Travis which surface about this time, may have originated from the lower Pecos. Weir (1976) and Prewitt (1981) have noted a decrease in midden size and a decrease in the range of burned rock middens in the late Middle Archaic.

The Late Archaic period began about 2300 B.P. when the regional climate was hot and dry. By the beginning of the Late Archaic Uvalde phase, a proliferation of projectile point types again occurred and burned rock middens were either no longer created or had become minor aspects of subsistence. During the early part of the Late Archaic, *Bulverde* and *Pedernales* dart point types were in use with the former likely originating to the north and west, while the latter is more likely aligned with the Edwards Plateau. Johnson and Goode (1994) note the possibility that *Pedernales* may in fact have developed from *Bulverde*. Settlement during the late part of the Archaic appears to have shifted away from midden localities. Rock shelters were used more frequently than previously for protection from the elements; however, terrace locations continued as most preferred site locations. Later in the Late Archaic, *Darl, Ensor, Frio*, and *Mahomet* point types became prominent. Increased cultural interaction between Central Texas and the eastern cultures occurred during the Late Archaic.

Following the early part of the Late Archaic, a period of cultural stability may have occurred in the area, comparable with the Twin Sisters Phase of Central Texas. Side/corner-notched projectile points of the types *Ensor, Frio* and *Fairland* are commonly encountered at sites dating to this period and their occurrence in only limited numbers in Central Texas suggests that the area was witnessing a developing cultural tradition of its own (Goode, 1984). Supportive indications in the archaeological record for this increase in a localized cultural manifestation can be seen at the Chesser Site, 41LE59, in Lee County (Rogers and Kotter, 1995). A breakdown of the long-established trade network between Central Texas and the cultures to the east appeared to have occurred by between 50 B.C. and A.D. 200 and this breakdown was likely accompanied by conflict. The interments at the Ernest Witte Site in Austin County appear to reflect this conflict. Increasing evidence for the spread of eastern religious cults is apparent beginning as early as 600 B.C. and lasting to about A.D. 600 which Johnson and Goode (1994) label the Late Archaic II subperiod.

Late Prehistoric Period (1250 to 200 B.P.)

This stage is evidenced in many parts of North America by the advent of incipient agriculture; however, in Central Texas, a hunting and gathering subsistence continued throughout the stage. For this reason, Prewitt (1981) has suggested the term "Neo-Archaic." A distinguishing assemblage of small projectile points indicative of diffusion of the bow and arrow to this region marks the early part of the Late Prehistoric Stage. The late part of this stage is evidenced by the appearance of ceramics as well as true cemeteries (Prewitt, 1974).

The Late Prehistoric Stage is represented in Central Texas by the Austin and Toyah phases. In this part of Central Texas, the Austin phase (1250 to 650 BP) is characterized technologically by expanding-stemmed (*Scallorn*) and subtriangular (*Granbury*) arrow points, serrated flakes, and *Friday*-type knives (Jelks, 1962; Prewitt, 1981). A paucity of sites representing the Austin phase and a change in settlement patterns suggest a decline in population (Black, 1989). Bison remains are all but absent from Austin phase sites, suggesting a marked decline in Bison population on the southern plains (Dillehay, 1974).

Diagnostic artifacts of the later Toyah phase (650 to 200 BP) include pointed-stemmed arrow points (*Perdiz* and *Cliffton*), *Covington*-type knives, tools made from bison bone, and flint drills (Jelks, 1962). Diagnostic ceramics associated with this stage are *Leon Plain* tempered with bone. The beginning of the Toyah phase coincides with an increase in bison remains in archaeological sites although reliance on deer and other smaller animals probably predominated.

It is unclear what the interaction between Central Texas peoples and those to the east was like during the late Prehistoric. Sandy paste ceramics, while infrequently encountered in the area, have been recovered at sites in Fayette County and to the north in Lee County (Rogers and Kotter, 1995). Arrow point types were shared between the areas to some extent, though there are stylistic differences. *Perdiz* type points for example, were used in both cultural areas, though researchers have noted sharp differences in their size, shape and method of manufacture (Johnson, 1994; Rogers, 1995). It is likely that conflict, first noted in the latest Late Archaic, continued to historic times and it is possible that the number of Austin Phase burials noted by Prewitt (1982) at the Loeve-Fox Site, reflects this continuing conflict.

Historic Background

During the early historic period, the time of the European contact and settlement, central Texas was inhabited by numerous aboriginal groups including the Jumano, Tonkawa, Lipan Apache, and Comanche (Newcomb, 1961). The Jumano initiated extensive trading activities with the Caddo in east Texas and the Trans Pecos groups to the west (Suhm et al., 1958). The Lipan Apache, Tonkawa, and Comanche entered the area from the Plains in pursuit of food. Their weapons included the bow and arrow and lance. Trade items such as glass beads, European-made ceramics, gun parts and metal projectile points indicate a contact period occupation.

The first Europeans to enter the area may have been Spanish explorers and missionaries on their way to the missions in east Texas. El Camino Real para Los Texas was, at the time, the principal road connecting Coahuila, Mexico with the former Spanish capital of the Texas province, Los Adaes (now Robelene, Louisiana). Spanish military forces used the route to counter French expeditions into what is now Texas as early as the mid 1680s. The Frenchman Louis Juchereau de St. Denis may have

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also traveled through the area in 1714 as he traveled from Natchitoches to San Juan Bautista on the Rio Grande (Pool, 1975). By the mid-eighteenth century, under the perceived threat of French encroachment into territories claimed by the Spanish Crown, Spanish friars and soldiers entered the central Texas area and established several missions. El Camino Real continued to see use through the nineteenth century, serving as an important transportation corridor to soldiers, merchants, and settlers alike.

Generally speaking, the small rural farming communities of the project area in the early twentieth century thrived until after World War II when changes in agricultural technology stimulated a nationwide shift away from family-run farms and toward large-scale agri-business operations. These strictly for profit commercial ventures relied less on traditional methods of field labor and more on large machines to efficiently cultivate and harvest large tracts of leased agricultural land.

Guadalupe County with Seguin as its county seat was created in March 1847, from portions of DeWitt's colony and Bexar County. It was named for the Guadalupe River what had received its title from Alonso de Leon in 1689, in honor of a painting of the Lady of Guadalupe that he bore on his standard.

Between 1827 and 1835, 36 settlers received land grants in what was to become Guadalupe County. However, by 1834 many of these early settlers had retired to Gonzales because of fear of Indian attacks and the lands remained vacant until 1837 when much of it was granted to veterans of the Texas Revolution. In 1839, a company of Texas Rangers under Matthew Caldwell took part in a battle with Mexican forces under the Command of Vicente Cordova near Seguin, and between 1839 and 1845 citizens of the county had numerous scrapes with Indians, Mexican invaders, and outlaws. The last Indian rain in the county occurred in 1885 (Webb, 1952; Tyler, 1996).

2.10.2 Literature and Records Review

A literature and records review was conducted for the purpose of determining the location and nature of previously recorded cultural resource sites in the study area. The cultural resource files at the Texas Archeological Research Laboratory (TARL) and at the Texas Historical Commission (THC) were reviewed for sites located within or adjacent to the study area. A search was conducted of both published and unpublished National Register of Historic Places (NRHP) data for sites listed on or determined eligible for listing to the NRHP. The list of State Archeological Landmarks (SAL) compiled by the THC was reviewed for sites determined significant by the state.

The records review conducted at TARL identified two recorded sites (41GU67 and 41GU68) within the boundaries of the study area. Site 41GU67 (Arrowhead Hill Site) represents a Middle Archaic to Late Prehistoric occupation located on the slope and top of a prominent knoll (Turpin, 2001). Site 41GU68 was recorded during a survey conducted by PBS&J for a fiber optic line (Morley, 2001). This site consists of a scatter of bottle glass and historic ceramics. Both of these sites have been determined not eligible for listing to the NRHP by the THC (Tuprin, 2001; Martin, 2001).

The review of the literature at the THC did not identify any NRHP listed or determined eligible for listing properties or SAL designated sites within the study area boundaries.

3.0 ENVIRONMENTAL AND LAND USE CONSTRAINTS

3.0 ENVIRONMENTAL AND LAND USE CONSTRAINTS

Section 2.0 of this report presents a description of resources within the study area which have potential environmental, social, or cultural value and should therefore be taken into consideration in selecting alternative routes, and ultimately a preferred route, for the proposed transmission line. Those resources which have particular value or are particularly sensitive to potential impacts from this type of project are discussed below. The following sections indicate areas to be avoided, where possible, and areas which should be crossed only with extreme care and possible mitigation.

3.1 NATURAL RESOURCES

The most sensitive natural resources within the study area include woodlands, both extensive upland tracts, as well as areas of bottomland/riparian habitat associated with the floodplains of major streams and creeks, such as Elm, Cottonwood, Krams, and Cantau creeks and their tributaries. The upland woodlands provide large, unfragmented blocks of valuable wildlife habitat. Riparian areas along rivers/streams provide a source of water, habitat, and provide corridors for wildlife to move through the area. In addition, these riparian zones are sensitive because of the potential for construction-related impacts to surface waters, and because of the possible presence of associated wetland habitats. While it is obvious that the proposed line cannot avoid crossing some of these creeks and sensitive areas, routing should be planned carefully, and mitigation efforts used where necessary.

