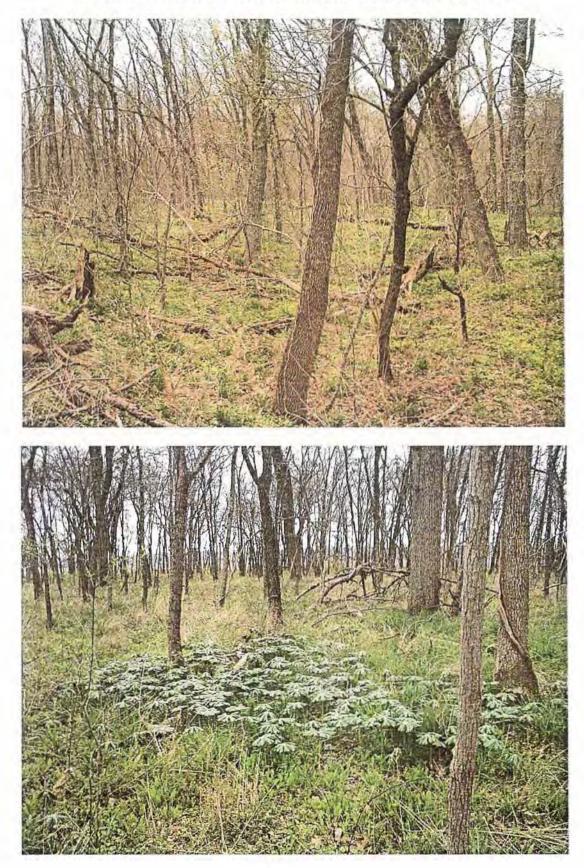


Forested area identified from 2004 aerial photograph where clearing activity had recently been conducted. Classification changed to Parks.

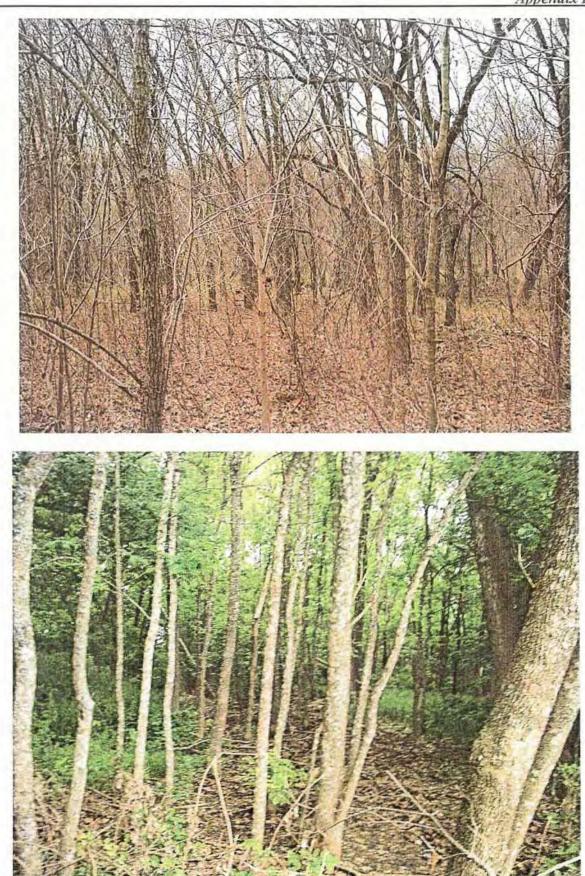
Lake Ralph Hall Preliminary Habitat Assessment Appendix D

REPRESENTATIVE PHOTOGRAPHS OF YOUNG FOREST

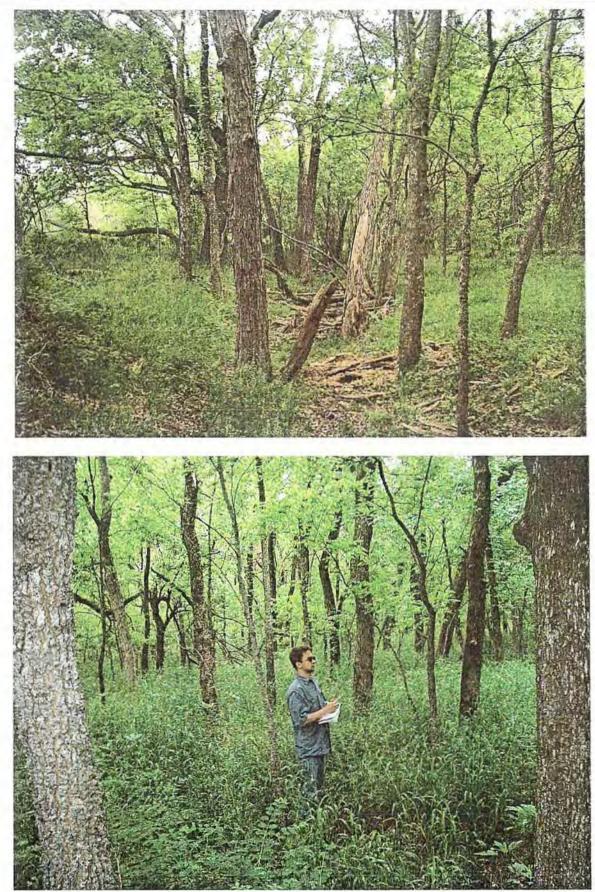
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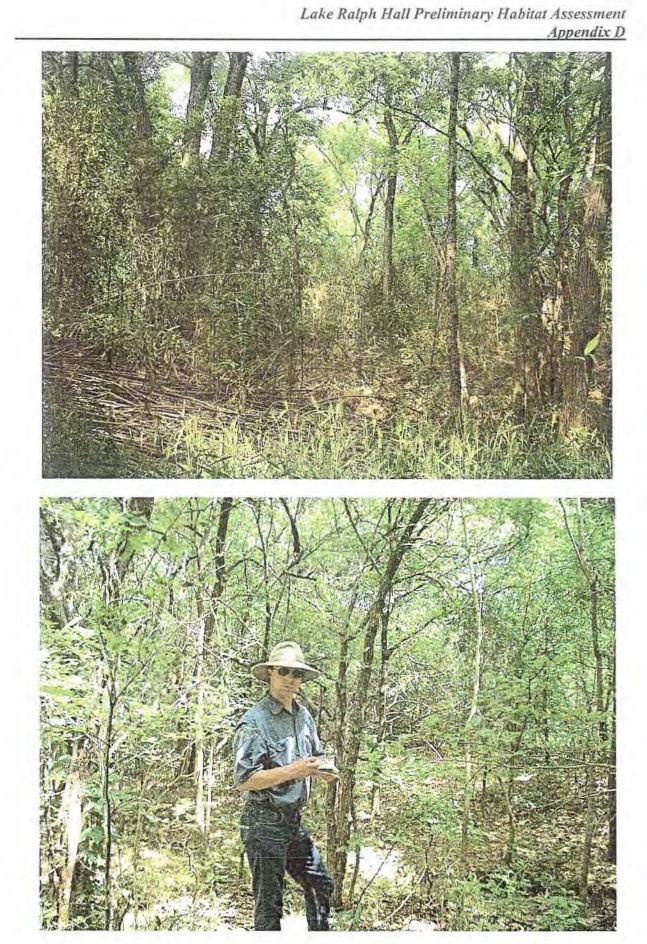


REPRESENTATIVE PHOTOGRAPHS OF YOUNG FOREST

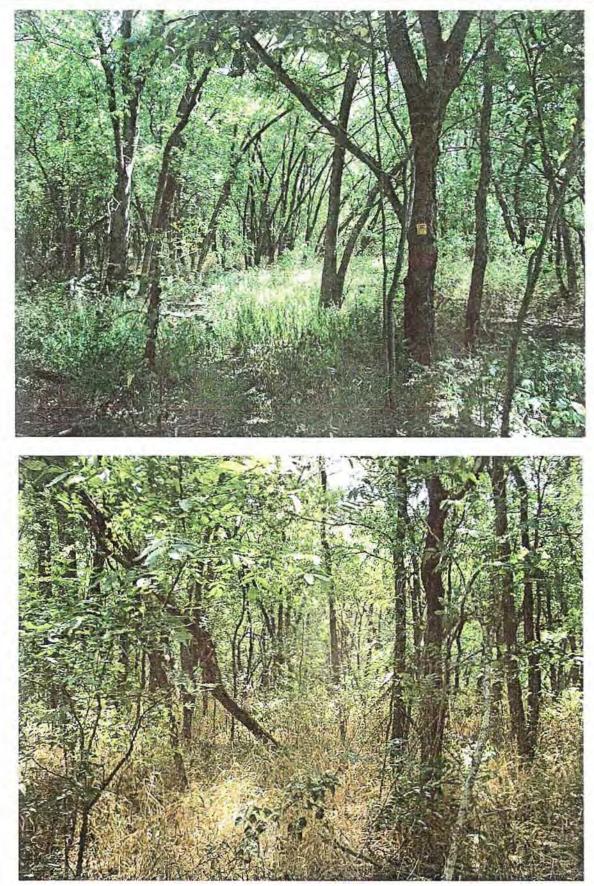


Lake Ralph Hall Preliminary Habitat Assessment Appendix D





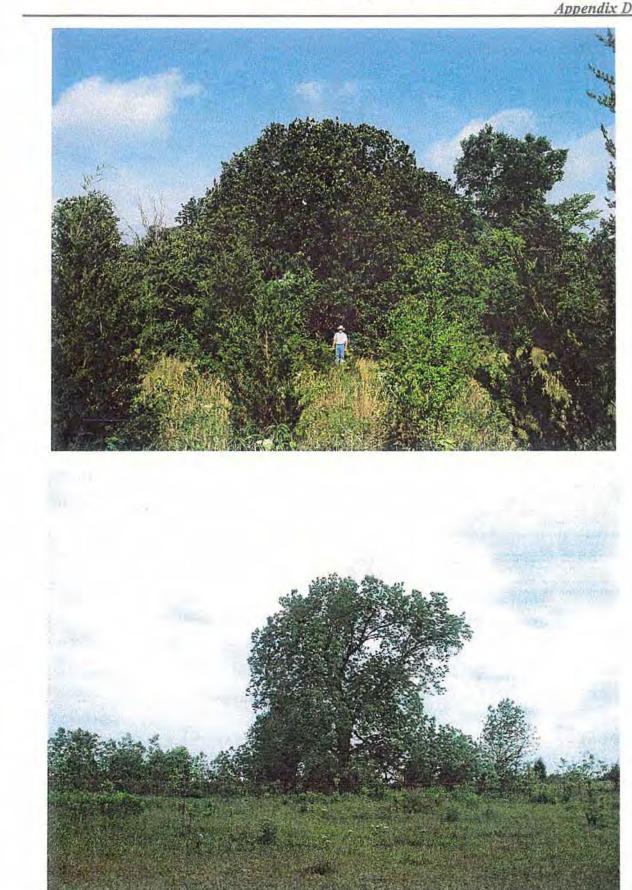
Lake Ralph Hall Preliminary Habitat Assessment Appendix D



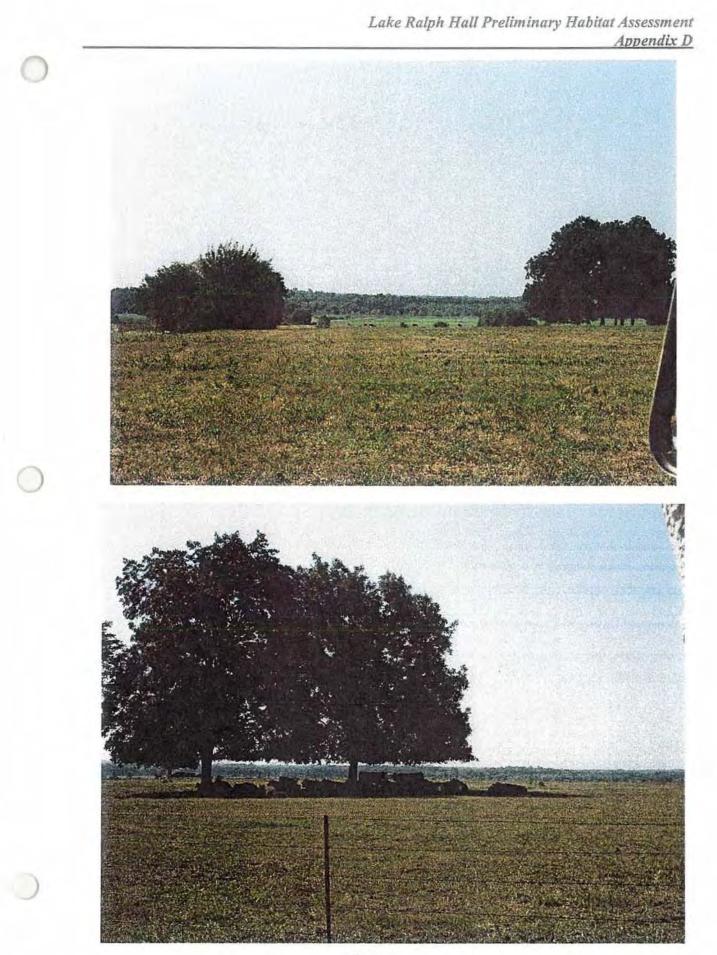
REPRESENTATIVE PHOTOGRAPHS OF PARTIALLY WOODED AREAS



REPRESENTATIVE PHOTOGRAPHS OF PARTIALLY WOODED AREAS

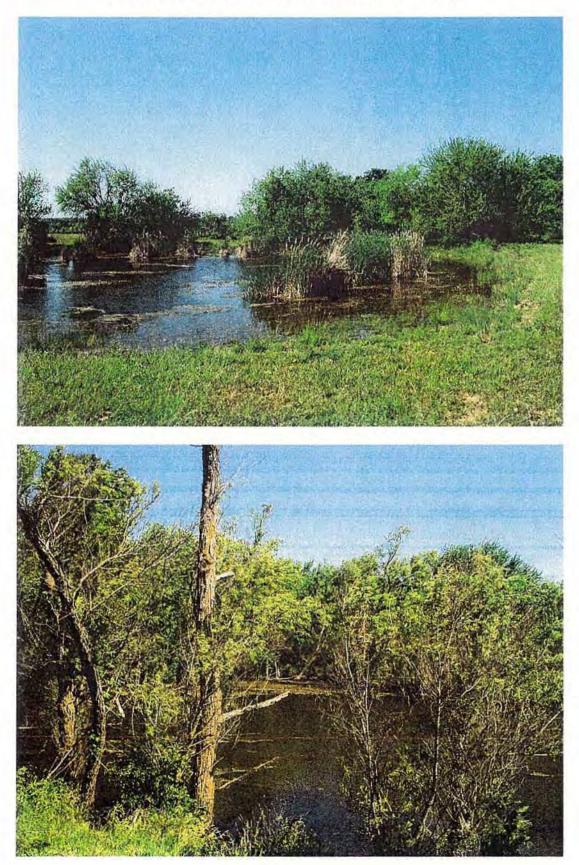


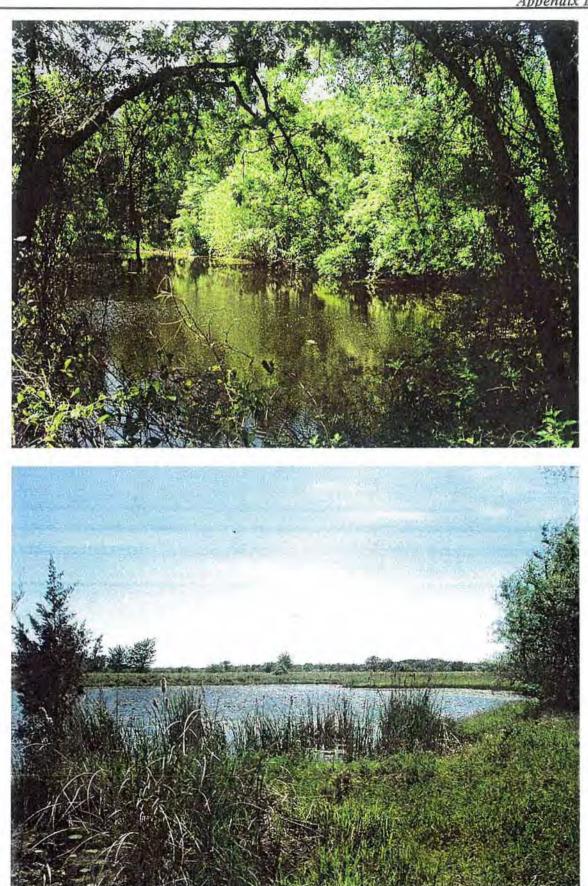
Lake Ralph Hall Preliminary Habitat Assessment Appendix D Lake Ralph Hall Preliminary Habitat Assessment Appendix D 17.74 小小的这



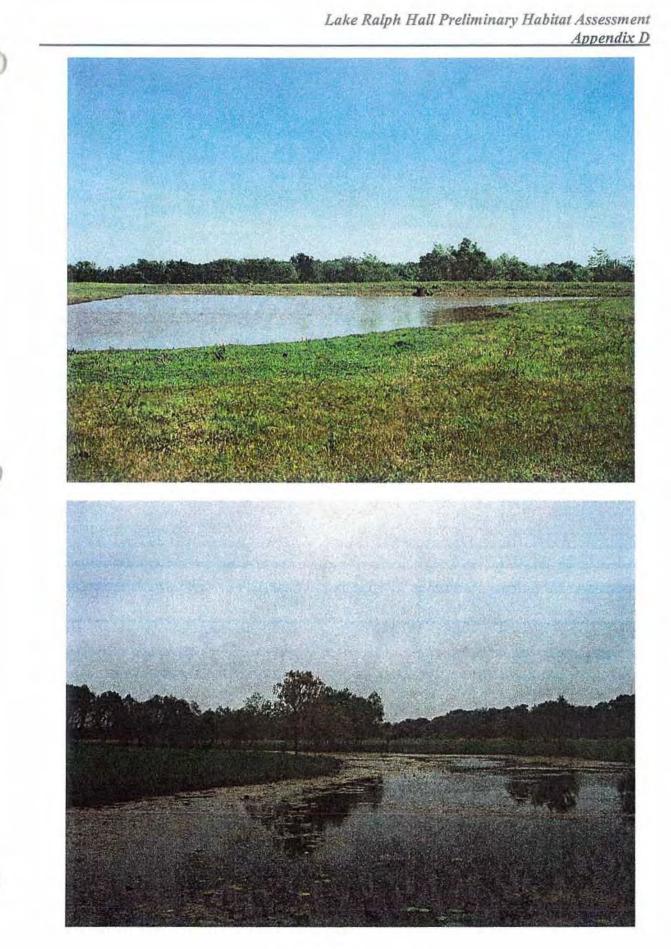
REPRESENTATIVE PHOTOGRAPHS OF PONDS

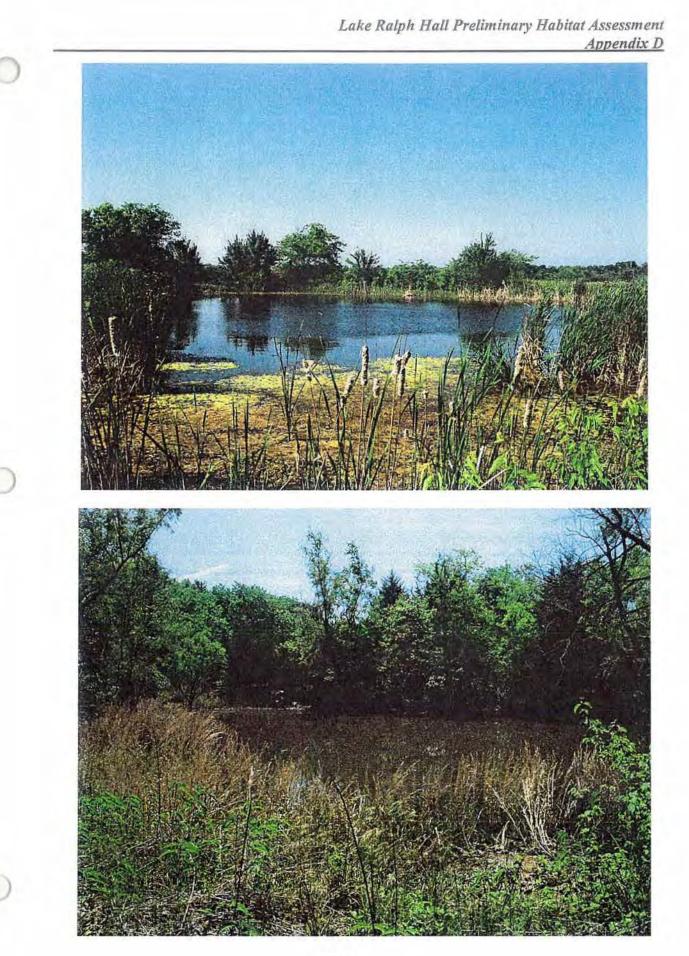
REPRESENTATIVE PHOTOGRAPHS OF PONDS



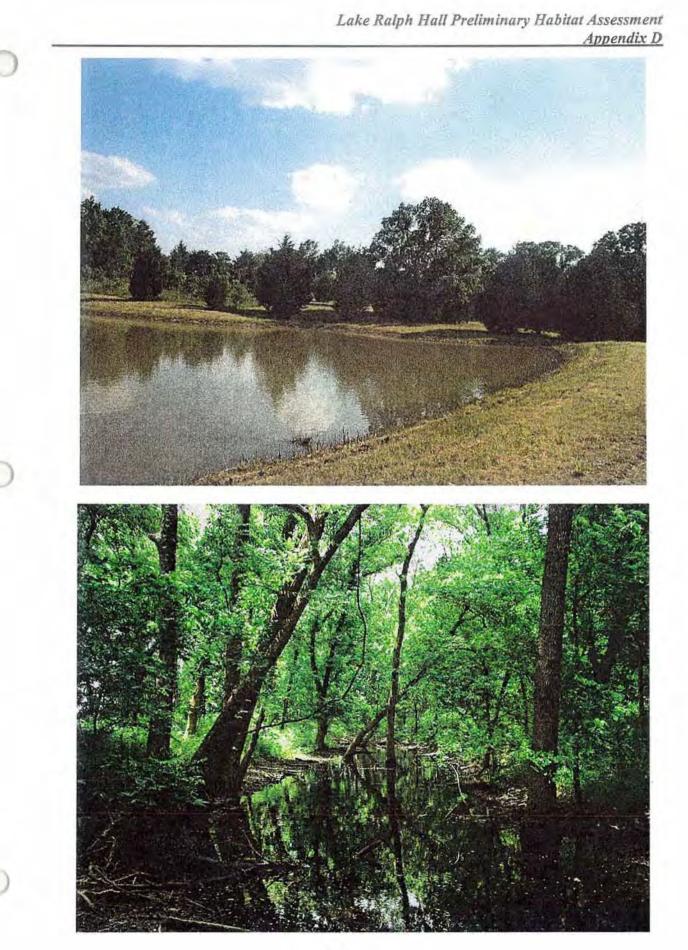


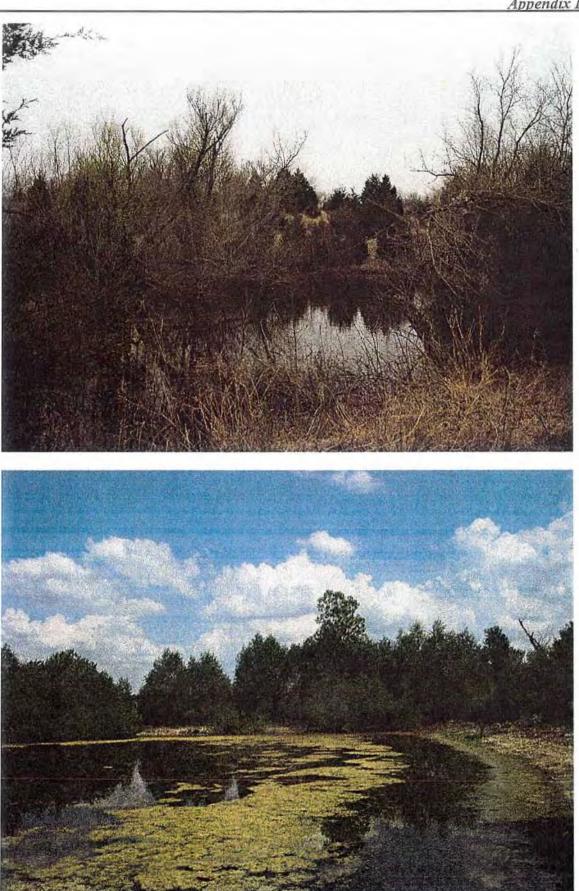
Lake Ralph Hall Preliminary Habitat Assessment Appendix D

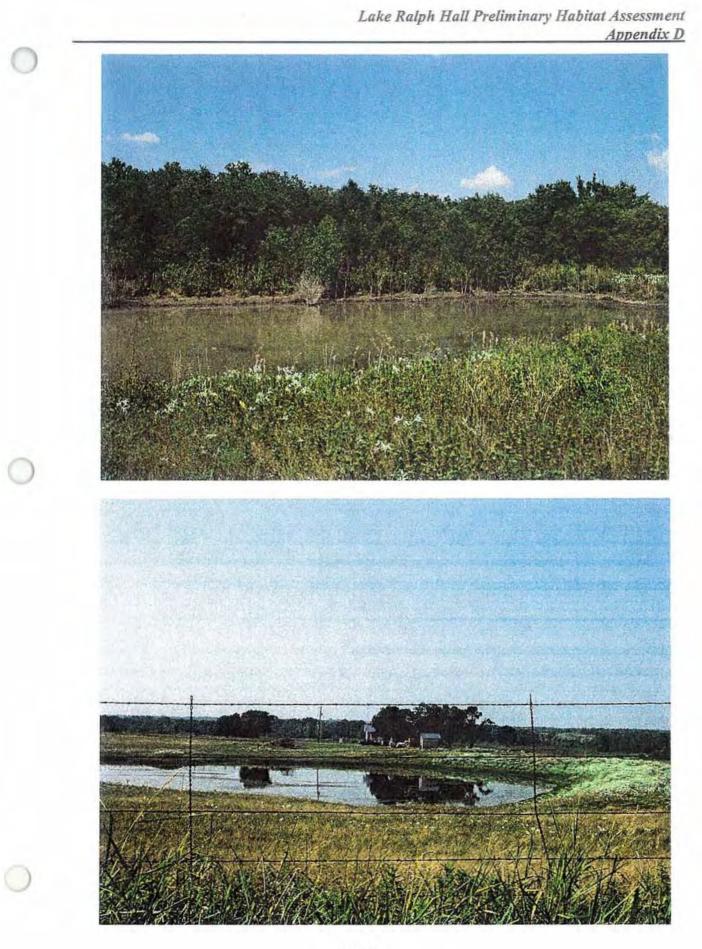












Lake Ralph Hall Preliminary Habitat Assessment Appendix E

BIOLOGICAL HABITAT COMPONENTS EVALUATION KEY

Value

Component 1 - Site Potential

Evaluate for all cover types.

Criteria²

| Substrate is composed or exhibits one or more of the following: 1) at least periodically supports predomi- nately hydrophytic vegetation; 2) is predominately undrained hydric soil and supports or is capable of supporting hydrophytic vegetation; 3) is saturated with water or covered by shallow water during 1-2 months during the growing season of each year (swamps, bogs, | 25 |
|---|----|
| marshes, and hardwood bottomlands exhibiting a high frequency of flooding). Alluvial substrate although less hydric than above; only temporarily or intermittently inundated or saturated for short periods (higher terraces of hard- | 25 |
| wood bottoms, riparian drainages). | 20 |
| Uplands with thick surface layer (generally greater than or equal to 10 inches) consisting of unrestricted loam (including sandy loam) or dark well structured (granulated) clay (including sandy clay). | 12 |
| Uplands with shallow surface layer (generally less than 10 inches) consisting of shallow soil over restrictive layer (rock, gravel, claypan, etc.) or deep, leached, droughty sand or, relatively light colored, poorly structured clay or | |
| gravelly/stony sand or clay. | 7 |
| Organic matter minimal or absent at the surface. (Includes undrained or saturated hydric soils not supporting vegetation i.e., mud flats). | 3 |
| Surface contains chemical compounds which would potentially limit growth of primary producers (salt, mine overburden containing heavy metals or acid | |
| compounds, surface pollution). | 1 |

Component 2 - Temporal Development of Existing Successional Stage

Determine currently existing successional stage (Criteria A); evaluate for all cover types except marshes. For this habitat type use Criteria B.

| Criteria A ³ | Value |
|--|-------|
| Old timber (100 or more years, trees >25 inches*) | 20 |
| Mature timber, old brush, climax prairie (40-99 years, trees 12-25 inches) | 12 |
| Pole and young timber, mature brush (11-39 years, trees <12 inches) | 6 |
| Grasslands in grazing disclimax** or early and mid-successional perennial | |
| grasses and forbs, hay meadows | 5 |
| Seedlings, saplings, young brush (3-10 years) | 3 |
| Annual native or introduced grasses, forbs, crops | 1 |
| | |

* Diameter at breast height (DBH)

** Example: Texas wintergrass-silver bluestem grasslands

body with a free connection to the sea and a measurable quantity of salt in its waters but with abundant or semi-abundant freshwater inflow (estuarine areas). Established mature communities or intermediate to well advanced successional stages occurring in fresh, brackish, or saline environments; freshwater inflow limited to generally small tributaries and localized runoff or overflow from flood conditions.

Aquatic or semi-aquatic communities occurring in generally early to intermediate successional stages as a result of periodic changes in moisture gradients; highly dependent on seasonal weather conditions.

