Chapter 4: Impacts of Proposed Action and Alternatives

Estimating the impacts of each alternative is based largely on the relative width of the mowing/underbrushing zone versus the habitat zone in each alternative. From a programmatic view (i.e. combining Grapevine and Lewisville Lakes into a single analysis), there are a total of approximately 26,669 acres between the Federal property line and the conservation pool elevation. Each alternative analyzed involved a different combination of these two zones, but always totaled to 26,669 acres. While more than twenty alternatives were initially analyzed, they fall into 3 major categories: the status quo alternative (i.e. continuing the current adjacent landowner activities guidelines); those that allow less mowing/underbrushing than current guidelines; and those that allow more mowing/underbrushing than current guidelines. A sub-category of alternatives included a conceptual analysis of either continuing with the current access path guidelines (each adjacent landowner can obtain a permit to maintain an access path to the water's edge) or reducing the number of access paths by allowing only "community" access paths where neighborhoods share a common access path. This analysis had to be conceptual, since there is no programmatic method to determine the specific number of individual or community access paths that might eventually exist at the two lakes. While that specific number can be considered incomplete or unavailable, it did not prevent a reasoned choice among alternatives since for each alternative, a conceptual analysis can forecast the effects of many individual access paths versus fewer community paths. Additionally, any new pedestrian access paths would have to be community access paths authorized by written permit, thereby allowing USACE to account for the number of permitted access paths.

Alternative 1, the no action or status quo alternative, has approximately 1,782 acres in the mowing/ underbrushing zone (some, but not all land in this zone is frequently mowed and underbrushed, whether a permit has been issued or not). The mowing/underbrushing zone represents approximately 6.4% of the study area. Additionally, there are approximately 24,956 acres in the habitat zone, that area between the mowing/underbrushing zone and conservation pool elevation (93.6%). Some of this area, while outside the permitted mowing/underbrushing zone, is frequently mowed and underbrushed. Finally, the status quo alternative allows adjacent landowners to request a permit for a community access path.

Alternatives 2, 3 and 4, the no mowing/underbrushing, the fire safety, and the minimum habitat buffer alternatives, would both result in less mowing/underbrushing activities than currently allowed. These alternatives would reduce the allowable mowing/underbrushing area to 0 acres of the study area under alternative 2, and approximately 1,012 acres of the study area (3.8%) under alternative 3. Alternatives 2 and 3 also allow adjacent landowners to request a permit for a community access path.

Alternatives 5, 6 and 7, the expanded mowing/underbrushing, mow all, and narrow shoreline variance alternatives, would result in more mowing/underbrushing activities than currently allowed. These alternatives would increase the current allowable mowing/underbrushing area (1,782 acres or 6.8% of study area) to 3,309 acres (12.4%) of the study area under the expanded mow alternative, to 26,669 acres (100%) of the study area under the mowing/underbrushing all areas alternative, or to 1,926 acres (7.2%) of the study area under the narrow shoreline variance alternative. These alternatives also allow adjacent landowners to request a permit for a community access path.

Most of the environmental effects analyzed in this environmental assessment, but not all, are proportional to the amount of mowing/underbrushing versus habitat area allowed under each alternative (see Table 4-1).

Table 4-1. Acreage and percent of study area within mowing/underbrushing zone and habitat zone for each alternative.

	Area, acres		Percent	
	Zone 1: mow zone	Zone 2: habitat zone	Zone 1: mow zone	Zone 2: habitat zone
Alternative 1 No action	1,782	24,413	6.8%	93.2%
Alternative 2 No mow	0	26,195	0.0%	100.0%
Alternative 3 Fire safety	1,063	25,133	4.1%	95.9%
Alternative 4 Minimum buffer	1,742	24,453	6.7%	93.3%
Alternative 5 Expanded mow	3,369	22,826	12.9%	87.1%
Alternative 6 Mow all	26,195	0	100.0%	0.0%
Alternative 7 Narrow shoreline variance	1,926	24,269	7.4%	92.6%

A. Potential land use and land cover changes

A result of an earlier programmatic environmental assessment for Lewisville Lake (U.S. Army Corps of Engineers, 1999) was that USACE determined that there would be no net gain or loss of any land use category at the lake. Grapevine Lake is managed in the same manner. None of the alternatives examined in this environmental assessment are proposing to change any land use classifications, nor would they affect any land use classifications. The alternatives considered in this environmental assessment would affect only the actions conducted in the Natural Resource Management Areas of both lakes. Lands designated as wildlife management areas account for approximately 59% of the total lands at Grapevine and Lewisville Lakes while designated recreational lands account for approximately 35%. Property owners adjacent to parks would still have to apply for a permit for any activities on Federal lands on a case-by-case basis so that USACE could ensure that permits did not interfere with park operations as required by regulations.

Figures 4-1 and 4-2 provide a representation of existing land cover at both lakes. The primary effects on land cover are based upon the width of the mowing/underbrushing and the habitat zones. Each alternative has a set mowing width (from 0 to 100 feet) except for the no mow and mow all alternatives. Table 4-2 provides acreages of each land cover class (woody, herbaceous, maintained grasses, barren and other) in each zone (mowing/underbrushing, zone 1; habitat management, zone 2) for each alternative.

B. Physiography (soils)

1. Activities in the Mowing/Underbrushing Zone

The minimum amount of leaf area necessary to ensure a healthy root system is called the basal zone of the grass, which provides the minimum area needed to photosynthesize nutrients for the roots (Owen et al., 1998). Under chronic mowing, the basal zone of grasses is frequently compromised and the plant cannot produce an adequate supply of food (Turner et al., 1993). Close-cropping seriously retards root development

(Phillips Petroleum Company, 1963), which leads to inadequate stabilization of soil particles, and sheet-and-rill soil erosion across land surfaces and shoreline erosion at the land-water interface can occur (Morgan, 1979). Observations along the shoreline of both Grapevine and Lewisville Lakes confirms that in areas with little or no vegetation, erosion is most severe. However, there are areas that have been cultivated into Bermuda grass lawns, and regularly mowed all the way to the shoreline (also noted in public workshops and site visits), that are not eroding. This is mainly due to the location of these types of areas. Most of these Bermuda grass lawns are located in protected coves or out of the prevailing winds, where erosion would be minimal. Sheet-and-rill erosion is likely to be higher in these Bermuda grass areas than would occur under the native vegetation of Cross Timbers or Blackland Prairies. None-the-less, the most erosion resistant shorelines at both lakes were those that have substantial amounts of tall vegetation such as buttonbush (*Cephalanthus occidentalis*) that grows at the shoreline, normally a few feet out into the water. This type of shoreline vegetation, several feet tall with dense canopy and stiff branches can break erosive wave action even when the lake fluctuates over several feet in elevation and has much deeper roots than mowed Bermuda grass.

If herbicides are allowed to control undesirable species, such as poison ivy (*Rhus radicans*), a wide variety of herbicides may potentially be utilized by adjacent landowners. Two commonly used herbicides that are used to control woody vegetation are Roundup® and Brush-B-Gon®. In soil, the half-life of glyphosate, the active ingredient in Roundup®, is 2 to 174 days. Glyphosate is degraded to amino methyl phosphonic acid (AMPA) by organisms in the soil and it, as well as AMPA, adsorbs to soil strongly (NPIC Technical Fact Sheet, 2000). Depending on soil type, the active ingredient in Brush-B-Gon®, Tyiclopyr, exhibits a half-life ranging from 1.1 to 90 days (NPIC Technical Fact Sheet, 2002). A study conducted in Minnesota by USACE revealed a mean half-life of 5.4 days for Triclopyr, while its main metabolite, 3, 5, 6-trichloropyridinol (TCP), had a mean half-life of 11.0 days (Petty et al., 1998).

The habitat management prescriptions under consideration at Grapevine and Lewisville Lake recommend that any herbicide use be pre-approved by USACE, applied on relatively small areas, and only by licensed herbicide applicators to assure that significant impacts to soils do not occur.

