the index provides general guidelines for minimizing environmental impact. Rectification should be located in the least valuable areas whenever possible.

3. The index provides information for area-wide land use planning decisions. In undeveloped areas destined for development, various types of development can be matched, according to their potential impact, with the appropriate type of creek habitat (i.e., parks and nature preserves with blues (V) and greens (IV); low density residential with greens (IV) and yellows (III); high density residential and commercial with yellows (III) and oranges (II). Also, an overall index value can be generated for a given creek by averaging its values, weighted by their proportional occurrence (length and width of stretches). This allows comparison of the ecological values of two or more creeks.

The index system is not a substitute for a thorough ecological site study in the evaluation of impact. However, it does pinpoint areas where such studies should be undertaken in impact evaluation. The flora and fauna in blue (V) and green (IV) areas should always be assessed and the potential impact of any proposed development carefully evaluated.

3.0 ASSESSMENT OF WALLER CREEK

Waller Creek extends about 7 km (4.5 mi) north of the Colorado River in central Austin. It lies in the Blackland Prairie vegetational area with the Edwards Plateau lying only a few kilometers to the west. Therefore, the vegetation is a mixture of eastern and western species, along with a large percentage of exotic or cultivated forms. The central portion of Austin through which Waller Creek flows was settled early and used predominately for residential and commercial purposes. The vast majority of development along the creek is more than 30 years old. The creek environs generally reflect the long-term impacts of urbanization. Most obvious are physical changes in the channel and flood plain. Less obvious are biological changes, mainly the intrusion of exotic and cultivated plants, the severe depression of aquatic life due to urban effluent, and the dominance of man-tolerant organisms in the terrestrial fauna.

The following general ecological descriptions are based on a brief site survey and a review of pertinent literature. Notable literature references utilized are the following:

Gould, F. W. 1969. Texas plants. A checklist and ecological summary. TAMU, College Station.

U. S. Soil Conservation Service. 1974. Soil Survey of Travis County, Texas. USDA, Washington, D. C.

Wermund, E. G. 1974. Approaches to environmental geology. Bureau of Economic Geology, UT Austin.

3.1 Physical Setting

Waller Creek passes through two major bedrock units. Moving north from the Colorado River, the creek passes through beds of unconsolidated sand and gravel alluvium, soft limestone, and finally, more alluvium. This is reflected in the nature of the banks and creek bed. Dirt and gravel banks with a gravel or

silt creek bed occur in the lower and upper reaches, while the middle sections contain areas of exposed limestone banks and a creek bed of solid rock and silt. The creek and its immediate environs are characterized by low relief; slopes are generally less than 5%.

Soils along the lower portion of the creek, from approximately Harris Dr to the Colorado River, are classed as Urban land. These soils have been altered by man's activities to such an extent that they no longer resemble natural soil associations in the area. From Harris Dr north to Duval St soils are of the Frio series. These are deep, friable, nearly level bottomland silty clay loams restricted to major streams and their tributaries. They developed over chalk in alluvium under tall grasses and a scattering of trees. Some of the land in this soil series is exposed chalk beds or chalk beds partly covered with shallow patches of sandy clay loam. Above Duval St the creek flows through Houston Black soils and Urban land. Houston Black soils are deep, moderately well-drained clays which developed in calcareous marls, alluvial clays, and chalk under a prairie of tall grasses. Most of the slopes of more than 4% are cut and shaped for urban development. The soil in these areas and in some areas not used for urban development has been altered by cutting and/or by filling with local or imported soil materials. This soil group presents special engineering problems when used for urbanization as a result of its high shrink-swell potential, corrosivity, slow permeability, and high erosion potential. Little native vegetation remains except for occasional trees.

Waller Creek has been physically impacted by urbanization perhaps more than any other of Austin's major creeks. The lower portion has been extensively altered mainly by commercial development. Major alterations include extensive cut and fill operations, bulkheading, channel rectification, and the use of the creek to carry public sewer lines and storm runoff as well as various commercial and residential effluents. The area

between 5th and 10th Sts is highly commercialized. The upper part of the creek which traverses old residential and recreational development is less obviously impacted. However, there are still noticeable minor alterations, many by local residents, which detract from the naturalness of the creek environs. Seriously eroded banks occur in the lower reaches where vegetation has been removed and banks have not been stabilized. Domestic refuse is heaviest along the extreme lower portion of the creek.