10

5

Component 3 - Uniqueness and Relative Abundance

1. Evaluate the habitat within the site according to the categories below.

| Category | Value |
|---|--------|
| Highly valuable for wildlife and is very uncommon, unique or irreplaceable | |
| (USFWS Mitigation Resource Category 1) | 20 |
| Highly valuable for wildlife but is relatively scarce or becoming scarce (USFWS Mitigation Resource Category 2) | 15 |
| Exhibits high to medium value for wildlife and is relatively abundant (USFWS Mitigation Resource Category 3) | 10 |
| Exhibits medium to low value for wildlife and is relatively abundant (USFWS | 5 |
| Mitigation Resource Category 4) Exhibits very low wildlife value regardless of abundance or scarcity | 5 0 |
| | Ũ |

Component 4 - Vegetation Species Diversity

Criteria A

Diversity of Woody Species

Evaluate the composition of readily observable woody species in the overstory, midstory, and understory by determining the number of species groups as represented by the following categories. Evaluate for all cover types except Swamps (Criteria C) and Marsh wetlands (Criteria D). Worksheet for Criteria A&B provided on page 25.

| Species Group ⁴ | Examples |
|----------------------------|--|
| Berry/Drupe | hackberry, mulberry, paw paw, hawthorn, winterberry, black haw, soapberry, persimmon, choke cherry, yaupon, dogwood, Am. beautyberry, greenbriar, dewberry, poison ivy, rattan vine, blackgum, grape, mulberry, holly, bumelia, huckleberry, sumac, Virginia creeper, sassafras, prickly ash, chinaberry, crab apple, agarito, lotebush, ivy tree vine, palmetto, peppervine; wax myrtle |
| Legume/Pod | mesquite, locust, redbud, Acacia spp., Eve's necklace, Sesbania spp. |
| Acorn | white oak, red oak, live oak, water oak, willow oak, post oak, bur oak |
| Nut/Nutlike | hickory, pecan, walnut, water elm, buttonbush, |

| Samara (Winged Fruit) | ephidra,bitternut, hornbean elm, ash, box elder, maple |
|---|--|
| Cone | pine, cypress, juniper |
| Achene | sycamore, Baccharis spp., sandsage, Clematis spp., salt bush |
| All others(capsules, follicles, burrs, hairy seeds) | willow, cottonwood, sweetgum, salt cedar, yucca, cactus, buttonbush, sweetgum, bois d'arc, creosotebush, Chinese tallow-tree |

Value assigned is equivalent to the number of groups represented (Maximum=8, If none is represented then value is 0)

Criteria B

Total Number of Occurring Woody Species

Determine the total number of readily observable woody species and assign value according to the following categories. Do not use for Swamps (Criteria C) or Marsh wetlands (Criteria D)

| | Value |
|--------------------|-------|
| 15 or more species | 7 |
| 10-14 species | 5 |
| 5-9 species | 3 |
| 1-4 species | 1 |
| None occurring | 0 |

Criteria C

Diversity of Vegetation in Swamps

Evaluate swamp areas according to the following categories:⁵

| | Value |
|---|-------|
| Seasonally flooded mixed bottomland hardwoods; inundation resulting from freshwater inflow | 15 |
| Seasonally flooded vegetation dominated by cypress-tupelo; inundation resulting from freshwater inflow | 10 |
| Continually flooded or infrequent, abrasively flooded vegetation comprised of one or more species; inundation resulting from freshwater, brackish or saline | |
| inflow | 6 |
| Continually flooded vegetation; inundation resulting from stagnant or impounded freshwater, brackish, or saline water conditions | 2 |

Criteria D

Diversity of Vegetation in Marshes and other similar wetland areas

Determine the major types of wetland vegetation present according to the following categories: rooted emergent vegetation, rooted submergent vegetation, rooted

vegetation with floating leaves, algal mat communities (microalgae), benthic or drifting seaweeds (macroalgae).

| | Value |
|--|-------|
| High - includes three or more of above categories. | 20 |
| Medium - includes two of the above categories. | 15 |
| Low - includes one of the above categories. | 5 |

Component 5 - Vertical Vegetation Stratification⁶

Evaluate canopy coverage of the following three categories of vegetation for all cover types except crops and marsh wetlands.

| Categories: | 1. Vegetation greater than 12 feet high | |
|----------------|---|-------|
| | 2. Vegetation 3-12 feet high | |
| | 3. Vegetation less than 3 feet high | |
| Criteria | | Value |
| All three cate | gories present, each accounting for at least 25 percent of ground | |
| cover | | 5 |
| • | e above categories present, each accounting for at least 25 | |
| percent of gro | ound cover | 4 |
| • | ne above categories present and accounting for at least 25 | |
| percent of gro | | 3 |
| None of the c | ategories together account for more than 25 percent of ground | |
| cover | | 1 |

Component 6- Additional Structural Diversity Components

Evaluate for all cover types except crops. Determine the presence of brush piles, rock piles, rocky crevices, snags, fallen logs, thick grass cover, brambles or thickets according to the following categories.

| Criteria | Value |
|--|--------|
| <u>Abundant</u> - Three or more of the above components readily apparent and observable from most locations with the site | 5 |
| <u>Moderate</u> - Any of the above components present, and observable with very little search effort | 3 |
| <u>Sparse</u> - Any of the above components present, but occurring infrequently or requiring significant search effort to locate <u>Absent</u> - None of the above components observed | 1 0 |

Component 7 - Condition of Existing Vegetation - Other

Use: Criteria A&B for cover types (other than crops and marsh wetlands) containing woody and/or herbaceous vegetation. Criteria C for cropland only. Criteria D for marsh wetlands.

Criteria A

Degree of utilization of woody vegetation by vertebrates and invertebrates

Criteria B

Availability of Herbaceous Vegetation. Do not evaluate for Crops (Criteria C) or Marsh Wetlands (Criteria D)

| | Value |
|---|-------|
| Good - Eight or more combined species of grasses and forbs readily | |
| observable. | 5 |
| Fair - Four to seven combined species of grasses and forbs readily observable | 3 |
| Poor - One to three combined species of grasses and forbs readily observable | 1 |
| None - Herbaceous vegetation lacking or absent | 0 |

Criteria C

Available Biomass (Evaluate for croplands only)

| | Value |
|--|-------|
| <u>High</u> - Biomass removed periodically, although not necessarily annually; removed biomass supplanted by other vegetation resulting from natural succession of invading species or overseeding of introduced species; (Ex. Rice or other crop on multi-year rotational system allowing for additional biomass | |
| accumulations between harvests). | 10 |
| <u>Moderate</u> - Most biomass removed annually or semi-annually but with some residual amount remaining during portions of the rotational period. Minimal bare ground conditions (Hay operations, crops grown for pasture or grazing, | |
| chiseled crops). | 5 |
| Low - Most biomass removed annually due to clean farming practices creating significant bare ground conditions (intensive row crop farming). | 1 |

Criteria D

Condition of Marsh Wetlands

Value

<u>Unaltered</u> - Quality of water and/or associated vegetation good, no foreseeable danger of environmental intrusion including pollution, contamination,

sedimentation, or stagnation.

<u>Stable</u> - Quality of water and/or associated vegetation good, although evidence exists that pollution, contamination sedimentation or stagnation could occur in the future or has occurred in the past.

<u>Degraded</u> - Degraded - Quality of water and/or associated vegetation poor or declining or degradation imminent.

5

1

WILDLIFE HABITAT APPRAISAL PROCEDURE FIELD EVALUATION FORMS

WHAP Biological Components Field Evaluation Form

I

| Project Proposed Lake Ralph Hall | Date: | 2005 | |
|----------------------------------|----------|------|--|
| Cover Type or Plant Association | Cropland | | |

| Habitat Components | Components Points (From Key) | | | | | | | |
|--|---------------------------------|-----|-----|-----|-----|----|-----|-------|
| Site No. | 179 | 458 | 434 | 127 | 546 | 32 | 543 | Total |
| 1. Site Potential | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 49 |
| 2. Temporal Development | | | | | | | | |
| Criteria A | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Criteria B (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 3. Uniqueness and Relative Abundance | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4. Vegetation Species Diversity | | | | | | | | |
| Criteria A | NA | NA | NA | NA | NA | NA | NA. | NA |
| Criteria B | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria C (Swamps Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 5. Vertical Stratification | NA | NA | NA | NA | NA | NA | NA | NA |
| 6. Additional Structural Diversity Components | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7. Condition of Existing Vegetation | | | | | | | | |
| Criteria A (Woody Vegetation) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria B (Heibaceous Vegetation) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria C (Croplands Only) | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 9 |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |

Average Habitat Quality Score for all sites within this cover type = <u>Total Points</u> x <u>1</u>

this cover type = <u>Total Points</u> Total number of sites 0.09 100

SPECIES LIST FOR CROP COVER TYPE

| Common Name | Scientific Name | Group | Layer |
|---------------------|----------------------|------------|------------|
| Bermuda grass | Cynodon dactylon | Caryopsis | herbaceous |
| Foxtail grass | Setaria italica | Caryopsis | herbaceous |
| Giant Ragweed | Ambrosia trifida | Achene | herbaceous |
| Japanese brome | Bromus japonicus | Caryopsis | herbaceous |
| Johnson Grass | Sorghum halepense | Caryopsis | herbaceous |
| Perennial ryegrass | Lolium perenne | Caryopsis | herbaceous |
| Prairie Peppergrass | Lepidium densiflorum | Silique | herbaceous |
| Southern Crabgrass | Digitaria ciliaris | Caryopsis | Herbaceous |
| White Clover | Trifolium repens | Legume/Pod | herbaceous |
| Wild Rye | Elymus sp. | Caryopsis | herbaceous |

WHAP Biological Components Field Evaluation Form

Project Proposed Lake Ralph Hall Date: 2005 Cover Type or Plant Association Pasture

| Habitat Components | Components Points (From Key) | | | | | | | |
|--|---------------------------------|----|-----|-----|-----|-----|----|-------|
| Site No. | 458 | 23 | 108 | 131 | 520 | 742 | 38 | Total |
| 1. Site Potential | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 49 |
| 2. Temporal Development | | | | | | | | |
| Criteria A | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Criteria B (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 3. Uniqueness and Relative Abundance | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 |
| 4. Vegetation Species Diversity | | | | | | | | |
| Criteria A | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria B | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria C (Swamps Only) | NA | NA | NA | NA | NA | NA | ŃA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 5. Vertical Stratification | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 21 |
| 6. Additional Structural Diversity Components | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7. Condition of Existing Vegetati | on | | | | | | | - |
| Criteria A (Woody Vegetation) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria B (Herbaceous Vegetation) | 5 | 5 | 1 | 5 | 3 | 5 | 3 | 27 |
| Criteria C (Croplands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NÅ. | NA | NA | NA | NA |

Average Habitat Quality Score for all sites within

this cover type = ____ **Total Points** x 1 0.20 Total number of sites 100

SPECIES LIST FOR PASTURE COVER TYPE

| Common Name | Scientific Name | Group | Layer |
|-------------------------|-------------------------|-------------|------------|
| Bermuda | Cynodon dactylon | Caryopsis | herbaceous |
| Buttercup | Ranunculus sp. | Achene | herbaceous |
| Cocklebur | Xanthium sp. | Achene | herbaceous |
| Curly Dock | Rumex crispus | Achene | herbaceous |
| Dewberry | Rubus trivialis | Berry/Drupe | herbaceous |
| Dotted Blue-eyed Grass | Sisyrinchium langloisii | Capsule | herbaceous |
| Fescue | Festuca arundinacea | Caryopsis | herbaceous |
| Fiddle Dock | Rumex pulcher | Achene | herbaceous |
| Johnson Grass | Sorghum halepense | Caryopsis | herbaceous |
| Prairie Phlox | Phlox pilosa | Capsule | herbaceous |
| Purple Threeawn | Aristida purpurea | Caryopsis | herbaceous |
| Showey Evening Primrose | Oenothera speciosa | Capsule | herbaceous |
| Spurred Butterfly Pea | Centrosema virginianum | Legume/Pod | herbaceous |
| Texas Prairie Parsley | Polytaenia texana | Schizocarp | herbaceous |
| Texas Toadflax | Nuttallanthus texanus | Capsule | herbaceous |
| Texas Vervain | Verbena halei | Nut/Nutlike | herbaceous |
| Trumpet Creeper | Campsis radicans | Capsule | herbaceous |
| Vetch | Vicia sp. | Legume/Pod | herbaceous |
| Violet | Viola sp. | Capsule | herbaceous |
| White Clover | Trifolium repens | Legume/Pod | herbaceous |
| Wild Onion | Allium canadense | Capsule | herbaceous |
| Woodsorrell | Oxalis sp. | Capsule | herbaceous |
| Yellow Thistle | Cirsium horridulum | Achene | herbaceous |

WHAP Biological Components Field Evaluation Form

Project Proposed Lake Ralph HallDate: 2005Cover Type or Plant AssociationGrasses

| Habitat Components | Components Points (From Key) | | | | | | | |
|--|---------------------------------|-----|-----|-----|-----|-----|----|-------|
| Site No. | 510 | 330 | 321 | 577 | 535 | 683 | 53 | Total |
| 1. Site Potential | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 49 |
| 2. Temporal Development | | | | | | | | |
| Criteria A | 1 | 1 | 1 | 1 | 1 | 1 | .5 | 11 |
| Criteria B (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 3. Uniqueness and Relative Abundance | 5 | 5 | 5 | 10 | 10 | 10 | 10 | 55 |
| 4. Vegetation Species Diversity | | | | | | | | |
| Criteria A | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria B | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria C (Swamps Only) | NA | NA | NA | NA | NA | NA | NA | ŇA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 5. Vertical Stratification | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 21 |
| 6. Additional Structural Diversity Components | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 4 |
| 7. Condition of Existing Vegetati | on | | | | | | | |
| Criteria A (Woody Vegetation) | ŇA | NA | NA | ŃA | NA | NA | NA | NA |
| Criteria B (Herbaceous Vegetation) | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 33 |
| Criteria C (Cropiands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |

Average Habitat Quality Score for all sites within

this cover type = $\frac{\text{Total Points}}{\text{Total number of sites}}$ $\frac{x \ 1}{100}$ = $\frac{0.25}{0.25}$

SPECIES LIST FOR GRASSES COVER TYPE

| Common Name | Scientific Name | Group | Layer |
|-------------------------------|---------------------------|-------------|------------|
| Annual Ragweed | Ambrosia artemisiifolia | Achene | herbaceous |
| Beaked Cornsalad | Valerianella radiata | Achene | herbaceous |
| Bermuda | Cynodon dactylon | Caryopsis | herbaceous |
| Big Bluestem | Andropogon gerardii | Achene | herbaceous |
| Japanese Brome | Bromus japonicus | Caryopsis | herbaceous |
| Bushy Bluestem | Andropogon glomeratus | Achene | herbaceous |
| Buttercup | Ranunculus sp. | Achene | herbaceous |
| Catchweed Bedstraw | Galium aparine | Schizocarp | herbaceous |
| Clasping Venus' Looking-glass | Triodanis perfoliata | Capsule | herbaceous |
| Common Selfheal | Prunella vulgaris | Nut/Nutlike | herbaceous |
| Common Sunflower | Helianthus annuus | Achene | herbaceous |
| Common Yarrow | Achillea millefolium | Achene | herbaceous |
| Cross-vine | Bignonia capreolata | Capsule | herbaceous |
| Curly Dock | Rumex crispus | Achene | herbaceous |
| Dewberry | Rubus trivialis | Berry/Drupe | herbaceous |
| Dill Family | Anethum sp. | Schizocarp | herbaceous |
| Dotted Blue-eyed Grass | Sisyrinchium langloisii | Capsule | herbaceous |
| Fiddle Dock | Rumex pulcher | Achene | herbaceous |
| Flameleaf Sumac | Rhus copallinum | Berry/Drupe | herbaceous |
| Flax | Linum sp. | Capsule | herbaceous |
| Foxtail Grass | Setaria sp. | Caryopsis | herbaceous |
| Giant Ragweed | Ambrosia trifida | Achene | herbaceous |
| Goldenrod | Solidago sp. | Achene | herbaceous |
| Green Wild Indigo | Baptisia sphaerocarpa | Legume/Pod | herbaceous |
| Greenbriar | Smilax bona-nox | Berry/Drupe | herbaceous |
| Henbit | Lamium amplexicaule | Nut/Nutlike | herbaceous |
| Illinois Bundleflower | Desmanthus illinoensis | Legume/Pod | herbaceous |
| Indian paintbrush | Castilleja sp. | Capsule | herbaceous |
| Johnson Grass | Sorghum halepense | Caryopsis | herbaceous |
| Little Bluestem | Schizachyrium scoparium | Achene | herbaceous |
| Milkweed | Asclepias sp. | Follicle | |
| Nettle Family | | Achene | |
| Nightshade | Solanum sp. | Berry/Drupe | |
| Pigweed | Amaranthus sp. | Utricle | |
| Prairie Peppergrass | Lepidium densiflorum | Silique | herbaceous |
| Prairie Plantain | Plantago elongata | Capsule | herbaceous |
| Prickly Pear Cactus | Opuntia sp. | Berry/Drupe | herbaceous |
| Purple Threeawn | Aristida purpurea | Caryopsis | |
| Quakinggrass | Briza minor | Caryopsis | herbaceous |
| Ryegrass | Lolium perenne | Caryopsis | herbaceous |
| Sensitive Briar | Schrankia spp. | Legume/Pod | herbaceous |
| Showy Evening Primrose | Oenothera speciosa | Capsule | herbaceous |
| Spurge Family | | Capsule | herbaceous |
| Spurred Butterfly Pea | Centrosema virginianum | Legume/Pod | |
| Sunflower Family | Aster sp. | Achene | herbaceous |
| Texas Dandelion | Pyrrhopappus carolinianus | Achene | |
| Texas Prairie Parsley | Polytaenia texana | Schizocarp | |
| Texas Vervain | Verbena halei | Nut/Nutlike | herbaceous |
| Trumpet Creeper | Campsis radicans | Capsule | herbaceous |

SPECIES LIST FOR GRASSES COVER TYPE

| Vetch | Vicia sp. | Legume/Pod | herbaceous |
|---------------------|----------------------------|-------------|------------|
| Virginia Creeper | Parthenocissus quinquefoli | Berry/Drupe | herbaceous |
| White Clover | Trifolium repens | Legume/Pod | herbaceous |
| Wild Geranium | Geranium caroliniuanum | Legume/Pod | herbaceous |
| Wild Onion | Allium canadense | Capsule | herbaceous |
| Wild Petunia | Ruellia sp. | Capsule | herbaceous |
| Yellow Sweet Clover | Melilotus indicus | Legume/Pod | herbaceous |
| Yellow Thistle | Cirsium horridulum | Achene | herbaceous |

WHAP Biological Components Field Evaluation Form

Project Proposed Lake Ralph Hall Date: 2005 Cover Type or Plant Association Forest

| Habitat Components | Components Points (From Key) | | | | | | | |
|--|---------------------------------|-----|-----|-----|-----|-----|-----|-------|
| Site No. | 684 | 510 | 706 | 330 | 518 | 539 | 742 | Total |
| 1. Site Potential | 12 | 12 | 12 | 7 | 7 | 12 | 12 | 74 |
| 2. Temporal Development | | | | | | | | |
| Criteria A | 6 | 12 | 12 | 12 | 12 | 12 | 12 | 78 |
| Criteria B (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 3. Uniqueness and Relative Abundance | 15 | 15 | 15 | 15 | 10 | 10 | 15 | 95 |
| 4. Vegetation Species Diversity | 4. Vegetation Species Diversity | | | | | | | |
| Criteria A | 7 | 8 | 7 | 6 | 5 | 4 | 8 | 45 |
| Criteria B | 7 | 7 | 7 | 7 | 5 | 3 | 5 | 41 |
| Criteria C (Swamps Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 5. Vertical Stratification | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 31 |
| 6. Additional Structural Diversity Components | 5 | 1 | 3 | 1 | 3 | 3 | 1 | 17 |
| 7. Condition of Existing Vegetation | | | | | | | | |
| Criteria A (Woody Vegetation) | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 31 |
| Criteria B (Herbaceous Vegetation) | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 33 |
| Criteria C (Cropiands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA. |

Average Habitat Quality Score for all sites within

this cover type = $\frac{\text{Total Points}}{\text{Total number of sites}}$ $\frac{x \ 1}{100}$ = $\frac{0.64}{2}$

SPECIES LIST FOR FOREST COVER TYPE

| Common Name | Scientific Name | Group | Layer |
|-------------------|----------------------------|-------------|--------------|
| American Elm | Ulmus americana | Samara | canopy |
| Black Willow | Salix nigra | Capsule | canopy |
| Blackjack Oak | Quercus marilandica | Acorn | canopy |
| Bois d' Arc | Maclura pomifera | Achene | canopy |
| Box Elder | Acer negundo | Samara | canopy |
| Bur Oak | Quercus macrocarpa | Acorn | canopy |
| Cedar Elm | Ulmus crassifolia | Samara | canopy |
| Cottonwood | Populus deltoides | Berry/Drupe | canopy |
| Eastern Red Cedar | Juniperus virginiana | Cone | canopy |
| Green Ash | Fraxinus pennsylvanica | Samara | canopy |
| Hackberry | Celtis laevigata | Berry/Drupe | |
| Hawthorn | Crataegus texana | Berry/Drupe | |
| Honey Locust | Gleditsia triacanthos | Legume/Pod | |
| Pecan | Carya illinoensis | Nut/Nutlike | canopy |
| Post Oak | Quercus stellata | Acorn | |
| Red Oak | Quercus texana | Acorn | |
| Texas ash | Fraxinus texensis | Berry/Drupe | |
| White Ash | Fraxinus americana | Samara | canopy |
| Winged Elm | Ulmus alata | Samara | |
| American Elm | Ulmus americana | Samara | |
| Bamboo | Phyllostachys sp. | Other | |
| Black Willow | Salix nigra | Capsule | |
| Bois d' Arc | Maclura pomifera | Achene | |
| Box Elder | Acer negundo | Samara | |
| Cedar Elm | Ulmus crassifolia | Samara | |
| Chickasaw plum | Prunus angustifolia | Berry/Drupe | understory |
| Chinaberry | Melia azedarach | Berry/Drupe | |
| Chinese privet | Ligustrum sinese | Berry/Drupe | |
| Chinquapin Oak | Quercus muehlenbergii | Acorn | |
| Cottonwood | Populus deltoides | Berry/Drupe | understory |
| Deciduous Holly | llex decidua | Berry/Drupe | |
| Eastern Red Cedar | Juniperus virginiana | Cone | understory |
| Eve's Necklace | Sophora affinis | Legume/Pod | understory |
| Green Ash | Fraxinus pennsylvanica | Samara | understory |
| Gum Bumelia | Bumelia lanuginosum | Berry/Drupe | understory |
| Hackberry | Celtis laevigata | Berry/Drupe | understory |
| Hawthorn | Crataegus texana | Berry/Drupe | understory |
| Honey Locust | Gleditsia triacanthos | Legume/Pod | understory |
| Mexican Plum | Prunus mexicana | Berry/Drupe | understory |
| Pecan | Carya illinoensis | Nut/Nutlike | understory |
| Post Oak | Quercus stellata | Acorr | understory |
| Rattlebush | Sesbania drummondii | Legume/Poo | l understory |
| Red Oak | Quercus shumardii | Acorr | |
| Redbud | Cercis canadensis | Legume/Poo | |
| Roughleaf Dogwood | Cornus drummondii | Berry/Drupe | |
| Sassafras | Sassafras albidum | Berry/Drupe | |
| Soapberry | Sapindus drummondii | Berry/Drupe | |
| Toothache Tree | Zanthoxylum clava-herculis | Berry/Drupe | |
| Wild Rose Bush | Rosa sp. | Achene | |

SPECIES LIST FOR FOREST COVER TYPE

| Annual Ragweed | Ambrosia artemisiifolia | Achene | herbaceous |
|------------------------|----------------------------|-------------|------------|
| Beaked Cornsalad | Valerianella radiata | Achene | herbaceous |
| Bermuda | Cynodon dactylon | Caryopsis | herbaceous |
| Browneyed Susan | Rudbeckia triloba | Achene | herbaceous |
| Bushy Bluestem | Andropogon glomeratus | Achene | herbaceous |
| Buttercup | Ranunculus sp. | Achene | herbaceous |
| Catchweed Bedstraw | Galium aparine | Schizocarp | herbaceous |
| Cocklebur | Xanthium sp. | Achene | herbaceous |
| Common Selfheal | Prunella vulgaris | Nut/Nutlike | herbaceous |
| Common Yarrow | Achillea millefolium | Achene | herbaceous |
| Coral Honeysuckle | Lonicera sempervirens | Berry/Drupe | herbaceous |
| Coralberry | Symphoricarpos orbiculatus | Berry/Drupe | herbaceous |
| Cross-vine | Bignonia capreolata | Capsule | herbaceous |
| Curly Dock | Rumex crispus | Achene | herbaceous |
| Dewberry | Rubus trivialis | Berry/Drupe | herbaceous |
| False Indigo | Amorpha fruticosa | Legume/Pod | herbaceous |
| Flameleaf Sumac | Rhus copallinum | Berry/Drupe | herbaceous |
| Foxtail Grass | Setaria italica | Caryopsis | herbaceous |
| Giant Ragweed | Ambrosia trifida | Achene | herbaceous |
| Giant Reed | Arundo donax | Caryopsis | herbaceous |
| Goldenrod | Solidago sp. | Achene | herbaceous |
| Grapevine | Vitis sp. | Berry/Drupe | herbaceous |
| Green Wild Indigo | Baptisia sphaerocarpa | Legume/Pod | herbaceous |
| Greenbriar | Smilax bona-nox | Berry/Drupe | herbaceous |
| Heavenly Bamboo | Nandina domestica | Berry/Drupe | herbaceous |
| Hedgenettle | Stachys sp. | | herbaceous |
| Illinois Bundleflower | Desmanthus illinoensis | Legume/Pod | herbaceous |
| Indian Paintbrush | Castilleja sp. | Capsule | herbaceous |
| Inland Sea Oats | Chasmanthium latifolium | Achene | herbaceous |
| Japanese Honeysuckle | Lonicera japonica | Berry/Drupe | herbaceous |
| Johnson Grass | Sorghum halepense | Caryopsis | herbaceous |
| Little Bluestem | Schizachyrium scoparium | Achene | herbaceous |
| Lizard's Tail | Saururus cernuus | Capsule | herbaceous |
| May Apple | Podophyllum peltatum | Berry/Drupe | herbaceous |
| Milkweed | Asclepias sp. | Follicle | herbaceous |
| Mint Family | | Nut/Nutlike | herbaceous |
| Mulberry | Morus sp. | Achene | herbaceous |
| Mustang Grape | Vitis mustangensis | Berry/Drupe | herbaceous |
| Mustard Family | | Silique | herbaceous |
| Perennial Ryegrass | Lolium perenne | Caryopsis | herbaceous |
| Plantain | Plantago sp. | Capsule | herbaceous |
| Poison Ivy | Toxicodendron radicans | Berry/Drupe | herbaceous |
| Prairie Plantain | Plantago elongata | Capsule | herbaceous |
| Prickly Pear Cactus | Opuntia sp. | Berry/Drupe | herbaceous |
| Quakinggrass | Briza minor | Caryopsis | herbaceous |
| Queen Anne's Lace | Daucus carota | Schizocarp | herbaceous |
| Sedge | Carex sp. | Achene | herbaceous |
| Showy Evening Primrose | Oenothera speciosa | Capsule | herbaceous |
| Slender Fimbry | Fimbristylis autumnalis | Achene | herbaceous |
| Spurred Butterfly Pea | Centrosema virginianum | Legume/Pod | herbaceous |

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SPECIES LIST FOR FOREST COVER TYPE

| Sunflower Family | Aster sp. | Achene | herbaceous |
|-----------------------|-----------------------------|-------------|------------|
| Texas Dandelion | Pyrrhopappus carolinianus | Achene | herbaceous |
| Texas Prairie Parsley | Polytaenia texana | Schizocarp | herbaceous |
| Texas Vervain | Verbena halei | Nut/Nutlike | herbaceous |
| Trumpet Creeper | Campsis radicans | Capsule | herbaceous |
| Vetch | Vicia sp. | Legume/Pod | herbaceous |
| Violet | Viola sp. | Capsule | herbaceous |
| Virginia Creeper | Parthenocissus quinquefolia | Berry/Drupe | herbaceous |
| Virginia Wildrye | Elymus virginicus | Caryopsis | herbaceous |
| White Clover | Trifolium repens | Legume/Pod | herbaceous |
| Wild Onion | Allium canadense | Capsule | herbaceous |
| Woodsorrel | Oxalis sp. | Capsule | herbaceous |

WHAP Biological Components Field Evaluation Form

Project Proposed Lake Ralph Hall Date: 2005
Cover Type or Plant Association Young Forest

| Habitat Components | Components Points (From Key) | | | | | | | |
|--|-------------------------------------|-----|-----|-----|-----|-----|-----|-------|
| Site No. | 167 | 127 | 108 | 519 | 325 | 520 | 749 | Total |
| 1. Site Potential | 12 | 12 | 7 | 7 | 7 | 7 | 7 | 59 |
| 2. Temporal Development | | | · | | | | | |
| Criteria A | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 42 |
| Criteria B (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 3. Uniqueness and Relative Abundance | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 70 |
| 4. Vegetation Species Diversity | 4. Vegetation Species Diversity | | | | | | | |
| Criteria A | 5 | 7 | 7 | 4 | 3 | 8 | 5 | 39 |
| Criteria B | 3 | 5 | 5 | 5 | 3 | 7 | 3 | 31 |
| Criteria C (Swamys Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 5. Vertical Stratification | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 28 |
| 6. Additional Structural Diversity Components | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 11 |
| 7. Condition of Existing Vegetati | 7. Condition of Existing Vegetation | | | | | | | |
| Criteria A (Woody Vegetation) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 |
| Criteria B (Herbaceous Vegetation) | 5 | 5 | 1 | 5 | 5 | 3 | 1 | 25 |
| Criteria C (Croplands Only) | NA | ŇA | NA | NA | NA | NA | NA | NA. |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |

Average Habitat Quality Score for all sites within

this cover type = $\frac{\text{Total Points}}{\text{Total number of sites}}$ $x \frac{1}{100} = \frac{0.49}{0.49}$