For those times and areas that soils are subjected to herbicidal treatments, minor adverse impacts would involve chemical residues that would last between approximately 1 to 200 days after application of herbicides, depending on the herbicide. Additionally the entire area may be subjected to mowing that may induce increased sheet and rill erosion. The degree of impact of each alternative would be proportional to the width of the mowing/underbrushing zone: from 0 acres for the no mowing/underbrushing alternative, to 3,369 acres for the expanded mow alternative, to 26,195 acres if the entire study area were opened to mowing and underbrushing.

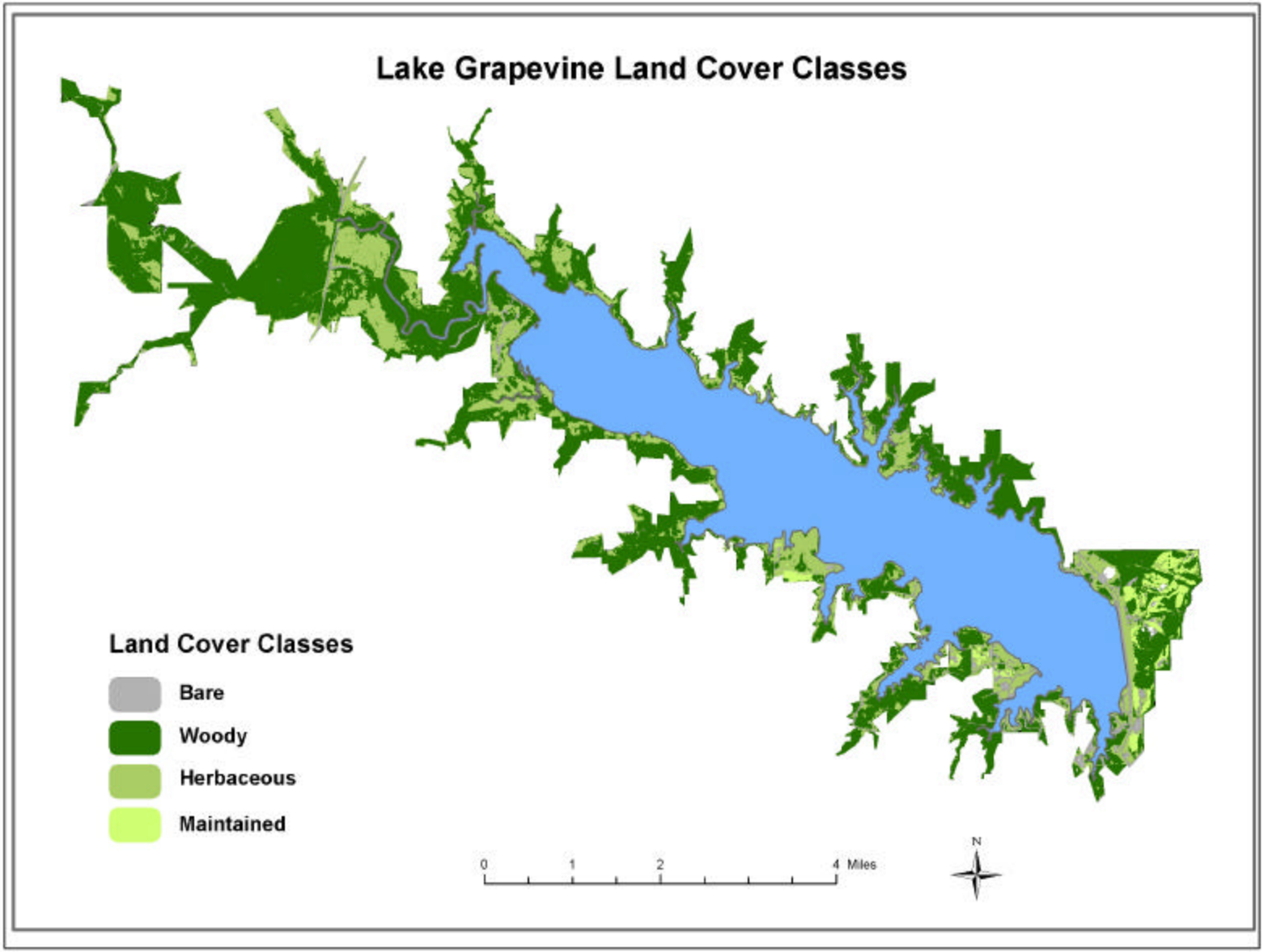

Figure 4-1. Land Cover Classes at Grapevine Lake

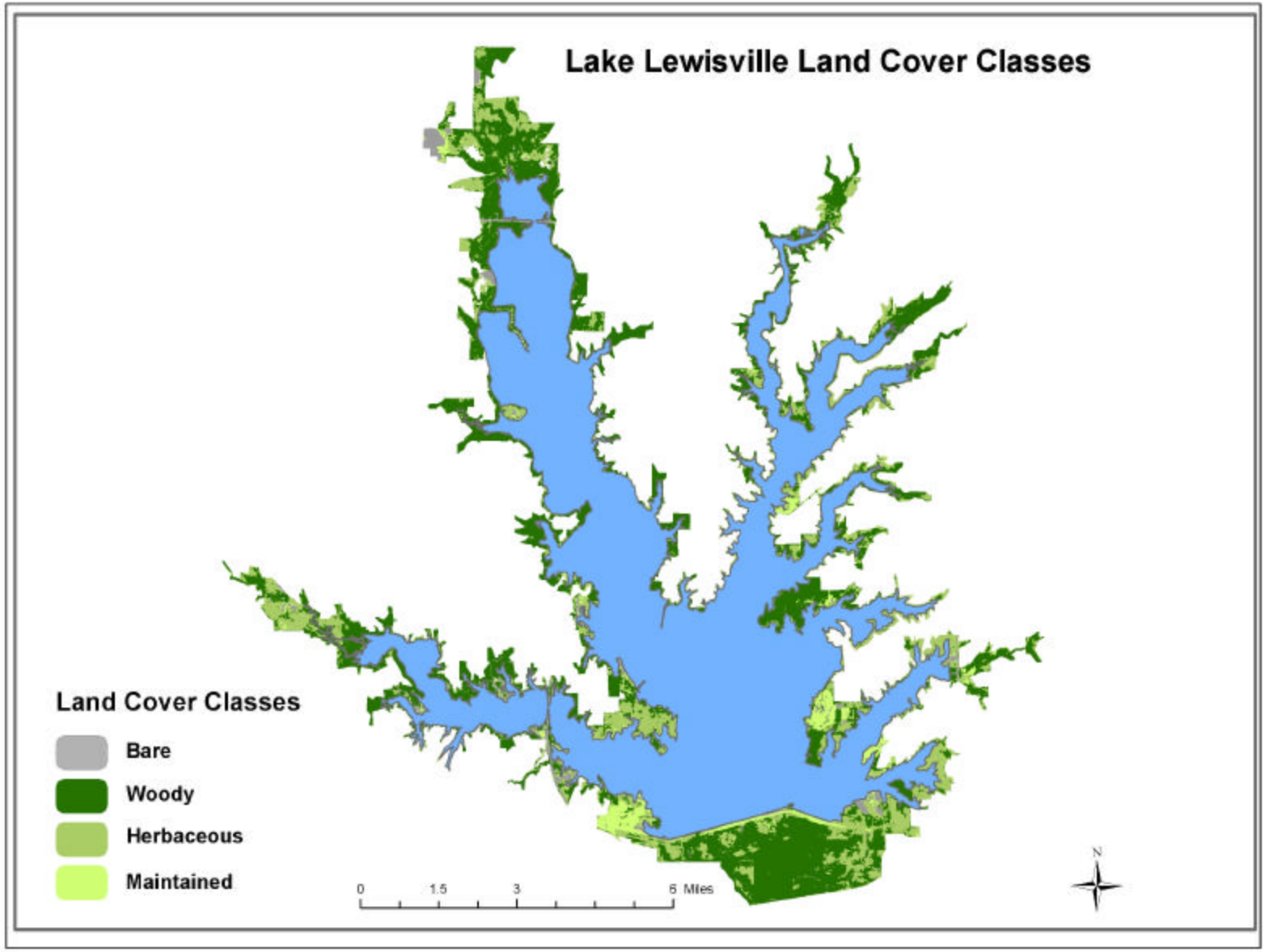

Figure 4-2. Land Cover Classes at Lewisville Lake

Table 4-2. Land cover acreage in mowing/underbrushing and habitat zones for each alternative.