3.2 HUMAN RESOURCES

The study area contains several categories of human and cultural resources which should be avoided if possible to minimize potential adverse impacts. Those areas considered to be particularly sensitive with regard to the location and construction of this proposed project are:

- Rural Residential Subdivisions - numerous residential subdivisions are located throughout the study area and are especially common in the eastern portion. These areas should be avoided, where possible, or crossed along existing ROWs or property lines, because of the number of habitable structures and the potential incompatibility of residential land uses with transmission lines.
- Recorded Cultural Resources Sites - there are a few recorded prehistoric cultural resources sites and several historic cemeteries within the study area.

3.3 CONSTRAINT AREAS

For the purpose of routing the proposed transmission line, the resources discussed above were classified as either "areas which should be avoided, if possible, by all alternative routes," or as "those areas which should be crossed only with extreme care and possible mitigation." These areas are shown on Figure 3-1 (map pocket).

AREAS TO BE AVOIDED

- Rural communities (Elm Creek, Duggar, Sweet Home, and Olmos), because of the concentration of potentially incompatible residential, commercial, and community land uses.
- Rural residential subdivisions, because of the concentration of habitable structures and the potential incompatibility of residential and utility ROW land uses.
- Cemeteries, for their cultural, social, and historic values

AREAS CROSSED WITH CARE/POSSIBLE MITIGATION

- Vegetated floodplains of major creeks and streams and adjacent wetlands for their ecological value as habitat and avian flight corridors, and their sensitivity to construction-related impacts.
- Large ponds and associated wetlands, for their ecological value to wildlife and their sensitivity to construction-related impacts.
- Recorded cultural resources sites (historic and prehistoric) for their social and historical value.

4.0 SELECTION AND EVALUATION OF ALTERNATIVES

4.0 SELECTION AND EVALUATION OF ALTERNATIVES

4.1 NO-ACTION ALTERNATIVE

Under the No Action Alternative, GVEC would not construct or operate the proposed 138-kV transmission line. Benefits from the proposed project would not occur.

4.2 ALTERNATIVE ROUTE SELECTION

For the Hickory Forest to New Berlin project, the LCRA and GVEC followed their previously established general procedures and methodology in the routing and design of transmission lines. The LCRA utilizes a six-phase approach for defining the project; obtaining environmental information; selecting preliminary alternative routes; conducting environmental, engineering and cost analyses; selecting primary alternative routes; evaluating primary alternative routes and selecting a preferred route; acquiring PUCT approval; and designing and constructing the transmission facility.

PBS&J initially conducted environmental studies and prepared a description of the existing environment within the study area for the proposed project (Section 2.0). PBS&J used information developed during these studies of the existing environment to select numerous preliminary alternative routes (Figure 4-1). These routes were selected by taking into account community values, existing and proposed land use, and areas of environmental concern.

GVEC reviewed these preliminary routes, taking into consideration the additional factors of engineering and cost constraints, and made several revisions by adding, deleting, or modifying individual links. These routes were then given to PBS&J and presented to the public at an open-house meeting in January 2002. Following the public open house meeting, and subsequent discussions with landowners, GVEC made several additional revisions to these routes. These revisions included deleting some links, adding new links, and modifying some existing links. These revisions were made in an attempt to further lessen potential environmental and land use impacts. Following this meeting, the revised alternatives (the primary alternative routes) were presented to PBS&J for a thorough environmental evaluation, which is the primary focus of Section 5.0 of this document. The locations of these routes are shown on figures 4-2 and 4-3 (map pocket). Table 4-1 illustrates the composition by link and the overall length of each primary alternative route.

4.3 ALTERNATIVE ROUTE EVALUATION

The evaluation of the alternative routes for the project involved studying a variety of environmental factors. Each of the alternative routes was examined in detail in the field at various times during 2001 and 2002. The analysis of each route involved the inventory and tabulation of the number or

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OVERSIZED MAP(S)

**TO VIEW
OVERSIZED MAP(S),
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TABLE 4-1

PRIMARY ALTERNATIVE ROUTE COMPOSITION AND LENGTH
HICKORY FOREST TO NEW BERLIN PROJECT

Route Number	Links	Length (miles)
1	D-E-G-I	11.12*
2	D-E-G-J-L	11.78
3	D-E-H-K-L	14.02
4	A-B-C′-D′-E-G-I	11.29*
5	A-B-C′-D′-E-G-J-L	11.96
6	A-B-C′-D′-E-H-K-L	14.20
7	A-B-C′-F-K-L	14.19
8	A-C-C′-D′-E-G-I	11.04*
9	A-C-C′-D′-E-G-J-L	11.70
10	A-C-C′-D′-E-H-K-L	13.95
11	A-C-C′-F-K-L	13.94

* Plus approximately 3,600 ft of new circuit on existing structures.

Note: For primary route locations, see figures 4-2 and 4-3 (map pocket).

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quantity of each environmental factor located along each route (e.g., number of habitable structures, amount of woodland crossed, etc.). The number or amount of each factor was determined by studying TxDOT county highway maps, recent black-and-white aerial photography, USGS topographic maps, and field verification. The environmental advantages and disadvantages of each alternative were then evaluated. A total of 34 environmental criteria were inventoried for each of the primary alternative routes for the project. These criteria are presented in Table 4-2.

TABLE 4-2

ENVIRONMENTAL CRITERIA FOR ALTERNATIVE ROUTE EVALUATION
HICKORY FOREST TO NEW BERLIN PROJECT

LAND USE	
1.	Length of alternative route
2.	Number of habitable structures[1] within 200 ft of ROW centerline
3.	Length of ROW utilizing existing transmission line ROW
4.	Length of ROW parallel to existing transmission line ROW
5.	Length of ROW paralleling property lines
6.	Length of ROW parallel to other existing ROW (highway, pipeline, roads, etc.)
7.	Length of ROW across parks/recreational areas
8.	Number of parks and/or recreational areas within 1,000 ft of ROW centerline
9.	Length of ROW through cropland
10.	Length of ROW through grazingland/pasture
11.	Length of ROW through mechanically irrigated pasture or cropland
12.	Number of pipeline crossings
13.	Number of transmission line crossings
14.	Number of U.S. and State highway crossings
15.	Number of FM road crossings
16.	Number of FAA-listed airfields within 10,000 ft of ROW centerline
17.	Number of commercial AM radio transmitters within 10,000 ft of ROW centerline
18.	Number of FM radio transmitters, microwave towers, etc. within 2,000 ft of ROW centerline
AESTHETICS	
19.	Estimated length of ROW within foreground visual zone[2] of U.S. and state highways
20.	Estimated length of ROW within foreground visual zone[2] of FM roads
21.	Estimated length of ROW within foreground visual zone[2] of recreational or park areas
ECOLOGY	
22.	Length of ROW through upland woodland
23.	Length of ROW through bottomland/riparian woodland
24.	Length of ROW across potential wetlands
25.	Length of ROW across known habitat of endangered/threatened species
26.	Length of ROW across open water (lakes, ponds)
27.	Number of stream crossings
28.	Length of ROW parallel (within 100 ft) to streams
29.	Length of ROW across 100-year floodplains
CULTURAL RESOURCES	
30.	Number of recorded historic or prehistoric sites crossed
31.	Number of recorded historic or prehistoric sites within 1,000 ft of ROW centerline
32.	Number of National Register listed or determined-eligible sites crossed
33.	Number of National Register listed or determined-eligible sites within 1,000 ft of ROW centerline
34.	Length of ROW through areas of high archaeological/historic site potential

[1] Residences, businesses, schools, churches, cemeteries, hospitals, nursing homes, etc.
[2] One-half mile, unobstructed

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5.0 ENVIRONMENTAL IMPACT OF THE ALTERNATIVE ROUTES

5.0 ENVIRONMENTAL IMPACT OF THE ALTERNATIVE ROUTES

5.1 NATURAL RESOURCES IMPACTS

5.1.1 Impacts on Geological Resources

Construction of the proposed transmission line will have no significant effect on geological features or resources of the area. The erection of the support structures will require the removal and/or disturbance of small amounts of near-surface materials, but will have no measurable impact on geologic resources along any of the alternative routes.

Some economically valuable geological resources (sand and gravel deposits and oil) occur in the study area and could be impacted if the selected route traversed areas producing those resources. However, none of the proposed alternative routes crosses areas of active excavations or existing oil fields, therefore, the project will have no significant impact associated with the loss or disturbance of these resources.

5.1.2 Impacts on Soils

The construction and operation of transmission lines normally create very few long-term adverse impacts on soils. The major potential impact upon soils from any transmission line construction would be erosion and soil compaction. The hazard of soil erosion is generally greatest during the initial clearing (where necessary) of the ROW.