SPECIES LIST FOR YOUNG FOREST COVER TYPE

| Common Name | Scientific Name | Group | Layer |
|--------------------|----------------------------|-------------|------------|
| American Elm | Ulmus americana | Samara | canopy |
| Black Willow | Salix nigra | Capsule | canopy |
| Bois d' Arc | Maclura pomifera | Achene | canopy |
| Box Elder | Acer negundo | Samara | canopy |
| Bur Oak | Quercus macrocarpa | Acorn | canopy |
| Cedar Elm | Ulmus crassifolia | Samara | canopy |
| Cottonwood | Populus deltoides | Berry/Drupe | canopy |
| Eastern Red Cedar | Juniperus virginiana | Cone | canopy |
| Green Ash | Fraxinus pennsylvanica | Samara | canopy |
| Hackberry | Celtis laevigata | Berry/Drupe | canopy |
| Honey Locust | Gleditsia triacanthos | Legume/Pod | canopy |
| Pecan | Carya illinoensis | Nut/Nutlike | canopy |
| Post Oak | Quercus stellata | Acorn | canopy |
| Red Oak | Quercus shumardii | Acorn | canopy |
| Toothache Tree | Zanthoxylum clava-herculis | Berry/Drupe | canopy |
| Black Willow | Salix nigra | Capsule | |
| Bois d' Arc | Maclura pomifera | Achene | understory |
| Cedar Elm | Ulmus crassifolia | Samara | understory |
| Chickasaw plum | Prunus angustifolia | Berry/Drupe | understory |
| Chinese Privet | Ligustrum sinese | Berry/Drupe | understory |
| Deciduous Holly | llex decidua | Berry/Drupe | understory |
| Eastern Red Cedar | Juniperus virginiana | Cone | understory |
| Eve's Necklace | Sophora affinis | Legume/Pod | understory |
| Green Ash | Fraxinus pennsylvanica | Samara | understory |
| Gum Bumelia | Bumelia lanuginosum | Berry/Drupe | understory |
| Hackberry | Celtis laevigata | Berry/Drupe | understory |
| Hawthorn | Crataegus texana | Berry/Drupe | understory |
| Honey Locust | Gleditsia triacanthos | Legume/Pod | understory |
| Mesquite | Prosopis glandulosa | Legume/Pod | understory |
| Mexican Plum | Prunus mexicana | Berry/Drupe | understory |
| Rattlebush | Sesbania drummondii | Legume/Pod | understory |
| Redbud | Cercis canadensis | Legume/Pod | understory |
| Soapberry | Sapindus drummondii | Berry/Drupe | understory |
| Toothache Tree | Zanthoxylum clava-herculis | Berry/Drupe | understory |
| Wild Rose Bush | Rosa sp. | Achene | understory |
| American Pokeweed | Phytolacca americana | Berry/Drupe | herbaceous |
| Annual Ragweed | Ambrosia artemisiifolia | Achene | herbaceous |
| Bermuda | Cynodon dactylon | Caryopsis | herbaceous |
| Japanese Brome | Bromus japonicus | Caryopsis | herbaceous |
| Bushy Bluestem | Andropogon glomeratus | Achene | herbaceous |
| Buttercup | Ranunculus sp. | Achene | herbaceous |
| Catchweed Bedstraw | Galium aparine | Schizocarp | herbaceous |
| Coralberry | Symphoricarpos orbiculatus | Berry/Drupe | herbaceous |
| Curly Dock | Rumex crispus | Achene | |
| False Garlic | Nothoscordum bivalve | Achene | |
| Giant Ragweed | Ambrosia trifida | Achene | |
| Greenbriar | Smilax bona-nox | Berry/Drupe | |
| Henbit | Lamium amplexicaule | Nut/Nutlike | |
| Inland Sea Oats | Chasmanthium latifolium | Achene | |

SPECIES LIST FOR YOUNG FOREST COVER TYPE

| Japanese Honeysuckle | Lonicera japonica | Berry/Drupe | herbaceous |
|-----------------------|------------------------|-------------|------------|
| Johnson Grass | Sorghum halepense | Caryopsis | herbaceous |
| Mulberry | Morus sp. | Achene | herbaceous |
| Mustard Family | | Silique | herbaceous |
| Perennial Ryegrass | Lolium perenne | Caryopsis | herbaceous |
| Poison Hemlock | Conium maculatum | Schizocarp | herbaceous |
| Poison Ivy | Toxicodendron radicans | Berry/Drupe | herbaceous |
| Prickly Pear Cactus | Opuntia sp. | Berry/Drupe | herbaceous |
| Sedge | Carex sp. | Achene | herbaceous |
| Spurge Family | | Capsule | herbaceous |
| Sunflower Family | Aster sp. | Achene | herbaceous |
| Texas Prairie Parsley | Polytaenia texana | Schizocarp | herbaceous |
| Trumpet Creeper | Campsis radicans | Capsule | herbaceous |
| Virginia Wildrye | Elymus virginicus | Caryopsis | herbaceous |

WHAP **Biological Components** Field Evaluation Form

Project Proposed Lake Ralph Hall Cover Type or Plant Association Parks

Date: 2005

| Habitat Components | Components Points (From Key) | | | | | | | |
|--|---------------------------------|-----|-----|-----|-----|-----|-----|-------|
| Site No. | 534 | 701 | 749 | 321 | 126 | 535 | 706 | Total |
| 1. Site Potential | 7 | 12 | 7 | 7 | 7 | 7 | 12 | 59 |
| 2. Temporal Development | | | | | | | | |
| Criteria A | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 42 |
| Criteria B (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | · NA |
| 3. Uniqueness and Relative Abundance | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 |
| 4. Vegetation Species Diversity | | | | | | | | |
| Criteria A | 6 | .6 | 3 | 4 | 2 | 8 | 7 | 36 |
| Criteria B | 3 | 3 | 1 | 1 | 1 | 7 | 5 | 21 |
| Criteria C (Swamps Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| 5. Vertical Stratification | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 24 |
| 6. Additional Structural Diversity Components | 0 | 1 | 0 | 1 | 3 | 1 | 1 | 7 |
| 7. Condition of Existing Vegetation | | | | | | | | |
| Criteria A (Woody Vegetation) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 |
| Criteria B (Heabaceous Vegetation) | 5 | 5 | 1 | 3 | 3 | 5 | 5 | 27 |
| Criteria C (Cropiands Only) | NA | NA | NA | NA | NA | NA | NA | NA |
| Criteria D (Marsh Wetlands Only) | NA | NA | NA | NA | NA | NA | NA | NA |

Average Habitat Quality Score for all sites within

this cover type = _____ Total Points x <u>1</u> = Total number of sites 100 0.41

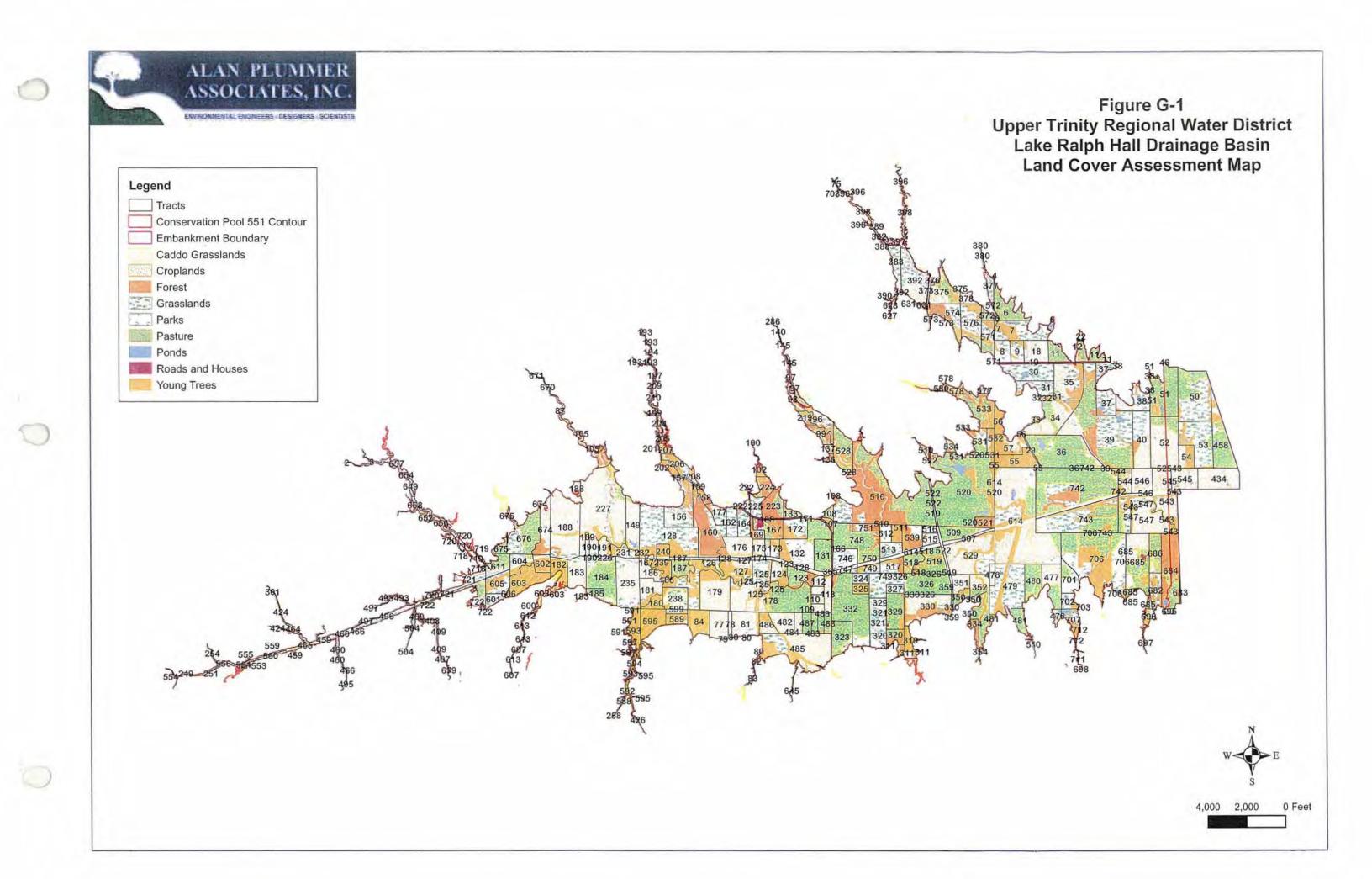
SPECIES LIST FOR PARKS COVER TYPE

| Common Name | Scientific Name | Group | Layer |
|-------------------------------|----------------------------|-------------|------------|
| American elm | Ulmus americana | Samara | canopy |
| Bois d' Arc | Maclura pomifera | Achene | canopy |
| Catalpa (cigar tree) | Catalpa speciosa | Capsule | canopy |
| Cedar Elm | Ulmus crassifolia | Samara | canopy |
| Green Ash | Fraxinus pennsylvanica | Samara | canopy |
| Hackberry | Celtis laevigata | Berry/Drupe | canopy |
| Pecan | Carya illinoensis | Nut/Nutlike | canopy |
| Post Oak | Quercus stellata | Acorn | canopy |
| Red Oak | Quercus shumardii | Acorn | canopy |
| Black Willow | Salix nigra | Capsule | understory |
| Bois d' Arc | Maclura pomifera | Achene | understory |
| Cedar Elm | Ulmus crassifolia | Samara | understory |
| Chickasaw plum | Prunus angustifolia | Berry/Drupe | |
| Chinese Privet | Ligustrum sinese | Berry/Drupe | |
| Chinquapin Oak | Quercus muehlenbergii | Acorn | understory |
| Deciduous Holly | llex decidua | Berry/Drupe | |
| Eastern Red Cedar | Juniperus virginiana | Cone | |
| Eve's Necklace | Sophora affinis | Legume/Pod | understory |
| Green Ash | Fraxinus pennsylvanica | Samara | understory |
| Gum Bumelia | Bumelia lanuginosum | Berry/Drupe | understory |
| Hackberry | Celtis laevigata | Berry/Drupe | understory |
| Hawthorn | Crataegus texana | Berry/Drupe | understory |
| Honey Locust | Gleditsia triacanthos | Legume/Pod | understory |
| Mesquite | Prosopis glandulosa | Legume/Pod | understory |
| Mexican Plum | Prunus mexicana | Berry/Drupe | understory |
| Post Oak | Quercus stellata | Acorn | understory |
| Rattlebush | Sesbania drummondii | Legume/Pod | understory |
| Roughleaf Dogwood | Cornus drummondii | Berry/Drupe | understory |
| Soapberry | Sapindus drummondii | Berry/Drupe | understory |
| Wild Rose Bush | Rosa sp. | Achene | understory |
| Annual Ragweed | Ambrosia artemisiifolia | Achene | herbaceous |
| Beaked Cornsalad | Valerianella radiata | Achene | herbaceous |
| Bermuda | Cynodon dactylon | Caryopsis | herbaceous |
| Big Bluestem | Andropogon gerardii | Achene | herbaceous |
| Japanese Brome | Bromus japonicus | Caryopsis | herbaceous |
| Bull Nettle | Cnidoscolus texanus | Capsule | herbaceous |
| Bushy Bluestem | Andropogon glomeratus | Achene | herbaceous |
| Buttercup | Ranunculus sp. | Achene | herbaceous |
| Catchweed Bedstraw | Galium aparine | Schizocarp | herbaceous |
| Clasping Venus' Looking-glass | Triodanis perfoliata | Capsule | herbaceous |
| Clover (yellow) | Meliotus indicus | Legume/Pod | herbaceous |
| Cockspur Grass | Echinochloa crus-pavonis | Caryopsis | herbaceous |
| Common Selfheal | Prunella vulgaris | Nut/Nutlike | |
| Common Sunflower | Helianthus annuus | Achene | herbaceous |
| Common Yarrow | Achillea millefolium | Achene | |
| Coral Honeysuckle | Lonicera sempervirens | Berry/Drupe | |
| Coralberry | Symphoricarpos orbiculatus | Berry/Drupe | |
| Cross-vine | Bignonia capreolata | Capsule | |
| Curly Dock | Rumex crispus | Achene | |

SPECIES LIST FOR PARKS COVER TYPE

| Dewberry | Rubus trivialis | Berry/Drupe | herbaceous |
|------------------------|-----------------------------|-------------|------------|
| Dotted Blue-eyed Grass | Sisyrinchium langloisii | Capsule | herbaceous |
| False Garlic | Nothoscordum bivalve | Achene | herbaceous |
| Fern | | Other | herbaceous |
| Fiddle Dock | Rumex pulcher | Achene | herbaceous |
| Flameleaf Sumac | Rhus copallinum | Berry/Drupe | herbaceous |
| Flax | Linum sp. | Capsule | herbaceous |
| Foxtail Grass | Setaria sp. | Caryopsis | herbaceous |
| Giant Ragweed | Ambrosia trifida | Achene | herbaceous |
| Goldenrod | Solidago sp. | Achene | herbaceous |
| Green Wild Indigo | Baptisia sphaerocarpa | Legume/Pod | herbaceous |
| Greenbriar | Smilax bona-nox | Berry/Drupe | herbaceous |
| Honey Locust | Gleditsia triacanthos | Legume/Pod | herbaceous |
| Illinois Bundleflower | Desmanthus illinoensis | Legume/Pod | herbaceous |
| Indian Paintbrush | Castilleja sp. | Capsule | herbaceous |
| Johnson Grass | Sorghum halepense | Caryopsis | herbaceous |
| Little Bluestem | Schizachyrium scoparium | Achene | herbaceous |
| Lyreleaf Sage | Salvia lyrata | Nut/Nutlike | herbaceous |
| Milkweed | Asclepias sp. | Follicle | herbaceous |
| Nettle | | Achene | herbaceous |
| Nightshade | Solanum sp. | Berry/Drupe | herbaceous |
| Poison Hemlock | Conium maculatum | Schizocarp | herbaceous |
| Poison Ivy | Toxicodendron radicans | Berry/Drupe | herbaceous |
| Prairie Peppergrass | Lepidium densiflorum | Silique | herbaceous |
| Prickly Pear Cactus | Opuntia sp. | Berry/Drupe | herbaceous |
| Purple Threeawn | Aristida purpurea | Caryopsis | herbaceous |
| Quakinggrass | Briza minor | Caryopsis | herbaceous |
| Sensitive-briar | Mimosa sp. | Legume/Pod | herbaceous |
| Showy Evening Primrose | Oenothera speciosa | Capsule | herbaceous |
| Spurred Butterfly Pea | Centrosema virginianum | Legume/Pod | herbaceous |
| Sunflower Family | Aster sp. | Achene | herbaceous |
| Texas Prairie Parsley | Polytaenia texana | Schizocarp | herbaceous |
| Texas Vervain | Verbena halei | Nut/Nutlike | herbaceous |
| Trumpet Creeper | Campsis radicans | Capsule | herbaceous |
| Vervain Family | | Nut/Nutlike | herbaceous |
| Vetch | Vicia sp. | Legume/Pod | herbaceous |
| Virginia Creeper | Parthenocissus quinquefolia | Berry/Drupe | herbaceous |
| Virginia Wildrye | Elymus virginicus | Caryopsis | herbaceous |
| White Clover | Trifolium repens | Legume/Pod | herbaceous |
| Wild Onion | Allium canadense | Capsule | herbaceous |
| Yellow Thistle | Cirsium horridulum | Achene | herbaceous |

LAND COVER ASSESSMENT MAP



F-2: Summary of SWAMPIM and WHAP Memorandum

MEMORANDUM

| Date: | November 10, 2009 |
|----------|---|
| То: | Mary Verwers, United States Army Corps of Engineers |
| From: | Jason Voight, Alan Plummer Associates, Inc. Loretta Mokry, Alan Plummer Associates, Inc. |
| Cc: | Larry Patterson, P.E., Upper Trinity Regional Water District Edward Motley, P.E., CH2MHill File 0346-004-03 |
| Subject: | USACE Project Number 2003-00336 Summary of SWAMPIM and WHAP Data Sets and Reports for the Proposed Lake Ralph Hall Project Site |

Background

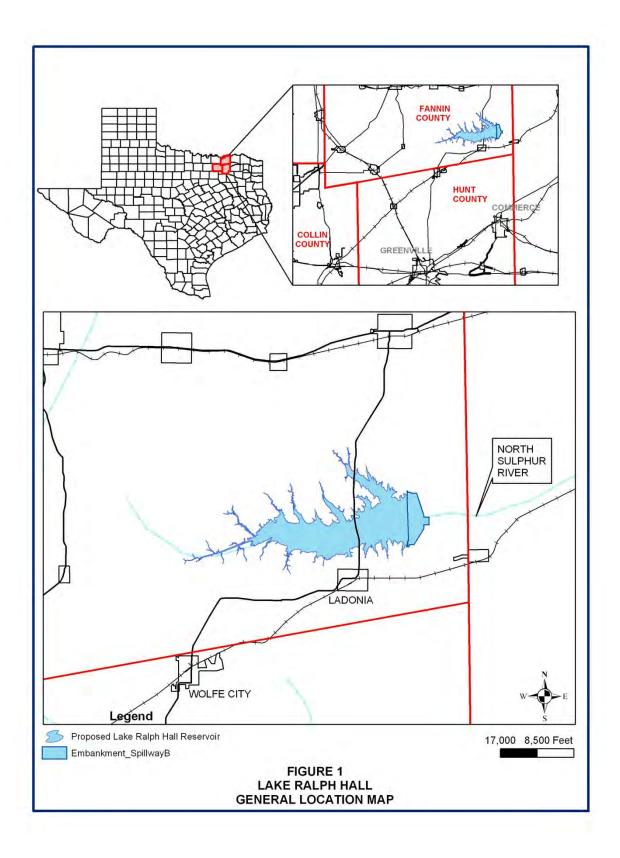
To date numerous reports and subsequent reports have been produced for the Lake Ralph Hall project documenting efforts conducted to assess aquatic resource functions as well as habitat quality. The following is a brief synopsis of the effort to date.

- August 2005 a draft Lake Ralph Hall Preliminary Habitat Assessment report documenting assessment of habitat and land cover within the project area using the Texas Parks and Wildlife Department's (TPWD) Wildlife Habitat Appraisal Procedure (WHAP) was circulated to the United States Army Corps of Engineers (USACE), U.S. Fish and Wildlife Department (USFWS), U.S. Environmental Protection Agency (USEPA), and the TPWD for review. During a project review meeting with Presley Hatcher (USACE Permits Chief) and Brent Jasper (USACE Project Manager for this project 2005-2008), the USACE provided a directive to use a functions based analysis rather than areal based analysis for developing appropriate mitigation for impacts associated with the project.
- January 2006 a project meeting was held with Presley Hatcher and Brent Jasper to discuss the outline for functions based analysis of Lake Ralph Hall. Comments were received from the USACE and incorporated into a draft Stream Watershed Assessment and Measurement Protocol Interaction Model (SWAMPIM) protocol for functional assessment of the Lake Ralph Hall project area.
- March 2006 the draft SWAMPIM protocol was submitted to the USACE for their review and comment; review comments were discussed at a project meeting with the USACE (Presley Hatcher and Brent Jasper).
- October 30, 2006 an application for a Section 404 permit was submitted to the Fort Worth District, USACE. The application included the Lake Ralph Hall Preliminary

Habitat Assessment dated December 6, 2005, the Biological Assessment of the North Sulphur River dated June 15, 2006, and the Draft Mitigation Plan dated October 26, 2006. The SWAMPIM protocol was used in the development of the mitigation plan to determine the existing aquatic resource functions of the project area and to project aquatic resource functions based on the mitigation proposal. A balance between pre- and post-project aquatic functions was shown to be obtainable within the proposed project boundary.

- February 4, 2009 an interagency meeting was hosted at the Lake Belton USACE office. At this meeting, a presentation was provided to the team to discuss the development of the SWAMPIM protocol and its application for assessing existing and post-project aquatic resources, which was used as the basis for the proposed draft mitigation plan. The interagency review team agreed to the use of the SWAMPIM and WHAP protocols for aquatic resource function and habitat assessment respectively within the Lake Ralph Hall project area. During the meeting, the agencies requested assessment of additional sampling points within the proposed mitigation areas along the upper reaches of tributaries to the North Sulphur River and within the Ladonia Unit of the Caddo National Grasslands. Attendees included representatives from the USACE, the U.S. Fish and Wildlife Department, the Texas Commission on Environmental Quality, the U.S. Forest Service, Upper Trinity Regional Water District, CPYI, CH2MHill, and Alan Plummer Associates, Inc.
- July 2009 USACE agreed to the proposed additional sampling points for SWAMPIM and WHAP assessment.
- August 24-29, 2009 representatives from APAI assessed the additional sampling points using SWAMPIM for the stream channels and WHAP for terrestrial habitat.
- September 16, 2009 the interagency review team participated in a field review of the additional sampling points. Based on the input received from the interagency review team during the on-site field review, the data sheets were revised for the additional sampling points. Attendees included representatives from the USACE, the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, the Texas Parks and Wildlife Department, the Texas Commission on Environmental Quality, Upper Trinity Regional Water District, CPYI, CH2MHill, and Alan Plummer Associates, Inc.

A general location map is provided as Figure 1.



Discussion of the Data within the Draft Mitigation Plan (dated October 26, 2006) to the Data Reassessed After 2009 Agency Review

Wildlife Habitat Appraisal Procedure (WHAP)

On-site observations conducted during spring and summer 2005 were used to assess habitat quality and desktop analysis of a 2003 aerial photograph was used to quantify the areal extent of specific land cover categories within the proposed Lake Ralph Hall project area. The following table (Table 1) details the data presented in the draft mitigation plan dated October 26, 2006. As of the time of the mitigation submittal, the project area, excluding aquatic resources, consisted of 22 percent cropland, 19 percent grasses, 28 percent pasture, 7 percent partially wooded grassland (parklike), 8 percent forest, and 16 percent young forest. The two forested communities displayed the highest habitat quality scores.

| Cover-type Category | Average Habitat Quality Score (HQ) | Total Area (Acres) | Habitat Units (HQxArea) |
|-------------------------------|---------------------------------------|--------------------|-------------------------|
| Cropland | 0.09 | 1,720 | 154.8 |
| Grasses | 0.25 | 1,435 | 358.75 |
| Pasture | 0.2 | 2,192 | 438.4 |
| Partially Wooded Grassland | 0.41 | 516 | 211.56 |
| Forest | 0.59 | 602 | 355.18 |
| Young Forest | 0.44 | 1,299 | 571.56 |
| Т | otal | 7,764 | 2,090.25 |

 Table 1: Wildlife Habitat Appraisal Procedure Data As Presented in the Draft Mitigation Plan

During the September 16, 2009 agency review, not all habitat cover-types were included in the assessment of additional sampling points. Only cropland, pasture, forest, and young forest cover types were reassessed during the September 2009 interagency site field review. Of the habitat cover types that were assessed in 2009, habitat quality scores were adjusted both upwards and downwards from the comments received. The following illustrates the habitat quality scoring for data gathered at the additional sampling points pre- and post-agency review.

| Site | Pre-Agency Visit | Post-Agency Visit |
|--------------|------------------|-------------------|
| Cropland | 0.15 | 0.20 |
| Pasture | 0.18 | 0.17 |
| Forest | 0.44 | 0.44 |
| Young Forest | 0.53 | 0.48 |

Scores for cropland improved, forest remained unchanged, but both pasture and young forest were downgraded slightly. All in all, there was less than one percent change downward from the pre-agency field review to the post-agency field review when all scores were summed (1.3 pre-agency review compared to 1.29 post-agency review).

When the scores for the additional sampling points are included with the original data for habitat assessment for the entire project area, the habitat quality scores decreased slightly from the values presented in the draft mitigation plan from 2,090.25 to 2,083.81, as shown in Table 2.

| incorporated into the Entire Habitat Assessment | | | | |
|---|---------------------------------------|--------------------|-------------------------|--|
| Cover-type Category | Average Habitat Quality Score (HQ) | Total Area (Acres) | Habitat Units (HQxArea) | |
| Cropland | 0.12 | 1,720 | 206.4 | |
| Grasses* | 0.25 | 1,435 | 358.75 | |
| Pasture | 0.19 | 2,192 | 416.48 | |
| Partially Wooded Grassland* | 0.41 | 516 | 211.56 | |
| Forest | 0.53 | 602 | 319.06 | |
| Young Forest | 0.44 | 1,299 | 571.56 | |
| Total | | 7,764 | 2,083.81 | |

 Table 2: Wildlife Habitat Appraisal Procedure Following September 2009 Agency Review

 Incorporated into the Entire Habitat Assessment

*Represents data used from the mitigation plan assessment

As illustrated above, the WHAP data used in the draft mitigation plan is consistent with the postagency field review data. Figure A-1 in Attachment A illustrates the WHAP data points for all assessments. The WHAP protocol and all WHAP data sheets are included in Attachment A.

Stream Watershed Assessment and Measu rement Protocol Interaction Model (SWAMPIM)

The primary goal of the draft mitigation plan is to provide compensation to existing aquatic resource functions and terrestrial habitats impacted by the construction of the Lake Ralph Hall project on a watershed basis rather than on an areal basis. The SWAMPIM protocol was developed to facilitate development of a functions based mitigation plan by assessing existing conditions and functions capacity and projecting future functions capacity of the project area with the proposed Lake Ralph Hall in place. The SWAMPIM protocol accounts for functions and watershed interactions of both streams and impoundments. The following table (Table 3) summarizes the results of the pre- and post-project functional capacities for streams and impoundments as outlined in the draft mitigation plan.

| 1 Ian dated October 20, 2000 | | | | | | |
|---------------------------------|----------------|---------------------------|--------------|----------------------|--|--|
| | Pre-P | roject | Post-Project | | | |
| STREAMS | Linear Feet of | Linear Feet of Functional | | Functional | | |
| | Stream | Capacity | Stream | Capacity | | |
| Within Conservation Pool | 589,066 | 532.98 | 74,546 | 361.11 | | |
| Outside of Conservation Pool | 113,111 | 94.43 | 113,111 | 165.94 | | |
| Former NSR | 11,020 | 22.59 | | | | |
| Restored NSR | | | 14,500 | 125.08 | | |
| Total | 124,131 | 650.0 | 202,157 | 652.13 | | |
| | Pre-Project | | Post-Project | | | |
| IMPOUNDMENTS | Area (Acres) | Resource Capacity | Area (Acres) | Resource Capacity | | |
| Within Conservation Pool | 72.5 | 30.83 | 7,566 | 5,783.5 | | |
| Outside of Conservation Pool | 40.7 | 16.58 | 40.7 | 16.58 | | |
| Total | 113.2 | 47.41 | 7,606.7 | 5,800.08 | | |

 Table 3: Functional Capacities for Streams and Impoundments as Outlined in the Draft Mitigation

 Plan dated October 26, 2006

Streams

The North Sulphur River and its tributaries within the proposed Lake Ralph Hall project area are characterized as intermittent (North Sulphur River) and ephemeral (tributaries) which do not retain water in perennial pools during periods of insufficient rainfall. Based on observations of this character during field work conducted in 2006 and for the additional sampling points in August 2009, the SWAMPIM scoring for some functional parameters was zero. During the interagency field review, some agency team members expressed the opinion that the scoring of zero for these parameters based on no flow observed was unduly penalizing ephemeral streams. Based on the input received during the field review, data for the additional sampling points were upgraded for the various parameters that dealt with no water in the channel. The comparison of the pre-agency to post-agency field review functional capacity scores for the additional sampling points is as follows:

| Site # | Pre-Agency Visit FC | Post-Agency Visit FC |
|-------------|---------------------|----------------------|
| N6 | 11.1 | 12.4 |
| N16 | 11.1 | 11.0 |
| N21 | 17.7 | 17.0 |
| N21-Trib 18 | 1.4 | 1.3 |
| N27 | 5.7 | 7.3 |
| S52 | 12.4 | 14.3 |
| S52-Trib 6 | 1.0 | 0.75 |
| S56 | 7.0 | 6.8 |
| S61 | 6.8 | 9.1 |

The data obtained from the post-agency field review was incorporated into the overall functional capacity data outlined in the draft mitigation plan. As shown in Table 4 when incorporating the post-agency reassessment data, the pre-project functional capacity within conservation pool decreased slightly whereas the outside of conservation pool functional capacity increased slightly.

| Table 4: Comparison of Functional Capacity Scores from the Mitigation Plan and the 2009 |
|---|
| Reassessment |

| Pre-Project Streams | Linear Feet of Stream | Mitigation Plan Functional | 2009 Reassessment Functional | |
|--------------------------|--------------------------|----------------------------------|------------------------------------|--|
| | | Capacity | Capacity | |
| Within Conservation | 589,066 | 532.98 | 519.30 | |
| Pool | 507,000 | 552.70 | 517.50 | |
| Outside of | 113,111 | 94.43 | 95.69 | |
| Conservation Pool | 113,111 | 74.43 | 95.09 | |
| Former NSR | 11,020 | 22.59 | 22.59 | |
| Total | 124,131 | 650.0 | 637.58 | |

The summary tables for the 2006 and 2009 pre- and post-project stream functional capacity calculations are included in Attachment B. These tables provide the linear feet and functional capacity index score for the stream channel categories identified by channel widths and the

corresponding functional capacity score for each category. As presented, the functional capacity indices outlined in the draft mitigation plan provided a more conservative picture of the aquatic resource functions within the proposed Lake Ralph Hall project area.