Effect on land cover	Mowing/underbrushing Zone (acres)						Habitat Zone (acres)						OVERALL TOTAL	PERCENT MOW
	Wooded	Herbs	Maint. grasses	Barren	Other	TOTAL	Wooded	Herbs	Maint. grasses	Barren	Other	TOTAL		
Alternative 1 No action	994	511	108	45	124	1,782	14,521	7,374	1,447	968	102	24,413	26,195	6.8%
Alternative 2 No mow	0	0	0	0	0	0	15,514	7,886	1,556	1,013	226	26,195	26,195	0.0%
Alternative 3 Fire safety	597	290	56	29	90	1,063	14,917	7,596	1,500	984	136	25,133	26,195	4.1%
Alternative 4 Minimum buffer	977	501	100	41	123	1,742	14,537	7,385	1,456	972	103	24,453	26,195	6.7%
Alternative 5 Expanded mow	1,954	984	197	88	146	3,369	13,561	6,901	1,359	926	79	22,826	26,195	12.9%
Alternative 6 Mow all	15,514	7,886	1,556	1,013	226	26,195	0	0	0	0	0	0	26,195	100.0%
Alternative 7 Narrow shoreline variance	1,057	559	137	50	124	1,926	14,458	7,326	1,418	963	102	24,269	26,195	7.4%

2. Activities in the Habitat Zone

If undesirable species are subjected to herbicidal control in the habitat zone, similar impacts to soils as those described for the mowing/underbrushing zone may occur (i.e. chemical residue would remain in the soils for periods of 1 to 200 days). The degree of impact of each alternative would be proportional to the width of the habitat zone.

Many studies indicate the efficacy of vegetated buffer zones to trap sediment and decrease erosion near aquatic resources, such as rivers, streams, and lakes (Tattari et al., 2003). Buffer zones ranging from 10 to 200 feet have been recommended to effectively trap sediment and maintain shore stabilization (see, for example, Nieswand, 1990 and Wisconsin Department of Natural Resources).

Research conducted on buffer zones reveals a variety of total suspended solids (TSS) removal at different buffer widths. Forested riparian buffer strips exhibited the greatest TSS removal, with 90% of suspended solids removed at buffer widths of 62 feet and 94% removal at 197 feet (Peterjohn and Correll, 1984). Grassed buffer strips removed less TSS, though still with considerable amounts: Reductions of 79 % in buffer widths from 66 to 98 feet (Young et al., 1980); and TSS removal in buffer widths of 30 feet at 84% (Dillaha, 1989) and 85% (Ghaffarzadeh et al., 1986). Table 2-1 compares different buffer widths and their TSS removal success.

Table 4-3 shows a comparison of how each alternative modification of adjacent landowner guidelines affects soils as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-3. Each alternative's relative effect on soils as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on soils	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential adverse effects on soils from less mowing and large decrease in potential sheet-and-rill erosion and herbicide use in mow zone	7% increase (small) in potential beneficial effects on soils from less mowing with large increase in protection from shoreline erosion and nonpoint pollution in habitat zone	B
Alternative 3 Fire safety	40% decrease (moderate) in potential adverse effects on soils from less mowing and moderate decrease in potential sheet-and-rill erosion and herbicide use in mow zone	3% increase (small) in potential beneficial effects on soils from less mowing with small increase in protection from shoreline erosion and nonpoint pollution in habitat zone	b
Alternative 4 Minimum buffer	2% decrease (small) in potential adverse effects on soils from less mowing and small decrease in potential sheet-and-rill erosion and herbicide use in mow zone	<1% increase (small) in potential beneficial effects on soils from less mowing with moderate increase in shoreline erosion and nonpoint pollution in habitat zone	b
Alternative 5 Expanded mow	89% increase (moderate) in potential adverse effects on soils from more mowing and moderate increase in potential sheet-and-rill erosion and herbicide use in mow zone	7% decrease (small) in potential protection from shoreline erosion and nonpoint pollution in habitat zone	A
Alternative 6 Mow all	1,370% increase (large) in potential adverse effects on soils from mowing and large increase in potential sheet-and-rill erosion and herbicide use in mow zone	100% decrease in potential protection from shoreline erosion and nonpoint pollution in habitat zone	A
Alternative 7 Narrow shoreline variance	8% increase (small) in potential adverse effects on soils from mowing and small increase in potential sheet and rill erosion and herbicide use in mow zone	<1% decrease (small) in potential protection from shoreline erosion and nonpoint pollution in habitat zone	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

C. Water Quality

1. Activities in the Mowing/Underbrushing Zone

As stated under the Physiography (soils) section frequent mowing can lead to soil erosion, which increases the turbidity of water. Likewise, if herbicidal control of undesirable species is allowed, runoff of herbicides residing on the soils after rainfall events may reach lakes, rivers or streams. In water, the half-life of glyphosate, the active ingredient in Roundup®, is less than 7 days (MSDS for Roundup®, 2002). As it and its metabolite, AMPA, adsorb strongly to soil, the potential for leaching into groundwater is low (NPIC Technical Fact Sheet, 2000). Triclopyr, the active ingredient in Brush-B-Gon®, degrades in water when exposed to sunlight and can last from 1 to 10 days depending on conditions (NPIC Technical Fact Sheet, 2002). In a study conducted by USACE, Triclopyr exhibited a half-life of 3.7 to 4.7 days while its metabolites, 3, 5, 6-trichloropyridinol and 3, 5 6-trichloro-2-methoxypyridine, had half-lives of 4.2 to 7.9 days (Petty et al., 1998).

Both Grapevine and Lewisville Lakes are designated for Aquatic Life Use, Contact Recreation Use, General Use, Fish Consumption Use, and Public Water Use, and therefore impacts to water quality from adjacent landowner guidelines are an important consideration. The degree of adverse impact on water quality, while still assumed to be minor due to restrictions on how herbicides are used, is proportional to the width of the mowing/underbrushing zone, and inversely proportional to the width of the habitat zone. A narrow mowing/underbrushing zone and a wide habitat zone would result in less water quality impact. A wide mowing/underbrushing zone and no habitat zone would result in more impact.

2. Activities in the Habitat Zone

If undesirable species are subjected to herbicidal control in the habitat zone, similar impacts to water quality as those described for the mowing/underbrushing zone may occur (i.e. runoff of herbicides residing on the soils after rainfall events may reach lakes, rivers or streams). The degree of impact of each alternative would be proportional to the width of the habitat management zone (from 0 acres for the mow all alternative to 26,195 acres for the no mow alternative.

As well as reducing total suspended solids (TSS) in the form of sediment, buffer zones also lessen the amount of nutrients, such as nitrogen and phosphorous, and other chemicals such as herbicides that can reach lakes, rivers and streams. Similar to TSS, forested riparian buffer strips result the greatest nitrogen and phosphorous removal, with decreases in phosphorus by 95% and as much as 100% of nitrogen in a 33-foot wooded strip (Vought et al., 1995). Results from grass buffer strips tended to be lower: a nitrogen removal of 84% and a phosphorous removal of 83% in widths 66 to 98 feet (Young et al.,1980); and reductions of 79% of phosphorous and 73% of nitrogen in grassed buffer strips 30 feet wide (Dillaha, 1989). Table 2-1 compares different buffer widths and their phosphorus and nitrogen removal success.

Although buffer zones act as a nutrient sink for most of the year, during the dormant season these buffer strips release phosphorous and other nutrients into the groundwater. Harvesting of plant biomass may reduce the amount of nutrients released during the dormant season (Osborne and Kovacic, 1993).

The removal of herbicides from runoff in buffer strips has also been researched. Studies with grass buffer strips in 15-foot widths removed 35% of herbicides, while 30 foot widths trapped 60% (Mickelson and Baker, 1993). In a riparian buffer, herbicide runoff was reduced by 95%, on average, in a 125-foot strip (Vellidis et al., 2002).