3.2 General Vegetation and Habitat Description

The extensive urbanization of Waller Creek has drastically affected its flora. Natural vegetation has been cleared or thinned, soil conditions changed by channel modifications and development, and cultivated species introduced. The remaining tree species found adjacent to the creek are dominated by pecan and elm in areas of extensive alluvial deposits and live oak and rock cedar in areas of exposed rock and thin soil. The opening of the creek banks along with landscaping and gardening activities has allowed cultivated species (e.g., paper mulberry, mimosa tree, tree-of-heaven, chinaberry tree, Chinese tallow tree, common fig, Kentucky wisteria, glossy privit, Japanese honeysuckle, bamboo, Georgia cane, water hyacinth, St. Augustine grass, Johnson grass) to become established along the banks. The disturbance has also allowed native weeds (e.g., willow, Roosevelt weed, rattle pod, Texas broomweed, horse-weed, giant ragweed, cocklebur, common sunflower) to prosper. Table I lists those species identified during a brief fall survey of the creek. The following paragraphs describe the overall environment of the creek moving north from the Colorado River.

Between South 1st St and the junction with the Colorado River, Waller Creek is relatively wide, shallow, and heavily impacted by man's activities. Erosion is evident along the banks, especially just below South 1st where the creek bends to the west

and cuts into the high dirt banks on the eastern side. Domestic trash and debris, including large concrete blocks, occur along this stretch. A large apartment complex extends to the creek's edge on the west with concrete bulkheads and riprap extending down to the water. Vegetation along this stretch ranges from mowed lawns around the apartment complex to small stands of native vegetation (e.g., live oak, willow, mesquite, Texas sugarberry, American elm, cottonwood, mulberry) mixed with cultivated species (e.g., chinaberry, chase tree, tree tobacco) mostly along the eastern creek bank.

Between South 1st and 5th Sts the creek traverses older, well spaced commercial development and a school playground. The channel is relatively wide and shallow with some sections concrete lined or riprapped. Cutting and filling is apparent. Erosion is evident in some areas where the banks have not been stabilized. Domestic debris and storm sewer drains are aesthetic detractions. The banks are generally open with buildings encroaching in only a few places. Vegetation consists of mowed grasses, scattered trees (e.g., willow, chinaberry, retama), and herbaceous species dominated by Johnson grass and giant ragweed. At the railroad crossing between 3rd and 4th Sts, a relatively dense stand of small chinaberry and willow exists.

From 5th through 7th Sts the creek banks are lined with stone and concrete. The creek forms essentially a deep, walled drainage ditch through old commercial development. Buildings back up to the walled banks. Trees occurring occasionally at street level above the limestone-bottomed channel along this stretch include pecan, willow, Texas sugarberry, paper mulberry, and chinaberry.

Above 7th St and continuing to 12th St, the creek channel becomes wider and more shallow, without high stone walls and crowded, encroaching buildings. The banks have been filled and bulkheaded in a few places; erosion is evident in places, especially nonbulkheaded cut banks. The creek bottom varies from

mud to limestone with shallow, swift water in places. Natural, woody vegetation occurs along much of this stretch. Trees, some of which are quite large, include live oak, Texas sugarberry, cottonwood, chinaberry, and mulberry. Dominant herbs are Bermuda and Johnson grass and giant ragweed. A parklike stand of live oaks over mowed grasses occurs between 9th and 10th Sts. A colony of Georgia cane exists between Red River and 10th Sts.

Between approximately 12th and 16th Sts, Waller Creek is currently severely impacted by construction activities associated with modification of Red River St, which it closely parallels. Before cut and fill operations began, much of this stretch was bordered by open space containing vegetation characterized by species such as live oak, cedar elm, and honey locust. Presently natural vegetation is limited to a few trees near the water and some shoreline stands. Manholes and storm sewer drains along the creek detract from its aesthetic appeal in this section as in others.

Between 17th and 18th Sts the creek passes through a more heavily vegetated area. Except for the impact of several large buildings on the east and parking lots on the west, this stretch has considerable aesthetic appeal. Trees and shrubs line both banks. On the west side are the remains of an old stone building amongst a mixture of native and cultivated vegetation. Common vegetation along this wooded stretch include live oak, cedar elm, honey locust, trumpet creeper, Virginia creeper, cocklebur, buffalobur, yellow oxalis, and common four o'clock. In marshy areas, other species such as burhead, eastern gamagrass, fiddledock, smartweed, rattle pod, water-primrose, umbrella water pennywort, and arrowhead occur.

Between 18th and 19th Sts, the creek bends west and north with a parking lot lying adjacent to the east and south. The banks have been cut and filled; concrete slabs, rocks, and trash litter the creek bed. A few large trees (e.g., oaks, elms,

sycamore, glossy privit) line the banks, becoming more dense toward 18th St. Understory vegetation is mostly grass and various weed species.