On-channel Impoundments

No changes were made to on-channel impoundments from what was presented in the draft mitigation plan. The interagency review team did not express any comments or concerns regarding the functional capacity scores presented for the impoundments. However, it should be noted that the pre-project resource capacity for existing impoundments scored a 47.41 whereas the post-project resource capacity with the construction of Lake Ralph Hall scored 5,800.08. Lake Ralph Hall grossly improves the post-project impoundment aquatic resource.

Figure B-1 in Attachment B illustrates the SWAMPIM data points used during the original assessments and the additional sampling points for the assessed in August 2009. The SWAMPIM protocol and all SWAMPIM data sheets are included in Attachment B.

Summary

Based on the mitigation proposal, a functional capacity score of 652.21 was primarily obtained through increased habitat potential, development of perennial pools within channels upstream of the conservation pool of the reservoir, and a decrease in erosion due to the curbing of current on-going head cutting. In keeping with the USACE's directive of mitigating this project through a functions based assessment, both the 2006 and 2009 pre-project functional capacity scores of 650.0 and 637.58 respectively are at or below the projected functional capacity improvements to the project area.

F-3: Biological Assessment of the North Sulphur River

ATTACHMENT 5 BIOLOGICAL ASSESSMENT OF NORTH SULPHUR RIVER

PREPARED BY ALAN PLUMMER ASSOCIATES, INC.





MEMO

TO: Chris Loft Texas Commission on Environmental Quality FROM: Bob Brandes foletthe Lorder

DATE: October 30, 2006

SUBJECT: Biological Sampling of the North Sulphur River and Instream Flow Requirements for Lake Ralph Hall

As we have discussed on several occasions, development of appropriate instream flow requirements for the proposed Lake Ralph Hall on the North Sulphur River is a challenge because of the unique eroded nature of the river channel, the occurrence of significant river flows in the vicinity of the dam site only immediately after substantial rainfall events, the absence of any significant habitat within the river channel to support a viable aquatic ecosystem, and the fact that biological organisms often are not found in the river at all because its channel is essentially dry. To document these conditions and obtain site-specific data in the vicinity of the proposed dam site, the Upper Trinity Regional Water District (UTRWD), the project sponsor, commissioned Alan Plummer Associates, Inc. (APAI) to undertake a biological sampling program on the river earlier this year. These sampling efforts and their results are described in two letters from APAI dated June 15, 2006 and August 28, 2006, both of which are attached hereto as Attachments A and B, respectively.

It is apparent from the results from these field studies that the biological resources of this reach of the North Sulphur River are fairly limited, even with pools of water in the river channel following a series of small rainfall events as occurred prior to and during the May 5th sampling activity¹. Only of a small variety of freshwater invertebrates were collected from the pools, with no fish species observed. Again, without rainfall, the channel of the river is essentially dry. As observed during the August 24th and 25th sampling event when no rainfall had previously occurred, there was no water present in the river channel and no biological activity.

Based on the results from the sampling that has been conducted by APAI, it is apparent that there is no significant existing biological community or aquatic ecosystem within the river channel that is sustained by the ephemeral flows that periodically occur in the river. At best, as described by APAI, the organisms that do occur are "opportunists" that are temporarily sustained by the occasional pools of water that occur after rainfall events and the temporary habitat that these

¹ About 1.5 inches of precipitation fell in the vicinity of the proposed Lake Ralph Hall dam site during the two weeks prior to the May 5th sampling event.

Mr. Chris Loft October 30, 2006 Page 2 of 3

pools provide. For this reason, it would appear that the development of some form of instream flow regime to attempt to mimic what occurs, or doesn't occur, naturally in the river under existing conditions would be difficult at best and may not be warranted. Instead, it might be more productive from a biological standpoint to utilize a portion of the inflows to Lake Ralph Hall, or some of the stored water in Lake Ralph Hall, to support a more viable ecosystem such as that being proposed by the UTRWD for restoration along a segment of the abandoned original channel of the North Sulphur River immediately below the dam.

As you know, we originally included in our water availability and yield analysis of Lake Ralph Hall a set of monthly instream flow requirements as a placeholder pending the development of more appropriate and meaningful information. These earlier instream flow requirements were derived using the Lyons desktop method applied to historical daily flow records from the existing streamflow gage on the North Sulphur River near Cooper. These calculations are summarized in the table included herewith as Attachment C, and as shown, even these estimated instream flow needs exhibit essentially zero values for four months of the year, i.e., July through October. Based on actual observations of the river flow in the vicinity of the dam site, it is obvious that the flows in the other eight months of the year certainly are not sustained at the levels indicated in the table, but rather are also zero the vast majority of the time when it is not raining in the river's upper watershed.

There is geologic evidence that there are certain formations along the channel of the North Sulphur River downstream of the dam site and closer to the streamflow gage near Cooper that potentially support sustained spring discharges, or at least seeps, for prolonged periods following rainfall events. Particularly, the Wolfe City and Pecan Gap sands are known to be characterized by such discharges. There is the possibility that it is the discharges from these formations that account for some of the observed river flows at the streamflow gage on the North Sulphur River near Cooper during the December-through-June period that result in the corresponding higher instream flow values derived with the Lyons method. It may be that this lower reach of the proposed Lake Ralph Hall dam site, and that the use of these flows to establish instream flow requirements for Lake Ralph Hall is not appropriate.

Enclosed with this memo is a copy of a video taken from a helicopter on October 11, 2005 of the reach of the North Sulphur River from the State Highway 24 crossing about 20 miles downstream of the proposed Lake Ralph Hall dam site (where the streamflow gage near Cooper is located) upstream to State Highway 68, which is about ten miles above the proposed Lake Ralph Hall dam site. This video clearly shows essentially no water in the river for about ten miles upstream and ten miles downstream of the proposed the Lake Ralph Hall dam site, but it does indicate the presence of isolated shallow pools of water along the lower segment of the river upstream of the streamflow gage near Cooper at the State Highway 24 crossing. Rainfall records for the area indicate that about one-half inch of precipitation fell in the watershed above the dam site on September 24th, followed by a few tenths of an inch of rainfall on September 28th and traces of rainfall on September 24th, with another half inch on September 28th, thus contributing to the pools of water shown in the river channel above the gage.



Mr. Chris Loft October 30, 2006 Page 3 of 3

As an alternative approach for providing for environmental flows, the UTRWD proposes to make all of the low-flow releases from Lake Ralph Hall, to the extent possible, through an outlet that contributes flows directly to the proposed restoration segment of the abandoned channel of the North Sulphur River located immediately below the dam in the south floodplain of the river. The balance of these flows not consumed within the restored segment of the abandoned river channel would be discharged back into the existing river channel through a controlled outlet structure, thus providing some sustained flow in the river for a short distance. While the design of the channel restoration project is still in progress, the low-flow releases from the reservoir to the restored channel will provide the necessary flow regime required to maintain the restored wetland area, with only part of this flow actually being consumed within the restored channel itself. Current plans for the project call for approximately 14,500 linear feet of the abandoned river channel on the south floodplain of the river to be excavated and restored, with plantings for creation and enhancement of riparian zones, wetlands, and corridors connecting to adjacent terrestrial habitat. In a river bottom area void of such conditions, this seems to be a much more appropriate and productive use of water from the river for environmental purposes than simply passing it downstream to flow through the existing barren and eroded channel of the river with no sustained habitat or biological resources.

In summary, the UTRWD is requesting that you give serious consideration to the approach described herein for providing appropriate environmental flows and for meeting the TCEQ's obligations for assuring that the proposed Lake Ralph Hall project will not adversely impact instream uses or water quality. We believe that the proposed approach will be an effective means for restoring riverine habitat in the area. As plans for the proposed river channel restoration project continue to evolve, we will keep you apprised of how the project will be configured and operated, and we would welcome any suggestions you might have for its improvement. In the meantime, if you have questions regarding what is being proposed, we will be glad to discuss them with you. Or if you want to visit the site and see firsthand the segment of the abandoned river channel that is being proposed for restoration, please let us know and we will be happy to arrange such a trip.

We appreciate your help with this effort and look forward to your comments regarding the approach being proposed by the UTRWD.

ATTACHMENT A

Letter Dated June 15, 2006 from Alan Plummer Associates, Inc. to Edward Motley, Chiang, Patel and Yerby, Inc.

RB



JAMES C. ACTSTAETTER, P.E. STEPHEN L COONAN, P.E. PEGGY W GLASS, Ph.D. DAVID A. GUDAL, P.E. BETTY L. IORDAN, P.E. ALAN H PLUMMER, JR., PE., DEE RICHARD H SMITH PE. ALAN R.TUCKER, PE

346-0402

June 15, 2006

Mr. Edward Motley, P.E. Chiang, Patel, and Yerby, Inc. 1820 Regal Row, Suite 200 Dallas, Texas 75235

ALAN PLUMMER ASSOCIATES, INC

RE: Biological Assessment of the Aquatic Community of the North Sulphur River

Dear Mr. Motley:

Samplings for the biological assessment study were conducted on May 5 and 10, 2006 to determine the type and extent of aquatic biological resources at three sampling locations within the North Sulphur River in the vicinity of the proposed Lake Ralph Hall dam site. The sampling locations were selected based on accessibility and their relationship to the proposed dam location to provide insight as to the degree of environmental flows required to support the existing aquatic ecosystem downstream of the dam. Prior to the on-site investigation, a procedure was developed based on existing sampling protocols, specifically the United States Environmental Protection Agency's Rapid Bioassessment Protocol for Streams and Wadeable Rivers (second edition) and the Texas Commission on Environmental Quality's (TCEQ) Surface Water Quality Monitoring Program, Habitat Assessment.

The locations of the three sampling stations are shown on Figure A-1, included in Attachment A. The three sampling stations were located upstream of the State Highway (SH) 34 Bridge, downstream of the Farm to Market Road (FM) 904 Bridge, and downstream of the SH 38 Bridge. The SH 34 site is located approximately 2.5 upstream of the proposed dam, and the most downstream site at SH 38 is about 7.5 miles below the dam. The FM 904 site is only about 1.5 miles downstream of the proposed dam site. Photographs from the on-site investigations of the sampling locations are also included in Attachment A.

At each of the three sampling locations, six pools were identified in the field to collect samples using three sampling techniques for each identified pool: 1) D-frame aquatic dip net for invertebrates, fish, and amphibians; 2) the Surber Stream Sampler for benthic invertebrates; and 3) a kick net for collecting large and small organisms in open water. The Surber Sampler is primarily used in flowing streams where the substrate is stirred allowing invertebrates to dislodge and flow downstream into the sampling net. However, due to the fact that there was not flow in the North Sulphur River at the time of the on-site investigations, samples from the Surber did not fully represent the community within the selected pool. The protocol for kick net sampling consists of sampling for a pre-determined time using a hand-held

220 SOUTH UNIVERSITY DRIVE í E 300 FORT WORTH TEXAS 76107-5737 PHONE 817-806-1700 METRO 817-870-2544 SAX 817-879-2536 www.xpaitsw.com

Mr. Edward Motley, P.E. June 15, 2006 Page 2 of 4

rectangular net. The collector stirs the substrate within the pool for five minutes while an assistant holds the net downstream and collects the sample. Since there was a lack of discernable flow and due to the shallow depths of the selected pools within the North Sulphur River, a field determination was made to use the D-frame aquatic dip net in lieu of the kick net. The collector walked in a clockwise direction in front of the D-frame aquatic dip net stirring the substrate within the pool for a total five minutes. The resulting D-frame samples provided a more detailed cross-section of the representative community within the various pools. Since a greater quantity of biota was collected with the D-frame, those samples were preserved and processed in the lab whereas the Surber samples were processed in the field.

In conjunction with the biological assessment, at each sampling location, a score was generated for the North Sulphur River's Functional Condition Index.¹ The data sheets from that assessment are included in Attachment B. Lastly, TCEQ's Surface Water Quality Monitoring Habitat Assessment was performed for each the three sampling locations. The descriptions of the physical parameters observed and the resulting scores from the habitat assessment are as follows:

<u>SH 34</u>

The pools sampled averaged approximately 20 meters by 15 meters with depths ranging from five to ten centimeters. The substrate consisted of clayey shale with some gravels intermixed. The shale observed was exposed bedrock. No discernable flow was observed and the water clarity was good. No rooted vegetation was observed. However, some detritus and filamentous algae were observed. The data collected were compiled into TCEQ's habitat assessment worksheet and the sampling location scored a 6, which is a habitat quality index of limited (poor). As an independent measure of the functional value of this location, the functional condition index for this sampling location is 0.31 out of a total possible score of 3.0.

FM 904

The pools sampled averaged approximately 15 meters by 10 meters with depths ranging from five to 22 centimeters. The substrate consisted of clayey shale with some gravels intermixed. The shale observed was exposed bedrock. No discernable flow was observed and the water clarity was good. No rooted vegetation was observed. However, some detritus and filamentous algae were observed. The data collected were compiled into TCEQ's habitat assessment worksheet and the sampling location scored a 4, which is a habitat quality index of limited (poor). As an independent measure of the functional value of this location, the functional condition index for this sampling location is 0.53 out of a total possible score of 3.0.

<u>SH 38</u>

^t The Functional Condition Index is a score based on a proposed method for evaluating stream functions. The proposed system is based on protocols used elsewhere in the United States. The proposed functional assessment protocol has not been approved by the USACE or any other regulatory agency.

Mr. Edward Motley, P.E. June 15, 2006 Page 3 of 4

The pools sampled averaged approximately 40 meters by 25 meters with depths ranging from five to 15 centimeters. The substrate consisted of clayey shale with some gravels intermixed. The shale observed was exposed bedrock. No discernable flow was observed and the water clarity was good. No rooted vegetation was observed. However, some detritus and filamentous algae were observed. The data collected were compiled into TCEQ's habitat assessment worksheet and the sampling location scored a 7, which is a habitat quality index of limited (poor). As an independent measure of the functional value of this location, the functional condition index for this sampling location is 0.47 out of a total possible score of 3.0.

From the three sampling locations, a variety of freshwater invertebrates were collected utilizing the aforementioned sampling techniques. The following table summarizes the total number of specimens collected for each sampling technique at each location. These numbers represent the total number of species identified at each of the six pools within the three sampling locations.

| | | Hwy 38 Bridge | | Hwy 904 Bridge | | Hwy 34 Bridge | |
|--------------------|-------------------------------|---------------|--------------------|----------------|--------------------|---------------|--------------------|
| Family Common Name | | Surber | D-Frame Dip Net | Surber | D-Frame Dip Net | Surber | D-Frame Dip Net |
| Amphipoda | Scuds | 0 | 1 | 2 | 0 | 0 | 6 |
| Baetidae | Mayflies | 0 | 6 | 0 | 4 | 1 | 23 |
| Caenidae | Mayflies | 38 | 361 | 155 | 811 | 41 | 425 |
| Cambaridae | Crayfish | 0 | 0 | 0 | 0 | 0 | J |
| Ceratopogonidae | Flies and Midges | 0 | 21 | 2 | 13 | 0 | 22 |
| Chironomidae | Flies and Midges | 84 | 591 | 92 | 288 | 75 | 934 |
| Cladocera | Water Fleas | 0 | 0 | 0 | 0 | 284 | 56 |
| Coenagrionidae | Damselflies | 0 | 0 | 0 | 2 | 0 | 0 |
| Collembula | Spring Tails | 0 | 0 | 0 | 0 | 0 | 1 |
| Copepoda | Tiny Crustaceans | 0 | 3 | 0 | 0 | 0 | 7 |
| Corixidae | Aquatic and Semi-Aquatic Bugs | 71 | 136 | 3 | 3 | 4 | 53 |
| Culicidae | Mosquitoes | 2 | 50 | 17 | 19 | 1 | 38 |
| Dolichopodidae | Flies and Midges | 0 | 0 | 0 | 0 | 2 | 3 |
| Gyrinidae | Water Beetles | 0 | 8 | 0 | 0 | 2 | 5 |
| Haliplidae | Water Beetles | 0 | 0 | 0 | 0 | 0 | 4 |
| Heptageniidae | Mayflies | 0 | 0 | 1 | 1 | 0 | 0 |
| Hydracarina | Water Mites | 0 | 2 | 6 | 0 | 0 | 1 |
| Hydrophilidae | Water Beetles | 0 | 14 | 5 | 15 | 5 | 25 |
| Libellulidae | Dragonflies | 3 | 12 | 8 | 24 | 3 | 55 |
| Ostracoda | Seed Shrimp | 0 | 38 | 0 | 0 | 0 | 48 |
| Planorbidae | Freshwater Snail | 0 | 0 | 0 | 0 | 0 | I |

Descriptions of the ecology for the identified species are included in Attachment C.

SUMMARY

The two most abundant families of invertebrates identified include Caenidae and Chironomidae at 39 and 44 percent, respectively. Both of these families are more Mr. Edward Motley, P.E. June 15, 2006 Page 4 of 4

tolerant of degraded streams and low dissolved oxygen conditions. It should be noted that all of the aforementioned invertebrates occur in areas typically found along the North Sulphur River including ponds, stock tanks, and ephemeral tributaries. During the on-site investigation, there were areas within the sampling locations where algae were colonizing thereby providing some habitat for the aforementioned species. Furthermore, detritus, decomposing shale sediment, and rooted terrestrial vegetation (e.g., Johnsongrass and rattlebush) were observed within the channel. This accumulation of sediment and rooted vegetation is most likely a product of the recent deficit of significant rainfall events in the area due to the extended drought conditions. Observations of the river channel in 2004 during a more normal rainfall period indicated that the channel is routinely scoured by flow resulting from typical rain events. This scouring includes removal of the oxidized shale in the river bottom, precluding any vegetative growth including algae. It should also be noted that the sampling was scheduled during spring rain events to ideally provide information when hopefully there was flow in the North Sulphur River. A rainfall event did occur on the morning of May 5th. However, this rain did not produce any detectable flow in the river. The limited pools within the river channel appeared to form more from seepage from small impoundments within the watershed, which enters the river channel along the shale bedrock layer.

The invertebrates identified during the sampling studies are common and abundant throughout the area and would be expected to colonize ephemeral to intermittent pools within the North Sulphur River even in the absence of river flow. The fact that flow in the river occurs only in response to rain events, leaving the bed of the river essentially dry the vast majority of the time would strongly suggest that a sustainable community of aquatic organisms (including invertebrates) cannot and does not exist within the river channel. The organisms observed are opportunists, temporarily sustained by the ephemeral pools and the limited temporal habitat these pools provide.

Should you have comments or questions, please feel free to phone either Loretta Mokry or myself at (817) 806-1700.

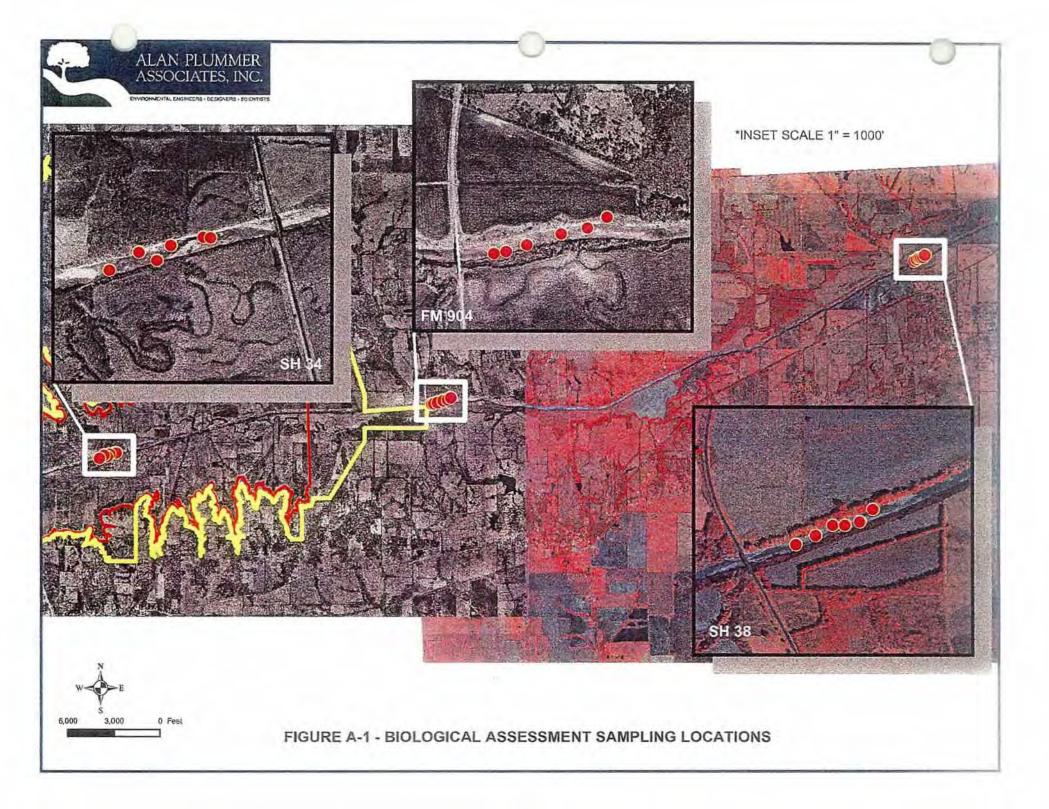
Sincerely,

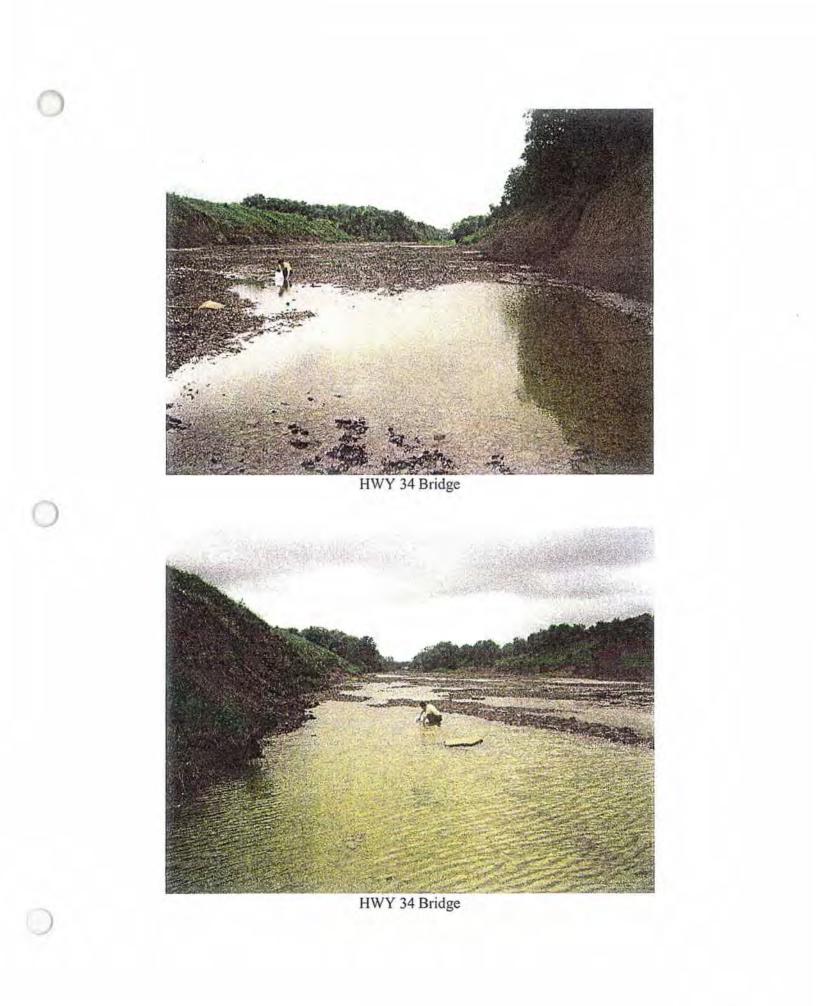
ALAN PLUMMER ASSOCIATES, INC.

Jason Voigh

Attachments

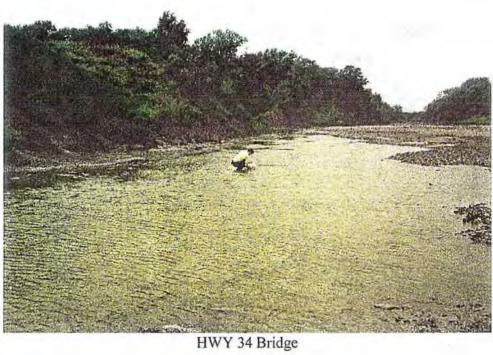
ATTACHMENT A





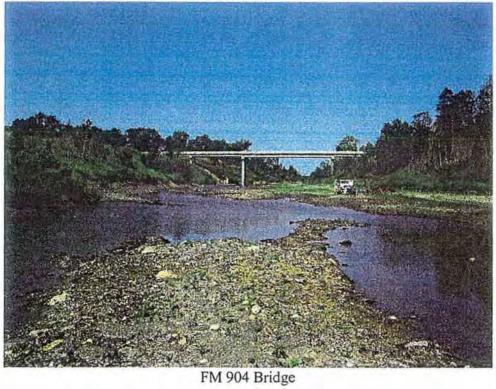


HWY 34 Bridge

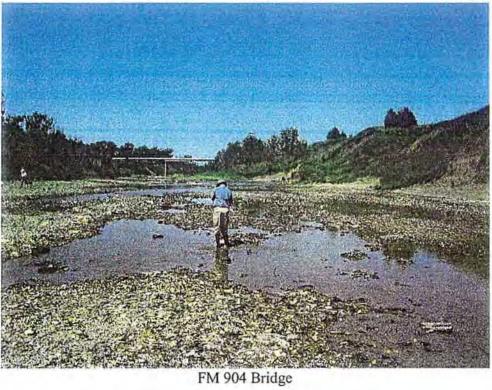




FM 904 Bridge

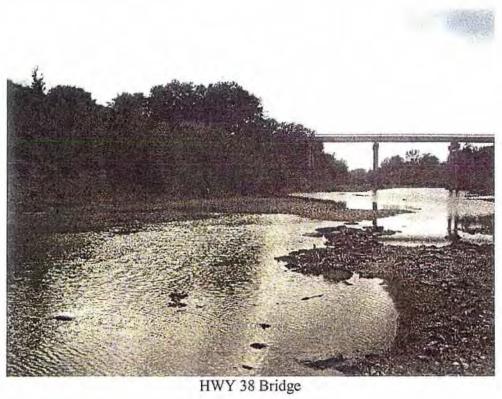






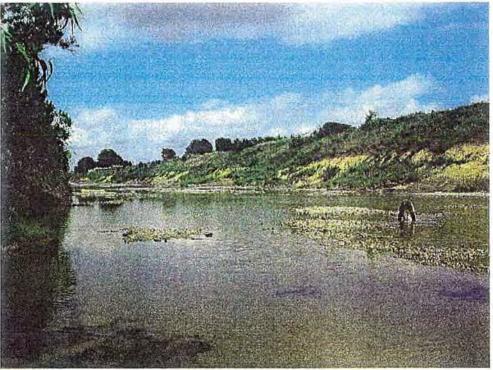


HWY 38 Bridge





HWY 38 Bridge



HWY 38 Bridge

ATTACHMENT B

| DROLOGIC FUN | CTIONS | 05\05\2006 Highway | 34 Bridge | SCORE | Reference Source |
|------------------------------------|--|---|--|----------|---------------------------------|
| 1. FLOW REGIME | | | |] | KDWP 2000 |
| TYPE | Perennial | Intermittent w/ Perennial Pools | Intermittent Ephemeral | | Kansas |
| Grade 2. CHANNEL COI | 10 9 8 | 7 6 5 ervation of Stream Channel Condition | | 4 | Subjective |
| 2. OTRANILL COL | ADITION, Measurement of ODS | STABOL OF GREEN CHAINER COLORI | | - | |
| | 0-1 | CONDITION CATEGORY | | | Barbour, 1999 EPA RBA pag |
| | Oplimal Natural channet; no structures of | Suboptimal r Some channelization (usually in | | - | 5-21; Newtor |
| | channelization minimal. No evider | ce bridge areas) or past channel | of the reach channelized widening. >80% of the reach riprap of or disrupted. Excess channelized. Degradation dikes of | | 1998 USDA |
| 2a.Channel | of downcutting or excessive late cutting. Normal frequency of | recovery of channel bed and bank | aggradation; braided levees prevent access to the | | NRCS SVAP page 7 |
| Condition/Alter ation (natural, | hydrological connection betwee channel and floodplain. | Acceptable frequency of overbani flows onto floodplain. | channel with excessive floodplain. | | page (|
| altered, or | chainer and noophain, | notra orno neocpiane. | flows onto the floodplain. | | |
| downcutting) | | | Historical Incision, dikes or levees restrict | | |
| | | | floodplain. | | |
| | | | | | |
| | | | | | |
| Grade | 10 9 8 | 7 6 5 | 4 3 2 1 0 | 0 | |
| | | | | - | w/ posintenne |
| 2h Olympic | Optimal | CONDITION CATEGORY Suboplimal | GRADE or SCORE Poor | 1 | w/ assistance and input fror |
| 2b.Channel Capacity to | Channel Capacity to Flow Frequen | cy Channel Capacity to Flow Frequenc | y Channel Capacity to Channel Capacity to Flow Frequence | У | Dr. Mike |
| Flow | Ratio is such that bank overflow fr storm events occur at a 1.25 to 2 | | ar such that bank overflow storm events are more frequent that | | Harvey and S Travant |
| Frequency Ratio (for 2- | year frequency. | every 1.25 years or less frequent | from storm events are every half year or less frequent than | | 116Valit |
| year peak | 0.75-1.25 | than every 2,5 years, <0.75 or >1.25 | more frequent than every 10 years. every year or less <0.24 or >2 | | |
| flow) | | | frequent than every 5 | | |
| | | | years. < 0.5 or >1.5 | | |
| Grade | 10 9 8 | 7 6 5 | 4 3 2 1 0 | 0 | |
| | | CONDITION CATEGORY | GRADE or SCORE | - | Newton, 199 |
| | Optimal | Suboptimal | Marginal Poor | | USDA/ NRCS |
| *** | Banks stable; evidence of erosio bank failure absent or minimal; (| | | t | SVAP page |
| 2c.Channel | of bank affected), perennial | 5-30% of bank in reach has areas | of waterline sparse (mainly banks; recently exposed tree roots | | 10: Barbour, al., 1999 EP. |
| Bank Stability (score each | vegetation to waterline; no raw undercut banks (some erosion | | scoured or stripped by common; tree falls and/or severely to lateral erosion), bank undercut trees common; many erode | | RBA page 5- |
| bank, left or | outside of meander bends O.K.) | no waterline in most places; recently | held by hard points areas; "raw" areas frequent along | | 26; USACE, Norfolk |
| right facing | recently exposed roots; no rece tree fails; | nt exposed tree roots rare but preser | It. (Irees, rock outcrops) straight sections and bends; obviou and eroded back bank sloughing; 60-100% of bank ha | si Is | District, 2004 |
| downstream) | | | elsewhere; 30-60% of erosional scars. | 1 | |
| | | | bank in reach has areas of erosion and bank | | |
| | | | undercutting; recently | | |
| | | | exposed tree roots and fine root hairs common: | | |
| Grade (Left) Grade (Righl) | 10 9 8 10 9 8 | 7 <u>6</u> 5 7 6 5 | 4 3 2 1 0 4 3 2 1 0 | | |
| Cidde (rugiti) | | | Avg.Scor | | |
| CHANNEL RO | UGHNESS FACTORS | ······································ | | - | |
| | | 60.10 m | |] | |
| | Optimal | CONDITION CATEGORY Suboptimal | Dear | - | Barbour, 199 EPA RBA |
| 3a.Channel | The bends in the stream increase | he The bends in the stream increase th | e The bends in the stream Channel straight; waterway has bee | in in | Chapter 5 pa |
| Sinuosity (bends in low | stream length 2.5 to 4 limes lon | er stream length 1.5 to 2.5 times long | ef increase the stream channelized for a long distance. | | 5-25; KDWP |
| gradient | Ihan if it was straight. Channe length/valley length at least >1 | | length 1 to 1.5 times Channel length/valley length_≤1.0 Channel length/valley length_≤1.0 | 1 | 1996 |
| stream) | | | straight line. Channel length/valley length 1.0 | | |
| | | | to 1.2. | | |
| Grade | 10 9 8 | 7 6 5 | 4 3 2 1 0 | c | đ |
| | | CONDITION CATEGORY | GRADE or SCORE | 4 | KDWP, 1990 |
| | Optimal | Suboptimal | Marginal Poor | 1 | Kansas |
| 3b. Boltom | Little or no channel enlargeme resulting from sediment | t Some gravel bars of coarse stone and well-washed debris present, lift | | | Subjective Evaluation o |
| Substrate | accumulation; channel is stab | | moderately unstable sand, silt, clay, or bedrock; unstable | | Aquatic |
| Composition | | | | | Habitats |
| | | | | | |
| | | | | | |
| Grade | 10 9 8 | 7 6 5 | 4 3 2 1 0 | | |