To provide adequate space for construction activities and to minimize corridor maintenance and operational problems, most woody vegetation is generally removed within the ROW. In these areas, only the leaf litter and a small amount of herbaceous vegetation would remain and the necessary movement of heavy equipment would disturb both. The most important factor in controlling soil erosion associated with construction activity is to revegetate areas that have potential erosion problems immediately following construction. Natural succession would revegetate the majority of the ROW. Critical areas such as steep slopes and areas of shallow topsoil may require additional seeding. To maximize the protection of both land and water resources, special care will be exercised when clearing near waterways. Vegetation on the stream banks will be left intact to the extent possible. Revegetation of these areas (if necessary) will take priority over less-critical areas. The ROW will be inspected both during and after construction to ensure that problem erosion areas are identified, and special precautions will be taken to minimize vehicular traffic over areas with very shallow soils.

Prime farmland soils, as defined by the NRCS, are soils that are best suited to producing food, feed, forage, or fiber crops. According to the SCS, approximately 38% of the soils in Guadalupe County can be classified as prime farmland soils. The U.S. Department of Agriculture recognizes the importance and vulnerability of prime farmlands throughout the nation and therefore encourages the wise use and conservation of these soils where possible. Whenever feasible, the alternative routes were aligned along existing roadways, fence lines, or other existing ROWs in an effort to minimize potential impacts (including those to prime farmland). Besides construction-related erosion, the major impact of the project on prime farmland soils would be the physical occupation of small areas at the base of the support structures, which would slightly reduce the potential of those areas for agricultural production. Impacts to prime farmland souls would be minor regardless of what alternative is selected.

5.1.3 Impacts on Water Resources

5.1.3.1 Floodplains

The proposed project will involve spanning several intermittent streams. As a result, some transmission line structures will be located within 100-year floodplains. These structures will be designed and constructed so as not to impede the flow of any waterway or create any hazard during flooding. Construction activity in floodplains could result in erosion and sedimentation impacts, especially if flooding occurred during the construction period. Support structures and maintenance access routes in the floodplain will not be located in obvious flood channels and thus should not significantly affect flooding. Careful siting of structures should eliminate the possibility of significant scour. None of the alternatives should have significant impacts on the function of the floodplains, nor adversely affect adjacent or downstream property. One-hundred year floodplains crossed by the alternative routes are primarily associated with Elm Creek, Cottonwood Creek, Konde Creek, Krams Creek, and Caney Creek. Route 6 crosses the least amount of 100-year floodplain (1,020 ft) followed by Route 10 (1,400 ft), Route 3 (1,820) and Route 7 (3,580 ft). The remaining routes cross a greater amount of 100-year floodplains ranging from 3,960 ft (Route 11) to 8,860 ft (Route 1).

5.1.3.2 Surface Water

Although all alternative routes cross some intermittent streams, the construction of the proposed 138-kV transmission line should have little adverse impact on surface waters of the area. The proposed transmission line will be designed to span all open water, and no structures will be placed in the streambed of any surface drainage. The main potential impact from any major construction project is siltation resulting from erosion, and potential pollution resulting from the accidental spillage of petroleum products (fuel, lubricants, etc.) or other chemicals. Vegetation removal could result in increased erosion potential of the affected areas, so that slightly higher than normal sediment yields may be delivered to area streams during a heavy rainfall. However, these short-term effects should be minor as a result of the relatively small area to be disturbed at any particular time, the short duration of the construction activities, and LCRA's efforts to control runoff from construction areas.

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Temporary crossings of streams will be avoided where possible. Following standard procedures, either crushed rock or culverts will be installed at crossings of intermittent streams where road access is necessary. Temporary construction roads will be located to prevent erosion and will be restored to original contours. If flowing water is present in any of the creeks to be spanned, construction machinery and equipment will be transported around via existing roads to avoid direct crossings. This will eliminate the necessity of constructing temporary low-water crossings, which might result in erosion, siltation and disturbance of the stream and its biota. If a stream to be spanned is dry at the time of construction, some earth may need to be moved to facilitate crossing, but the area will ultimately be restored to preconstruction conditions. Selective clearing (i.e., use of chain saws instead of heavy machinery), if necessary at stream crossings, will be undertaken to minimize erosion problems. Highly erodible areas adjacent to streams (stream banks) will not be cleared unless necessary. Section 1.6.1 (Clearing) and 1.6.2 (Construction) of this report detail the LCRA's standard guidelines for controlling soil erosion and sedimentation of waterways. All stream crossings will be revegetated where soils are disturbed or original vegetation removed. Where significant soil disturbance cannot be avoided in close proximity to streams, silt fences will be installed between the area of disturbance and the waterway to prevent excessive siltation in those waterways. Care will be taken to prevent brush from spilling into or blocking stream channels. Construction of the line over a stream could result in some temporary erosion or short-term disturbance resulting in siltation, but impacts would be minimal and localized, because of the intermittent nature of the majority of the streams crossed by the alternative routes. No long-term adverse effects are anticipated.

Although Route 1 crosses the fewest streams (17), it has the most ROW parallel to streams (within 100 ft) (5,680 ft). Routes 2 and 3 cross 18 streams. Route 2 also has approximately 5,060 ft of ROW parallel to streams (within 100 ft). Although Route 3 crosses one more stream than Route 1 and the same number as route 2, it does not have any ROW parallel to streams (within 100 ft). Routes 5, 6, and 7 make the most stream crossings (21). Of the alternative routes considered, Route 3 is the preferred route when just considering stream crossings and ROW parallel to streams.

5.1.3.3 Ground Water

The construction, operation and maintenance of the proposed transmission line is not expected to adversely affect ground water resources in the study area or its vicinity. The effect of the proposed transmission line on ground water resources will be negligible because the line will be erected above ground rather than being buried. Furthermore, soil erosion control measures can minimize erosion and resulting siltation, as well as minor nutrient loading of the water resources. The amount of recharge area disturbed by construction is insignificant compared to the total amount of recharge area available for the ground water systems in the region. No measurable alteration of aquifer recharge capacity should occur, and the likelihood of ground water contamination is not significant.

The main potential impact on ground water resources from any construction project is pollution resulting from the accidental spillage of petroleum or other chemical products. Efforts will be made during construction for proper control and handling of any petroleum or other chemical products. The most effective method to avoid ground water impact is the implementation of proper spill-prevention and spill-response plans. The LCRA has a comprehensive spill response plan and will utilize it if necessary; moreover, such control measures would be in place as additional precautionary measures during the construction phase of the project.

5.1.4 Impacts on Ecosystems

5.1.4.1 Vegetation

The primary impact to vegetation resulting from ROW clearing and construction for the proposed transmission line would be the removal of existing woody vegetation from the areas required for the ROW. Table 6-1 (Ecology) presents the linear extent of important vegetation communities and the potential wetlands crossed by each of the alternative routes. The greatest amount of vegetation clearing would be required in upland woodland and bottomland/riparian woodland communities causing additional forest fragmentation in an area that is predominantly hay and pastureland. In contrast, minimal clearing would be necessary in cropland, pasturelands, or where paralleling existing roads or other ROWs. Within pasturelands and croplands, the ROWs might be temporarily unavailable for grazing or cultivation during construction; however, following project completion the ROW could generally be used as the landowner desires, with some exceptions.

The potential impacts of each of the alternative routes on vegetation communities were measured in linear feet and based on interpretation of aerial photography (black-and-white photography at a scale of 1 inch = 800 ft). In addition, an effort was made to cross-reference additional sources including USGS 1:24,000 topographic maps, and an FWS NWI map (1:100,000 scale).

All alternative routes will cross relatively small amounts of woodland (combined upland and bottomland/riparian woodlands) ranging from 23,416 ft (Route 9) to 35,064 ft (Route 3). The least impact to bottomland/riparian woodland would result from Route 10 (2,526 ft). The least impact to upland woodland would result from Route 8 (17,314 ft).

Potential wetlands occurring along the alternative routes may include wetter portions of bottomland/riparian habitat (not all bottomland/riparian woodlands would be considered as jurisdictional wetlands by the USACE) and forested, emergent, and submerged areas associated with streams and open water impoundments. Depressional wetland areas are likely to occur within floodplains of study area streams. According to NWI mapping for the study area, no wetlands are known to occur along any of the primary alternative routes.

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All of the alternative routes make a numerous stream crossings, with Route 1, making the least (17) and routes 5, 6, and 7 the most (21). Route 3 makes 18 stream crossings but has no ROW parallel to and within 100 ft of streams, to Route 1, which has 5,680 ft of ROW parallel (within 100 ft) to streams. Route 6 crosses the least amount of 100-year floodplains (1,020 ft) and has no ROW parallel to streams. The streams of the study area, where crossed by proposed alternative routes, are relative small, headwater streams. Associated wetlands at the stream crossings and within floodplains are expected to be small and easily spanned. Relatively little in the way of impacts to wetlands area likely to result regardless of what alternative route is selected. The greatest potential impact would be from the removal of vegetation, particularly woodland vegetation, adjacent to streams.

Some bottomland/riparian habitat associated with study area streams will likely be impacted by construction activities. Once vegetation is removed or disturbed near streams, the potential for erosion and sedimentation increases. Placement of erosion-control devices downstream of areas disturbed by construction activities will help to check the flow of runoff toward stream or tributary crossings. In close proximity to streams, erosion control measures will be positioned between the disturbed area and the waterway to prevent siltation into any water of the U.S. Placement of fill material within waterways and jurisdictional wetlands is subject to USACE regulation.