The impact of the habitat zone, working as a shoreline buffer, on water quality would be proportional to the width of the habitat zone. The wider the zone, the better the zone would be for reducing soil particles, nutrients and herbicides from reaching the lakes, rivers or streams.

Table 4-4 shows a comparison of how each alternative modification of adjacent landowner guidelines affects water quality as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-4. Each alternative's relative effect on water quality as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on water quality	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential adverse effects on water quality from mowing with large increase in protection of water quality from nonpoint pollution in mow zone	7% increase (small) in potential beneficial effects on water quality from less mowing with large increase in protection of water quality from nonpoint pollution in habitat zone	B
Alternative 3 Fire safety	40% decrease (moderate) in potential adverse effects on water quality from less mowing with moderate increase in protection of water quality from nonpoint pollution in mow zone	3% increase (small) in potential beneficial effects on water quality from less mowing with small increase in protection of water quality from nonpoint pollution	b
Alternative 4 Minimum buffer	2% decrease (small) in potential adverse effects on water quality from less mowing with small increase in protection of water quality from nonpoint pollution in mow zone	<1% increase (small) in potential beneficial effects on water quality from less mowing with moderate increase in protection of water quality from nonpoint pollution	b
Alternative 5 Expanded mow	89% increase (moderate) in potential adverse effects on water quality from mowing with moderate decrease in protection of water quality from nonpoint pollution in mow zone	7% increase (small) in potential adverse effects on protection of water quality from nonpoint pollution	A
Alternative 6 Mow all	1,370% increase (large) in potential impacts to water quality from mowing with large decrease in protection of water quality from nonpoint pollution in mow zone	100% increase (large) in potential adverse effects on protection of water quality from nonpoint pollution	A
Alternative 7 Narrow shoreline variance	8% increase (small) in potential impacts to water quality from mowing with small decrease in protection of water quality from nonpoint pollution in mow zone	<1% increase (small) in potential adverse effects on protection of water quality from nonpoint pollution	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

D. Wetlands

1. Activities in the Mowing/Underbrushing Zone

The potential for encountering fringe wetlands in the mowing/underbrushing zone at the Grapevine and Lewisville Lake shoreline is small. While the ecosystem based vegetation management prescriptions indicate that mowing and underbrushing in all wetland areas should be avoided, there is the potential that inadvertent adverse impacts might occur. There is an increased likelihood of encountering riverine wetlands as one travels up the tributaries draining into the main lake bodies, and those tributaries approach the Federal property line. Impacts to wetlands encountered in this zone would be proportional to the width of the mowing/underbrushing zone since mowing and underbrushing or applying herbicides to control undesirable species on or near these wetlands would adversely impact all wetland functions.

2. Activities in the Habitat Zone

The potential for encountering fringe wetlands in the habitat zone, including the shoreline, at Grapevine and Lewisville Lakes is also small. There is an increased likelihood of encountering riverine wetlands as one moves up the tributaries draining into the main lake bodies, and those tributaries approach the Federal property line. Impacts to wetlands encountered in the habitat management zone would be proportional to the width of this zone if herbicides are applied to control undesirable species.

Table 4-5 shows a comparison of how each alternative modification of adjacent landowner guidelines affects wetlands as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small, moderate and large. The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-5. Each alternative's relative effect on wetlands as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on wetlands	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential to encounter wetlands in mow zone	7% increase (small) in potential to encounter wetlands in habitat zone	b
Alternative 3 Fire safety	40% decrease (moderate) in potential to encounter wetlands in mow zone	3% increase (small) in potential to encounter wetlands in habitat zone	b
Alternative 4 Minimum buffer	2% decrease (small) in potential to encounter wetlands in mow zone	<1% increase (small) in potential to encounter wetlands in habitat zone	b
Alternative 5 Expanded mow	89% increase (moderate) in potential to encounter wetlands in mow zone	7% decrease (small) in potential to encounter wetlands in habitat zone	a
Alternative 6 Mow all	1,370% increase (large) in potential to encounter wetlands in mow zone	There is no habitat zone under this alternative.	a
Alternative 7 Narrow shoreline variance	8% increase (small) in potential to encounter wetlands in mow zone	<1% decrease (small) in potential to encounter wetlands in habitat zone	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

E. Biological Resources

1. Flora

a. Activities in the Mowing/Underbrushing Zone

Studies on mowing have indicated a multitude of effects on flora. For example, some experiments show mowing may allow the incursion of exotic species that out compete the native flora (Gibson et al., 1993). Other studies suggest diversity is maintained by mowing (Collins et al., 1998) or increases (Beltman et al., 2003). Effects on biomass are less conclusive as some studies support increases during the growing season (Penfound, 1964), while other studies show decreases (Beltman, 2003). Research regarding the removal of understory vegetation indicates no negative impacts on overstory species and an increase in diversity of herbaceous species (Horsley, 1994).

If undesirable species in the mowing/underbrushing zone are controlled with herbicides, adjacent landowners might hire licensed herbicide applicators who select herbicides such as Roundup® or Brush-B-Gon®. Roundup® is applied to the foliage of the plant, but is translocated throughout the vascular tissue, including the roots, eventually killing the plant. It will affect all plants contacted by the spray, including grasses (Monsanto, 2002). Brush-B-Gon® controls many annual and perennial broadleaf weeds, including poison ivy (NPIC Technical Fact Sheet, 2002). Since it also affects most broadleaf plants, care must be taken to protect these species.

Applying herbicides in the mowing/underbrushing zone may also adversely affect native and desirable species. Because the vegetation management prescriptions indicate that herbicides should only be applied to relatively small areas by licensed herbicide applicators, adverse impacts are expected to be minor. None-the-less, the degree of impact on flora in the mowing/underbrushing zone is proportional to the width of the mowing/underbrushing zone of each alternative. A narrow mowing/underbrushing zone would result in less impact to flora. A wide mowing/underbrushing zone would result in more impact.

b. Activities in the Habitat Zone

If undesirable species are subjected to herbicidal control in the habitat zone, similar impacts to flora as those described for the mowing/underbrushing zone may occur (i.e. removal of undesirable species), but the strategy would be to remove undesirable species so that native species could occupy the newly opened niche. Thus, it is considered a beneficial impact to native flora. To maintain aquatic habitat along streams, investigation of research indicates buffers should be 35 to 100 ft wide (Wenger, 1999). Buffer zones can increase plant diversity (Tattari et al., 2003), though woody buffer strips have the greatest native plant species richness (Paine and Ribic, 2002). Compared to disturbed areas, grassed buffer strips provided the best erosion control, but the lowest plant species diversity due to the domination of nondesirable species (Paine and Ribic, 2002). Another study concluded that buffers from 10 meters to 30 meters were necessary to conserve biological richness (Spackman and Hughes, 1994). Table 2-2 compares different buffer widths necessary to maintain species diversity.

Table 4-6 shows a comparison of how each alternative modification of adjacent landowner guidelines affects flora as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-6. Each alternative's relative effect on flora as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on flora	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential adverse effects of mowing and herbicide use on flora in mow zone	7% increase (small) in potential adverse effects of herbicide use on flora in habitat zone	B
Alternative 3 Fire safety	40% decrease (moderate) in adverse potential effects of mowing and herbicide use on flora in mow zone	3% increase (small) in potential adverse effects of herbicide use on flora in habitat zone	b
Alternative 4 Minimum buffer	2% increase (small) in potential beneficial effects of mowing and herbicide use on flora in mow zone	<1% decrease (small) in potential adverse effects of herbicide use on flora in habitat zone	b
Alternative 5 Expanded mow	89% increase (moderate) in potential adverse effects of mowing and herbicide use on flora in mow zone	7% decrease (small) in potential adverse effects of herbicide use on flora in habitat zone	A
Alternative 6 Mow all	1,370% increase (large) in potential adverse effects of mowing and herbicide use on flora in mow zone	There is no habitat zone under this alternative.	A
Alternative 7 Narrow shoreline variance	8% increase (small) in potential adverse effects of mowing and herbicide use on flora in mow zone	<1% decrease (small) in potential adverse effects of herbicide use on flora in habitat zone	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

2. Fauna

a. Activities in the Mowing/Underbrushing Zone

Faunal species are affected by mowing based on their habitat use. For example, a study of five passerine birds indicated a general avoidance of mowed vegetation, although dickcissels (*Spiza americana*) tend to prefer mowed grasses in the warm seasons (Walk and Warner, 1999). Small mammals, such as the vole (*Microtus agrestis*), can benefit from annual mowing as a habitat favorable to tunneling is created (Tattersall et al., 2000). Birds nesting on the ground or in shrubs are negatively affected by understory removal, while canopy species may benefit (Rodewald and Smith, 1998).