| | | | | | CON | NUTION | ATECOS | ~~ ? | SRADE or | ecope | | | | | | KDWP, 1996 |
|--------------------------------------|--|---|--|--|----------------|-------------------------------|-------------|----------|--------------|--|----------------|------------------------|-----------|---|------|-------------------------------------|
| | | Optima | <u>.</u> | | 001 | Suboptim | | | | rainal | 1 | | Poor | | | Newton et al. |
| 3c. Instream Botlom Topography | Diverse bo | | | w including | Channait | | | tha | | tiom include | Chaone | | | es <3 of the | | 1998 |
| 3c. Instream Bollom Topography | >7 of the boulders/ debris overhar vegetat | e following /gravel, log , backwate nging vege led shallow t banks, or | : dee s/lar rs/ox latior s, ro | p pools, ge woody xbows, n, riffles, otwads, | | ted in Oplin | | | < 5 of the | items listed i t Category | | | | I Category | | USDA/NRC SVAP page |
| Grade | | pools | | | | | | | ļ | | <u> </u> | | | | | |
| Grade | 10 | 9 | | 8 | 7 | 6 | 5 | | 4 | 3 | 2 | | 1 | 0 | 1 | |
| Giade | | | | | CON | IDITION C | ATEGO | RY C | SRADE or | SCORE | | | | | | |
| or | | Optima | | | | Suboptim | al | | Ma | rginal | | ł | Poor | | | |
| Or 3c. Manning's n | | 0.05 to 0.4 | 099 | | | 0.035 to 0. | .05 | | | 03 or >0.10 t).15 | obstructi | on to flo nelizatio | w or 0.0 | excessive I1 to 0.02 due lean, smooth | | - |
| Grade | 10 | 9 | Τ | 8 | 7 | 6 | 5 | | 4 | 3 | 2 | | 1 | 0 | | |
| | | | | | | | | | | | | | | | | |
| 1 | | Optima | | | CON | | | <u> </u> | SRADE or | | | | | | | USACE, |
| 3d. Channel | Incision r | atio_>1.0 <1 | | nd Where | Incision ra | Suboptim atio >1.2 <1. | | ere | | rginal tio >1.4 < 2. | l Incision r | | and W | here channel | | Norfolk District, 200 |
| Incision | | slope >2%; | | | | lope >2%, | | | | ere channel | | | | ent ratio_4.4; | | SAAM For |
| (TLB/BFD=BH | | 4; Where c | | | | 4: Where cl | | | | e > 2%, | | | nnel sio | | | #1 and VT |
| R; 1/BHR*Adj | <u>≤</u> 2%; E | ntrenchme | int ra | ntio >2.0 | <u>≤</u> 2%, E | ntrenchmer | nt ratio >2 | 0 | | ent ratio >1.4 nannel slope | | Irenchr | nent rati | o_ 2 .0 | | Stream |
| Factor =CI) | | | | | | | | | _<2%. Er | itrenchment o >2.0 | | | | : | | Geomorphi Assessmer Phase 2 |
| TLB = | <u>_</u> | 10 | | | BHR = | 1 | **** | | | | | | | | | |
| BFD = | | 10 | | | | | | | 1 | | 1 | | | | | |
| Grade | 10 | 9 | | 8 | 7 | 6 | 5 | | 4 | 3 | 2 | | 1 | 0 | 0 | Į |
| DYNAMIC SUR | FACE WA | TER STC | RAC | GE | | | | | | | | | | | | |
| | | | | | | IDITION | ATECOL | VC | RADE or | 100pc | | | | ····· | | Maurian at |
| | | Optima | al | | COP | Suboptim | | ir e | | rginal | 1 | | Poor | | | Newlon, et 1998 USD |
| 4a.Pools | Deep and | | - | abundant; | Pools pr | esent, but n | | nt; | | resent, but | Pools al | | | tire boltom is | | NRCS SV |
| (abundant, | | | | ool bottom | | 30% of the p | | | | rom 5-10% c | f disce | ernible. | No wat | er = zero. | | page 14; |
| present or | | due to dep least 5 fee | | or pools are | | due to depth at least 3 fe | | oois | | I bottom is ie to depth, c | | | | | | Barbour, et |
| absent) | | 16451 0 166 | a uec | եր. | 210 | at least 5 le | ei ueep, | | the pools a | re less than | 3 | | | | | 1999 |
| | | | | | | | | | | deep. | | | | | | |
| Grade | 10 | 9 | T | 8 | 7 | 6 | 5 | | 4 | 3 | 2 | 1 | 1 | 0 | 1 | |
| 4b, Channel | | | | | 001 | DITION | ATECO | | GRADE or | RCORE | | · | | | | |
| Flow Status | | Oplima | 1 | | 001 | Subontim | | <u></u> | | rginal | | | Poor | | | Barbour, et |
| (degree to | Water rea | aches base | | oth lower | Water fil | Is >75% of | | ole | | 25-75% of th | el Verv little | | | nel and mosli | | 1999 EPA |
| which channel is filled) | | and minimation | | | | el; or <25% ostrate is ex | | ł | for niffle s | channel, an ubstrates are exposed. | present a | s standi | | s. No water = | | page 5-19 9#5; TCEC 1999: VAN |
| Grade | 10 | 9 | Ι | 8 | 7 | 6 | 5 | | 4 | 3 | 2 | | 1 | 0 | 1 1 | 2005 |
| | | | * | | | <u>~</u> | almulatio- | ofr | Lunghan C. | nosite lad- | I Total C | | atal D | sible Score | | 4 |
| | | | | | | 0 | nculation | ur | UNCLION US | ipacity nide | x - 10(8) 5 | core/1 | | | 0.07 | 4 |
| 1 | | | | | | | | | | | | | | FCI = #/100 | 1 | 1 |

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| 1. | NOTES SEDIMENT TR | ANSPORT | I/DEPOSITI | ON | | | | | | | | |] |
|-----------------------------------|-------------------------------------|----------------|----------------------------------|-----------------|--------------|-----------------------------|---------------------------------|---------------|--|-------------|--------------------------------|--------------------------------------|---|
| | 1 | | | | | | | | 00005 | | | | 4 |
| | | ļ | Optimal | | | Suboptim | ATEGORY (| | SCORE | | Poor | | - |
| | 1a, Bank | Banks sta | | of erosion o | Moderaleh | | requent, smal | | y unstable; 30- | Unstable; | | d areas; "raw | 4 |
| | Stability (score each bank, left | bank failu | ire absent or | minimal; little | areas of er | osion most | ly healed over | 60% of bar | nk in reach has | areas ír | requently all | ong straight | |
| | or right facing | potential to | or future prot bank affecte | | 5-30% of b | erosion. | h has areas o | | erosion; high otential during | | | obvious bank of bank has | |
| | downstream) | | | | | 01001011, | | | oods. | | erosional sc | | |
| | | | | | | | | | | | | | |
| | <u> </u> | L | | | | | | ļ | | | | | ļ |
| | Grade (Left) Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 | 0 | |
| | | | | 1 <u>v</u> | · | <u> </u> | | L | <u> </u> | L | -J | Avg.Score | - |
| | | | | | | | | | | | | | - |
| | | | Optimal | | | Suboptim | ATEGORY | | SCORE arginal | | Poor | | - |
| <u>e</u> | 1b. Channel Bottom Bank | Bottom 1/3 | 3 of bank is ge | enerally highly | Bollom | | is generally | Bottom 1 | /3 of bank is | Botiom 1/3 | | enerally highly | 7 |
| liab | Stability | resistant p | slant/soil mate | rix or materia | resistant pl | lant/soil ma | trix or materia | | highly erodible | | | anUsoil matrix | |
| Age | | | | | | | | | lant/soil matrix promised. | SEV | erely compr | omised. | |
| One Variable | | | | | | | | 00111 | | | | | |
| Only 0 | Grade (Left) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| Ő | Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 Avg.Score | |
| e for | | | | | | | | | | | | / | |
| Score | or | | Outinal | | 00 | | ATEGORY | | | 1 | | | 4 |
| Enter | 1c. Channel Sediments or | >50% a | Optimal ravel or large | r substrate: | 30-50% g | Suboptim ravel or lar | ai ger subsirate; | | arginal oravel or larger | Substrate | Poor is uniform s | sand, sill, clay | |
| 5 | Substrate | gravel, o | obble boulde | rs; dominant | dominant | t substrate | type is mix of | substrat | le; dominant | or | bedrock; ur | | 1 |
| | Composition | substrate | te type is grav stable | vel or larger. | | th some fine oderately s | er sediments; table | | /pe is finer than It may still be a | | | | |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| | WATER APPE | 1 | | 1 | · · · | 1 | | 1 | 1 <u>~</u> | <u> </u> | | | + |
| | | | | | | | | | | | | ,, |] |
| | | | Optimal | | | Suboptim | ATEGORY | | SCORE arginal | I | Poor | | - |
| | | Very clea | ar, or clear bu | t tea-colored | Occasiona | | especially after | | ible cloudiness | | i or muddy ap | pearance most | |
| | | | sible at depth (colored); no | | | | ears rapidly; h 1.5-3 ft; ma | | e time; objects lepth 0.5-1.5 ft; | | | to depth <0.5 ft; be bright-green | |
| 1 | Water Clarity | | colored), no | | | | color; no oil | | ins may appea | other obvio | ous water pol | lutants; floating | |
| | ******* | subme | erged objects | or rocks, | shee | n on water | surface. | | r; battom racks rged objected | | | , sheen or heavy No water = zero | |
| | | | | | | | | | d with film. | | | | |
| | | | | | | | | | | | | | |
| | Canda | L | | 8 | 7 | | E | | 1 2 | 2 | | 0 | |
| | Grade | 10 | 9 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 | | |
| | PRESENCE O | F AQUATI | C VEGETA | TION: Pres | ence and Pe | ercent Cov | erage | | | | | | |
| | | | | | | | MTCOODY | 20405 | 0000 | | | | 4 |
|] | | | Optimal | | T COI | Suboptim | ATEGORY | | arginal |] | Poor | | - |
| ble | 3a. Nutrient | 1 | water along e | | | r or slightly | greenish wate | Greenish w | ater along entire | | , gray, or bro | wn water along | 1 |
| aria | Enrichment | | aquatic plan s low quantal | | | ire reach; n on stream | noderale alga | | bundance of lush phyles; abundant | | reach; dense les clog strea | e stands of m; severe algal | 1 |
| 0 | | | of macrophyt | | | onstream | subsilates. | algal growth, | especially during | blooms cre | ate thick alga | it mais in stream | |
| 6 | (| | growth press | ent. | 1 | | | warm | er months. | | gae present d traie. No wat | lue to unstable ter = zero. | |
| | | | | | | | | | | | | | |
| yind | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 |
| or Only | 1 | | | | | NDITION | ATEGORY | | POODE | | | | - |
| ire for Only | | | Optimal | | | Suboptin | | | arginal | Γ | Poor | | 1 |
| Scare for Only | or | Winen n | resent, aqual | ic vegetation | | ominant in | pools, larger | Algal mats | present, some | | ats cover b | ottom, larger |] |
| Iter Score for Only | Or 3b. Aquatic | Turnenthi | | d patches of | p p | lants along | edge | larger plan | ts, few mosses | | | channel or NC to unstable | 1 |
| Enter Score for Only One Variable | | consists | | | | | | 1 | | | | | 1 |
| Enter Score for Only | 3b. Aquatic | consists | algae. | | | | | | | | ale. No wa | aler = zero. | |
| Enter Scare for Only | 3b. Aquatic | consists 10 | | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | aler = zero. | |

| | | | | COM | VDITION CA | | | | | · | |
|---|---|--|----------------------------------|-------------------------|---|-----------------------------|---|--|---------------|-----------------------------------|--------------------------------|
| | Mainly man | Optimal | | 1 | Suboptima | | | rginal | | Poor | - black in color |
| | Mainly consi: wit | hout sedim | | | and wood so Jebris wilhou | | debris; co organic | es or woody arse and fine malter with liment, | and foul | odor (anae | erobic) or no |
| Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 5 LAND USE PA | TTERN: Ber | vond Imme | diate Ripari | an Zone | | | | | | | |
| | | | | | | | | ······································ | | | |
| | | | | CON | VDITION CA | | | | | | |
| | 1 logligtush | Optimal ed, consisti | | Deterrer | Suboptima ent pasture r | | | irginal | | Poor | |
| | | | ng of forest, and/or natura | | s and swamp | | | w crops and some wooded | i ii | fainly row c | aops |
| | | wetlands. | | | crops | | | be present bui led patches | | | |
| Grade (Left) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 6 RIPARIAN ZON | | | 1811 11757 | | | ······ | | | | | Avg.Score |
| O NIFARIAN 201 | | | INUITT. | ····· | | | | | | - <u>\</u> | |
| | | | | 100 | VDITION CA | TEGORY | GRADE or S | SCORE | | | |
| 6a. Riparian | | Optimal | |] | Suboptima | | | irginal | | Poor | |
| Zone Width | | | 8 meters (1-2 shrubs, or tall | | nian zone 12-1 nnel width w/tre | | | arian zone 6-12 1/3-1/2 active | Width of ripa | rian zone < 6 | meters (natural active channel |
| (from stream edge to field) | grasses), h | ns with trees, numan activiti mpacted zon | es have not | grasses), hui | man activities I impacted zone | ave minimally | channel wi | human activities | width), littl | | getation due to |
| Grade (left) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 0 |
| Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | | | | | | | | | | | Avg.Score |
| | ļ | Optimal | | | VDITION CA | | | | r | | |
| | | | nture trees or | 75-90% str | Suboptima eambank vege | | | rginal streambank | Less than | Poor 60% streamb | ank vegelation |
| 6b. Riparian | >90% plant | | | | | al and mature | vegetation o | f mixed grasses | coverage of | consisting mo | stly of pasture |
| 6b. Riparian Zone | >90% plant shrubs, prain | ie grasses, or | | | | | | wound lean or | grasses, fe | ew trees & sh | rubs; low plant |
| Zone Vegetation | shrubs, prain riparian zon | ie grasses, or ne intact or dis | ruption from | trees behi | nd; disruption | evident with | and sparse | | dancity har | at danniv ees | |
| Zone Vegetation Protection/ | shrubs, prain riparian zon | ie grasses, or | ruption from | trees behi | | evident with | shrub spi frequent wi | ecies; breaks th some gullies | | nk deeply sca Ill along its le | |
| Zone Vegetation | shrubs, prain riparian zon | ie grasses, or ne intact or dis | ruption from | trees behi | nd: disruption | evident with | shrub spi frequent wi | ecies; breaks | | | |
| Zone Vegetation Protection/ | shrubs, prain riparian zon | ie grasses, or ne intact or dis | ruption from | trees behi | nd: disruption | evident with | shrub spi frequent wi | ecies; breaks th some gullies | | | |
| Zone Vegetation Protection/ | shrubs, prain riparian zon grazin 10 | ie grasses, or ne intact or dis ng/mowing m 9 | ruption from | trees behi | nd: disruption | evident with | shrub spi frequent wi | ecies; breaks th some gullies | | | |
| Zone Vegetation Protection/ Completeness | shrubs, prain riparian zon grazin | ie grasses, or ne intact or dia ng/mowing m | sruption from inimal. | trees behi breaks oc | ind; disruption courring at inter meters, | evident with vals of >50 | shrub spi frequent wi and scars e | ecies; breaks th some gullies very 50 meters, | 2 | ill along its le | ngth. |
| Zone Vegetation Protection/ Completeness Grade (Left) | shrubs, prain riparian zon grazin 10 | ie grasses, or ne intact or dis ng/mowing m 9 | sruption from inimal. | trees behi breaks oc | ind; disruption courring at inter meters, | evident with vals of >50 | shrub spi frequent wi and scars e | ecies; breaks th some gullies very 50 meters, | 2 | ill along its let | ngth. |
| Zone Vegetation Protection/ Completeness Grade (Left) | shrubs, prain riparian zon grazin 10 | ie grasses, or ne intact or dis ng/mowing m 9 | sruption from inimal. | trees behi breaks oc | ind: disruption courring at inter meters, | evident with vals of >50 | shrub spi frequent wi and scars e 4 4 | cites; breaks th some gullies very 50 meters. | 2 | Il along its ter | ngth. |

| | | | | 05\05\2006 Highway | 34 Bridge | | SCORE So |
|---|-------------------------------------|--|---|--|---|--|--|
| 1 | 1 FLOW REGI | ME | | | | |] |
| | TYPE | Perennial | | Intermittent w/ Perennial Pool | | Ephemeral | KD |
| | Grade | 10 9 | 8 | 7 6 5 | 4 3 | 2 1 0 | 4 20 |
| 2 | 2 EPIFAUNAL | SUBSTRATE/AVAILABLE C | OVER | | | | 1 |
| | | Optimal | | Suboptimal | Marginal | Poor |] |
| | | Wilhin stream bed, greater coverage by stable habitat | | Within stream bed, 30-50% coverage by stable habitat features favorable | | Less than 10% habitat features present; lack of habitat is obvious; | US No |
| | | favorable for stream faunal of | colonization | for stream faunal colonization and/ | or features favorable for stream | substrate unstable or lacking; | 20 |
| | | and/or fish/amphibian cover, features non transient, Features | | fish/amphibian cover. Many habita features not transient. (See Excelle | | concrete lined channels. Habitat features and pools buried or lacking, | SA |
| | | include snags, submerged lo | gs, undercul | Calegory for habital feature | availability may be less than | channel bollom may be flat. | 10 |
| | | banks, roots, cobble, rocks, p packs, pools and glides, or | | components.) | desirable, substrate may be frequently disturbed. (See | 1 | (pa Ba |
| | | habitat at a stage to allow c | | | Excellent Category for habitat | ļ | al. |
| | | | | | feature components.) | | EP |
| | | | | | | | Pa al., |
| | | | | | | | AU |
| | Grade | 10 9 | 8 | 7 6 5 | 4 3 | 2 1 0 | 1 |
| 3 | 3 STREAM BC | TTOM SUBSTRATE: Pool S | Substrate Cr | naraclerization | | | - |
| | | Optimat | | Suboptimal | Marginal | Poor | |
| | 1 | Mixture of substrate materials and firm sand prevalent; roo | | Mixture of soft sand, mud, or clay, mud may be dominant; some root | | Hard pan clay or bedrock; no rool mat or submerged vegetation | Ba al. |
| | | submerged vegetation of | | mals and submerged vegatation | submerged vegetation. | | RE |
| | | | | present. | | | pa |
| | | | | | | | Pa al. |
| | Grade | 10 9 | 8 | 7 6 5 | 4 3 | 2 1 0 | 1 AL |
| | | ······································ | | 1 | | 11 | jj |
| 4 | 4 POOL VARIA | ABILITY Optimal | | Puhantimal | Maminal | Door | 4 |
| | | Even mix of large-shallow, I | arge-deep. | Suboptimal Majority of pools large-deep; very | Marginal Shallow pools much more | Poor Majority of pools small-shallow or | Ba |
| | | small-shallow, small-deep po | ools present | few shallow. | prevalent than deep pools | pools absent | al. |
| | | | | | | [| RE |
| | | | | | | | pa Pa |
| | | | | | | | al. |
| | Grade | 10 9 | 8 | 7 6 5 | 4 3 | 2 1 0 | 1 |
| 5 | 5 SEDIMENT (| DEPOSITION/SCOURING Optimal | ····· | Cubapting | Marrisof | Dees | - |
| | | <5% of channel bottom affecte | d by scour or | Suboplimal 5-30% affected by scour or deposition | Marginal 30-50% affected by scour or | Poor More than 50% of the boltom in a state | Ba |
| | | deposition, | | Scour at constrictions and wohre grade steepen. Some deposition in pools | deposition. Deposits and scour at obstructions, constrictions and | of flux or change nearly yearlong. Pools minimal or obsent due to heavy | s al. |
| | | | | shepen oone accoston in poola | bends. Some filling of pools. | deposition or excessive scounting | RE |
| | 1 | 1 | | | | | 100 |
| | | | | | | | |
| | | | | | | | Pa al. |
| | Grade | 10 9 | 8 | 7 6 5 | 4 3 | 2 1 0 | Pa |
| 6 | Grade 6 CHANNEL F | LOW STATUS | 8 | | | | Pa al. |
| 6 | | LOW STATUS Optimal | | Suboptimal | Marginal | Poor | Pa al. 1 7 1 1 1 1 1 1 1 1 |
| 6 | | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su | both lawer | | Marginal Water fills 25-75% of the available channel and/or iffle | Poor Very little water in the channel and mostly present in standing pools; or | Pa al. |
| 6 | | LOW STATUS Optimal Water reaches the base of | both lawer | Suboplimal Water fills >75% of the channel; o | Marginal r Water fills 25-75% of the | Poor Very little water in the channel and | Pa al. 1 70 19 WW WW Ba al. 2 |
| 6 | | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su | both lawer | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is | Marginal Water fills 25-75% of the available channel and/or iffle | Poor Very little water in the channel and mostly present in standing pools; or | Pa al. 1 7 7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 |
| 6 | | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su | both lawer | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is | Marginal Water fills 25-75% of the available channel and/or iffle | Poor Very little water in the channel and mostly present in standing pools; or | Pa al. 1 70 19 WW WW Ba al. 2 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 | both lawer | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is | Marginal Water fills 25-75% of the available channel and/or iffle | Poor Very little water in the channel and mostly present in standing pools; or | Pa al. 1 TC 19 WM Ba al. 19 WM Ba al. 20 19 NM Ba Ba al. |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION | both lower ibstrate is | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is exposed 7 6 5 | Marginal Water fils 25-75% of the available channel and/or iffle substrates are mostly exposed 4 3 | Poor Very little water in the channel and mostly present in standing pools; or stream is dry 2 1 0 | Pa al. 1 TC 19 WM Ba al. 19 WM Ba al. 20 19 NM Ba Ba al. |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Optimal | both lower ubstrate is | Suboptimal Water fills 75% of the channel; o <25% of channel substrate is exposed 7 6 5 Suboptimal | Marginal Water fills 25-75% of the available channel and/for infile substrates are mostly exposed 4 3 Marginal | Poor Very little water in the channel and mostly present in standing pools; or stream is dry 2 1 0 Poor | Pa al. 1 770 99 WW 826 81, 81, 81 82 82 81 82 82 82 82 82 82 82 82 82 82 82 82 82 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, atleration, absent or maintal; normal | both lower ubstrate is 8 or dredging and stable | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is exposed | Marginal Water fils 25-75% of the available channel and/or iffle substrates are mostly exposed 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | Poor Very little water in the channel and mostly present in standing pools; or stream is dry 2 1 0 Poor Banks shored with gabion, riprap, or concrete. Concrete or riprap lined | Pa al. 1 70 19 WW 88 81 |
| | 6 CHANNEL F | LOW STATUS | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is | Marginal Water fills 25-75% of the available channel and/or ifile substrates are mostly exposed 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | Poor Very lille water in the channel and mostly present in standing pools; or stream is dry 2 1 0 2 1 0 Banks shored with gabion, riprap inge channels, instream habitat nabitat | Pa al. 1 770 99 WW 82 84 84 84 84 84 84 84 84 84 84 84 84 84 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, atleration, absent or maintal; normal | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is exposed | Marginal Water fils 25.75% of the available channel and/or iffle substrates are mostly exposed 4 4 Marginal Alteration or channelization may be extensive; embankments (including spoil pices) or shoring structures present on both banks, normal | Poor Very lillo water in the channel and mostly present in standing pools; or stream is dry 2 1 0 2 1 0 Banks shored with gabion, riprap, or cancrete. Concrete or riprap lined channels. Instream habitat significantly altered by stormwater o other inputs. Over 80% of the | Pa al. 1 79 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 |
| | 6 CHANNEL F | LOW STATUS | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is exposed | Marginal Water fills 25-75% of the available channel and/or rifle substrates are mostly exposed 4 3 Marginal Alteration or channelization may be extensive; embankments (including spoil pitos) or storing structures) present on both banks; normal stable stream meander pattern | Poor Very little water in the channel and mostly present in standing pools; or siteam is dry 2 1 0 Poor Banks shored with gabion, riprap, or cancrete. Concrete or riprap lined channels. Instream habilat significantly altered by stormwater o | Pa al. 1 770 99 WW 82 84 84 84 84 84 84 84 84 84 84 84 84 84 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, afteration, absent or maintait, normal stream meander pattern. A | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is | Marginal Water fills 25-75% of the available channel and/or iffle substrates are mostly exposed 4 4 4 4 4 4 4 4 5 Marginal Alteration of channelization may be extensive: embaakments (including spoil present on both banks: normal stable stream meander pattern thas not recovered, Alteration from storwater inputs may be | Poor Very lillo water in the channel and mostly present in standing pools; or sitearn is dry 2 1 0 2 1 0 Banks shored with gabion, riprap, or concrete. Concrete or inprap lined channels, instream habital significantly altered by stormwater o other inputs. Over 80% of the stream reach altered. | Pa al. 1 70 19 WW Ba al. 8 al. 8 al. 8 al. 9 al. 1 7 9 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, afteration, absent or maintait, normal stream meander pattern. A | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is exposed 7 6 5 Suboptimal Some alteration or channelization present, usually adjacent to astructures, (such as bridge dutumonts or culvents); evidence c past alteration, (i.e., channelization may be present, but streem patter and stability have recovered; recer alteration is not present. Minor alteration or solorwaster or othe | Marginal Water fills 25-75% of the available channel and/or iffle substrates are mostly exposed 4 3 4 3 Alteration or channelization may be extensive; embankments (inclusing spoil pites) or storing structures) present on both banks: normal stable stream meander pattern thas net recovered. Alteration from stormwater inputs may be extensive, 40.50% of stream | Poor Very lillo water in the channel and mostly present in standing pools; or sitearn is dry 2 1 0 2 1 0 Banks shored with gabion, riprap, or concrete. Concrete or inprap lined channels, instream habital significantly altered by stormwater o other inputs. Over 80% of the stream reach altered. | Pa al. 1 70 19 WW 82 84 84 84 84 84 84 92 92 7 7 85 85 85 85 85 92 92 92 92 92 92 92 92 92 92 92 92 92 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, afteration, absent or maintait, normal stream meander pattern. A | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is | Marginal Water fills 25-75% of the available channel and/or iffle substrates are mostly exposed 4 4 4 4 4 4 4 4 5 Marginal Alteration of channelization may be extensive: embaakments (including spoil present on both banks: normal stable stream meander pattern thas not recovered, Alteration from storwater inputs may be | Poor Very lillo water in the channel and mostly present in standing pools; or sitearn is dry 2 1 0 2 1 0 Banks shored with gabion, riprap, or concrete. Concrete or inprap lined channels, instream habital significantly altered by stormwater o other inputs. Over 80% of the stream reach altered. | Pa al. 1 70 19 WW Ba al. 8 4 8 4 8 4 7 7 7 7 7 7 7 7 7 7 7 7 7 7 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, afteration, absent or maintait, normal stream meander pattern. A | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is exposed 7 6 5 Suboptimal Some alteration or channelization present, usually adjacent to astructures, (such as bridge dutumonts or culvents); evidence c past alteration, (i.e., channelization may be present, but streem patter and stability have recovered; recer alteration is not present. Minor alteration or solorwaster or othe | Marginal Water fills 25-75% of the available channel and/or iffle substrates are mostly exposed 4 4 3 Marginal Alteration or channelization may be extensive; embankments (including spoil pitos) or storing structures present on both banks; normal stable stream meander pattern thas net recovered. Alteration from stormwater inputs may be extensive, 40.90% of stream | Poor Very lillo water in the channel and mostly present in standing pools; or sitearn is dry 2 1 0 2 1 0 Banks shored with gabion, riprap, or concrete. Concrete or inprap lined channels, instream habital significantly altered by stormwater o other inputs. Over 80% of the stream reach altered. | Pa al. 1 70 19 WW Ba al. 70 9 8 9 7 7 7 7 7 7 7 7 8 8 8 8 9 7 8 9 7 8 9 7 9 7 |
| | 6 CHANNEL F Grade 7 CHANNEL A | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, alteration, absent or mainial; normal stream meander pallem, A stornwater inputs absent | both lower ubstrate is 8 or dredging and stable Iteration by or minimal | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is | Marginal Water fils 25-75% of the available channel and/or iffle substrates are mostly exposed 4 3 Marginal Alteration or channelization may be extensive; embankments (including spoil pites) or sitoring structures present on both banks: normal stable stream meander pattern has not recovered. Alteration from stormwater inputs may be extensive. 40-80% of stream reach attered. | Poor Very lillo water in the channel and mostly present in standing pools; or sitearn is dry 2 1 0 2 1 0 Banks shored with gabion, riprap, or concrete. Concrete or inprap lined channels, instream habitat significantly altered by stormwater o other inputs. Over 80% of the stream reach altered. | Pa al. al. 770 99 98 86 81 87 92 97 97 97 97 97 97 97 97 97 97 97 97 97 |
| | 6 CHANNEL F | LOW STATUS Optimal Water reaches the base of banks; <5% of channel su exposed 10 9 LTERATION Channelization, afteration, absent or maintait, normal stream meander pattern. A | both lawer abstrate is 8 bot dredging and stable iteration by | Suboptimal Water fills >75% of the channel; o <25% of channel substrate is exposed 7 6 5 Suboptimal Some alteration or channelization present, usually adjacent to astructures, (such as bridge dutumonts or culvents); evidence c past alteration, (i.e., channelization may be present, but streem patter and stability have recovered; recer alteration is not present. Minor alteration or solorwaster or othe | Marginal Water fills 25-75% of the available channel and/or iffle substrates are mostly exposed 4 4 3 Marginal Alteration or channelization may be extensive; embankments (including spoil pitos) or storing structures present on both banks; normal stable stream meander pattern thas net recovered. Alteration from stormwater inputs may be extensive, 40.90% of stream | Poor Very lillo water in the channel and mostly present in standing pools; or sitearn is dry 2 1 0 2 1 0 Banks shored with gabion, riprap, or concrete. Concrete or inprap lined channels, instream habital significantly altered by stormwater o other inputs. Over 80% of the stream reach altered. | Pa al. 1 70 19 WW Ba al. 70 9 8 9 7 7 7 7 7 7 7 7 8 8 8 8 9 7 8 9 7 8 9 7 9 7 |