In conclusion with regard to the fewest potential impacts to vegetation, routes 9 and 2 are first and second choices, respectively. Although Route 9 crosses a relatively large amount of 100-year floodplains and ROW parallel to streams, it would have the least amount of impact to combined woodlands (upland and bottomland/riparian woodlands) than the other alternative routes. Route 2 crosses approximately 1,448 more woodland (bottomland and upland combined), and makes two less stream crossings than Route 9, and has the second-least amount of ROW parallel to streams overall. Routes 3 and 6 are the least desirable when considering combined impacts to upland and bottomland/riparian woodlands (eleventh and tenth choices, respectively), since they would require more clearing of woodlands than the other routes.

Construction within the ROW will be performed in such a manner as to minimize adverse impacts to vegetation and to retain existing ground cover wherever possible. Clearing restrictions will be designed to minimize the damage to local vegetation and retain native ground cover wherever possible. Clearing will only occur where necessary to provide access and working space and to protect conductors. If necessary, soil conservation practices will be undertaken to protect local vegetation and ensure a successful restoration program for disturbed areas. Erosion and stream sedimentation will be controlled by accepted procedures.

5.1.4.2 Wildlife

The impacts of transmission lines on wildlife can be divided into short-term effects resulting from physical disturbance during construction and long-term effects resulting from habitat loss and modification. The net effect on local wildlife of these two types of impacts, as the result transmission line construction, is usually minor. Clearing and construction will directly and/or indirectly affect most animals that reside or wander within the transmission line ROW. The heavy machinery used for clearing and construction may kill some small, low-mobility forms. These include several species of amphibians, reptiles, mammals, and if ROW clearing occurs during breeding season, the young of many species including nesting and fledgling birds. Burrowing animals such as mice and shrews may similarly be negatively impacted as a result of soil compaction caused by heavy machinery. Larger, more mobile species such as birds, deer, foxes, and squirrels may avoid the initial clearing and construction activities and move into adjacent areas outside the ROW. Wildlife in the immediate area may experience a slight loss of browse or forage material during construction; however, the prevalence of similar habitats in adjacent areas and re-growth of vegetation in the ROW following construction will minimize the effects of this loss.

The increased noise and activity levels during construction could potentially disturb breeding or other activities of species inhabiting the areas adjacent to the ROW. These impacts are expected to be temporary, however. Thus, although the normal behavior of many wildlife species may be disturbed during construction, little long-term damage to the populations of such organisms will result.

Once construction is completed and the vegetation recovers, most forms of wildlife will move back into the ROW. Periodic clearing, which may temporarily cause some negative impacts to wildlife, typically improves the habitat for species that prefer ecotonal or "edge habitats." With the increase in sunlight penetration to a previously dense shrub/tree stratum, more perennial forbs and grasses will germinate. Such edge habitats are preferred by many species such as eastern cottontail, white-tailed deer, and northern bobwhite. In some areas, the stacking of brush along borders of ROWs could also serve to increase the edge habitat and provide additional cover for wildlife. Species such as white-tailed deer that require open areas as well as dense cover may also use the ROW.

Several studies have indicated that forest fragmentation has a detrimental effect on some avian species that show a marked preference for large undisturbed forest tracts (Robbins et al., 1989; Terborgh, 1989). Studies have also demonstrated that individual species are not randomly distributed with regard to habitat size. Also, it has been demonstrated that area-sensitive species requiring forest interior habitat are typically more sensitive to fragmentation than edge-adapted species and are particularly affected by predation, brood-parasitism, and other impacts on nesting success (Terborgh, 1989; Faaborg et al., 1992). Neotropical migrants within the study area could become vulnerable to nest predation or parasitism by edge species such as American crow (*Corvus brachyrhynchos*), and brown-headed cowbird (*Molthrus ater*) as a result of fragmentation of woodlands by the transmission line ROW.

Transmission lines can benefit some bird species, particularly raptors, by providing nest sites and hunting perches. One of the more common species that uses transmission line structures for

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nesting is the red-tailed hawk (*Buteo jamaicensis*), however the greatest use of these structures is for hunting perches (Olendorff et al., 1981). The wires and structures could increase the number of roosting (or perching) sites over parts of the transmission line route for such species as the red-tailed hawk, American kestrel (*Falco sparverius*), mourning dove, and eastern bluebird (*Sialia sialis*). The danger of electrocution to birds will be insignificant since the distance between conductors, or conductor and structure or ground wire on 138-kV transmission lines is usually greater than the wingspan of any bird in the area (i.e., >6 ft.).

The transmission line (both structures and wires) will present a hazard to flying birds, particularly migrants. Because small birds such as passerines tend to migrate at lower altitudes than large birds (Tucker, 1975, cited by Gauthreax, 1978), their potential for collisions should be greater. Most migrant species however, including passerines, should be minimally affected during migration since their normal flying altitudes are greater than the heights of the proposed transmission structures (Willard, 1978; Gauthreax, 1978). Large birds are more prone to collisions because their large wingspans and lack of maneuverability make avoiding obstacles more difficult (Avian Power Line Interaction Committee (APLIC), 1994).

Collisions tend to increase in frequency during the fall when migrating flocks are denser and flight altitudes are lower in association with cold air masses, fog, and inclement weather. The greatest danger of mortality exists when birds are flying low or when terminating a flight during periods of low ceiling, poor visibility, and drizzle, and may have difficulty seeing obstructions. For resident birds or for birds during periods of non-migration, those most prone to collision are often the largest and most common in a given area (Rusz et al., 1986; APLIC, 1994). Resident birds, or those in an area for an extended period, learn the location of power lines and become less susceptible to wire strikes (Avery, 1978). Raptors are typically uncommon victims of transmission line collisions due to their great visual acuity (Thompson, 1978). In addition, many raptors only become active after sufficient thermal currents develop, which is usually late in the morning when poor light is generally not a factor (Avery, 1978).

Power lines within daily use areas are responsible for most bird collisions. Waterfowl species are vulnerable because of their low altitude flight and high speed. Species that travel in flocks, such as blackbirds and many shorebirds, are also vulnerable, since dense flocks make movements around obstacles more difficult for individuals in the flock (APLIC, 1994).

Several means can be employed to minimize transmission line impacts on birds in flight. The initial placement of a transmission line is the most important consideration (Avery, 1978; APLIC, 1994). The proximity of a transmission line to areas of frequent bird use is critical. This is especially true for daily use areas (such as feeding areas) or other areas where birds may be taking off and landing regularly (APLIC, 1994). The position of the individual structures can also help reduce collisions. An in-depth study in North Dakota indicated that birds in flight tend to avoid the transmission line structures, presumably because such structures are visible from a distance. Instead, most appear to fly over the lines in the mid-span region. In areas where the transmission line passes between roosting and foraging areas, the structures can be placed in the center of the flyway (i.e., where the birds are more likely to fly) to increase their visibility, in addition to heavily marking the wires Faanes (1987).

Other factors that should be considered in the initial transmission line routing are the height of the surrounding vegetation and the topography of the area (APLIC, 1994). The height of transmission lines relative to the surrounding vegetation can help reduce the probability of collisions. Lines built at the height of the surrounding trees seldom are a problem for forest-dwelling birds, and large birds will avoid the treeline, thus avoiding the transmission line (Thompson, 1978; APLIC, 1994). Topographical features such as valleys, ridges, mountain passes should also be considered, to avoid important flight paths.

The configuration of wires of a transmission line, including the ground wires, also should be considered. Faanes (1987) reported that 97% of birds observed colliding with a power line did so with the ground (static) wire, largely as a result of trying to avoid the conductors. Beaulaurier (1981) found that removal of the ground wire at two study sites in Oregon resulted in a reduction in collisions of 35% and 69%. Lines configurations grouped more into a horizontal plane are generally better than lines grouped in a vertical plane (APLIC, 1994).

Increasing the visibility of the wires by using markers such as orange aviation balls, black-and-white ribbons or spiral vibration dampers, particularly at mid-span, can reduce the number of collisions. Beaulaurier (1981) reviewed 17 studies involving marking ground wires or conductors and found an average reduction in collisions of 45% compared to unmarked lines.

The greatest potential impact to wildlife from transmission line projects would primarily result from the destruction of forest habitats. Forestlands, particularly, are relatively static environments that require greater regenerative time compared to pastureland, cropland, grassland, or emergent wetlands. In most cases, wetlands can be spanned with little or no resulting impact to wildlife. In general, because vegetation provides habitat for wildlife, the preferred route from a vegetation standpoint is usually also the preferred route from a wildlife standpoint.

Impacts to aquatic ecosystems will be negligible since all stream crossings will be spanned and erosion-control measures will be employed at all crossings. Land clearing and/or construction activities may result in increased suspended solids entering the creeks traversed by the transmission line. This would be a temporary impact because higher than normal suspended solid loads would cease as areas disturbed by construction became revegetated. Stock ponds should receive no impact from the proposed transmission line, since the line will span these features.

Alternative Route 9 is the preferred route considering impacts to wildlife because it would require the least amount of woodland clearing. Route 2 is considered the second choice from a wildlife perspective, because it would require the second-least amount of woodland clearing. Routes 9 and 2 are also among the shortest alternatives (fourth- and fifth-shortest, respectively). Route 3 is the last choice considering impacts to wildlife, because it would require the greatest amount of clearing of forest and it is the third-longest route.