If undesirable species in the mowing/underbrushing zone are controlled with herbicides, adjacent landowners might hire licensed herbicide applicators who select herbicides such as Roundup® or Brush-B-Gon®. Roundup® is moderately toxic to fish and slightly toxic to aquatic invertebrates, on an acute basis (Monsanto, 2002) and is practically non-toxic to birds (NPIC Technical Fact Sheet, 2000). Triclopyr, the active ingredient in Brush-B-Gon®, is practically non-toxic to fish, while its major metabolite, TCP, is moderately toxic to fish (NPIC Technical Fact Sheet, 2002). Triclopyr is also practically non-toxic to aquatic invertebrates (NPIC Technical Fact Sheet, 2002). Because the vegetation management prescriptions indicate that herbicides

should only be applied to relatively small areas by licensed herbicide applicators, adverse impacts are expected to be minor.

The impact of mowing and underbrushing adversely affects some floral species and beneficially affects other floral species, which may have a subsequent influence on the fauna that utilize an area. These impacts would be proportional to the width of the mowing/underbrushing zone of each alternative. A narrow mowing/underbrushing zone would result in less impact to fauna. A wide mowing/underbrushing zone would result in more impact.

b. Activities in the Habitat Zone

If undesirable species are subjected to herbicidal control in the habitat zone, similar minor adverse impacts to fauna as those described for the mowing/underbrushing zone may occur (e.g., very small impact from herbicides to fauna in the habitat zone). When invasive floral species are removed from the habitat management zone, and native species encouraged, the newly opened niches represent a beneficial impact to native fauna. These impacts would be proportional to the width of the habitat zone of each alternative. A narrow habitat zone would result in less beneficial impact to fauna. A wide habitat zone would result in more beneficial impact.

Recommended widths of buffer strips for ecological concerns are typically much wider than those recommended for water quality concerns. To protect wildlife habitats near riparian areas, buffers of 30 meters (98 feet) to 100 meters (328 feet) are suggested in reviews (Castelle et al., 1994; Wenger, 1999; Bernthal, 1999; Fischer et al., 2000). Three to five times as many animals utilize buffer sites compared to pasture sites (Chapman and Ribic, 2002). Buffer zones serve as useful habitat for several salamander species and widths over 40 meters (131.2 feet) had approximately the same abundance and diversity, while managed forests had 50% less species richness and 33% less abundance (Vesely and McComb, 2002). Some studies indicate that buffer zones increase bird diversity (Tattari et al., 2003), while others found no difference in species abundance or richness compared to controls, though edge species, such as the blue jay (*Cyanocitta cristata*), were more common in buffer strips (Mieklejohn and Hughes, 1999). Research concerning the maintenance of bird species richness recommends buffer strips ranging from 230 feet to 574 feet (Johnson and Brown, 1990; Spackman and Hughes, 1993).

Table 4-7 shows a comparison of how each alternative modification of adjacent landowner guidelines affects flora as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-7. Each alternative's relative effect on fauna as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on fauna	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential adverse effects of mowing and herbicide use on fauna in mow zone	7% increase (small) in potential adverse effects of herbicide use on fauna in habitat zone	B
Alternative 3 Fire safety	40% decrease (moderate) in adverse potential effects of mowing and herbicide use on fauna in mow zone	3% increase (small) in potential adverse effects of herbicide use on fauna in habitat zone	b
Alternative 4 Minimum buffer	2% increase (small) in potential beneficial effects of mowing and herbicide use on fauna in mow zone	<1% decrease (small) in potential adverse effects of herbicide use on fauna in habitat zone	b
Alternative 5 Expanded mow	89% increase (moderate) in potential adverse effects of mowing and herbicide use on fauna in mow zone	7% decrease (small) in potential adverse effects of herbicide use on fauna in habitat zone	A
Alternative 6 Mow all	1,370% increase (large) in potential adverse effects of mowing and herbicide use on fauna in mow zone	There is no habitat zone under this alternative.	A
Alternative 7 Narrow shoreline variance	8% increase (small) in potential adverse effects of mowing and herbicide use on fauna in mow zone	<1% decrease (small) in potential adverse effects of herbicide use on fauna in habitat zone	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

3. Wildlife Habitat

a. Future without ecosystem management prescriptions.

Modifications of adjacent landowner guidelines could involve changing the width of the mowing/underbrushing zone and/or the shoreline buffer zone, but not include ecosystem management prescriptions (see Appendix H). If this happens, a reasonable assumption is that current levels of habitat quality measured in the existing mowing/underbrushing zone will exist in the future under any given mowing/underbrushing zone width. Likewise, a reasonable assumption is that current levels of habitat quality measured in the existing non-mowing/underbrushing zone will exist in the future under any given mowing/underbrushing zone width. This assumption implies that if the width of the current mowing/underbrushing zone is reduced, the overall quality of the study area will go up because succession would increase the habitat quality in those areas that would no longer be mowed. Likewise, if the width of the current mowing/underbrushing zone is increased, the overall quality of the study area will go down.

Under status quo conditions (i.e. the current adjacent landowner guidelines at Grapevine and Lewisville, a 25 foot and 50 foot wide mowing/underbrushing zone respectively) there are currently approximately 1,782 acres in the mowing/underbrushing zone providing approximately 640 Habitat Units of the total 14,621 Habitat Units

in the study area. For each alternative, habitat quality scores in the mowing/underbrushing zone were assumed to mimic the average scores currently observed under existing conditions in the mowing/ underbrushing zone (0.46 in wooded areas and 0.30 in herbaceous/grassland areas). Likewise, habitat quality scores in the habitat zone were assumed to mimic the average scores currently observed under existing conditions the habitat zone (0.70 in wooded areas and 0.43 in herbaceous/grassland areas). (See Table 3-11 for existing condition habitat quality scores.) Table 4-8 indicates the number of Habitat Units for each alternative. The degree of impact on wildlife habitat in the mowing/underbrushing zone is proportional to the width of the mowing/underbrushing zone and the habitat zone of each alternative. If mowing/underbrushing zone were to be expanded to include the entire study area (i.e. Alternative 6), a total of approximately 9,924 Habitat Units would still occur, but 4,698 Habitat Units would be lost over existing conditions. If the mowing/underbrushing zone were eliminated (i.e., Alternative 2), a total of approximately 14,945 Habitat Units would occur, an increase of 324 Habitat Units over existing conditions, even without ecosystem based vegetation management efforts. The other alternatives result in a range of 133 additional Habitat Units to a loss of 307 Habitat Units.

Table 4-8 shows a comparison of how each alternative modification of adjacent landowner guidelines affects habitat units as compared to the existing adjacent landowner guidelines. Assuming that no vegetation management prescriptions are implemented. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-8. Effects of Alternatives on Habitat Units at Grapevine and Lewisville Lakes if no ecosystem based vegetation management prescriptions are implemented.