As the creek traverses the University of Texas campus from approximately 19th through 26th Sts, it ranges from relatively natural and little disturbed to highly modified. The channel itself varies from more or less natural (e.g., behind the UT Alumni Center) to rectified and concrete lined (e.g., south of 26th St). The banks are rather steep in some areas and range from soil to low limestone cliffs and boulders. The creek bed itself is mainly rock or gravel. Little domestic debris occurs along this stretch. The vegetation varies from dense, narrow streamside thickets to large scattered trees over a mowed, well manicured St. Augustine grass lawn. Dominant trees are cypress, pecan, live oak, rock cedar, willow, and Texas sugarberry. Some trees are quite large (e.g., cypress with dbh > 1 m). Dense stands of streamside vegetation, such as occurs between the San Jacinto St bridge and Memorial Stadium and north of 21st St behind the Alumni Center contain understory species such as grape, soapberry, honeysuckle, peppervine, privit, Virginia creeper, ruellia, trumpet creeper, giant ragweed, and moonseed-vine as well as an overstory of large trees. Birds are numerous in these heavily vegetated areas, especially during migration periods.

North of the university area, the creek flows through Eastwoods Park. Here the channel has been modified with occasional bulkheading of rock or concrete. The park vegetation is dominated by large, widely spaced trees (pecan, cedar elm, live oak) over a mowed lawn. However, other species including shrubs and herbaceous species occur. These include privit, coma, yaupon, bamboo, grape, poison ivy, giant ragweed, frostweed, coral-berry, box elder, catbriar, and drummond wax-mallow. This area is heavily used by birds, especially migrants in the spring and fall.

From 31st St north to 38th, the creek winds through an old residential district. The channel ranges from narrow, totally

rectified by stone and mortar retaining walls at the southern end of this stretch to nonchannelized and relatively natural (except for some filling of adjacent yards) toward the northern end. Lawns back up to the creek throughout this stretch except for an open, parklike schoolyard south of Harris St. The creek bed and the banks in some sections are exposed limestone. Concrete is sometimes evident in the creek bed. Vegetation exists as a well developed narrow strip of native and cultivated species. A park-like situation prevails along most of this stretch with a well developed streamside canopy of large trees (mostly pecan, Texas sugarberry, and willow) over an understory which varies from fairly dense shrubs and vines to open St. Augustine grass lawns. Among the common understory species are poison ivy, Japanese honeysuckle, grape, redbud, and various cultivated herbs and shrubs. Bird use of this stretch appears to be relatively heavy.

The creek traverses Hancock Golf Course between 38th and 41st Sts. The channel is natural except for modifications such as cart crossings. Steep streambanks and low limestone cliffs border the creek in some areas. The streamside vegetation is parklike with large live oak, pecan, red cedar, tree-of-heaven, American elm, and bois d'arc over an understory of grasses.

From 41st to Duval, the creek has an aspect similar to that in the residential stretch south of 38th. The channel is restricted and concrete or stone lined in several places. The concrete-covered sewer line in the creek bed is often apparent. Domestic debris seems more prevalent than in similar areas downstream. Mowed lawns come down to the creek's edge. Large live oak, pecan, Texas sugarberry, eastern cottonwood, and mulberry occur over St. Augustine grass along with a variety of cultivated species including English ivy, glossy privit, periwinkle, and cane. Ragweed and Japanese honeysuckle are dominant understory plants in some areas.

The creek bends west under Duval St and passes through the grounds of the Elizabeth Ney Museum. Here the narrow channel

is modified by a small dam and footbridge. The vegetation is a lush mixture of native and exotic species. Large specimens of cottonwood, willow, and pecan form an overstory over such species as glossy privit, catawba-tree, Texas oak, poison ivy, honeysuckle and others. On the museum grounds above the narrow floodplain of the creek, are various xeric adapted species (e.g., century plant, prickly pear) and grasses. This quiet, heavily vegetated area is utilized by birds, especially migrating warblers in the spring and fall.

The creek passes through a small park south of 48th St. The channel has been modified. Little native vegetation exists except for a few medium to large trees which line the creek. Mowed Bermuda grass covers the banks. The creek is rectified as it crosses Ave F and 45th St. A few weed species including willow compose the vegetation.

From 45th to the UT intramural fields the creek traverses a residential neighborhood. Houses and lawns encroach on the creek bank which has been modified in places. Dominant trees are cottonwood, American elm, Texas sugarberry, and willow over a weedy understory of Johnson grass mixed with other species. A stand of elderberry occurs along the stream banks.