5.1.4.3 Endangered and Threatened Species

No state or federal endangered, threatened, or SOC plant species are expected to occur within the study area, and the project is not expected to negatively affect any of the endangered, threatened, or SOC wildlife species that could occur in the study area. Generally, the majority of the species of potential occurrence in the study area are highly mobile and either do not normally utilize local environments or pass through the area only during migration. The peregrine falcon whooping crane, interior least tern, bald eagle, mountain plover, white-faced ibis, and piping plover are migrants for which transmission lines may present a hazard. Normal flying altitudes during migration, however, are greater than the height of the proposed transmission line structures. Transmission lines may provide roosting sites for some migrating birds passing through the area. The loggerhead shrike, which is a resident bird that is expected to occur within the study area, may be directly affected by the project, particularly if clearing and construction results in the destruction of active nest sites. As mentioned in Section 2.6.3.1, the loggerhead is a SOC that is not protected under the Endangered Species Act. Impacts to individual loggerhead shrikes, should they occur, would not present a threat to the species. Aquatic species, such as Cagle's map turtle and the Guadalupe bass, if they inhabit study area streams, occur in habitats that would be spanned, and therefore would not be negatively affected.

5.2 HUMAN RESOURCES IMPACTS

5.2.1 Socioeconomic Impacts

For this project, minimal short-term local employment will be generated. GVEC normally uses its own employees during the clearing and construction phase of transmission line projects. However, a portion of the project wages will find their way into the local economy through purchases such as fuel, food, lodging, and possibly building materials. ROW easement payments will be made to individuals whose lands are crossed by the transmission line based on the appraised land value, and this will result in increased income to those landowners. GVEC is subject to paying local property tax on land or improvements. Since GVEC will only require easements for the proposed line, none of this land will be taken off the tax rolls. The cost of permitting, designing, and constructing the line will be paid for through revenue generated by the sale of electrical service.

Potential long-term economic benefits to the community resulting from construction of this project are based on the requirement that electric utilities provide an adequate and reliable level of power throughout their service areas. Economic growth and development rely heavily on adequate public utilities, including a reliable electrical power supply. Without this basic infrastructure a community's potential for economic growth is constrained.

5.2.2 Impacts on Community Values

The term "community values" is included as a factor for the consideration of transmission line certification under Section 37.056(c)(4) of the Texas Utilities Code, although the term has not been specifically defined for regulatory purposes by the PUCT. However, in the CCN application for transmission lines, the PUCT requests information concerning the following items under the general heading "Community Values."

- approvals or permits required from other governmental agencies
- general description of the area
- residences, businesses, schools, churches, cemeteries, hospitals, nursing homes or other habitable structures within 200 ft of the centerline of the proposed project
- AM, FM, microwave and other electronic installations in the area
- FAA-registered airstrips located in the area
- irrigated pasture or croplands utilizing center-pivot or other traveling irrigation systems

Each of the above items, insofar as it affects community values, is discussed in the appropriate section of this document.

For the purposes of evaluating the effects of the proposed transmission line, PBS&J has defined the term community values as a "shared appreciation of an area or other natural or human resource by a national, regional, or local community." Adverse effects upon community values are defined as aspects of the proposed project which would significantly and negatively alter the use, enjoyment, or intrinsic value attached to an important area or resource by a community. This definition assumes that community concerns are identified with the location and specific characteristics of the proposed transmission line and do not include possible objections to electric transmission lines per se.

Impacts on community values can be classified into two areas: (1) direct effects, or those effects which would occur if the location and construction of a transmission line results in the removal of, or loss of public access to, a valued resource; and (2) indirect effects, or those effects which would result from a loss in the enjoyment or use of a resource due to the characteristics (primarily aesthetic) of the proposed line, structures or ROW. Impacts on community values, whether direct or indirect, can be more accurately gauged as they affect recreational areas or resources and the visual environment of an area (aesthetics). Impacts in these areas are discussed in detail in sections 5.2.4 and 5.2.5 of this report.

5.2.3 Impacts on Land Use

Land use impacts from transmission line construction are usually determined by the amount of land (of whatever use) displaced by the actual ROW and by the compatibility of electric transmission line ROW with adjacent land uses. During construction, temporary impacts to land uses within the ROW could occur due to the movement of workers and materials through the area. Construction noise and dust, as well as temporary disruption of traffic flow, may also temporarily affect residents and businesses in the area immediately adjacent to the ROW. Coordination between GVEC, contractors, and landowners regarding access to the ROW and construction scheduling should minimize these disruptions.

The primary criteria considered to measure potential land use impacts for this project included proximity to habitable structures (i.e., residences, businesses, schools, churches, hospitals, nursing homes, etc.), overall length, length using or paralleling existing transmission line ROW, and length parallel to other existing ROW (roads, highways, pipeline, etc.).

Generally, the most important measure of potential land use impact is the number of habitable structures located in the vicinity of each route. PBS&J staff determined the number and distance of habitable structures along each route by evaluating and measuring aerial photographs and ground-truthing that information (with a laser rangefinder) in the field, where possible. For this project there was a wide range in the number of habitable structures within 200 ft of the alternative routes. Routes 4 and 1 have five and six such structures, respectively, while routes 2, 5, 9, and 11 all have 25 or more habitable structures within 200 ft. Route 9 has the most; 30.

The least impact to land use generally results from locating new lines either within, or parallel to, existing transmission line ROW. Routes utilizing Link I (1, 4, and 8) were able to use an open position on GVEC's Capote to Hickory Forest 138-kV transmission line for approximately 3,600 ft. This was the only existing transmission line ROW available for use in this project. The location of two existing 345-kV transmission lines within the study area afforded some opportunity for paralleling existing ROW. However, these two lines generally run in a southeast-northwest direction, while this project requires an east-west route. Nonetheless, all routes parallel at least some of these existing 345-kV ROWs. Routes 4, 5, 6, and 7 parallel the most (9,700 ft), and routes 8, 9, 10, and 11 parallel the least (2,050 ft).

Paralleling other existing compatible ROW is also generally considered a positive routing criteria, and was recently approved as an amendment to the PUCT's substantive rules for transmission line certification. For this project, Route 9 parallels the most existing ROW (44,450 ft), while Route 4 parallels the least (13,400 ft). However, much of this existing ROW is roads/highways, and because habitable structures are often located along roads and highways, the route paralleling the most ROW (Route 9), also has the greatest number of structures within 200 ft (30). In this case the opposite is also true; the route which parallels the least existing ROW (Route 4) also has the fewest habitable structures (5).

Paralleling property lines, where existing compatible ROW is not available, is another positive routing criteria, and was also part of the PUCT's recent amendment to its substantive rules regarding transmission line certification. In this regard, Route 7 parallels the greatest amount of property lines (not on existing roads or highways); at 34,850 ft. Route 9 parallels the least amount of property lines (5,550 ft).

Finally, the overall length of a particular alternative route can be an indicator of the relative level of land use impacts. That is, generally (all other things being approximately equal), the shorter the route, the less land is crossed and the fewer potential impacts will result. In this regard, Route 8 is the shortest alternative at 58,300 ft (11.04 miles), while Route 6 is the longest at 74,975 ft (14.20 miles).

Since the ROW for this project will not be fenced or otherwise separated from adjacent lands, there will be no long-term or significant displacement of farming or grazing activities. Most existing agricultural land uses may be resumed following construction. No crop or pasture land irrigated by circle-pivot or other above-ground mechanical means was identified on aerial photos or by PBS&J field surveys.

The proposed transmission line would have a minimal effect on communication operations in the area. No AM/FM radio transmitters were identified within the study area. One electronic communications tower, an AT&T long-distance telephone facility, is located on Zion Hill Road and is within 2,000 ft of routes 2, 3, 5, 6, 7, 9, 10, and 11.

5.2.4 Impacts on Recreation

Potential impacts to recreational land use include the disruption or preemption of recreational activities. Since none of the proposed alternative routes cross, or come within 1,000 ft of, any designated park or recreation area, there will be no impacts in this area.

5.2.5 Impacts on Aesthetics

Aesthetic impacts, or impacts on visual resources, exist when the ROW, lines and/or structures of a transmission line system create an intrusion into, or substantially alter the character of, the existing view. The significance of the impact is directly related to the quality of the view, in the case of natural scenic areas, or to the importance of the existing setting in the use and/or enjoyment of an area, in the case of valued community resources and recreational areas.

In order to evaluate aesthetic impacts, field surveys were conducted to determine the length of the proposed transmission line that would be visible from selected areas. These areas included those of potential community value, recreational areas, particular scenic vistas that were encountered during the field survey, and U.S. and state highways which cross the study area. Measurements were made to estimate the length of each alternative route that would fall within recreational or major highway foreground visual zone (one-half mile, unobstructed by vegetation or topography). The determination of the visibility of the transmission line from various points was calculated from USGS maps and aerial photography.

Construction of the proposed 138-kV transmission line could have both temporary and permanent aesthetic effects. Temporary impacts would include views of the actual assembly and erection of the structures and clearing of the ROW. Where wooded areas are cleared, the brush and wood debris could have a temporary negative impact on the local visual environment. Permanent impacts from the project would involve the views of the structures and lines as well as views of cleared ROW.