| | | The bends in the stream length 3 to was in a straigh braiding is consi- plains and othe parameter is no | o 4 times long It line. (Note dered normal r low-lying ar | er than if it - channel in coastat eas, This | stream k | in the stream ength 2 to 3 ti il was in a str | | increase the times longer th | n the stream stream 1 to 2 en If II was in a ht line | | raight; waters ized for a lon | vay has been g distance | al. RI Pi al. | larbo II. 199 RBA # Parso II 20 LUSR |
|----|--------------|---|--|---|---|---|---|---|---|---|--|--|---|---|
| | Grade | 10 | 9 | 8 | | 6 | 5 | 4 | 3 | 2 | 1 7 | 0 | 0 | |
| | | | *···· | <u> </u> | · / | 1 0 | 1 2 | 4 | <u> </u> | L | | 1 | 0 | |
| 9 | 9 BANK STAE | SILITY (SCORE EA | ACH BANK) Optimal | | | Suboptim | al | Mar | oinal | | Poor | | | |
| | | Banks stable; evi failure absent or | | | | | equent, small healed over. | | stable; perennial vaterline sparse | | no perennial ; severe eros | | | Barbo al. 19 |
| | | affected), perenni no raw or undercu outside of mea recently exposed | al vegetation It banks (som ander bends (| to waterline; e erosion on D.K.); no | 5-30% of t minor undercuttic waterline | bank in reach r erosion and ng; perensial e in most plac | has areas of /or bank vegetation to | (mainly scoure lateral erosion hard points outcrops) ann elsewhere; 30- reach has area bank undercu exposed tree ro hairs common | d or stripped by), bank held by (trees, rock d eroded back -60% of bank in s of erosion and uting; recently tols and fine rool n; high erosion uring floods | banks; re common; undercu eroded ar along str obvious ba bank | cently expose tree falls and it trees comm eas; "raw" ar aight sections ank sloughing has erosions | ed tree roots for severely non; many eas frequent and bends; ; 60-100% of | R [*] P. あるひ N D 22 #: a | RBA Parso AUSF JSAC Vorfo Distric 2004 43; Si and B |
| | Grade | 10 | 1 9 | 8 | 7 | 1 6 | 5 | 4 | 3 | 2 | 1 1 | 1 0 | | rom Iensl |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 | 0 | 0 | |
| | | | | | | | | | | | Avg.Scon | *1 | 0 | |
| 10 | 10 VEGETATIN | E PROTECTION | (SCORE E/ Optimal | ACH BANK | } | Suboptim | al | hAar | ginal |] | Poor | | | |
| | | More than 90% of and immediate ri native vegets | f the streamb parian zones htion, includin shrubs, or nor retative disrup g minimal or | covered by g trees, twoody blion through not evident; | covered one cla represent not alf potential than one | | ank surfaces jetation, but is not well- n evident but int growth extent; more otential plant | 50-70% of the surfaces covered disruption obvi- bare soil or con- vegetation con- one-half of the | ginal le streambank zd by vegetation ious; patches of losely cropped nmon; less than potential plant ht remaining. | surfaces disruption is very h removed | n 50% of the s covered by of streambar igh; vegetatio to 5 centimet rage stubble | vegetalion; ik vegetation in has been ers or less in | ai R P ai A K | Barbo Sarbo RBA Parso Sal., 20 AUSF KDW 2000 |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | Peter |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | Avg.Scor | | 0 | |
| 11 | | ZONE (SCORE EA | | | | | | ····· | ····· | | | | 1 | |
| | | | Optimal zone >18 m king lots, roa | dbeds, clear- | human act | | 12-18 motors; mpacted zone | Width of ripa meters; humai | rginal tian zone 6-12 n activilies have te a great deal. | little or no | Poor riparian zone riparian vege human activit | tation due to | a R P a | Barbo al., 19 RBA Parso al., 20 AUSF |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2 | 1001 |
| | | | | | 1 | - 1 | | 1 | | | Avg.Scor | | 2 | |
| 12 | 12 RIPARIAN | HABITAT CONDIT | | E EACH B | ANK) | | | | | | | | | Norfo |
| | | Tree stratum (db >60% tree canopy layers may in herbaceous, a moses/lichens at the high end c additional layers end if ≤1 additi | y cover. (Add iclude: sapling and leaf litter nd woody deb of Excellent ra are present. | ditional forest g, shrub, including wis.) Score a inge if <u>></u> 2 Score at low | i with 30% (See examples Score at i if ≥2 ad present additional | to 60% free of Excellent Cal of additional he high end of Iditional fores I. Score al lo | ches) present canopy cover, legory for forest layers, of Good range t layers are w end if ≤1 s are present. with stumps | Tree stratum present, with < cover. (See Es for example: forest layers.) 4 end of Fai additional laye Score at k additional laye OR area co maintained a dense herbi | rginal ((db)>3 offs tree canopy coellent Category s of additional Score at the high r range $i \ge 2$ ers are present are present mistis of non- nud naturelized aceous and/or regetation. | surface lands, culv mainta denuded | Poor atum absent; es, cropłands, verted stream ined herbace surfaces, ac pasture, and | mine spoil s, mowed and ous areas, lively grazed | 1 F | SAAI Form Field |
| | 2 Determi | | e for each b (or for field Optimal | y measurin | g or estimation | ating length | and width. h) and Scor | Land Use GIS e for each rìpa | maps may be | used for ti n the bloc | his. ks below. Poor | Ensure t %Ripari equ | Below he sums of ian Blocks al 100 | |
| | Right Bank | %Riparian Area Score | · | | | | | | | | 100 2 | 100 | <u> </u>] | |
| | | SubCl | 1 | 0 | 1 | 0 | | 1 | 0 | 1 | 2 | 1 | | |
| | <u> </u> | %Riparian Area | | <u> </u> | <u> </u> | 60 | | 1 | 40 | + | | 100 | ┨ | |
| | Left Bank | Score | 1 | | ļ | 5 | | 1 | 3 | | | | | |
| | | SubCl | | 0 | <u>I</u> | 3 | ····. | <u></u> | 1.2 | SubCl=(| 0 %RA*Score | 1 s*0.01) | | |
| | | ····· | | · · · · · · · · · · · · · · · · · · · | · · · · · · · · · · · · · · · · · · · | | | T | · · · · · · · · · · · · · · · · · · · | Rt Bank | CI> | 4.2 | Ci 3.1 | |
| | (| | | | | | | | | | | | | |

0

| | ROLOGIC FUN | CTIONS | | | 05\10\2006 | | Highway 9 | 04 Bridge | | | | | SCORE | Reference Source |
|----|------------------------------------|-------------|----------------------------------|--------------|--------------|--------------------------------|--------------------------------|-----------------|--------------------------------|---------------------------------------|----------------------------------|----------------|---------|------------------------------|
| 1. | FLOW REGIME | : | | | | | | ······ | | ····· | | | | KDWP 2000 |
| | TYPE | | Perennial | | Intermitte | nt w/ Perer | nial Pools | Inter | mittent | | Ephemera | | | Kowp 2000 Kansas |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 4 | Subjective |
| 2. | CHANNEL CON | IDITION: I | Measuremer | t or Observ | ation of Str | eam Chanr | nel Condition | IS | | | | | | |
| | | | | | 001 | | ATEGORY (| | COPE | | | | | Barbour, 1999 |
| | | | Optimal | | | Suboptima | | | ginal | 1 | Poor | | | EPA RBA page |
| | | | hannel; no st | | Some ch | annelization | (usually in | Allered cha | nnol; 40-80% | | I is actively do | | | 5-21: Newton, |
| | | | ion minimal, 1 | | | reas) or pas | | | n channelized | | >80% of the re lized. Degrada | | | 1998 USDA/ |
| | 2a.Channel | | tting or exces Normal freq | | | | id and banks | | ied. Excess ion; braided | | s preveni acce | | | NRCS SVAP |
| | Condition/Alter ation (natural, | hydrologi | cal connectio | n between | | | of overbank | channel w | ith.excessive | | floodplain. | | | page 7 |
| | allered, or | chan | nnel and flood | lplain. | flow | s onto flood | lplain. | | of overbank he floodplain | | | | | |
| | downcutting) | | | | | | | | ncision,dikes | | | | | |
| | | | | | | | | | es restrict | | | | | |
| | | | | | | | | fioo | dplain. | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | (| | | | |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 | 0 | 0 | |
| | | | J | ~~~~ | 1 | | | I | | | | | | |
| | | | | | | | TEGORY (| | | · · · · · · · · · · · · · · · · · · · | | | | w/ assistance |
| | 2b.Channel | Chaprel C- | Optimal pacity to Flow | Francisco | | Suboptima | | | rginal Capacity to | Channel | Poor Capacity to Fit | W Francisco | | and input from |
| | Capacity to | | h that bank o | | | | | | capacity to ency Ratio is | | uch that bank | | | Dr. Mike Harvey and St |
| | Flow Frequency | | nts occur at a | | | | frequent that | such that t | ank overflow | slorm ev | ents are more | | | Travant |
| | Ratio (for 2- | У | vear frequency 0.75-1.25 | ý, | | 5 years or le 1 every 2,5 y | ess frequent | | n events are quent than | every ha | If year or less every 10 year | | |] |
| | year peak | | 0.70-1.20 | | | =0.75 or >1. | | | ear or less | | <0.24 or >2 | | | |
| | flow) | | | | | | | frequent I | han every 5 | | | | | |
| | | | | | | | | | ars. or >1.5 | | | | | |
| | | | | | | | | | | ļ | | | | |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | <u> 3</u> | 2 | 1 | 0 | 0 | |
| | | | | | CON | DITION C | ATEGORY | BRADE or | SCORE | | | | | Newton, 1998 |
| | | | Optimal | | | Suboptima | | | rginal | 1 | Poor | ************ | | USDA/ NRCS |
| | | | le; evidence | | | | equent, smal | | ely unstable; | | ; no perennial | | | SVAP page |
| | 2c.Channel | | e absent or m k affected), p | | | | healed over. Thas areas c | | vegelation to parse (mainly | | ne; severe ero ecently expos | | | 10; Barbour, et |
| | Bank Stability | vegetatio | n to waterline | ; no raw or | minor | erosion and | l/or bank | scoured o | r stripped by | commo | n; tree falls and | d/or severely | | al., 1999 EPA RBA page 5- |
| | (score each | | banks (some meander ben | | | | l vegetation t | | osion), bank | | trees common 'raw" areas fre | | | 26; USACE, |
| | bank, left or right facing | | exposed roots | | | | ces; recently a but present | | hard points ck outcrops) | | ections and be | | | Norfolk |
| | downstream) | | tree falls; | | | | | and ero | ded back | bank slou | ighing; 60-100 | % of bank has | | District, 2004 |
| | | | | | | | | | e; 30-60% of ich has areas | | erosional sca | irs, | | |
| | | | | | | | | | in and bank | 1 | | | | |
| | | | | | 1 | | | | ing; recently | | | | | |
| 1 | | | | | | | | fine root by | ree roots and airs common: | 1 | | | | |
| | Grade (Left) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2 | |
| | Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 Avg.Score | 2 | |
| | l | | | | | | | ····· | | | | Avg.Scole | <u></u> | 1 |
| 3 | CHANNEL ROI | JGHNESS | FACTORS | | | | | | | | | | 1 | 1 |
| | | | | · | | | | | | | | | | |
| | | | Ontime | | CON | | ATEGORY | | | 1 | Poor | | { | Barbour, 1999 |
| | 3a.Channel | The bends i | Optimal in the stream | increase the | The bends i | Suboptima n the stream | | Ma The bends | in the stream | Channel | Poor straight; water | way has been | | EPA RBA Chapter 5 pag |
| | Sinuosity | stream ler | ngih 2.5 to 4 t | imes longer | stream leng | yth 1.5 to 2.8 | 5 times longe | increase | the stream | chann | elized for a lor | g distance. | | 5-25; KDWP, |
| | (bends in low gradient | | was straight, illey length at | | | | line. Channe | | to 1.5 times | Channe | al length/valley | length_1.0 | | 1996 |
| | stream) | iengni/va | mey lengin ai | 19651 - 1.5. | iengany | alley length | 1.210 1.5 | | an if it was a ne. Channel | | | | 1 | |
| | | | | | | | | length/val | ley length 1.0 | | | | | |
| | | | | | | | | to | 1.2. | | | | ļ | |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2 |] |
| | | | | | | DITION | | 20402 | | | | | 4 | |
| | 1 | | Optimal | | CON | DITION C/ Suboptima | ATEGORY | | SCORE | T | Poor | | 4 | KDWP, 1996 Kansas |
| | | Little or r | no channel er | largement | Some oray | | arse stones | | bars of rocks | Channel | divided into br | aids or stream | 1 | Subjective |
| | 3b. Bottom | resu | lling from sea | liment | and well-wa | shed debris | present, little | sands, and | silt common | is chanr | nelized; substr | ate is uniform | | Evaluation of |
| | Substrate | accumu | lation; channe | el is stable | silt; | moderately | stable | moderal | ely unstable | sand, sil | t, clay, or bedr | ock; unstable | 1 | Aquatic |
| | Composition | | | | | | | [| | | | | 1 | Habitats |
| | | | | | | | | | | | | | | |
| | | | | | | | | 1 | | | | | | |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0 | |
| | | | | | | | | | | | | | | |

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| | | | | | | | | | | lanus (1945) | KHIMIIIIIIIIIIIIIIIIIIII | | ~~~~ | | | 1 | [|
|---|--|--|-------------------------------------|---|-------------------|-------------------------|-------|---------------|---------------------|--------------|--------------------------|-------------|---------|--------------------------|--------------------------------|----------|-----------------------------|
| 1 | | | | | 00 | UDITION | 188 | TEGORY (| | SCO | NOE | | | | | | KDWP, 1996; |
| | | Optima | | | | Subop | | | | argin | | | | Poor | | | Newton et al., |
| | Divoreo h | | | hy including | Channel | | | es 5-7 of the | | | | Chang | el hot | | es <3 of the | | 1998 |
| Sc. Instream Bottom Topography Grade | >7 of th boulders debris overha | ne following gravel, log s, backwate nging vege ited shallow | g: der gs/lar ers/o etatio | ep pools, rge woody xbows, m, riffles, | | | | I Category | < 5 of the | item | s listed in tegory | | | | I Calegory | | USDAVNRCS SVAP page 1: |
| | | ut banks, or pools | r side | | | | | | | | | | | | | | |
| Grade | 10 | 9 | Т | 8 | 7 | 6 | | 5 | 4 | | 3 | 2 | | 1 | 0 | 1 | |
| 202 | | • | | | | | | | | 000 | | | | | | | |
| | | Optima | al | · | | Subop | | TEGORY (| | argin | | r | | Роог | | | |
| Di Oľ 3c, Manning's | ····· | 0.05 to 0. | | | | 0.035 k | | | 0.021 10 0 | | | 0.16 | to D.2 | 20 due to 6 | excessive | { · · · | |
| n sc. Maining s | | | | | | | | | | 0,15 | | | neliza | |)1 to 0.02 due lean, smooth | | |
| Grade | 10 | 9 | | 8 | 7 | 6 | | 5 | 4 | | 3 | 2 | | 1 | 0 | | |
| | | | | | | UDITION | 100 | TEGORY | DADE - | 000 | 200 | | | | ······ | | USACE, |
| | | Optim | al | | | Subop | | | | argin | | | | Poor | | { | Norfolk |
| 3d. Channel | Incision r | alio_>1.0 < | | ind Where | | atio_1.2 | <1.4 | and Where | Incision r | | | Incision | ratio > | | inere channel | | District, 2004 |
| Incision | | | | renchment | | | | trenchment | | | shannel | | | | ent ratio_4.4; | 1 | SAAM Form |
| (TLB/BFD=BH | | 4; Where Entrenchma | | | | | | nnel slope | | pe > 2 | | | | hannel sio chment rat | | | #1 and VT |
| R; 1/BHR*Adj Factor =CI) | <u><</u> 2%; t | intrencome | entra | atio >20 | <u><</u> 2%, E | ntrenchn | nent | ratio >2.0 | Entrench | | auo > 1.4; iei slope | 5 | nırənc | nment rat | 10_42.0 | | Stream |
| Facior | | | | | | | | | | | chment | | | | | | Geomorphic |
| | | | | [| | | | | ra | tio >2 | .0 | | | | | | Assessment Phase 2 |
| TLB = | | 10 | | | BHR = | | | | ļ | | | | | | | - | i nuse a |
| BFD = | | 10 | | | BHK = | 1 | | | | | | | | | | 1 | |
| Grade | 10 | 1 9 | T | 8 | 7 | 6 | | 5 | 4 | <u> </u> | 3 | 2 | T | 1 | 0 | 1 1 | |
| · | | | | | | | | | L | | | | | | | | |
| 4 DYNAMIC SUF | RFACE W/ | ATER STO | ORA | GE | | | | | | | | | | | | 1 | |
| | | • | | • | | | | TEOODV | 0.00 | | | | | | | { | N |
| | | Oplim | ~ | · | | Subop | | TEGORY (| | argin | | I | | Poor | | | Newton, et al 1998 USDAJ |
| 4a.Pools | Deep an | | | abundant; | Pools or | | | abundant; | | | ent, but | Pools a | bsent | | tire boltom is | 1 | NRCS SVAF |
| (abundant, | greater Ih | an 30% of | the p | pool bottom | from 10- | 30% of th | ie po | ol bottom is | | | 5-10% of | | | e. No wat | | | page 14; |
| present or | | e due to de 1 least 5 fer | | or pools are | | due to de at least 3 | | or the pools | the po obscure o | | ttom is | | | | | | Barbour, et a |
| absent) | a | , least 5 let | elue | ep. | are | at least 3 | ieet | deep. | the pools | | | | | | | | 1999 |
| | | | | | | | | | | et dee | | | | | | 1 | |
| | | | | | | | | | | | | | | | | | |
| Grade | 10 | 9 | Τ | 8 | 7 | 6 | | 5 | 4 | T | 3 | 2 | | 1 | 0 | 3 | 1 |
| | | | | | | | | | | | | | | | | 1 |] |
| 4b. Channel Flow Status | | 0 | | | CO | | | TEGORY | | | | | | | | | |
| (degree to | \Mater re | Optim aches bas | | halfs lower | Water fi | Subop | | e available | Water fills | argin | | Ven litt | a wat | Poor | nel and mosti | - | Barbour, et a 1999 EPA R |
| which channel | | and minim | | | | iel; or <25 | | | | | nnel, and | | | | s, No water = | 1 | page 5-19 /A |
| is filled) | | el substrate | e is e | exposed. | | bstrate is | | | | | rates are | 1 | | zero. | | | 9#5; TCEQ |
| | | | | | | | | | most | y exp | osed. | | | | | | 1999; VANR. |
| Grade | 10 | 9 | | 8 | 7 | 6 | | 5 | 4 | | 3 | 2 | | 1 | 0 | 2 | 2005 |
| | | | | | | | | | L | | | Į | | | | <u> </u> | |
| | | | | | | | Calc | ulation of I | unction C | apac | ity Index | = Total \$ | Score | | ssible Score | | 1 |
| | | | | | | | | | | | | | | | FCI = #/100 | 1 | |

and the second second

| | TYPE | | · · · · · · · · · · · · · · · · · · · | | [| | | | | | T | | | |] | Source |
|-------------------------|------------------------------|---------------|---------------------------------------|-------------------------------------|---|----------------------------|------------|-----------|---------------|-------------------------------------|--------------|-------------------------|----------|-------------------------------|---|----------------------|
| 1. | NOTES SEDIMENT TR | ANSPORT | DEPOSI | TION | | | | | | | | | | | 1 | |
| | | | | | | | | | | | | | | | 1 | |
| | | | Optimai | | <u>, cc</u> | NDITION | | GORY (| SRADE or | SCORE arginal | | Po | | | | Newton, et al., |
| | 1a, Bank Stability (score | Banks stab | | e of erosion o | Moderate | | | nl, smal | Moderate | y unstable; 30 | - Unstable; | | | reas; "raw | | 1998 |
| | each bank, left | | | r minimal; little blems, <5% c | | | | | 60% of ba | nk in reach ha | is areas | | | straight | | USDA/NR |
| | or right facing | | bank affect | | 3-30% 01 | erosíc | | aleas o | | erosion; high otential during | | | | ious bank bank has | | CS SVAP page 10; |
| | downstream) | | | | | | | | t t | oods. | | erosiona | I scars | | | Barbour, |
| | | | | | | | | | | | | | | | | et al., |
| | Grade (Left) | 10 | 9 | 8 | 7 | 6 | 1 | 5 | 4 | 3 | 2 | 1 | | 0 | 2 | 1999 EPA |
| | Grade (Right) | 10 | 9 | 8 | 7 | 6 | | 5 | 4 | 3 | 2 | 1 | | 0 | 2 | |
| | l | | | | | | ······ | | | | | | <i>F</i> | vg.Score | 2 | - |
| | | | | | CC | NDITION | CATE | GORY | SRADE or | SCORE | | | | | - | Galli, |
| | 1b. Channel | | Optima | | | Subopt | imal | | M | arginal | | Po | | |] | 1996 |
| Variable | Bottom Bank | | | jenerally highly Irix or maleria | | 1/3 of bar plant/soil n | | | | 1/3 of bank is highly erodibl | | | | rally highly soil matrix | | Wash- COG |
| Varí | Stability | | | | | | | | material; | olant/soil matr | | erely co | | | | RSAT |
| One | | | | | | | | | com | promised. | | | | | | No. 1 |
| | Grade (Left) | 10 | 9 | 8 | 7 | 6 | T | 5 | 4 | 3 | 2 | 1 | | 0 | 0 | |
| Only | Grade (Right) | 10 | 9 | 8 | 7 | 6 | | 5 | 4 | 3 | 2 | 1 | | 0 | 0 | |
| e for | | | | | | | | | | | | | / | vg.Score | 0 | |
| Score | or | | | | CC | | | GORY | GRADE or | | | | | | | Barbour, |
| Enter 5 | 1c. Channel Sediments or | >50% are | Optima avel or larg | er substrate; | 30-50% | Subopt gravel or l | | hstrate' | | arginal gravel or larg | er Substratz | Po | | i, silt, clay | - | et al., 1999 ; |
| 띱 | Substrate | gravel, col | bble bould | ers; dominant | domina | nt substrat | te type is | s mix of | substra | te; dominant | 01 | bedrock | | | 1 | Petersen, |
| | Composition | substrate | type is gra stable | avel or larger; | | rith some f noderatel | | liments; | | ype is finer tha It may still be | | | | | | et al., |
| | Grade | 10 | 9 | 8 | 7 | 1 6 | | 5 | 4 | 3 | 2 | 1 | | 0 | 2 | 1992 |
| 2 | WATER APPE | ARANCE: (| Clarity or ' | Visibility | | | | | J | | | | | | 1 | |
| | | | | | | MOITION | ICATE | COBY | GRADE or | SCOPE | | | | | - | Newton, |
| | | | Optima | 1 | <u>_</u> | Subopt | | GURIN | | arginal | T | Po | or | | 1 | et al., |
| | | | | ut tea-colored 1 3-6 feet (less | | ally cloudy event, but | | | Consider | able cloudines le time; object | s Very turbi | | | pth <0,5 ft; |] | 1998 |
| | Water Clarity | if slightly c | colored); n | o oil sheen on | objects vi | sible al de | epth 1.5- | 3 ft; mag | visible to a | lepth 0.5-1.5 | slow movi | ng water n | nay be t | right-green; | | USDA/ NRCS |
| | vealer charity | | | able film on ts or rocks. | | lightly grei en on wat | | | slow section | ons may appe n; bottom rock | algal mats. | surface so | cum, she | its; floating ien or heav; | | SVAP |
| | | | | | | | | | or sume | rged objected | | n on suría | ce. No 1 | valer = zero | 2 | page 11 |
| | | | | | | | | | cover | ed with film. | | | | | | |
| | | | | | | | | | | | | | | | | |
| | Grade | 10 | 9 | 8 | 7 | 6 | | 5 | 4 | 3 | 2 | 1 | I | 0 | 2 | 1 |
| 2 | DDESENCE OF | | VECETI | TIONI: Droco | non ond I | Doroont C | 0.0000 | | | | | | | | 4 | |
| 3 | PRESENCE O | AUAIN | VLUCIA | TION. PIES | and dill t | GICCIN C | overage | - | | | | | | | 1 | |
| | | | | | 00 | | | GORY | GRADE or | | | | | |] | Newton, |
| <u>e</u> | | Clearve | Optima | I entire reach: | Fairly de | Subopt | | lish wate | | arginal /ater along entir | Pea pres | Po n. oray. or | | vater along | 4 | et al., 1998 |
| uiable | 3a. Nutrient | diverse a | iquatic plai | nt community | along er | tire reach | ; modera | ale algal | reach; overa | ibundance of lu | sh entir | e reach; di | ense sta | nds of | | USDA/ |
| s Va | Enrichment | | | aties of many des; little algal | | n on strea | m substi | rates. | | phyles; abunda especially duri | | | | evere algal ts in stream | | NRCS |
| One | | | rowth pres | | | | | | warn | er months. | | gae prese strale. No | | unstable | | SVAP page 12 |
| hly. | | | | | | | | | | | 300. | Maie. 140 | wate: • | 2010. | | page 12 |
| Score for Only One Vari | Grade | 10 | 9 | 8 | 7 | 6 | | 5 | 4 | 3 | 2 | 1 | | 0 | | 1 |
| ie f | | | | | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | NIDITIO | LCATE | CODV - | DADE | 00005 | | | | | - | Determon |
| Sco | or | | Optima | 1 | | Subopt | | GURY | GRADE or M | arginal | | Po | or | | 4 | Petersen, et al., |
| Enter | 3b. Aquatic | | seni, aqua | tic vegetation | | dominant i | in pools, | | Algal mate | present, son | | ats cove | r bollo | m, larger |] | 1992 |
| ш | Vegetation | consists o | of moss ar algae. | id patches of | ' | plants alon | ng edge. | | liarger plar | its, few mosse | | | | nnel ar NC Instable | 1 | RCE form |
| | | | | | | | | | | | | rate. No | | | | No. 13 |
| | Grade | 10 | 9 | 8 | 7 | 6 | | 5 | 4 | 3 | 2 | 1 | | 0 | 1 |] |
| | 1 | | | | | | | | | | | | | | 1 | 1 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