Effect on habitat units without prescriptions	Mow/underbrush Zone		Habitat Zone		Total Habitat Units	Percent Change over Status-Quo	Effect Relative to Status-Quo[1]
	Wooded	Herbaceous & Grasslands	Wooded	Herbaceous & Grasslands			
Alternative 1 No action	457	183	10,189	3,793	14,622	Status-Quo	Status -Quo
Alternative 2 No mow	0	0	10,886	4,060	14,945	+2.2 %	b
Alternative 3 Fire safety	275	102	10,467	3,911	14,754	+0.9 %	b
Alternative 4 Minimum buffer	450	177	10,200	3,801	14,628	0.0 %	nc
Alternative 5 Expanded mow	899	349	9,515	3,552	14,315	-2.1%	a
Alternative 6 Mow all	7,137	2,788	0	0	9,924	-32.1%	A
Alternative 7 Narrow shoreline variance	486	205	10,144	3,760	14,596	-0.2 %	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

b. Future with ecosystem management prescriptions

Adjacent landowner guidelines could involve changing the width of the mowing/underbrushing zone and/or the habitat zone, and include ecosystem management prescriptions (see Appendix H) that could be implemented by community groups, lead by a master naturalist, with permit issued by USACE. If this happens, a reasonable assumption is that current levels of habitat quality measured in the existing mowing/underbrushing zone will continue to exist in a future mowing/underbrushing zone. However, with ecosystem based vegetation prescriptions applied to the habitat zones, a reasonable assumption is that future habitat quality can be improved by overcoming the limiting factors that currently are keeping Grapevine and Lewisville Lakes habitat quality at its moderate levels.

A careful examination of the WHAP results indicates the limiting factors, those that are keeping the Habitat Quality scores at low average levels at Grapevine and Lewisville Lakes, are due to the fact that most of the study area would not support wetland, bog, marsh, or bottomland hardwood habitat (the “site potential” factor; it is the most important factor in WHAP, worth 25 of the possible 100 points in WHAP). Existing conditions at Grapevine and Lewisville Lakes for this factor average 12.03 points in forested areas, and average 11.48 points in grasslands (both mowed and unmowed grasslands). Under active ecosystem management prescriptions, this factor might be raised to an average of 15 points in both forested and grassland areas.

The second most limiting factor (“uniqueness and relative abundance” factor; worth 20 of the total WHAP points) is that most of the study area is currently not, nor could it be managed to become what is considered “highly valuable for wildlife and very uncommon, unique or irreplaceable”. Existing conditions at Grapevine and Lewisville Lakes for this factor average 6.88 points in forested areas, and 4.85 in grassland areas. However, this factor could reasonably be raised to an average of 15 points, if the habitat in the study area could be managed to a level considered “high to medium value for wildlife, and is relatively abundant”.

The other variables have less importance in WHAP (i.e. between 5 and 8 points available), and the area’s average for those variables is closer to the maximum available points. None-the-less, under active ecosystem management prescriptions, it appears reasonable that overall WHAP scores in forested areas in the habitat management and shoreline management zones could be raised from an existing average of 56.44 points to a future average of 78 points, and in grassland areas in the habitat management and shoreline management zones the scores raised from an existing average of 33.42 points to a future average of 74 points.

Using these assumptions, habitat quality scores in the mowing/underbrushing zone were assumed to mimic the average scores currently observed under existing conditions in the mowing/ underbrushing zone (0.46 in wooded areas and 0.30 in herbaceous/grassland areas). When ecosystem based vegetation management prescriptions are fully implemented and become fully functional (estimated to be 50 years), habitat quality scores in the habitat zone were assumed to increase to 0.78 in wooded areas and 0.74 in herbaceous/ grassland areas.

Under status quo conditions (i.e. the current adjacent landowner guidelines at Grapevine and Lewisville, a 25 foot and 50 foot wide mowing/underbrushing zone respectively) there are currently approximately 1,782 acres in the mowing/underbrushing zone providing approximately 640 Habitat Units of the total 14,621 Habitat Units in the study area. For each alternative, habitat quality scores in the mowing/underbrushing zone were assumed to mimic the average scores currently observed under existing conditions in the mowing/ underbrushing zone. However, habitat quality scores in the habitat zone were assumed to increase as described above. Table 4-9 indicates the number of Habitat Units for each alternative, assuming ecosystem based vegetation prescriptions is applied to the entire habitat zone, but it is important to emphasize that these prescriptions would only be applied to a much smaller area. The degree of impact on wildlife habitat in the mowing/underbrushing zone is proportional to the width of the mowing/underbrushing zone and the habitat zone of each alternative. If mowing/underbrushing zone were to be expanded to include the entire study area (i.e. Alternative 6), a total of approximately 9,924 Habitat Units would still occur, but 4,698 Habitat Units would be lost over existing conditions. If the mowing/underbrushing zone were eliminated (i.e., Alternative 2), and the ecosystem based vegetation management prescriptions were applied to the entire habitat zone, a total of approximately 19,088 Habitat Units would occur, an increase of 4,446 Habitat Units over existing conditions. The other alternatives, again assuming ecosystem based prescriptions were applied to the entire habitat zone, would result in a range of 3,316 to 4,121 additional Habitat Units over existing conditions. In all

likelihood, however, the ecosystem management prescriptions would only be applied to a small percentage of the total habitat zone since community groups are unlikely to have the resources, both time and money, to fully implement the prescriptions.

Table 4-9 indicates the impact of each alternative on total Habitat Units when ecosystem based vegetation management prescriptions are implemented and become fully functional as described above. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative (still assuming no ecosystem based vegetation management prescriptions in the habitat zone under status-quo) and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-9. Effects of Alternatives on Habitat Units at Grapevine and Lewisville Lakes if ecosystem based vegetation management prescriptions are fully implemented.

Effect on habitat units with prescriptions	Mow/underbrush Zone		Habitat Zone		Total Habitat Units	Percent Change over Status-Quo	Effect Relative to Status-Quo[1,2]
	Wooded	Herbaceous & Grasslands	Wooded	Herbaceous & Grasslands			
Alternative 1 No action	457	183	10,189	3,793	14,622	Status-Quo	Status-Quo
Alternative 2 No mow	0	0	12,101	6,987	19,088	+30.5 %	B
Alternative 3 Fire safety	275	102	11,635	6,730	18,743	+28.2 %	B
Alternative 4 Minimum buffer	450	177	11,339	6,542	18,508	+26.6 %	B
Alternative 5 Expanded mow	899	349	10,578	6,112	17,938	+22.7 %	B
Alternative 6 Mow all	7,137	2,788	0	0	9,924	-32.1 %	A
Alternative 7 Narrow shoreline variance	486	205	11,277	6,471	18,440	+26.1 %	B

[1] a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change
[2] Significant beneficial impacts to wildlife, as compared to status-quo, are expected if ecosystem based vegetation management prescriptions are fully implemented, but significant beneficial impacts to wildlife are not expected if ecosystem based vegetation management prescriptions are not fully implemented. USACE believes that community groups will have the resources to achieve beneficial effects on wildlife habitat quality on only a small percentage of the more than 20,000 acres in the habitat zone, and will therefore not cross the significance threshold.

4. Threatened and Endangered Species

Currently, no threatened or endangered species are known to occur in the Lewisville or Grapevine Lake areas, and therefore no impact would be expected from any alternative.

F. Air Quality

1. Activities in the Mowing/Underbrushing Zone

The only impacts to air quality would be due to emissions from frequent mowing during summer months with hand operated lawn mowers in the mowing/underbrushing zone. These impacts would occur during summer months when ozone exceedances are more common. Air quality impacts from activities in the mowing/underbrushing zone would be proportional to the width of the mowing/underbrushing zone of each alternative. U.S. Environmental Protections Agency (2004) estimates that nonroad, nonhandheld, gas, spark ignition engines up to 6 horsepower (most lawnmowers fall in this category) emit between 13 and 40 grams of hydrocarbon and 1.8 and 2.0 grams of nitrogen oxides per horsepower per hour (depending on whether the engine is side-valved or overhead-valved, respectively). These two pollutants are highlighted because they contribute to ozone formation, and Grapevine and Lewisville Lakes are in non-compliance regions for ozone. Assuming a mowing rate of 0.5 acres per hour with 5 horsepower mowers, the entire mowing/underbrushing zone would require 3,564 hours to mow under status quo conditions (1,782 acres), and emit between approximately 232,000 and 713,000 grams (500 to 1,600 pounds) of hydrocarbons per mowing. Nitrogen oxides would be emitted at a rate of between approximately 32,000 and 36,000 grams (70 and 80 pounds) of nitrogen oxides per mowing. To put this in perspective, the Federal Transit Authority (2004) estimates that light duty vehicles (1995 model year) average approximately 2.3 grams of hydrocarbons and 0.77 grams of nitrogen oxides per mile driven at average speeds (35 mph). It would take approximately 100,000 to 300,000 cars traveling 1 mile at 35 mph to generate the same amount of hydrocarbons as one complete mowing. This happens many times over each day in the Dallas/Fort Worth metropolitan area. A narrow mowing/ underbrushing zone would result in less impact to air quality. A wide mowing/underbrushing zone would result in more impact.