SH 123 cuts the study area roughly into two halves: east and west. This is the only state or U.S. highway in the study area and carries the most traffic. Routes 1, 4, and 8 would have the least ROW (approximately 5,280 ft) within the foreground visual zone of SH 123. The foreground visual zone is defined as that part of the transmission line within one-half mile of an observer, which is also visible (i.e., not obstructed by terrain or trees). Routes 3, 6, 7, 10, and 11 would be the most visible, having approximately 9,300 ft of the line within the foreground visual zone. Because there is generally less traffic, there is also less of a visual impact to motorists on FM roads. In this regard, Route 1 would have the least length (approximately 3,340 ft) in the foreground zone, while Route 4 would have the greatest (approximately 8,890 ft).

Table 6-1 in Section 6.0 of this report presents specific data on line visibility for each of the primary alternative routes in each of the categories discussed above. GVEC will attempt to mitigate, as much as possible, the potential aesthetic impacts of the proposed project in the area, regardless of which route is eventually selected. Several possible mitigative measures relating to aesthetics are detailed in Section 1.4.9 of this report.

5.2.6 Impacts to Transportation/Aviation

Potential impacts to transportation could include temporary disruption of traffic and conflicts with proposed roadway and/or utility improvements, and may include increased traffic during construction of the proposed project. However, such impacts are usually temporary and short-term.

The proposed transmission line facilities will have little or no effect on aviation operations within the study area. Structure heights will vary between 80 and 100 ft, depending upon structure design and location. According to Federal Aviation Regulations, Part 77, notification of the construction of the proposed transmission line will be required if structure heights exceed the height of an imaginary surface extending outward and upward at a slope of 100 to 1 for a horizontal distance of 20,000 ft from the nearest point of the nearest runway of a public or military airport having at least one runway longer than 3,200 ft. If a runway is less than 3,200 ft, notification will be required if structure heights exceed the height of an imaginary surface extending at a slope of 50 to 1 for a distance of 10,000.

According to PBS&J's preliminary calculations, construction of the proposed transmission line along any of the proposed alternative routes would not fall under the above criteria with respect to notification of the FAA. Following PUCT approval of a route for the proposed transmission line, GVEC will make a final determination of the need for FAA notification. The result of this notification, and any subsequent coordination with the FAA, could include changes in line design and/or potential requirements to mark and/or light the line.

5.3 CULTURAL RESOURCES IMPACTS

Any construction activity has the potential for adversely impacting cultural resource sites. Although this transmission line project is being constructed without federal funding, permitting, or assistance, federal guidelines established under Section 106 of the National Historic Preservation Act of 1966, as amended, provide useful standards for considering the severity of possible direct and indirect impacts. According to the Secretary of the Interior's Guidelines for protection of historical and archaeological resources (36CFR800), adverse impacts may occur directly or indirectly when a project causes changes in archaeological, architectural, or cultural qualities that contribute to a site's historical or archaeological significance.

5.3.1 Direct Impacts

Direct impacts to recorded or unrecorded cultural resources sites may occur during the construction phase of the proposed transmission line and cause physical destruction or alteration of all or part of a resource. Typically, direct impacts are caused by the actual construction of the line or through increased vehicular and pedestrian traffic during the construction phase. The increase in vehicular traffic may damage surficial or shallowly buried sites, while the increase in pedestrian traffic could potentially result in vandalism of some sites. Although this traffic could lead to easier access to some sites, GVEC generally does not allow public access to its easements and most easements are on private property, further limiting access. Additionally, construction of a transmission line may directly alter, damage, or destroy historic buildings, engineering structures, landscapes, or districts. Direct impacts may also include isolation of a resource from, or alteration of, its surrounding environment (setting).

5.3.2 Indirect Impacts

Indirect impacts include those caused by the project that are further removed in distance, or which occur later in time but are reasonably foreseeable. These indirect impacts may include introduction of visual or audible elements that are out of character with the resource or its setting. Indirect impacts may also occur as a result of alterations in the pattern of land use, changes in population density, accelerated growth rates, or increased pedestrian or vehicular traffic (although again, GVEC does not allow public access to its easements). Historic buildings, structures, landscapes and districts are among the types of resources that might be adversely impacted by the indirect impact of the proposed transmission towers and lines.

5.3.3 Mitigation

The preferred form of mitigation for cultural resources is avoidance. An alternative form of mitigation of direct impacts can be developed for archaeological and historical sites with the implementation of a program of detailed data retrieval. Indirect impacts on historical properties and landscapes can be lessened through careful design and landscaping considerations. Additionally, relocation may be possible for some historic structures.

5.3.4 Summary of Cultural Resource Impacts

High-probability areas (HPA) for prehistoric sites include upland settings near a source of available lithic raw material, terraces and other landforms overlooking or within 1,000 ft of reliable water sources, and areas of recent alluvium. These sites are often expressed as lithic scatters composed of debitage, projectile point fragments, bifaces, cores, and choppers. Sometime concentrations of burned rock or hearth features are also present.

Sites dating to the Historic Period are present in Guadalupe County. Historic sites, naturally, would be most abundant adjacent to historic roadways. Site 41GU68, which is located within the study area boundaries, is a historic site located on a gentle, east-facing slope between York Creek tributaries. No structural remains are associated with this site and it appears to represent a single episode of dumping. Two historic sites that are composed of structural remnants and artifact scatters that date to the early twentieth century are 41GU59 and 41GU46. Site 41GU59 is a historic house site composed of a septic tank, concrete slab, foundation supports, and a domestic artifact scatter. Other than an estimated time of occupation (between 1920 and 1960) little else is known of the site and the original recorders recommended no further investigation. Site 41GU46 is a historic barn/former residence. The site is composed of a small barn formerly used as a residence and a scatter of historic domestic ceramics. This site is also undated, but the artifacts described by the original recorders are typical of those found in early to mid- twentieth century sites.

Multi-component sites are expressed as a combination of prehistoric and historic artifact scatters. The prehistoric components lack diagnostic artifacts, but the historic components are composed of bottle glass or ceramic fragments typical of twentieth century deposits.

The proposed construction of GVEC's Hickory Forest to New Berlin Transmission Line has the potential to impact unrecorded archaeological and historical sites. The literature and records review conducted for this project identified two previously recorded cultural resource sites within the boundaries of the study area. Of these, one (41GU67) is about 1,000 feet from Link D and the other (41GU68) is about 1,500 ft from links E, G, and H. Both of these sites have been determined not eligible for listing to the NRHP by the THC (Turpin, 2001; Morley, 2001).

Each of the routes described below was evaluated using the following three variables: 1) the number of known sites crossed or within 1,000 ft; 2) the number of known NRHP or SAL sites listed or determined eligible for listing crossed or within 1,000 ft and; 3) the amount of HPA crossed by each route. However, since no sites are crossed by any of the proposed routes and the one site that was recorded within 1,000 ft of three of the proposed routes has been determined not eligible by the THC, these variables were all equal and not used during the evaluation process. The only variable used for the ranking of the proposed routes was the length of HPA crossed by each of the proposed alternative routes.

Eleven routes made up of various combinations of 14 links were evaluated for the proposed 138-kV transmission line project in Guadalupe County, Texas. The links range in length from 1,950 ft (Link A) to 36,800 ft (Link K). Each link labeled A, B, C, C', D, D' and E through L was individually assessed for the probability of containing cultural resource sites before the route was evaluated in its entirety. Thirteen of the links do not cross or come within 1,000 ft of a known cultural resource site. The only link that is within 1,000 ft of a known site is Link D. None of the recorded sites are located within the ROW of any of the routes. Because a cultural resources survey has not been conducted for the entirety of any of the proposed routes, the possibility of impacting unknown archaeological and historic sites does exist.

Link A is 1,950 ft long. Of this length, about 1,515 ft have been identified as HPA for the occurrence of previously unrecorded cultural resource sites. Link B is 12,875 ft in length and contains about 9,146 ft of HPA. Link C is 11,550 ft long, of which about 8,416 ft is considered HPA for archaeological sites. Link C' is 2050 ft in length and contains approximately 1,967 ft of HPA. Link D is 19,400 ft long and has about 12,539 ft identified as HPA. Link D' is 3,490 ft in length and contains approximately 3,262 ft identified as HPA. Link E is 4,800 ft long and contains about 3,080 ft identified as HPA. Link F is 14,200 ft in length and contains approximately 9,482 ft of HPA. Link G is 8,650 ft long, of which about 8,744 ft have been identified as HPA for the occurrence of previously unrecorded cultural resources. Link H has a length of 6,000 ft, of which approximately 8,102 ft has been identified as HPA. Link I is 25,650 feet long and contains about 19,008 ft of HPA. Link J is 22,100 feet long and

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contains about 15,453 ft of HPA. Link K is 36,800 ft long and contains about 12,095 ft of HPA. The final link, Link L, is 7,050 ft in total length, approximately 1,566 ft of which has been identified as HPA for the occurrence of previously unrecorded cultural resource properties.