As the creek passes east of the UT intramural fields it is narrow, channelized and bordered by weedy growths of willow, mesquite, Texas sugarberry, bois d'arc, Texas ash, chinaberry, coma, sycamore, Roosevelt weed, Johnson grass, Bermuda grass, poison ivy, goldenrod and others.

The headwaters of the creek are behind a housing tract just north of 51st St. The channel is narrow, shallow, rectified, and heavily overgrown in weedy species. Only a few Texas sugarberry trees occur. The predominant plants are Johnson grass, giant ragweed, smartweed, annual sunflowers, and young willows.

3.3 Terrestrial Fauna

The terrestrial fauna of the creek is typical of urban streams in the city. The bird fauna varies from predominantly man-tolerant forms (e.g., English sparrows, grackles, starlings, robins) in more open, heavily impacted areas to a diverse mixture of resident and migrant song birds in more natural, heavily vegetated sections. Common mammals are fox squirrels and opossums, especially in wooded parklike and residential areas, and probably rats, as well as feral and domestic cats and dogs. Amphibians and reptiles found along other Austin creeks occur in Waller Creek. Large aggregations of Mexican toads, which inhabit the surrounding residential areas, utilize the creek for breeding in the spring and summer. The highest diversity of mammals and birds occurs in the more heavily wooded and diverse stretches such as occur on the UT Austin campus and in the parks and older residential developments between UT and 45th St.

3.4 Aquatic Biota

Waller Creek is probably the most seriously polluted of Austin's urban creeks. It receives heavy loads of nutrients and a variety of noxious chemicals from storm sewers, domestic sewage leakage and overflow during storms, and various discharges from local homeowners and adjacent institutions. This is reflected in a low diversity of aquatic organisms, heavy algal growths, and unpleasant odors along much of the creek, especially the lower reaches. Few aquatic organisms exist along the commercial stretch below 10th St. The aquatic organisms found in the creek are generally dominated by pollution tolerant forms such as *Physa* sp., a pulmonate snail which can endure the low oxygen concentration of water rich in organic material by moving out onto emergent stones or vegetation. Few aquatic insects are normally present. Clumps of filamentous sewage bacteria can

be found on stones in areas with gentle currents. Despite these adverse conditions the creek supports a fish fauna which includes mosquitofish, shiners, and sunfishes, common to urban creeks in Austin, as well as a population of the introduced Mexican tetra. Frog and toad larvae are present during the spring and fall.

3.5 Ecological Value Index

Fig. 1 is a map of Waller Creek showing the ecological index ratings. No IV (green) ratings were assigned. However, several III (yellow) areas retain a pleasant, parklike atmosphere and are worthy of preservation for aesthetic or recreational, if not strictly ecological reasons. These include the wooded stretches on the UT Austin campus, Eastwoods Park, and the area around the Elizabeth Ney Museum. Also of some aesthetic value are stretches through older residential and recreational developments north of the UT Austin campus. These traverse quiet areas, well vegetated with mixtures of native and exotic plants and dominated by an overstory of large live oaks, pecan, and cypress.

Key to Numbers and Symbols Used in Figures

Symbol	Ecological Index	Value	Color Code
	I	lowest	red
	II		orange
	III		yellow
	IV		green
	V	highest	blue

Numbers separated by commas refer to values assigned for channel condition, floral condition, and faunal condition, respectively. See pages 2 and 3 of this report for an explanation of these values.

TABLE I

COMMON FLORA OF WALLER CREEK

(Fall Survey)