2. Activities in the Habitat Zone

The only impacts to air quality would be due to emissions from rare (once every year or two) mowing with hand operated lawn mowers in the habitat zone. These impacts would occur during fall months after native grasses have stored the maximum amount of nutrients possible in their roots. Impacts to air quality from rare mowing in the habitat management zone are likely to be negligible since ozone exceedances rarely occur at this time of year.

Table 4-10 shows a comparison of how each alternative modification of adjacent landowner guidelines affects air quality as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-10. Each alternative's relative effect on air quality as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on air quality	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential adverse effects of less mowing on air quality in mow zone	Little effect on air quality due to little mowing in habitat zone, which would not occur during ozone season.	B
Alternative 3 Fire safety	40% decrease (moderate) in potential adverse effects of less mowing on air quality in mow zone	Little effect on air quality due to little mowing in habitat zone, which would not occur during ozone season.	B
Alternative 4 Minimum buffer	2% increase (small) in potential beneficial effects of less mowing on air quality in mow zone	Little effect on air quality due to little mowing in habitat zone, which would not occur during ozone season.	b
Alternative 5 Expanded mow	89% increase (moderate) in potential adverse effects of more mowing on air quality in mow zone	Little effect on air quality due to little mowing in habitat zone, which would not occur during ozone season.	A
Alternative 6 Mow all	1,370% increase (large) in potential adverse effects of more mowing on air quality in mow zone	There is no habitat zone under this alternative.	A
Alternative 7 Narrow shoreline variance	8% increase (small) in potential adverse effects of more mowing on air quality in mow zone	Little effect on air quality due to little mowing in habitat zone, which would not occur during ozone season.	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

G. Noise

1. Activities in the Mowing/Underbrushing Zone

The only impacts to noise levels would be due to frequent mowing during summer months with pushed lawn mowers (average approximately 85 dB) in the mowing/underbrushing zone. EPA Noise Criteria (1974) for outdoor noise levels identified limits of 70 dB (24 hours per day) for hearing loss consideration and 55 dB for activity interference. It is unlikely that mowing would occur for more than a few hours per mowing, and therefore it is not anticipated that noise levels will exceed the EPA criteria. The noise impacts that would occur from activities in the mowing/underbrushing zone would, none-the-less be proportional to the width of the mowing/underbrushing zone of each alternative due to the range of mowing duration. A narrow mowing/underbrushing zone would result in less impact to noise level, while a wide zone would result in more impact.

2. Activities in the Habitat Zone

The only impacts to noise levels would be due to rare (once every year or two) mowing with hand operated lawn mowers in the habitat management zone. These impacts would occur during fall months after native grasses have stored the maximum amount of nutrients possible in their roots. Impacts to noise levels from rare mowing in the habitat management zone are likely to be negligible.

Table 4-11 shows a comparison of how each alternative modification of adjacent landowner guidelines affects air quality as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small, moderate, and large. The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-11. Each alternative's relative effect on noise as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on noise	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential adverse effects of less mowing on noise in mow zone	Little effect on noise due to little mowing in habitat zone.	b
Alternative 3 Fire safety	40% decrease (moderate) in potential adverse effects of less mowing on noise in mow zone	Little effect on noise due to little mowing in habitat zone.	b
Alternative 4 Minimum buffer	2% increase (small) in potential beneficial effects of less mowing on noise in mow zone	Little effect on noise due to little mowing in habitat zone.	b
Alternative 5 Expanded mow	89% increase (moderate) in potential adverse effects of more mowing on noise in mow zone	Little effect on noise due to little mowing in habitat zone.	a
Alternative 6 Mow all	1,370% increase (large) in potential adverse effects of more mowing on noise in mow zone	There is no habitat zone under this alternative.	a
Alternative 7 Narrow shoreline variance	8% increase (small) in potential adverse effects of more mowing on noise in mow zone	Little effect on noise due to little mowing in habitat zone.	a

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

H. Recreation and Open Space

Since this assessment only addresses the mowing, underbrushing and access path guidelines of the Shoreline Management Plan that pertains to adjacent landowners, there will be no impacts involving the designated recreation areas maintained by USACE at Grapevine and Lewisville Lakes (approximately 9,061 of the 26,195 acres between the property line and the conservation pool elevation). None-the-less, some

adjacent landowners have indicated that they wish to maintain Federal lands between their property and the shoreline in a manner that encourages intense recreational use (e.g. parkland type use) of lands currently designated by the USACE as low density recreational lands.

Table 4-12 shows a comparison of how each alternative modification of adjacent landowner guidelines affects recreational use of lands designated as low density recreational lands at Grapevine and Lewisville Lakes as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-12. Each alternative's relative effect on potential intense recreational use of lands designated as low density recreational lands as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect of intense recreational use of lands designated as low density recreational lands	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in potential intense recreational use of lands designated as low density recreational or wildlife lands in mow zone	no change in potential intense recreational use of lands designated as low density recreational or wildlife lands in habitat zone	A
Alternative 3 Fire safety	40% decrease (moderate) in potential intense recreational use of lands designated as low density recreational or wildlife lands in mow zone	3% decrease (small) in potential intense recreational use of lands designated as low density recreational or wildlife lands in habitat zone	a
Alternative 4 Minimum buffer	2% decrease (small) in potential intense recreational use of lands designated as low density recreational or wildlife lands in mow zone	<1% decrease (small) in potential intense recreational use of lands designated as low density recreational or wildlife lands in habitat zone	a
Alternative 5 Expanded mow	89% increase (moderate) in potential intense recreational use of lands designated as low density recreational or wildlife lands in mow zone	7% increase (small) in potential intense recreational use of lands designated as low density recreational or wildlife lands in habitat zone	B
Alternative 6 Mow all	1,370% increase (large) in potential intense recreational use of lands designated as low density recreational or wildlife lands in mow zone	100% increase (large) in potential intense recreational use of lands designated as low density recreational or wildlife lands	B
Alternative 7 Narrow shoreline variance	18% increase (small) in potential intense recreational use of lands designated as low density recreational or wildlife lands in mow zone	<1% increase (small) in potential intense recreational use of lands designated as low density recreational or wildlife lands in habitat zone	b

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

An underlying need that USACE is responding to in its consideration of modifying allowable adjacent landowner activities on Federal land is to manage and conserve natural resources while providing quality public outdoor recreation experiences (both intense recreation, and low density recreation) for present and future generations. USACE attempts to balance needs and desires of adjacent landowners while managing and conserving natural resources on public lands for all, not just for those who own property adjacent to those public lands. People in north Texas, an area that has experienced rapid urbanization for the past half-century and considering that Federal lands account for only approximately 1.5% of Texas, see public land as an exceptionally valuable resource. Any activities that adjacent landowners are permitted to do that alter public lands, especially lands designated for low density recreational use or for wildlife purposes (15,344 acres at the two lakes) are often viewed by the general public and other resource agencies (e.g. the Fish and Wildlife Service) as counter to the expectations of USACE's environmental stewardship of public lands.