Route 1 is made up of the following four links, D-E-G and I, that cumulatively total 58,700 ft (14.12 miles) in length. The total HPA for the occurrence of cultural resource sites for Route 1 is about 40,370 ft (7.64 miles). Route 2 consists of links D-E-G-J and L. Combined, these links are 62,200 ft (11.78 miles) long, of which approximately 41,380 ft (7.83 miles) are identified as HPA for the occurrence of cultural resource sites. Route 3 includes links D-E-H-K and L and is 74,050 ft (14.02 miles) in length. The total length of HPA identified for Route 3 is about 37,382 ft (7.07 miles). Route 4 is 59,625 ft (11.29 miles) in length, of which about 73,720 ft (8.28 miles) has been identified as HPA for the occurrence of previously unrecorded archaeological sites. Route 5 consists of eight links, A-B-C'-D'-E-G-J and L. The total length of Route 5 is 63,125 ft (11.96 miles), of which approximately 44,733 ft (8.47 miles) has been identified as HPA for the occurrence of unrecorded cultural resource properties.

Route 6 is made up of links A-B-C'-D'-E-H-K and L, which cumulatively total 74,975 ft (14.20 miles) in length. Approximately 40,733 ft (7.71 miles) fit the description of HPA. Route 7 is a combination of six links, A-B-C'-F-K and L. The total length of Route 7 is 74,925 ft (14.19 miles), of which approximately 35,770 ft (6.77 miles) have been identified as HPA. Route 8 includes links A-C-C'-D'-E-G and I. Combined, these links add up to 53,300 ft (11.04 miles). Of these, about 72,990 ft (8.14 miles) are identified as HPA. Route 9 contains eight links and is 61,800 ft long (11.70 miles). The approximate distance of HPA is 44,003 ft (8.33 miles). Route 10 is 73,650 ft (13.95 miles) long. Of this distance, about 40,003 ft (7.57 miles) has been determined to be HPA. Route 11 consists of links A-C-C'-F-K and L. The cumulative length of this route is 73,600 feet (13.94 miles); about 35,040 ft (6.63 miles) is identified as HPA for the occurrence of unrecorded archaeological sites.

5.3.5 Conclusions

Route 11 is the preferred route from a cultural resources perspective. The preferred alternate route is Route 7. Route 11 is the preferred route because it does not cross or come within 1,000 ft of any previously recorded site(s) and because it contains the least amount of HPA; 35,040 ft (6.63 miles). The preferred alternate also does not cross any previously recorded site(s), nor is it located within 1,000 ft of any previously recorded sites(s). This route contains 35,770 ft (6.774 miles) of HPA, only slightly more (730 ft or .138 mile) than the preferred route. The third choice is Route 3 (7.07 miles of HPA), followed by Route 10 (7.57 miles of HPA) and Route 1 (7.64 miles of HPA).

The remaining six routes were not ranked, but the order of preference would be based on the length of HPA for each of the proposed routes.

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6.0 PREFERRED ROUTE SELECTION

6.0 PREFERRED ROUTE SELECTION

6.1 EVALUATION OF ALTERNATIVE ROUTES

PBS&J, with review and assistance from GVEC and the LCRA, evaluated numerous preliminary alternative routes for the Hickory Forest to New Berlin Project, taking into consideration engineering, cost, environmental, operation, and maintenance criteria. As a result of this evaluation (summarized in Section 4.0) these routes were narrowed down to eleven primary alternative routes, which were then subjected to a detailed environmental analysis by PBS&J, and an engineering and cost analysis by the LCRA. The preferred and alternate routes were selected from these primary alternatives.

6.1.1 Public Involvement Program

GVEC and the LCRA held one public open-house meeting at the Hillcrest Assembly of God in Seguin on January 8, 2002. Landowners along the alternative routes were invited, as well as local elected officials. These meetings were intended to solicit comments from citizens, landowners, and public officials concerning the proposed project. The meetings had the following objectives:

- Promote a better understanding of the proposed project including the purpose, need, and potential benefits and impacts
- Inform and educate the public with regard to the routing procedure, schedule, and decision-making process
- Ensure that the decision-making process accurately identifies and considers the values and concerns of the public and community leaders

Public involvement contributed both to the evaluation of issues and concerns by GVEC, LCRA, and PBS&J, and to the selection of a preferred route for the project.

At the meeting, rather than a formal presentation in a speaker-audience format, GVEC, LCRA, and PBS&J staff utilized space by setting up several information stations. Each station was devoted to a particular aspect of the routing study and was manned by GVEC, LCRA, and/or PBS&J staff. Each station had maps, illustrations, photographs, and/or text explaining each particular topic. Interested citizens and property owners were encouraged to visit each station in order, so that the entire process could be explained in the general sequence of project development. The information station format is advantageous because it allows attendees to process information in a more relaxed manner and also allows them to focus on their particular area of interest and ask specific questions. More importantly, the one-to-one discussions with GVEC/LCRA/PBS&J staff encourage more interaction from those citizens who might be hesitant to participate in a speaker-audience format.

GVEC staff at the first station signed visitors in and handed out a questionnaire. The questionnaire solicited comments on citizen concerns as well as an evaluation of the information presented in the open house. Copies of the questionnaires can be found in Appendix A. Completed questionnaires were received by GVEC or the LCRA either at the meeting or later, by fax or mail. Following is a summary of questionnaire responses received from this meeting.

Of the 53 citizens/landowners who signed in at the public meeting, 38 completed questionnaires were turned in. Another seven questionnaires were received by the LCRA after the meeting. Thirty-eight percent of these respondents indicated that the need for the project had been fully explained; 1 percent felt that the need had not been fully explained; while the rest did not answer the question.

When asked about their situation with regard to the proposed project alternative routes, responses were as follows:

- 58 percent said an alternative route was near their home
- 1 percent said an alternative route was near their business
- 47 percent said an alternative route was on or near their property

Respondents listed the following factors they thought the LCRA and GVEC should give the most attention to when considering alternative routes (in order, from most to least mentions, with total in parentheses):

- Follow existing easements and fencelines (10)
- Avoid current and future homesites (9)
- Effect on property value (5)
- Parallel existing transmission lines (4)
- Consider population density (2)
- Put future lines on properties with no existing lines (2)
- Need for the project (1)
- Relocate New Berlin Substation (1)
- Health effects (1)
- Least impact (1)
- Don't impact developed land (1)
- Landowner's wishes

The questionnaire also asked each respondent which route they would like the LCRA and GVEC to select for the proposed project, either by describing the route or highlighting it on the attached map. Some people only indicated a preference for a link; others suggested modifications of the

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proposed alternatives; and some expressed no preference for a route. The preferences (with percentage of total in parentheses) were as follows:

- Route 1 = 5 (11%)
- Route 2 = 5 (11%)
- Route 3 = 2 (<1%)
- Route 4 = 1 (<1%)
- Route 5 = 1 (<1%)
- Route 6 = 0
- Route 7 = 5 (11%)
- Route 8 = 1 (<1%)
- Route 9 = 2 (<1%)
- Route 10 = 0
- Route 11 = 17 (38%)

Another question asked of all respondents was whether they had any specific information that they would like the LCRA and GVEC to consider in the routing of this project. Among the responses (in no particular order) were the following:

- Modify proposed route near New Berlin Substation
- Consider least impact on tree removal
- Already lives near existing line; new line would be "dual infringement"
- Conservation
- Should follows roads
- Cost
- Avoid homes
- Private airstrip near alternative route
- Already have too many easements on property
- Health effects
- Use existing easements
- Benefit local property owners

The last question on the questionnaire asked for additional comments or questions. Responses (again, in no particular order) were as follows:

- Have alternative sources of power to the New Berlin Substation been considered? (2)
- LCRA/GVEC should listen to landowners and publicize preference prior to filing CCN application.
- Follow the pipeline.
- Consider health hazards and property values.
- Opposed to alternative crossing property because of planned residential development.

- Why is project needed? Because of new power plant on Interstate 10?
- Why is there no southern route alternative?
- Transmission line will make land worthless.
- LCRA should buy all land they devalue.

Following the open-house meeting several changes were made to the alternative routes. Some links were dropped, some were modified, and one new link was added. GVEC sent letters (and questionnaires) to any landowner potentially affected by one of the link revisions, who had not been invited to the original public meeting. As of the date of this report, 11 questionnaires were returned to GVEC.

The following information is a summary from those 11 respondents:

Seven of the eleven said a proposed route was near their home, while three reported that an alternative would cross their property. Two others reported a proposed route near a future homesite, and one person said a route would cross his ranch and future subdivision.

Suggested factors for considering alternative routes included:

- small landowners vs. large landowners
- follow existing easements and ROWs (4)
- avoid homes or future homesites (2)
- route on least-developed property
- minimize disturbance to fields and pasture
- choose shortest route
- utility ROWs reduce crop production
- consider number of nearby homes
- underground, if possible

When asked which route they would like the LCRA/GVEC to select, routes 1 and 7 each received one mention, while routes 5, 8, and 11 were the preference of two respondents each. People who voiced opposition suggested they would prefer any route using Link K, while another was against routes 4, 5, 6, 8, 9, or 10 (which each include Link D').