| | | | | 0.0 | UDITION C. | ATEGORY (| GRADE or S | SCORE | | | | P |
|---|-----------------------------|--|-------------------------------|--------------------------|-----------------------------------|--|--|--|---|--------------------------------|---|---------------------------------|
| | | Optimal | | <u> </u> | Suboptima | | | irginal | [| Poor | | e |
| | | sisting of leav | | | and wood s | carce; fine | No leav | es or woody | | | - black in color | 1 |
| | W | ithout sedim | ent. | organic (| iebris wilhou | it sediment. | organic | arse and fine matter with liment. | | | erobic) or no e to excessive | R |
| Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2 |
| LAND USE PA | TTERN: Be | eyond Imme | diate Ripari | an Zone | | ·····, | | | | | | |
| | | | | CO | | ATEGORY | SRADE or S | SCORE | | | | P |
| | | Optimal | | | Suboptima | | | arginal | | Poor | | e |
| | | bed, consistir live prairie, a wellands. | | | ent pasture and swamp crops | | pasture; s areas may | w crops and some wooded be present bu | | Mainly row c | торь | 1: R N |
| O | 40 | | | | <u> </u> | | | ted patches | ļ | | | |
| Grade (Left) | 10 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | $\frac{1}{1}$ | 0 | 1 |
| Grade (Right) | IV | 1 3 | l0 | L/ | <u> </u> | 1 3 | 4 | <u> </u> | <u> </u> | <u> </u> | Avg.Score | 2 |
| RIPARIAN ZON | | AND CONT | INI IITY. | | | | | | | | Avg.50016 | |
| | <u></u> | | | | | | · | | | | | |
| | | ····· | | CO | VDITION C | ATEGORY | GRADE or S | SCORE | | | | в |
| 6a. Riparian | | Optimal | | T | Suboptima | | | arginal | I | Poor | | a |
| Zone Width | | parian zone >1 | | | rian zone 12- | 18 meters (1/2- | Width of rip | anan zone 6-12 | | | meters (natural | 10 |
| (from stream edge to field) | | tihs with frees, human activiti impacted zoni | es have not | | | rees, shrubs, or have minimally e. | channel wi | 1/3-1/2 active dlh vegetated), human activilies. | width), littl | | active channel getation due to ties. | P ei R U |
| Grade (left) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 |
| | | | | ******** | *** | | | | L | | Avg.Score | 2 |
| | | | | CO | | ATEGORY | | | | | | B |
| ar 51 - | | Optimal | | | Suboptima | | | arginal | | Poor | | e |
| 6b. Riparian Zone Vegetation Protection/ Completeness | shrubs, prai riparian zo | it density of ma irie grasses, or one infact or dis cing/mowing m | marsh plants, ruption from | young speci frees beh | | | vegetation of and sparse shrub sp frequent with | streambank of mixed grasses e young tree or ecies; breaks th some gullies wery 50 meters. | coverage o grasses, fo density; bar | consisting mo ew trees & sh | ank vegetation ostly of pasture inubs; low plant irred with gulties ngth. | 1 # P e 1 R # |
| Grade (Left) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2 |
| Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2 |
| · · · · · · · · · · · · · · · · · · · | | | | | | | | | | | Avg.Score | 2 |
| | | | | | <u></u> | | Turnelland Co | an a Nee Instance | - Total Can | ro/Tatol D | ossible Score | 0,1875 |

| ARIABLES | FLOW REGI | | 05\10\2006 Highway 9 | 04 Bridge | | SCORE SC |
|----------|----------------------|---|---|--|--|--------------|
| 1 | TYPE | ME Perennial | Intermittent w/ Perennial Pools | Intermittent | Ephemeral | KI |
| | Grade | 10 9 8 | 7 6 5 | 4 3 | 2 1 0 | 4 20 |
| | CONCALINAL | | | | | 4 |
| 2 | EPIFAUNAL | SUBSTRATE/AVAILABLE COVER Optimal | Suboplimal | Marginal | Poor | 1 |
| | | Within stream bed, greater than 50% | Wilhin stream bed, 30-50% coverage | Within stream bed, 10-30% | Less than 10% habital features | 1 U |
| | | coverage by stable habitat features, | by stable habitat features favorable | coverage by stable habitat | present; lack of habitat is obvious; substrate unstable or lacking; | N |
| | | favorable for stream faunal colonization and/or fish/amphibian cover, Most habilat | for stream faunal colonization and/or fish/amphibian cover. Many habitat | features lavorable for stream faunal colonization and/or | concrete lined channels. Habilat | 20 S/ |
| | | features non transient. Features may | features not transient. (See Excellent | fishfamphibian cover; habitat | features and pools buried or lacking, | Fo |
| | | include snags, submerged logs, undercut banks, roots, cobble, rocks, persistent leaf | Category for habitat feature components.) | availability may be less than desirable, substrate may be | channel bollom may be flat | (P |
| | | packs, pools and glides, or other stable | | frequently disturbed. (See | | Ba |
| | | habitat at a stage to allow colonization | | Excellent Category for habitat (calure components.) | | al. El |
| | | | | testure components.) | | P |
| | | | | | | al |
| | | | | | - | AI |
| | Grade | 10 9 8 | 7 6 5 | 4 3 | 2 1 0 | . 2 |
| | | | | | | |
| 3 | STREAM BO | OTTOM SUBSTRATE: Pool Substrate Ct Optimal | | Marchael | Poor | - 1 |
| | 1 | Mixture of substrate materials, with gravel | Suboptimal Mixture of soft sand, mud, or clay; | Marginal All mud or clay or sand bottom; | Hard pan clay or bedrock; no root | Bi |
| | | and firm sand prevalent; root mats and | mud may be dominant; some root | little or no root mat; no | mat or submarged vogetation | al |
| | | submerged vegetation common. | mats and submerged vegatation | submerged vegetation. | | R |
| | | 1 | present. | | | pa Pi |
| | | | | | | al |
| | Grade | 10 9 8 | 7 6 5 | 4 3 | 2 1 0 | 1 |
| | | | | · | | |
| 4 | POOL VARIA | | | | |] [|
| | | Optimal Even mix of large-shallow, large-deep. | Suboptimal Majority of pools large-deep; very | Marginal Shallow pools much more | Poor Majority of pools small-shallow or | В |
| | | small-shallow, small-deep pools present | few shallow. | prevalent than deep pools | pools absent | al |
| | | | | | | R |
| | ſ | | | | | pi |
| | | | | | | P. |
| | Grade | 10 9 8 | 7 6 5 | 4 3 | 2 1 0 | + |
| ţ | | DEPOSITION/SCOURING | | | | ' |
| | | Optimal | Suboptimat | Marginal | Poor |] |
| | | <5% of channel bottom affected by scour or deposition | 5-30% affected by scour or deposition, Scour at constrictions and weite grades | 30-50% affected by scour or deposition. Deposits and scour at | More than 50% of the bottom in a state of Rux or change nearly yearlong. Pool | |
| | | | steepen. Some deposition in pools | obstructions, constructions and | minimal or absent due to heavy | R |
| | | | | bends. Some filing of pools. | deposition or excessive scouring. | p |
| | | | | | | P |
| | | 10 9 8 | | | 2 1 0 | al al |
| | Grade | 10 9 8 | 7 6 5 | 4 3 | | |
| f | 5 CHANNEL F | LOW STATUS | | | | |
| | | Optimal | Suboptimal | Marginal | Poor | 1 |
| | | Water reaches the base of both lower banks; <5% of channel substrate is | Water fills >75% of the channel; or <25% of channel substrate is | Water fills 25-75% of the available channel and/or tiffle | Very little water in the channel and mostly present in standing pools; or | |
| | | exposed | exposed | substrates are mostly exposed | stream is dry | a |
| | | | | | | R |
| | 1 | *** | | | · · · · | p |
| | Cond | | <u> </u> | | 2 1 1 1 0 | P |
| - | Grade 7 CHANNEL A | 10 9 8 I TERATION | 7 6 5 | 4 3 | 2 1 0 | ⁴ |
| | 1 | Optimal | Suboptimal | Marginal | Poor | |
| | | Channelization, alteration, or dredging | Some alteration or channelization | Alteration or channelization | Banks shored with gabion, riprap, o | |
| | | absent or minimal; normal and stable stream meander pattern. Alteration by | present, usually adjacent to structures, (such as bridge | may be extensive; embankments (including spoil | concrete, Concrete or riprap lined channels, Instream habitat | N D |
| | 1 | stormwater inputs absent or minimal | abutments or culverts); evidence of | piles) or shoring structures | significantly altered by stormwater o | н 12 |
| | | | past alteration, (I.e., channelization) | present on both banks; normal | | Ś |
| | | 1 | may be present, but stream pattern and stability have recovered; recent | stable stream meander pattern has not recovered. Alteration | sugam reach allered, | F |
| | | | | from stormwater inputs may be | | (1 |
| | | | alteration is not present. Minor | | | |
| | | | alteration from stormwater or other | extensive, 40-80% of stream | | |
| | | | | extensive, 40-80% of stream reach altered. | | e |
| | | | alteration from stormwater or other | | | |
| | | | alteration from stormwater or other | | | eR |
| | Grade | 10 9 8 | alteration from stormwater or other | | 2 1 0 | e R P |
| | Grade | | alteration from stormwater of other inputs. | reach altered. | 2 1 0 | e R P |

· ·

| D 9 8 7 6 5 4 3 2 1 0 DRE EACH BANKS) Design of mining (5% of bank beer or mining (5% of bank or dimando) bends OK); no episod roots; no recent the falls: waterline, severe roots on tobark of monoto bends OK); no exposed roots; no recent the falls: waterline, severe roots may beade over. Marginal waterline, severe roots on tobark waterline, severe roots may beade over. Unstable: the point waterline, severe roots may beade on monoto bends OK); no episod roots; no recent the falls: waterline in more nails places; recent waterline, severely waterline in more nails places; recent waterline in evores and fine on hank undercalling; recently exposed in evores and fine one hank undercalling; recently potential during floods Poor D 9 8 7 5 4 3 2 1 0 D 9 8 7 5 4 3 2 1 0 D 9 8 7 5 4 3 2 1 0 D 9 |
|---|
| Oplimal Suboptimal Madgrafial Poor able; evidence of erosion or bank bable; oridinant; (<5% of bank perennial vegetation to waterline; source of monotory bank perennial vegetation to waterline; source of monotory bank sposed roots; no recent tee falls: Moderately stable; infrequent, small areas of erosion and/or bank waterline in most places; recently exposed roots; no recent tee falls: Unstable; source or soin micro resion and/or bank waterline in most places; recently exposed roots; no recent tee falls: Unstable; source or soin monotor resion and/or bank waterline in most places; recently exposed ree roots and for root hairs common; high erosion potential during floods Unstable; source or soin monotor resion and/or severely undercut trees common; many eroded mera; 'rwa' races; frequent along straight sections and bank undercutting; recently exposed ree roots and fine root hairs common; high erosion potential during floods Image: source or soin bank has erosional scars. 0 9 8 7 6 5 4 3 2 1 0 0 9 8 7 6 5 4 3 2 1 0 0 9 8 7 6 5 4 3 2 1 0 0 9 8 7 6 5 4 3 |
| Oplimal Suboptimal Madgrafial Poor able; evidence of erosion or bank bable; oridinant; (<5% of bank perennial vegetation to waterline; source of monotory bank perennial vegetation to waterline; source of monotory bank sposed roots; no recent tee falls: Moderately stable; infrequent, small areas of erosion and/or bank waterline in most places; recently exposed roots; no recent tee falls: Unstable; source or soin micro resion and/or bank waterline in most places; recently exposed roots; no recent tee falls: Unstable; source or soin monotor resion and/or bank waterline in most places; recently exposed ree roots and for root hairs common; high erosion potential during floods Unstable; source or soin monotor resion and/or severely undercut trees common; many eroded mera; 'rwa' races; frequent along straight sections and bank undercutting; recently exposed ree roots and fine root hairs common; high erosion potential during floods Image: source or soin bank has erosional scars. 0 9 8 7 6 5 4 3 2 1 0 0 9 8 7 6 5 4 3 2 1 0 0 9 8 7 6 5 4 3 2 1 0 0 9 8 7 6 5 4 3 |
| D 9 8 7 6 5 4 3 2 1 0 Avg.Score CTION (SCORE EACH BANK) Optimal Marginal Poor Colspan="4">Colspan="4">Colspan="4">Colspan="4">Avg.Score Optimal Avg.Score Optimal Poor Covered by native vegetation, but covered by native vegetation covered by vegetation covered by native vegetation covered by vegetation covered by native vegetation covered by vegetation covered by native vegetation covered by native by n |
| Avg.Score Avg.Score Optimal Marginal Poor Oof the streambank surfaces Suboptimal Poor Suboptimal Marginal Poor Suboptimal Marginal Poor Suboptimal Marginal Poor Suboptimal Surfaces covered by vegetation, but covered by vegetation, but covered by vegetation of streambank vegetation or closely cropped vegetation. Surfaces covered by vegetation of streambank vegetation or closely cropped vegetation. Notice streambank surfaces Surfaces covered by vegetation. Notice streambank surfaces Surfaces covered by vegetation. Notice streambank vegetation. Surfaces covered by vegetation. Surfaces covered by vegetation. Notice streambank vegetation. Surfaces covered by vegetation. Surfaces covered by vegetation. Notice streambank vegetation. Surfaces covered by vegetation. Surfaces covered by vegetation. Surfaces covered by vegetation. Surfac |
| Optimal Suboptimal Marginal Poor 190% of the streambank surfaces 70-90% of the streambank surfaces 50-70% of the streambank surfaces Sufface Streambank surfaces Surfaces covered by vegletation. It is streambank surfaces covered by vegletation. It is up the streambank surfaces Less than 50% of the streambank surfaces Surfaces covered by vegletation. It is surfaces covered by vegletation. It is surfaces covered by vegletation. It is very light vegletation of streambank vegletation and streambank vegletation or one closely cropped vegletation closely cropped vegletation. It is very light vegletation and streambank vegletation are streambank vegletation or one closely cropped vegletation closely cropped vegle |
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| D 9 8 7 6 5 4 3 2 1 0 Avg_Score DRE EACH BANK) Optimal Suboptimal Marginal Poor riparian zone >18 meters; human activities have impacted zone Width of riparian zone 6-12 Width of riparian zone 6-12 Night of riparian zone 12-18 meters; human activities have impacted zone meters; human activities have impacted zone a great deal. |
| Avg.Score ORE EACH BANK) Oplimal Marginal Poor riparian zone > 18 meters; human activities nave impacted zone mis, or crops) have not impacted only minimatly). |
| Optimal Suboptimal Marginal Poor riparian zone > 18 meters; human Width of riparian zone 12-18 meters; Width of riparian zone 6-12 Width of riparian zone 6-12 <td< td=""></td<> |
| Optimal Suboptimal Marginal Poor riparian zone > 18 meters; human Width of riparian zone 12-18 meters; Width of riparian zone 6-12 Width of riparian zone 6-12 <td< td=""></td<> |
| |
| 0 9 8 7 6 5 4 3 2 1 0 |
| 0 9 8 7 6 5 4 3 2 1 0 Avg.Score |
| ONDITION (SCORE EACH BANK) |
| Optimal Suboptimal Marginal Poor |
| tum (dbh>3 inches) present, wih Tree stratum (dbh>3 inches) present. s may include: sapling, shub, s may include: sapling, shub, tereas and veck devis, Scene al tow he high here are present. haves nare present. Score at low and local tayers are t additional lorest layers are present. t additional lorest mere shub town and is 1 additional lorest are present. Score at low end if ≤1 additional layers are present |
| 0 9 8 7 6 5 4 3 2 1 0 Below |
| areas along each stream bank into Condition Categories and Condition Scores using the above descriptors footage for each by measuring or estimating length and width. Land Use GIS maps may be used for this. In Area (or for field purposes, enter length and width) and Score for each riparian category in the blocks below. |
| Optimal Suboptimal Marginal Poor an Area 25 75 100 |
| <u>3</u> <u>2</u> 0 0 0.75 1.5 |
| |
| an Area 60 40 100 5 3 |
| 0 3 1.2 0 |
| SubCl=(%RA*Scores*0.01) RI Bank Ct> 2.25 C |
| Calculation of Function Capacity Index = Total Score/Total Possible Score().19 |

| VARIABLES | CTIONS | | | 05\05\200 | 6 | Highway 3 | 8 Bridge | | | | | | SCORE | Reference Source |
|--|--|--|---|--|---|---|--|---|---|--|--|--|-------|---|
| FLOW REGIME | <u>±:</u> | | | | | | T | | | | | | | KDWP 2000 |
| TYPE | | Perennial | | Intermitt | ent w/ Per | ennial Pools | Interr | nittent | · . | Ephe | meral | | Į | Kansas |
| Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | | I | 0 | 4 | Subjective |
| CHANNEL CO | NDITION: M | leasureme | ent or Obsen | vation of St | ream Char | nnel Condilio | 15 | <u></u> | | | | | 1 | 1 |
| | | | | CON | IDITION (| CATEGORY (| GRADE or S | CORE | | | | | 1 | Barbour, 1999 |
| | | Optimal | | | Suboptim | | | ginal | | | or | |] | EPA RBA pag |
| | | | tructures or No evidence | | | on (usually in ast channel | Altered char | nnel; 40-80% channelized | | | | nculting or | [| 5-21; Newton |
| | | | essive lateral | | | h significant | | ed, Excess | | | | ch riprap o on,dikes or | | 1998 USDAJ NRCS SVAP |
| 2a.Channel Condition/Alter | cutting. | Normal free | quency of | recovery o | of channel b | oed and banks | aggradati | on; braided | levee | s prever | l access | | | page 7 |
| ation (natural, | I HARDIORIC | | on between | | | cy of overbank | | Ih excessive | | flood | plain. | | | Page |
| altered, or | chant | nel and floo | opiain. | 101 | ws onto floo | oopiain. | | of overbank ne floodplain. |) | | | | | 1 |
| downcutting) | | | | | | | | ncision.dikes | | | | | | 1 |
| | | | | | | | | s restrict | | | | | | |
| | | | | | | | flood | lplain. | | | | | | [|
| |] | | | | | | | | | | | | | |
| | | | | | | | | | ĺ | | | | 1 | |
| Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | | 1 | 0 | 0 | 7 |
| | | | | ·I | J | | 1 | L | ·~ | | | | | 7 |
| | | | | CON | IDITION C | CATEGORY O | RADE or S | CORE | | | | |] | w/ assistance |
| 2b.Channel | | Optimal | | | Suboptin | | | ginal | | | 100 | | | and input from |
| Capacity to | | | w Frequency overflow from | | | low Frequency k overflow from | | Capacity to ency Ratio is | | | | Frequency erflow from | | Dr. Mike |
| Flow | | | a 1.25 to 2.5 | | | e frequent that | | ank overflow | | | | quent than | | Harvey and S Travant |
| Frequency Ratio (for 2- | ye | ear frequenc | | | | less frequent | | events are | every ha | | | quent than | | 1. avant |
| year peak | | 0.75-1.25 | | tha | n every 2.5 <0.75 or >1 | | | quent than ear or less | | | 0 years. I or >2 | | | |
| flow) | | | | | -0.75 07 2 | 1,20 | | han every 5 | | ~0.2 | 10172 | | | |
| | | | | | | | ye | ars, | | | | | | |
| | | | | 1 | | | < 0.5 | or >1.5 | | | | | | |
| Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | | 1 | 0 | 0 | 2 |
| | | ····· | | | DITION | ATEOODY | 00405 | CODE | | | | | _ | 1 |
| | | Optimal | | | Suboptin | CATEGORY (| | pinal | T | D | 100 | | - | Newton, 1998 |
| | Banks stabl | | e of erosion o | Moderate | | nfrequent, smal | | ly unstable; | Unstable | | | egetation at | | SVAP page |
| | bank failure | absent or r | minimal; (<5% | areas of e | rosion most | lly healed over. | perennial | regetation to | waterli | ne; seve | re erosic | on of both | 1 | 10; Barbour, |
| 2c.Channel Bank Stability | | c affected), p | perennial ie; no raw or | | | ch has areas c nd/or bank | | parse (mainly r stripped by | | | | tree roots or severely | | al., 1999 EP. |
| (score each | | | e erosion on | | | ial vegetation t | | sion), bank | | | | nany eroder | d | RBA page 5- |
| bank, left or | | | nds O.K.); no | waterline | in most pla | aces; recently | held by h | hard points | | | | ient along | | 26; USACE, Norfolk |
| right facing | recently ex | xposed root tree falls; | ts; no recent | exposed t | ree rools ra | are but present | | k outcrops) ded back | | | | ds; obvious of bank has | | District, 2004 |
| downstream) | | 000 1000, | | 1 | | | | : 30-60% of | Danicalor | | al scars | | 1 | |
| | | | | 1 | | | | ch has areas | | | | | | |
| | | | | 1 | | | of erosio | n and bank | | | | | } | |
| | | | | | | | undercutti | na: meanth | 1 | | | | | |
| | | | | | | | | ng: recently ee roots and | | | | | | |
| Orada II att | | | | | | | exposed tr | ee roots and irs common: | ļ | | | | | |
| Grade (Left) | 10 | 9 | 8 | 7 | 6 | 5 | exposed tr fine root ha | ee roots and irs common: 3 | 2 | | 1 | 0 | | |
| Grade (Left) Grade (Right) | 10 10 | <u>9</u> 9 | 8 8 | 777 | 6 | 5 | exposed tr | ee roots and irs common: | ļ | | 1 | 0 | | 2 |
| Grade (Right) | 10 | 9 | 8 | | | | exposed tr fine root ha | ee roots and irs common: 3 | 2 | | 1 | | | |
| | 10 | 9 | 8 | | | | exposed tr fine root ha | ee roots and irs common: 3 | 2 | | 1 | 0 | | |
| Grade (Right) | 10 | 9 | 8 | 7 | 6 | 5 | exposed tr fine root ba 4 4 | ee roots and irs common: 3 3 | 2 | | 1 | 0 | | 2 |
| Grade (Right) CHANNEL RO | 10 | 9 FACTORS | 8 | 7 | | 5 CATEGORY | exposed to fine root ha 4 4 6 GRADE or S | ee roots and irs common: 3 3 3 6CORE | 2 | | 1 | 0 | | 2 2 Barbour, 199 |
| Grade (Right) CHANNEL RO 3a,Channel | UGHNESS I | 9 FACTORS Optimal | 8 | 7 COI | 6 NDITION (Suboplin | 5 CATEGORY | exposed tr fine root ha 4 4 4 GRADE or S Mar | ee roots and irs common: 3 3 5 5 5 CORE ginal | 2 2 | p | | 0 Avg.Score | | 2 2 Barbour, 199 EPA RBA |
| Grade (Right) CHANNEL RO 3a,Channel Sinuosity | 10 UGHNESS I | 9 FACTORS Optimal n the stream gth 2.5 to 4 | 8 n increase the limes longer | 7 COI The bends stream ler | 6 NDITION (Suboptim in the street ogth 1.5 to 2 | 5 CATEGORY nal am increase the 2.5 times longe | exposed tr fine cost ha 4 4 GRADE or 5 Mar 5 The bends 1 increase | ee roots and irs common: 3 3 SCORE ginal in the stream the stream | 2 2 Channel chann | pi straight; elized fo | 1 Dor waterwa r a long | 0 Avg.Score ay has beer distance. | | Barbour, 199 EPA RBA Chapter 5 pa 5-25; KDWP |
| Grade (Right) CHANNEL RO 3a Channel Sinuosity (bends in low | UGHNESS I | 9 FACTORS Optimal n the stream glh 2.5 to 4 was streight | 8 nincrease the limes longer t. Channel | COI | 6 NDITION (Suboptim in the streat ogth 1.5 to 2 as a straigh | 5 CATEGORY nal am increase the 2.5 times longe at line. Channe | exposed tr fine root ha 4 4 GRADE or S Mar The bends increase increase increase | ee roots and irs common: 3 3 SCORE ginal in the stream the stream to 1.5 times | 2 2 Channel chann | pi straight; elized fo | 1 Dor waterwa r a long | 0 Avg.Score ay has beer | | 2 Barbour, 199 EPA RBA Chapter 5 pa |
| Grade (Right) CHANNEL RO 3a,Channel Sinuosity | UGHNESS I | 9 FACTORS Optimal n the stream glh 2.5 to 4 was streight | 8 n increase the limes longer | COI | 6 NDITION (Suboptim in the streat ogth 1.5 to 2 as a straigh | 5 CATEGORY nal am increase the 2.5 times longe | GRADE or S GRADE or S Mar The bends increase longer that | ee roots and irs common: 3 3 SCORE ginal in the stream the stream | 2 2 Channel chann | pi straight; elized fo | 1 Dor waterwa r a long | 0 Avg.Score ay has beer distance. | | Barbour, 199 EPA RBA Chapter 5 pa 5-25; KDWP |
| Grade (Right) CHANNEL RO 3a,Channel Sinuosity (bends in low gradient | UGHNESS I | 9 FACTORS Optimal n the stream glh 2.5 to 4 was streight | 8 nincrease the limes longer t. Channel | COI | 6 NDITION (Suboptim in the streat ogth 1.5 to 2 as a straigh | 5 CATEGORY nal am increase the 2.5 times longe at line. Channe | GRADE or S GRADE or S Mar The bends increase length 1 t longer tha straight lir iength/vall/ | ee roots and ins. common: 3 3 3 SCORE ginal in the stream the stream to 1.5 times an if it was a e. Channel ey length 1.0 | 2 2 Channel chann Channel | pi straight; elized fo | 1 Dor waterwa r a long | 0 Avg.Score ay has beer distance. | | Barbour, 199 EPA RBA Chapter 5 pa 5-25; KDWP |
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|---|--|---|--|---|--|---|--|--|--|---|---|---|------------------------|---------------------|---|-----|--|
| | | Optima | | | | Subopti | | | | argina | | | | 200C | | 1 | Newton e |
| 3c. Instream Bottom Topography | >7 of the boulders/ debris overhan vegetat | te following s/gravel, log s, backwate nging vegel ted shallow | s/ian ers/o latio /s, ro r side | rge woody xbows, n, riffles, potwads, | | bottom inc sted in Opt | | | Channel b < 5 of the Optim | items | s listed in | | | | les <3 of the al Category | | 1998 USDA/NF SVAP pa |
| Grade | 10 | 9 | Τ | 8 | 7 | 6 | | 5 | 4 | | 3 | 2 | 1 | 1 | 0 | 0 | |
| Grade | | | | | 100 | UDITION | CATE | COPY | GRADE or | 500 | סב | | | | | - | |
| Or 3c. Manning's | | Optima | al | 1 | 001 | Subopti | | .00111 | | argina | | | | Poor | | 1 | Į |
| 3c. Manning's n | | 0,05 to 0.1 | .099 | | | 0.035 to | 0.05 | | 0.021 to 0 | .03 or 0.15 | >0,10 to | obstructio | on to fic ielizatio | w or 0.0 | excessive D1 to 0.02 du Ilean, smoolf | | |
| Grade | 10 | 9 | | 8 | 7 | 6 | | 5 | 4 | | 3 | 2 | | 1 | 0 | 1 | |
| | | | | | 100 | NDITION | CATE | GORY | GRADE or | SCO | RE | | | | | - | USACE, |
| | | Optima | al | 1 | | Subopti | | | | argina | | | | Poor | | 1 | Norfolk |
| 3d. Channel Incision (TLB/BFD=BH R; 1/BHR*Adj Factor =CI) | channel s ratio >1. | slope >2%; .4; Where c | ; Eni chan | renchment net slope | channel s ratio >1. | atio_≥1.2 < slope >2% .4; Where intrenchme | , Entre | nchment el slope | and Wr slop Entrenchn Where c ≤2%, E | nere c pe > 2 nent ra channe | hannel %. atio >1.4; el slope chment | slope >2 Whe | %, Entere cha | renchme | Mere channa ant ratio_4.4: pe_2%, io_2.0 | | District, 2 SAAM Fi #1 and V Stream Geomorp Assessm Phase 2 |
| TLB = | | 10 | | | BHR = | 1 | | | | | | | | | | - | |
| BFD = | | 10 | | | | | | | | | | | | | | | |
| Grade | 10 | 9 | L | 8(| 7 | 6 | | 5 | 4 | | 3 | 2 | | 1 | 0 | 0 | 4 |
| | | | | | | | | | | | ~~~~~~ | | | | | | 1 |
| 4 DYNAMIC SUF | RFACE WA | ATER STO | DRA | GE | ····· | | | | | | | | | | | | |
| 4 DYNAMIC SUF | RFACE WA | ATER STC | DRA | GE | 100 | | CATE | GORY | | 500 | PE | | | | | 4 | Newlon |
| DYNAMIC SUF | boulders/gravel, logs/large w/ debris, backwaters/oxbow/ overhanging vegetation, riff vegetated shallows, rootwar undercut banks, or side char pools 10 9 8 Optimal 0.05 to 0.099 10 9 8 0.05 to 0.099 10 9 8 10 9 10 9 10 9 10 10 9 10 10 10 10 10 10 10 10 10 10 10 10 10 | GE | 100 | NDITION Subopti | | GORY | RADE or | SCO argina | | 1 | | Poor | ····· | - | | | |
| 4a.Pools | Deep and | Optima d shallow p | al | abundant; | Pools pr | Subopti resent, but | mal not at | oundant; | Mi Poois | argina prese | al nt, but | | osent, c | or the en | itire bottom is | | 1998 US NRCS S |
| | Deep and greater the is obscure | Optima d shallow p ian 30% of e due to dep | al bools the p | abundant; pool boiton or pools are | Pools pr from 10-3 obscure of | Subopti | mal not at pool t ith, or t | oundant; botlom is | Mi Pools shallow; the po obscure d the pools | argina prese from t ol bot lue to | al nt, but 5-10% of lom is depth, or ss than 3 | disce | osent, c | or the en | itire bottom it | | 1998 US NRCS S page 14; |
| 4a.Pools (abundant, present or | Deep and greater that is obscure at | Optima d shallow p ran 30% of t e due to deg t least 5 fee | al bools the p | abundant; pool boiton or pools are | Pools pr from 10-3 obscure of | Suboptin resent, but 30% of the due to dep | mal not at pool t ith, or t | oundant; botlom is | Mi Pools shallow; the po obscure d the pools | argina prese from { ol bot lue to are les | al nt, but 5-10% of lom is depth, or ss than 3 | disce | osent, c | or the en | | 2 | 1998 US NRCS S page 14; Barbour, 1999 |
| 4a.Pools (abundant, present or absent) Grade | Deep and greater that is obscure at | Optima d shallow p ran 30% of t e due to deg t least 5 fee | al bools the p | abundant; pool boltom or pools are ep. | Pools pr from 10-3 obscure o are 7 | Subopti esent, but 30% of the due to dep at least 3 t 6 | mal not at pool t ith, or t feet de | oundant; botlom is the pools bep. 5 | M Pools shallow; the po obscure d the pools fee 4 | argina prese from 5 ol bot lue to are les et dee | al nt, but 5-10% of lom is depth, or ss than 3 p. 3 | disce | osent, c | or the en No wal | ler = zero, | | 1998 USI NRCS S ¹ page 14; <i>Barbour,</i> 1999 |
| 4a.Pools (abundant, present or absent) Grade 4b. Channel | Deep and greater that is obscure at | Optime d shallow p han 30% of t e due to deg t least 5 fee 9 | al bools the j pth. de | abundant; pool boltom or pools are ep. | Pools pr from 10-3 obscure o are 7 | Suboptinesent, but 30% of the due to dep at least 3 to 6 NDITION | mal not at pool I th, or I feet de CATE | oundant; botlom is the pools bep. 5 | Mi Pools shallow; the po obscure d the pools fee 4 3RADE of | argina prese from { ol bot iue to are les et dee | al nt, but 5-10% of lom is depth, or ss than 3 sp. 3 DRE | disce | osent, c ernible. | or the en No wal | ler = zero, | | 1998 USI NRCS S page 14; Barbour, 1999 |
| 4a.Pools (abundant, present or absent) Grade | Deep and greater that is obscure at 10 | Optima d shallow p an 30% of due to dep t least 5 fee 9 9 Optima | al noois the j pth. c et de | e abundant; pool boltom or pools are ep. 8 | Pools pr from 10-3 obscure o are 7 COI | Subopti esent, but 30% of the due to dep at least 3 t 6 | mal not at pool I ih, or I feet de CATE mal | bundant; botlom is the pools hep. 5 GORY (| Mi Pools shallow; the po obscure d the pools fee 4 3RADE of | argina prese from 5 ol bot lue to are les et dee | al nt, but 5-10% of lom is depth, or ss than 3 p. 3 DRE al | disce 2 | osent, c ernible. | nr the en No wat | ler = zero, | 2 | Barbour, (1999 |
| 4a.Pools (abundant, present or absent) Grade 4b. Channel Flow Status (degree to which channel is filled) | Deep and greater the is obscure at 10 Water real banks channe | Optima d shallow p nan 30% of t e due to deg t least 5 fee g Optima eaches bass and minim el substrate | al pools the p pth. c el de al al al al ar | abundant; bool boltom or pools are ep. <u>8</u> both lower mount of ixposed. | Pools pr from 10- obscure are 7 COt Water fil chann sut | Suboptil esent, but 30% of the due to dep at least 3 i at least 3 i at least 3 i both Suboptil Its >75% o et; or <25% bstrate is e | mal not at pool t ith, or t feet de CATE mal if lhe a % of ch | 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 | Mi Paols Shallow; the pools fee 4 3RADE or M Water fills available Jor riffee mosti | argina preset from 5 ol bot lue to are les et dee SCC argina 25-75 e chan substr | al nt, but 5-10% of lom is depth, or ss than 3 p. 3 DRE al 5% of the anel, and ates are osed. | 2 Very little present a | osent, c ernible. | r the en No wal | ler = zero. 0 nel and mosi s. No water | 2 | 1998 US NRCS S' page 14; Barbour, 1999 Barbour, 1999 EP, page 5-11 9#5; TCE |
| 4a.Pools (abundant, present or absent) Grade 4b. Channel Flow Status (degree to which channel | Deep and greater that is obscure at 10 Water real banks | Optima d shallow p nan 30% of a due to deg t least 5 fee 9 Optima eaches base a nd minim | al pools the p pth. c el de al al al al ar | abundant; bool boltom or pools are ep. 8 8 both lower mount of | Pools pr from 10-: obscure o are 7 7 COt Water fil chann | Suboptii esent, but 30% of the due to dep at least 3 t 6 NDITION Subopti Ils >75% o el; or <25% | mal not at pool t ith, or t feet de CATE mal if lhe a % of ch | bundant; bottom is the pools bep. 5 GORY (vailable hannel | Mi Pools shallow; the pools fee 4 3RADE of M Water fills available Jor nifte s | argina preset from 5 ol bot lue to are les et dee SCC argina 25-75 e chan substr | al nt, but 5-10% of lom is depth, or ss than 3 p. 3 0RE al 5% of the net, and ates are | disce 2 Very little | osent, c ernible. | r the en No wal | ler = zero, | 2 | 1998 US NRCS S page 14; Barbour, 1999 Barbour, |
| 4a.Pools (abundant, present or absent) Grade 4b. Channel Flow Status (degree to which channel is filled) | Deep and greater the is obscure at 10 Water real banks channe | Optima d shallow p nan 30% of t e due to deg t least 5 fee g Optima eaches bass and minim el substrate | al pools the p pth. c el de al al al al ar | abundant; bool boltom or pools are ep. <u>8</u> both lower mount of ixposed. | Pools pr from 10- obscure are 7 COt Water fil chann sut | Suboptii resent, but 30% of the due to dep at least 3 i 6 NDITION Suboptii Ils >75% o et; or <25° bstrate is c | mal not ab pool t th, or t feet de <u>CATE</u> mal f lhe a % of ch expose | 5 Solory of the pools are | Mi Paois shallow; the po obscure d the pols fee 4 3RADE or Mater fills available Jor riftle s mostl 4 | argina prese from 5 col bot lue to are les et dee r SCC argina 25-75 e chan substr y exps | al nt, but 5-10% of lom is depth, or ss than 3 p. 3 DRE al 5% of the nnel, and ates are osed. 3 | disce 2 Very little present a 2 | ssent, c ernible. | r the en No wal | ler = zero. 0 nel and mosi s. No water | - 1 | 1998 US NRCS S page 14; Barbour, 1999 Barbour, 1999 EP, page 5-11 9#5; TCE 1999; VA 2005 |