Table 4-13 shows a comparison of how each alternative modification of adjacent landowner guidelines affects USACE's environmental stewardship of lands not designated as recreational lands as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-13. Each alternative's relative effect on USACE's environmental stewardship of lands designated as low density recreational or wildlife lands as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on USACE's environmental stewardship	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% increase (large) in managing public lands for environmental stewardship in mow zone	7% increase (small) in managing public lands for environmental stewardship in habitat zone	B
Alternative 3 Fire safety	40% increase (moderate) in managing public lands for environmental stewardship in mow zone	3% increase (small) in managing public lands for environmental stewardship in habitat zone	B
Alternative 4 Minimum buffer	2% increase (small) in potential managing public lands for environmental stewardship in mow zone	<1% increase decrease (small) in managing public lands for environmental stewardship in habitat zone	b
Alternative 5 Expanded mow	89% decrease (moderate) in managing public lands for environmental stewardship in mow zone	7% decrease (small) in managing public lands for environmental stewardship in habitat zone	A
Alternative 6 Mow all	1,370% decrease (large) in managing public lands for environmental stewardship in mow zone	100% decrease (large) in managing public lands for environmental stewardship	A
Alternative 7 Narrow shoreline variance	No change since variance will require habitat mitigation by permittee.	No change since variance will require habitat mitigation by permittee.	nc

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

I. Socioeconomic Conditions

The socioeconomic impacts associated with modifying adjacent landowner guidelines may involve the costs and effort that some adjacent landowners might incur to reduce or remove species they find undesirable (e.g. rodents and snakes) from their private property, or the costs associated with property loss if wildland fires damage or destroy private property. Wildland fire concerns would be important to adjacent landowners who have structures (e.g., homes, storage sheds) within 30 feet of the Federal property line. The National Interagency Fire Center (www.nifc.gov) and the organization Firewise (www.firewise.org) have recommended a 30-foot wide firebreak between wildland areas and structures, where fuel sources (e.g. grasses and shrubs) are trimmed or removed, and tree branches removed up to 12 feet above the surface of the ground to prevent the ladder effect of flames climbing a tree and reaching the canopy. Additionally, the ecosystem based vegetation prescriptions suggest mowing the habitat area once every year or two as a mechanical method of removing wildland fire fuels in a manner to mimic what natural fires would do in uncontrolled conditions.

Table 4-13 shows a comparison of how each alternative modification of adjacent landowner guidelines affects socioeconomic factors as compared to the existing adjacent landowner guidelines. The relative effect can be partially quantified by determining the percent change in sizes of the mowing/underbrushing and habitat zones between the no action or status-quo alternative and every other alternative analyzed. Here, the relative effect was qualified as small (less than 10% change from status quo), moderate (10% to 20% change from status quo) and large (greater than 20% change from status quo). The quantitative and qualitative determination can lead to a small beneficial effect (b), a significant beneficial effect (B), a small adverse effect (a), or a significant adverse effect (A).

Table 4-13. Each alternative's relative effect on socioeconomics as compared to Alternative 1, the No Action or Status-Quo alternative.

Effect on Socioeconomics	Zone 1: mow zone	Zone 2: habitat zone	Effect Relative to Status-Quo[1]
Alternative 1 No action	1,782 acres	24,413 acres	Status-Quo
Alternative 2 No mow	100% decrease (large) in width of (mow) zone that tends to discourage wildlife from approaching property line. 100% decrease (large) in firebreaks.	Mowing once every one or two years can remove most wildland fire fuel.	A
Alternative 3 Fire safety	Little or no effect since both lakes already have at least 25-foot wide mow zones	Mowing once every one or two years can remove most wildland fire fuel.	nc
Alternative 4 Minimum buffer	2% decrease (small) in width of (mow) zone that tends to discourage wildlife from approaching property line. 2% decrease (small) in potential firebreaks in narrow areas.	Mowing once every one or two years can remove most wildland fire fuel.	a
Alternative 5 Expanded mow	Little or no effect since both lakes already have at least 25-foot wide mow zones	Mowing once every one or two years can remove most wildland fire fuel.	nc
Alternative 6 Mow all	Little or no effect since both lakes already have at least 25-foot wide mow zones	There is no habitat zone under this alternative.	B
Alternative 7 Narrow shoreline variance	Little or no effect since both lakes already have at least 25-foot wide mow zones	Mowing once every one or two years can remove most wildland fire fuel.	nc

[1]a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

Summary of Impacts of Proposed Action and Alternatives

Table 4-14 summarizes the relative general effects of each mowing/underbrushing alternative when compared to the no-action (or status quo) alternative. Table 4-15 summarizes the relative effects of each access path alternative.

Table 4-14. Relative Effects for Alternatives as Compared to the No Action/Status Quo Alternative.

Effects on Environment		Alternative 1 No action/Status quo	Alternative 2 No mow	Alternative 3 Fire Safety	Alternative 4 Minimum Buffer	Alternative 5 Expanded mow	Alternative 6 Mow all	Alternative 7 Narrow Shoreline Variance
Physiography (Soils)		current level of sheet and rill and shoreline erosion	B	b	b	A	A	a
Water Quality		current level of non-point pollution	B	b	b	A	A	a
Wetlands		current level of encountering fringe or riverine wetlands (current level is very low)	b	b	b	a	a	a
Flora		current level of species richness and diversity; some undesirable and exotic species; possibility of fire due to dry grass/ underbrush	B	b	b	A	A	a
Fauna		current level of species richness and diversity; some undesirable and species	B	b	b	A	A	a
Wildlife	without ecosystem prescriptions	mixture of habitats for tall/short-grass & under/over-story species; some undesirable species in nonmowed areas; 14,622 Habitat Units	b	b	nc	a	A	a
	With ecosystem prescriptions	mixture of habitats for tall/short-grass & under/over-story species; some undesirable species in nonmowed areas; 18,440 Habitat Units	B[2]	B[2]	B[2]	B[2]	A	B[2]
T&E Species		None in lake area						
Air Quality		some emissions from lawn mowers during summer months	B	b	b	A	A	a
Noise		current level of noise from mowing	b	b	b	a	a	a
Recreational use of non-recreational lands		current level of recreational use of lands not designated as recreational lands	A	a	a	b	B	b
Environmental stewardship of non-recreational lands		current level of environmental stewardship of lands not designated as recreational lands	B	b	b	A	A	nc
Socio-Economic		current levels of: cost and effort to control undesirable species on private land; potential property loss from wildland fire; and shoreline access for adjacent land owners	A	nc	a	nc	B	nc
Does alternative cross significance threshold?		No	Yes	No[2]	No[2]	Yes	Yes	No[2]

[1] a-small adverse, A-significant adverse, b-small beneficial, B-significant beneficial, nc-no change

[2] Significant beneficial impacts to wildlife, as compared to status-quo, are expected if ecosystem based vegetation management prescriptions are fully implemented, but significant beneficial impacts to wildlife are not expected if ecosystem based vegetation management prescriptions are not fully implemented. USACE believes that community groups will have the resources to achieve beneficial effects on wildlife habitat quality on only a small percentage of the more than 20,000 acres in the habitat zone, and will therefore not cross the significance threshold.

Table 4-15. Relative Effects Associated with Access Paths

Effects on Environment	Impacts of Access Paths		
	Individual Paths	Community Paths	No Paths
Physiography (Soils)	some gully and shoreline erosion	reduction of gully and shoreline erosion	least amount of gully and shoreline erosion
Water Quality	some turbidity due to mowing for paths	less turbidity	least turbidity
Flora	little effect on flora	little effect on flora	little effect on flora
Fauna	some species utilize existing paths as corridors	fewer corridors	fewest corridors
Wildlife	more habitat fragmentation	some habitat fragmentation	least habitat fragmentation
T&E Species	none in lake area		
Air Quality	little effect on air quality	little effect on air quality	little effect on air quality
Noise	some noise from mowing	decrease in noise from lawnmowers	no noise from lawnmowers
Recreational use of non-recreational lands	non-recreational lands are most accessible	non-recreational lands are accessible	non-recreational lands are least accessible
Environmental stewardship of non-recreational lands	non-recreational land is most accessible	non-recreational land is accessible	non-recreational land is least accessible
Socio-Economic	shoreline is most accessible for adjacent landowners	shoreline is accessible to adjacent landowners	shoreline is least accessible to adjacent landowners

Chapter 5: Permits and Regulatory Requirements as Required

None of the activities associated with the preferred alternative are expected to require Clean Water Act, Section 404 wetlands permits, nor Clean Water Act National Discharge Elimination System permits.