Common Name	Scientific Name	Family
TREES		
Bald cypress	*Taxodium distichum*	Taxodiaceae
Rock cedar	*Juniperus ashei*	Cupressaceae
Black willow	*Salix nigra* var. *nigra*	Salicaceae
Plains cottonwood	*Populus sargentii* var. *sargentii*	
Pecan	*Carya illinoinensis*	Juglandaceae
Live oak	*Quercus fusiformis*	Fagaceae
Texas oak	*Quercus texana*	
Texas sugarberry	*Celtis laevigata*	Ulmaceae
Cedar elm	*Ulmus crassifolia*	
American elm	*Ulmus americana*	
Red mulberry	*Morus rubra*	Moraceae
Bois d'arc	*Maclura pomifera*	
Paper mulberry	*Broussonetia papyrifera*	
Sycamore	*Platanus occidentalis*	Platanaceae
Mimosa-tree	*Albizia julibrissin*	Leguminosae
Honey mesquite	*Prosopis glandulosa*	
Redbud	*Cercis canadensis* var. *texensis*	
Honey locust	*Gleditsia triacanthos*	
Retama	*Parkinsonia aculeata*	
Tree-of-heaven	*Ailanthus altissima*	Simaroubaceae
Chinaberry-tree	*Melia azedarach*	Meliaceae
Chinese tallow tree	*Sapium sebiferum*	Euphorbiaceae
Texas boxelder	*Acer negundo* var. *texanum*	Aceraceae
Soap-berry	*Sapindus saponaria* var. *drummondii*	Sapindaceae
Coma	*Bumelia lanuginosa* var. *oblongifolia*	Sapotaceae
Mexican persimmon	*Diospyros texana*	Ebenaceae
Texas ash	*Fraxinus texensis*	Oleaceae
Catawba-tree	*Catalpa speciosa*	Bignoniaceae
SHRUBS AND VINES		
Cat-brier	*Smilax bona-nox*	Liliaceae
Common fig	*Ficus carica*	Moraceae
Texas virgin's-bower	*Clematis drummondii*	Ranunculaceae
Leather-flower	*Clematis pitcheri*	
Agarito	*Berberis trifoliolata*	Berberidaceae

TABLE I (cont'd)

Common Name	Scientific Name	Family
Eastern gamagrass	*Tripsacum dactyloides*	Gramineae
Bermuda grass	*Cynodon dactylon*	
Umbrella-sedge	*Cyperus odoratus*	Cyperaceae
Ball moss	*Tillandsia recurvata*	Bromeliaceae
Erect dayflower	*Commelina erecta* var. *angustifolia*	Commelinaceae
Water-hyacinth	*Eichhornia crassipes*	Pontederiaceae
Twisted-leaf yucca	*Yucca rupicola*	Liliaceae
Mistletoe	*Phoradendron tomentosum* subsp. *tomentosum*	Viscaceae
Fiddle dock	*Rumex pulcher*	Polygonaceae
Smartweed	*Persicaria hydropiperoides*	
Lamb's-quarters	*Chenopodium album*	Chenopodiaceae
Matt chaff-flower	*Alternanthera caracasana*	Amaranthaceae
Redroot pigweed	*Amaranthus retroflexus*	
Common four-o'clock	*Mirabilis jalapa*	Nyctaginaceae
Spiderling	*Boerhaavia erecta*	
Rattlebush	*Sesbania drummondii*	Leguminosae
Yellow wood-sorrel	*Oxalis dillenii*	Oxalidaceae
Prairie-tea	*Croton monanthogynus*	Euphorbiaceae
Toothed spurge	*Euphorbia dentata*	
Drummond wax-mallow	*Malvaviscus arboreus* var. *drummondii*	Malvaceae
Spreading sida	*Sida filicaulis*	
Missouri violet	*Viola missouriensis*	Violaceae
Water-primrose	*Ludwigia octovalis* subsp. *octovalis*	Onagraceae
Umbrella water-pennywort	*Hydrocotyle umbellata*	Umbelliferae
Violet heliotrope	*Heliotropium amplexicaule*	Boraginaceae
West Indian lantana	*Lantana camara*	Verbenaceae
Western horse-nettle	*Solanum dimidiatum*	Solanaceae
Buffalo bur	*Solanum rostratum*	
American nightshade	*Solanum americanum*	
Tree tobacco	*Nicotiana glauca*	
Fiddle-leaf tobacco	*Nicotiana repanda*	
Coastal water-hyssop	*Bacopa monnieri*	Scrophulariaceae
Wild petunia	*Ruellia nudiflora*	Acanthaceae
Ruellia	*Ruellia brittoniana*	
Red-seeded plantain	*Plantago rhodosperma*	Plantaginaceae
Late-flowering thoroughwort	*Eupatorium serotinum*	Compositae
Texas broomweed	*Xanthocephalum texanum*	
Tall goldenrod	*Solidago altissima*	

TABLE I (cont'd)

Common Name	Scientific Name	Family
Horse-weed	*Conyza canadensis* var. *glabrata*	Compositae
False ragweed	*Parthenium hysterophorus*	
Giant ragweed	*Ambrosia trifida*	
Marsh fleabane	*Pluchea purpurascens*	
Cocklebur	*Xanthium strumarium*	
Mexican hat	*Ratibida columnaris*	
Common sunflower	*Helianthus annuus*	
Frostweed	*Verbesina virginica*	
Yellow carpet-daisy	*Calyptocarpus vialis*	
Prickly lettuce	*Lactuca serriola*	
Common dandelion	*Taraxacum officinale*	