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(ANN)

| | TYPE | | | Source |
|-----------------------------|---|--|--|---|
| 1 | NOTES SEDIMENT TR | ANSPORT/DEPOSITION | | |
| 1. | | | | |
| | | CONDITION CATEGORY GRADE or SCORE | 1 | |
| | 1a. Bank | Optimal Suboptimal Marginal Poor Banks stable; evidence of erosion of Moderately stable; infrequent, small Moderately unstable; 30- Unstable; many eroded areas; "raw | | |
| | Stability (score each bank, left or right facing downstream) | bank failure absent or minimal; little areas of erosion mostly healed over potential for future problems, <5% of 5-30% of bank in reach has areas of bank affected. bank affected. | | USDA/NR CS SVAP page 10; Barbour, et al., |
| | Grade (Left) | 10 9 8 7 6 5 4 3 2 1 0 | 3 | 1999 EPA |
| | Grade (Right) | 10 9 8 7 6 5 4 3 2 1 0 Autocard | 3 | |
| | | Avg.Score | | |
| | | CONDITION CATEGORY GRADE or SCORE | | |
| Ø | 1b. Channel | Optimal Suboptimal Marginal Poor Boltom 1/3 of bank is generally highly Bottom 1/3 of bank is generally highly | | |
| One Variable | Stability | resistant plant/soil matrix or material, resistant plant/soil matrix, or material, plant/soil matrix compromised. | | COG RSAT |
| only c | Grade (Left) | 10 9 8 7 6 5 4 3 2 1 0 | 0 | |
| | Grade (Right) | 10 9 8 7 6 5 4 3 2 1 0 Avg.Score | | |
| re for | | | | |
| Score | or | CONDITION CATEGORY GRADE or SCORE Optimal Suboptimal Poor | aight s bank cs SVAP k has bank cs SVAP gage 10; Barbour, et al., 1999 EP. 0 3 0 3 Score 3 | |
| Enter | 1c. Channel Sediments or | >50% gravel or larger substrate; 30-50% gravel or larger substrate; 10-29.9% gravel or larger Substrate is uniform sand, silt, clay, | | |
| ш | Substrate Composition | gravel, cobble boulders; dominant substrate type is gravel or larger; stable moderately stable gravel with some finer sediments; stable moderately stable gravel, but may still be a | | |
| | Grade | | 3 | |
| 2 | WATER APPE | RANCE: Clarity or Visibility | [| |
| | | CONDITION CATEGORY GRADE or SCORE | | |
| | | Optimal Suboptimal Marginal Poor Very clear, or clear but tea-colored. Occasionally cloudy, especially after Considerable cloudiness Very turbid or muddy appearance most | | |
| | | objects visible at depth 3-6 feet (less objects visible at depth 1,5-3 ft; may visible to depth 0,5-1,5 ft; slow moving water may be bright-green: | | |
| | Water Clarity | surface. To noticeable film on submerged objects or rocks. have slightly green color, no oil sheen on water surface. So we sections may appeal peagreen; bottom rocks or sumerged objected covered with film. | | SVAP |
| | Grade | | | |
| | | | | |
| 3 | PRESENCE O | AQUATIC VEGETATION: Presence and Percent Coverage | | |
| | | CONDITION CATEGORY GRADE or SCORE | | Newton, |
| ល | 1 | Optimal Suboptimal Marginal Poor Clear water along entire reach; Fairly clear or slightly greenish water along entire Pea green, gray, or brown water along | | |
| Score for Only One Variable | 3a. Nutrient Enrichment | Clear water along entire reach; diverse aquatic plant community includes low quantaties of many species of macrophyles; little algal growth present. Clear water along entire reach; moderate algal growth on stream substrates. Green gray, or brown water along entire reach; dense stands of growth on stream substrates. Species of macrophyles; little algal growth present. Clear water along entire reach; moderate algal growth on stream substrates. Clear macrophyles; abundant algal growth, especially during warmer months. | | USDA/ NRCS SVAP |
| or Ö | Grade | 10 9 8 7 6 5 4 3 2 1 0 | 1 | |
| are f | | CONDITION CATEGORY GRADE or SCORE | | Petersen |
| SC SC | or | Optimal Suboptimal Marginal Poor | | et al., |
| Enter | 3b. Aquatic Vegetation | When present, aquatic vegetation consists of moss and patches of algae. Algae dominant in pools, larger Algal mats present, some larger plants along edge. Algal mats present, some larger plants, few mosses Algal mats cover bottom, larger plants dominate the channel or NO algae present due to unstable substrate. No water = zero. | | 1992 RCE form No. 13 |
| | Grade | 10 9 8 7 6 5 4 3 2 1 0 | | |
| | | | | |

| | | | | | | CORE | E or S | GR. | ATE | ITION C | OND | C | | | | | | | | | | | | | |
|-------|--|--|---------|---------------|------|---|------------------|-------|--------|---|------|----------------------------|------------------|------------------|-------------------|----------------------|-------------------------|----------------|--------------------------------|---------|--|--|--|--|--|
| | | Poor | | | Т | roinal | | Ī | | uboptim | | | | | imal | Opt | | | | | | | | | |
| | Fine organic sediment - black in color and foul odor (anaerobic) or no sediment present due to excessive scouring | | | | | No leaves or woody debris; coarse and fine organic matter with sediment. | | | | nd wood s oris wilho | | | boow | | of leav sedime | M | | | | | | | | | |
| | 0 | 1 | T | 2 | | 3 | 4 | | T | 6 | T | 7 | 8 | | 9 | 1 | 10 | + | Grade | C | | | | | |
| | | | | | | | | | | | | 7000 | Zinoria | diata | Immon | word | CDNI- D | | ANDUSED | Ē | | | | | |
| | | ATTERN: Beyond Immediate Riparian Zone CONDITION CATEGORY GRADE or SCORE | | | | | | | | | | | | | Ē | AND 00011 | 1 | | | | | | | | |
| | | | | | | | | GR | | | | CI | | | | | | 1 | | | | | | | |
| | | Poor | | , | | rginal | | | | uboptim | | | | | imal | | L- | | | | | | | | |
| | ops | row cro | viaini | P | but | w crops and ome wooded be present bu ed patches | ture; s s may | | | it pasture ind swam crops | | | prest, natura | ig of f nd/ör | airie, a ands. | tive pra | Undistur ristine na | P | | | | | | | |
| | 0 | 1 | 1 | 2 | - | 3 | 4 | + | | 6 | T | 7 | 8 | [| 9 | T | 10 | + | Grade (Left) | 1 | | | | | |
| | 0 | 1 | 1 | 2 | - | 3 | 4 | 1 | | 6 | - | 7 | 8 | | 9 | 1 | 10 | 5 | Grade (Right) | | | | | | |
| 1 | Avg.Score | | | | | | | | | | | | | | | | | | | Г | | | | | |
| | | ····· | | ····· | | | | | | | | | Υ: | INUL | CONT | AND (| WIDTH | DNE | RIPARIAN ZO | 6 F | | | | | |
| | | | | | | 0005 | | | ATT | TION | | | | | | | | - | | | | | | | |
| | | Poor | | r | | roinal | | GR. | | UTION C | | | | | imal | Ont | ····· | $\cdot \vdash$ | 6a. Riparian | | | | | | |
| | notors (natural | | | Width of ripa | 12 | arian zone 6-12 | | t v | | in zone 12- | | Width of n | s (1-2 | mete | | | Midth of ri | | Zone Width | | | | | | |
| | live channel talion due to :s. | | le ripa | width), litt |), | /3-1/2 active dih vegetated), human activities | nnel wic | y i | s have | el width w/i n activities apacted zon | huma | 1 active of grasses), i | | es hav | activiti | | hannel wid grasses), | · I | (from stream edge to field) | | | | | | |
| | 0 | 1 | 1 | 2 | - | 3 | 4 | 1 | T | 6 | T | 7 | 8 | [| 9 | T | 10 | - | Grade (left) | C | | | | | |
| | 0 | 1 | | 2 | | 3 | 4 | 1 | | 6 | | 7 | 8 | | 9 | | 10 |) | Grade (Right) | C | | | | | |
| | Avg.Score | | | | | 0.000 | | | | | | | | | ····· | | | | | | | | | | |
| | | Poor | | r | | rginal | | GR | | UTION C | | | | | imal | | | - | | | | | | | |
| | nk vegetation | | | Less Ihan | | streambank | | + | | mbank veg | | 75-90% | es or | ture tr | | | >90% pla | h | 6b. Riparian | | | | | | |
| | lly of pasture | | | | | e vegetation of mixed grasses | | | | along char | | | | | | | hrubs, pra | | Zone | ł | | | | | |
| | ibs; low plant ed with gullies | | | | | young tree or cies; breaks | | | | ; disruption | | | from | | | ine intac ing/mov | nparian za | | Vegetation | | | | | | |
| | | ng its leng | | | es | th some gullies | uent wil | | | melers, | | | | | | | 3.41 | | Protection/ | | | | | | |
| | | | | | rs. | very 50 meters. | scars e | a | | | | | | | | | | s | Completenes | ľ | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1 | | 2 | | 3 | 4 | | | 6 | | 7 | 8 | r | 9 | | 10 | _ | Grade (Left) | - | | | | | |
| | 0 | 1 | | 2 | | 3 | 4 | 1- | | 6 | -+ | 7 | 8 | | 9 | | 10 | 5 | Grade (Right) | | | | | | |
| 2 | Avg.Score | | | • | | <u></u> | | | | | | | | . | | * | | · | X | | | | | | |
| | 1 | | | | | | - | _ | | ~ | | | | | | | | | | | | | | | |
| 0,187 | ssible Score | stal Pos | ore/T | = Total Scr | ay = | inacily Index | on Ca | ~ *** | | | | | | | | | | | | 1 | | | | | |

| /ARIABLES | 1 EL OW DE OF | | | | 05\05\200 | | Highway 3 | a Bridge | ····· | | | | SCORE |
|-----------|----------------------|--------------------------------------|----------------------------|----------------|---------------|----------------------------------|---------------------------------------|----------------|--|-------------|---------------------|-----------------------------------|-------|
| | 1 FLOW REGI | | Perennial | | Intermitte | ent w/ Pere | nnial Pools | Inter | mittent | | Epheme | ral | - |
| | Grade | 10 | 9 | 8 | 7 | 5 | 5 | 4 | 3 | 2 | 1 | 0 | 4 |
| | | SUBSTRATE/A | | | | | | | | | | | - |
| | 2 CT IL AURAL | | Optimal | | 1 | Suboptima | | Mar | ginal | | Poor | | - |
| | | Within stream | | | | am bed, 30-5 | | Within stream | n hed, 10-30% | | | pital features | 1 |
| | | coverage by s favorable for sti | | | | nabital feature faunal coloni | | | stable habitot able for stream | | | tat is obvious; or lacking; | |
| | | and/or fish/amph | ibian cover. I | Aost habitat | fish/amphi | blan cover. N | Aany habitat | faunal colon | ization and/or | concrete | lined chan | nels. Habitat | |
| | | features non lu include snags, s | | | | t transient. (S | | | n cover; habitat ay be less than | | | rried or lacking, nay be flat, | · |
| |] | banks, roots, col | bble, rocks, pe | ersistent leaf | | components | | desirable, sul | bstrate may be | onacine | | toj ne not. | |
| | | packs, pools ar habitat at a sta | | | | | | | sturbed. (See | | | | |
| | | 1120121 21 2 30 | ige to anow of | nomeanon | | | | | mponents.) | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | · · · · · | | | | | ····· | |
| | Grade | 10 | 9 | 8 | 1 / | 6 | 5 | 4 | 3 | 2 | <u> . 1</u> | 0 | 11 |
| : | 3 STREAM BO | TTOM SUBSTR | ATE: Pool S | ubstrate C | haracterizat | ion | | | · | | | | 1 |
| | | | Optimal | | | Suboptima | | | rginal | | Poor | |] |
| | | Mixture of substr and firm sand p | | | | soft sand, m | | | r or sand bollom; rool mal; no | | | drock, no root vegetation. | |
| | | | vegetation co | | | i submerged | | | i vegetation. | 11141 01 3 | oomorgeo | vegennen. | |
| | | | | | | present. | | | | | | | |
| | (| | | | | | | | | | | | |
| | Grade | 10 | 9 | 8 | | 6 | 5 | 4 | 3 | 2 | 1 1 | 0 | |
| | Grade | 10 | <u>_</u> | <u> </u> | · | 1 | 1 0 | 44 | 1 | <u> </u> | <u> </u> | | |
| | 4 POOL VARIA | | | | | | | | | | | |] |
| | | Even mix of lar | Optimal | mo doop | Majarity | Suboptima of pools large | | | rginal Is much more | Moloriu e | Poor | hall-shallow or | 4 |
| | | small-shallow, s | | | Majoray c | few shallow | | | an deep pools | majority o | pools abs | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | 1 | | | |
| | | | | | | | | | | | | | |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 |
| | | DEPOSITION/SC | | 1 | | | | | -1 | 1 | | | |
| | | <5% of channel l | Optimal | | E 20112 - 11- | Suboptime | | | rginal | | Poor | bollom in a state | _ |
| | | | deposition. | oy scoul of | Scour at co | nstrictions and | weive grades | | led by scour or losits and scour of | | | yearlong. Pool | |
| | | | | | steepen. | Some deposit | ion in pools | | constrictions and filling of pools | | | due to heavy sive scouring | |
| | | ĺ | | | | | | Benda, Gon | initig of pools | | | | |
| | | | | | | | | | | | | | 1 |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 | 0 | |
| | | | | | | | · · · · · · · · · · · · · · · · · · · | | | | | | |
| I | 6 CHANNEL F | | Optimal | | | Suboptima | | | rginal | ····· | Poor | | - |
| | | Water reaches | | ooth lower | Water fills | >75% of the | | | 25-75% of the | Very little | | e channel and | - |
| | | banks: <5% | of channel sul | ostrate is | <25% (| of channel su | bstrate is | | nel and/or riffle | mostly pre | | inding pools; o | r |
| | | | exposed | | | exposed | | substrates are | mostly exposed | 1 | stream is | ary | |
| | | 1 | | | 1 | | | 1 | | | | | 1 |
| | | | | | | | | | | | | | |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 |
| | 7 CHANNEL A | | Ontimal | | 1 | Cubent | | | (m) m l | 1 | Der | | 4 |
| | | Channelization | Optimal , alteration, o | r dredoino | Some # | Suboptima eration or cha | | | rginal channelization | Banks sho | Poor red with ta | abion, riprap, o | 7 |
| | | absent or min | imal; normal a | ind stable | prese | n, usually ad | jacent to | may be | extensíve; | concrete. | Concrete | or riprap lined | |
| | | stream meand stormwater in | | | | ures, (such a or culverts); | | embankments | including spoil | | | eam babital sy slormwater r | |
| | | i and the second second | | , -increitar | past altera | tion, (I.e., chi | annelization) | present on bol | th banks; normal | other in | puts. Ove | r 80% of the | |
| | | J | | | | esent, but str ly have recov | | | meander patiern | stre | ham reach | altered. | |
| | | | | | | n is not prese | | | ered. Alleration or inputs may be | | | | |
| | | | | | | from stormwi | | extensive. 40 | -80% of stream | 1 | | | |
| | | | | | | | | i reach | allered, | L | | | |
| | | | | | | inputs. | | 1 | | 1 | | | |
| | | | | | | inpuls. | | | | | | | |
| | | | | | | inpuls. | | | | | | | |
| | Grade | 10 | 9 | 8 | 7 | inputs. | 5 | 4 | 3 | 2 |]1 | 0 | 1 |
| | Grade 8 CHANNEL S | | 9 | 8 | | - | 5 | 4 | 3 | 2 |]1 | 0 | 1 |

 \bigcirc

| | | The bends in the stream length 3 to was in a straigh braiding is consi- plains and other | o 4 limes lon I line, (Note dered norma r low-lying a | nger than il il e - channel al in coastal reas, This | stream l | ength 2 to 3 t it was in a str | | increase the times longer to | in the stream stream 1 to 2 han if it was in a ht line | | zed for a lon | vay has been g distance | | Barbo al. 199 RBA # Parso al., 20 |
|----|----------------|---|--|---|--|--|--|---|--|---|--|--|----------------------|---|
| | | parameter is no | ot easily rate areas). | ed in these | | | | | | | | | | AUSR |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0 | |
| 9 | 9 BANK STAB | ILITY (SCORE EA | CH BANK |) | | | | | ty | | | | | |
| | | Banks stable; evi | Optimal | sion or bank | htodecate | Suboptim | al equent, small | | rginal stable; perennial | Linstable: r | Poor | vegetation at | | Barbo |
| | | failure absent or affected), perennia no raw or undercu outside of mea recently exposed i | minimal; (< al vegetation t banks (son inder bends | 5% of bank 1 to waterlino; ne prosion on O.K.); no | areas of e 5-30% of I mino undercutti waterline | rosion mostly bank in reach r erosion and ag; perennial e in most place | healed over. has areas of or bank vegetation to | vegetation to t (mainly scourd lateral erosion hard point outcrops) an elsewhere; 30 reach has area bank underc exposed tree m hairs commo | waterline sparse of or stripped by), bank held by (frees, rock d eroded back +50% of bank in as of erosion and uting; recently pots and fine rooi n; high erosion luming floods | waterline banks; rec common; undercu eroded are along stra obvious ba bank | : severe cros cently expose tree falls and it trees comm eas; "raw" an light sections | ion of both ad tree roots i/or severely non; many eas frequent and bonds; ; 60-100% of | | al. 19 RBA Parso al., 20 AUSR USAC Norfol Distric 2004 #3; Sc and B |
| 1 | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 3 | from Hensi |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | Avg.Score | 0 | 2 | |
| 10 | 10 VEGETATIV | E PROTECTION | SCORE F | ACH BANK | | | | | | | | | 1 | |
| | | (| Optimal | | 70.008 | Suboptim | | | rginal | Loop that | Poor | ntraamhank | 1 | Bache |
| | | More than 90% of and immediate rij native vegeta understory s macrophytes; veg grazing or mowing almost all plants a | barian zones lion, includis hrubs, or no etative dism g minimat or | s covered by ng trees, inwoody iption through not evident; | covered one cla represen not aff potential than one | by native ver ass of plants led; disruption fecting full pla | is not well- n evident but int growth extent; more ptential plant | surfaces cover disruption obv bare soil or o vegetation cor one-half of th | ne streambank ed by vegelation nous; patches of dosely cropped mmon; less than e potential plant pht remaining. | surfaces disruption is very hi removed t | covered by of streambar gh; vegetatio | nk vegetation In has been ers or less in | | Barbo al. 19 RBA 1 Parso al., 20 AUSF KDWI 2000; |
| | | | | | | | | | | | - r | | | Peter |
| | Grade Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 Avg.Scor | 0 0 | 1 | |
| 11 | 11 RIPARIAN Z | ONE (SCORE EA | |) | ······ | | | | | | | | 1 | |
| | | Width of ripatian activities (I.e., par cuts, lawns, or cu | king lots, roi | adbeds, clear- | human ac | | 12-18 meters mpacted zone | Width of ripa meters; huma | rginal nian zone 6-12 n activilies have ne a great deal. | little or no. | Poor riparian zone riparian vege numan activit | dation due to | | Barbo al., 11 RBA Parso al., 20 |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 | 1 0 | 3 | AUSF |
| | Grade | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 1 | 0 | 1 |] |
| | | | | | | | | | | | Avg.Scor | e; | 2 | |
| 12 | 12 RIPARIAN H | ABITAT CONDIT | ION (SCO) Optimal | RE EACH B/ | ANK) | Suboptim | | 1 149 | rginal | 1 | Poor | | | Norfo |
| | | Tree stratum (db) >60% tree canopy layers may ini herbaccous, a mosses/lichens an lhe high end o additional layers s end if ≤1 additio | h>3 inches) cover. (Ad clude: saplin nd leaf litter id woody de f Excellent r are present. | Iditional forest ing, shrub, including bris.) Score at ange if >2 Score at low | with 30% (See examples Score at t if ≥2 ad present additiona | um (dbh>3 in to 60% free Excollent Ca of additional he high end iditional fores t. Score at ic | ches) present canopy cover, legory for forest layers, of Good range it layers are w end if ≤1 s are present. /ilh stomps | Tree stratum present, with < cover. (See E for example forest layers.) end of Fa additional lay Score at additional lay OR area co maintained dense herb | (db)r-3 inches) 30% inches) 30% inches) 30% inches) 30% inches Score at the high range if ≥2 ers are present low end if ≤1 ers are present on sists of non- and naturalized accous and/or vegetation. | surface lands, culv maintai denuded | slum absent; s, croplands, | mine spoil is, mowed and ous areas, lively grazed | 3 | Form |
| | Grade | 10 10 riparian areas a | 9 Iong each | 8 stream bank | 7 | 6 dition Cater | 5 Tories and C | 4 | 3 es using the at | 2 Dive descri | 1 iptors | 0 Ensure I | Below he sums of | |
| | 2. Determin | e square footage %Riparian Area | for each b | by measuring | g or estim | ating length | and width, h) and Scor | Land Use GIS e for each ripa | maps may be | used for th n the block | nis, | %Ripar equ | ian Blocks al 100 | |
| | Right Bank | %Riparian Area Score | a di serie ini a di | | | | | | | | 2 | 100 | | - |
| | THUR DANK | SubCl | | 0 | | 0 | ····· | | 0 | | 2 | 1 | L | 1 |
| | L | Managine Are- | ļ | | ļ | 60 | | | 40 | 1 | | 100 | <u></u> | - |
| | Left Bank | %Riparian Area Score | | | | 5 | | | 3 | 1 | | 100 | 1 | 1 |
| | | SubCl | 1 | 0 | L | 3 | | L | 1.2 | SubCI-10 | 0 %RA*Score | C 0 011 | | - |
| | | | | | | | | | | 134001=[| ALCOLE WAR | 3 1.011 | 1 | .) |
| | | | | | | | | | | Rt Bank (| CI> | 4.2 | Cl 3.1 |] |

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ATTACHMENT C

BRIEF DESCRIPTION OF THE ECOLOGY FOR THE IDENTIFIED SPECIES

INSECTS

Mayflies (Ephemeropterans) (all larvae identified)

Baetidae are widespread and abundant occurring in a variety of streams and also in permanent and temporary ponds or littoral zones (areas of shallow water where light penetrates to the bottom allowing for rooted plant growth) of lakes.

Caenidae are widespread and common in a variety of lotic (running or flowing streams) and lentic (standing water) habitats, including slow-moving streams of all sizes, spring seeps, marshes, swamps, ponds, and lakes. They frequent sediments and often are partially covered with silt. They are generally more tolerant of lower levels of dissolved oxygen.

Heptageniidae are widespread and abundant in streams, wave-swept shorelines of lakes, or in vernal (in the Spring) ponds adjacent to streams. They typically inhabit rocks, wood, debris, and other strata to which they cling.

Flies, midges, and mosquitoes (Dipterans) (all larvae identified)

Ceratopogonidae or biting midges typically live in moist terrestrial habitats; however, many species do occur in aquatic habitats that include marshes, swamps, ponds, lakes, and streams.

Chironomidae or midges are the largest family of aquatic insects. They inhabit all types of permanent and temporary aquatic habitats. Larvae are an extremely important part of the aquatic ecosystem serving as prey for other organisms. Larvae are quite tolerant of lowered levels of dissolved oxygen including some species surviving in areas where oxygen levels are undetectable (blood worms – which were identified at all sampling locations). The larvae are primarily herbivores and detritivores feeding on fine bottom particles.

Culicidae or mosquitoes are common and widespread usually occurring in shallow, nonflowing or semi-flowing habitats such as swamps, shallow temporary or permanent ponds and marshes, and heavily vegetated margins of lakes and streams. They are not found in moving water or water subjected to wave action. The reason for this is that they obtain oxygen from use of breathing tubes at the water surface and wave action and current disrupt the water surface inhibiting their ability to obtain oxygen. Mosquitoes often dominate the insect community of temporary ponds and marshes, especially those that flood in spring and summer. The mosquito larvae feed on organic debris and microorganisms.

Dolicopodidae or long-legged flies develop in a wide variety of lotic and lentic habitats. Little information is available for this family.