When asked to provide specific information to consider when routing the proposed line, or for additional comments, the following was offered:

- landowner already has 345-kV easement on property
- landowner already has distribution line on property (2)
- suggested routing in least-populated area
- suggested transmission line would decrease property value (3)

- questioned why private landowners have to support the electrical needs of the entire community and other communities without choice or proper compensation.
- one landowner was upset at not being invited to open-house meeting and suggested that there should have been a second public meeting for "newly affected" landowners. This landowner has existing transmission lines already impacting property.

6.1.2 Environmental Evaluation

In evaluating the primary alternative transmission line routes, environmental and engineering/cost considerations were handled separately. PBS&J used a consensus process to evaluate the potential environmental impact of the alternative routes. PBS&J professionals with expertise in different environmental disciplines (terrestrial and aquatic ecology, land use/planning, and cultural resources) evaluated all eleven primary alternative routes. This evaluation was based on data collected for 35 separate environmental criteria, comments from local, state, and federal agencies, public involvement, and field reconnaissance of the study area and proposed alternative routes. The amount or number of each environmental criterion measured along the primary alternative routes is presented in Table 6-1. Each person on the evaluation team independently analyzed the routes from the perspective of their particular discipline and subsequently discussed their independent results as a group. Factors of particular importance in the land use/planning evaluation included the number of habitable structures within 200 ft, the length of ROW paralleling existing ROW, including existing transmission line ROW, and length parallel to property lines. The main factor considered important in the ecological evaluation was length through upland woodlands and bottomland/riparian woodlands. Since no recorded sites were crossed by any route, and there was only one recorded site within 1,000 ft of any route, the cultural resources evaluation focused primarily on the length across areas of predicted high probability for the occurrence of cultural resources.

The relationship, sensitivity, and relative importance of the major environmental criteria were determined by the evaluation group as a whole. The group agreed that, for this project, there were several areas (habitable structures, ROW and property lines paralleled), where potential impacts would provide an important basis for evaluating and comparing the routes, and that no single criteria would significantly outweigh the others when selecting a preferred route. A preferred route based solely on measurable environmental factors was selected by reaching a consensus of the group. At the same time, the group ranked the top five primary alternatives in order of their potential environmental impact. This ranking is shown in Table 6-2. Although all alternative routes evaluated in this report are environmentally acceptable routes, it was the consensus of PBS&J evaluators that Route 4 was the most favorable alternative after evaluating the objective criteria.

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OVERSIZED MAP(S)

**TO VIEW
OVERSIZED MAP(S),
PLEASE GO TO
CENTRAL RECORDS.**

(512) 936-7180

TABLE 6-2

ENVIRONMENTAL RANKING OF
PRIMARY ALTERNATIVE ROUTES
HICKORY FOREST-NEW BERLIN PROJECT

	Ranking*			
Route	Land Use	Ecology	Cultural Resources	Consensus
1	2	5	5	2
2	—	2	—	—
3	—	—	3	—
4	1	4	—	1
5	—	—	—	—
6	5	—	—	5
7	4	—	2	4
8	3	3	—	3
9	—	1	—	—
10	—	—	4	—
11	—	—	1	—

* Routes ranked in order of preference; 1-5.

The land use evaluation concentrated on habitable structures, length of ROW parallel to existing ROW, and length of ROW parallel to property lines. Route 4 had the fewest number of habitable structures within 200 ft (5); used the most existing transmission line ROW; and paralleled the most existing transmission line ROW. This lead to its selection as the preferred "land use" alternative.

Route 9 crossed the least amount of woodland (upland and bottomland/riparian combined) and this was the primary factor leading to its selection as the preferred route from an ecological perspective. Other ecological criteria were either relatively equal or absent.

Since none of the primary alternatives crossed any known cultural resources sites, and only came within 1,000 ft of one known site, the cultural resources evaluation was based solely on the length of each route across areas determined to have a high probability of containing cultural resources. This led to the selection of Route 11 as the preferred route (35,040 ft of HPA).

During the consensus discussion all evaluators agreed that, with no known endangered species habitat, no potential wetlands impacts, and in the absence of known, significant cultural resources, land use concerns would be the primary evaluation criteria used to recommend a preferred route. The group also agreed that Route 4 would be the recommended preferred route, with Routes 1, 8, 7 and 6 recommended alternate routes.

PBS&J's decision to select Route 4 as the recommended preferred route was based on the following advantages among the objective criteria.

- third-shortest alternative route
- least number of habitable structures within 200 ft
- uses greatest length of existing transmission line ROW (tied with routes 1 and 8)
- greatest length of ROW parallel to existing transmission line ROW (tied with routes 5, 6, and 7)
- crosses no cropland (tied with route 6)
- least visible from U.S. and state highways

The selection of routes 1, 6, 7, and 8 as the recommended alternate routes was based on the same criteria: habitable structures, amount of existing ROW used or paralleled, and length of property lines paralleled.

6.1.3 GVEC Review

GVEC conducted an extensive review of PBS&J's environmental data, recent aerial photography, USGS 7.5-minute topographic maps, public input gathered at the open house meetings, and other public information, prior to selection of a preferred route. This review included engineering, community values, land use issues, and a detailed study of aerial photography. Field reconnaissance of all primary alternative routes was conducted from public roads and items of importance noted.

6.1.4 Cost Ranking

The LCRA provided monetary cost estimates for each of the five ranked primary alternative routes. The total cost for each route was determined by calculating the cost per mile of each factor relevant to the construction of a 138-kV transmission line (i.e., ROW, construction, materials, engineering, survey, etc.). The difference in cost between the highest- and lowest-ranked alternative and the monetary ranking of the five ranked primary routes is presented in Table 6-3.

6.1.5 Comments from Agencies and Officials

The following local, state, and federal agencies and officials were contacted by letter in October 2001 by GVEC and PBS&J to solicit comments, concerns, and information regarding potential environmental impacts, permits, or approvals for the construction of the proposed 138-kV transmission line in southeast Texas. Maps of the study area were included with each letter. Sample copies of GVEC's and PBS&J's letters and responses received as of the date of this report are included in Appendix B.

- Mayor, City of New Berlin
- Guadalupe County Judge
- Guadalupe County Commissioner, Precinct 1
- Guadalupe County Commissioner, Precinct 4
- Guadalupe County Floodplain Administrator
- Seguin ISD Superintendent
- Alamo Area Council of Governments (AACOG)
- Texas Department of Transportation (TxDOT), Aviation Division
- Texas Department of Transportation (TxDOT), Division of Environmental Affairs
- Texas Historical Commission (THC)
- Texas Natural Resource Conservation Commission (TNRCC)
- Texas Parks and Wildlife Department (TPWD), Biological and Conservation Data Systems
- Texas Parks and Wildlife Department (TPWD), Resource Protection Division
- Texas Water Development Board (TWDB)
- Federal Aviation Administration (FAA)

TABLE 6-3

COST RANKING
OF PRIMARY ALTERNATIVE ROUTES
HICKORY FOREST-NEW BERLIN PROJECT

Route	Length (miles)	Cost ($)	Cost Rank
4	11.29*	3,920,800	2
1	11.12*	3,696,127	1
8	11.04*	4,209,412	3
7	14.19	4,633,668	4
6	14.20	4,699,664	5

Source: LCRA, 2002.

*Plus approximately 3,600 ft of new circuit on existing structures.

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- Federal Emergency Management Agency (FEMA), Natural and Technological Hazards Division
- National Park Service (NPS)
- Natural Resources Conservation Service (NRCS)
- U.S. Army Corps of Engineers (USACE)
- U.S. Environmental Protection Agency (EPA), Region 6
- U.S. Fish and Wildlife Service (FWS)

FEMA stated that Guadalupe County participates in the National Flood Insurance Program and recommended that the County Floodplain Administrator be contacted. FEMA's concerns are the possible negative impact to identified special flood hazard areas, which includes 100-year floodplains.

The THC commented that not much of the study area had been surveyed by professional archeologists and that it was possible that the proposed project could have adverse effects on historic properties. The agency suggested that areas with a high potential for containing historic properties be identified and avoided. They also requested additional information, including alternative routes, be provided when available, and noted that surveys of portions of the line could be required.

The EPA responded by recommending that efforts be taken to minimize "non-point sources" of pollution resulting from construction, and referenced the EPA's National Pollutant Discharge Elimination System (NPDES) storm water general permit requirements. The agency also mentioned potential air quality impacts and solid waste disposal as areas of concern.

TxDOT stated that their San Antonio District office has requested copies of all regulatory permits and clearances where proposed transmission lines cross state-maintained roads and highways. Since there were not alternative routes at the time the letter was sent, TxDOT had no additional comments.

TPWD provided information on federal and state listed endangered, threatened, and candidate species of potential occurrence in Guadalupe County. They also expressed concerns with regard to potential impacts to wetlands, riparian areas, floodplains, native vegetation communities, and remnant natural communities, and recommended that these areas be identified and avoided. The agency included two publications with recommendations to follow the guidelines included in each. These publications were: *TPWD Guidelines for Construction and Clearing within Riparian Areas* and *TPWD Recommendations for Electrical Transmission Line Design and Construction.* TPWD's letter also included information regarding permits for disturbing streambeds and impacting wetlands and waters of the U.S., information on the Migratory Bird Treaty Act, and methods to minimize or avoid avian electrocutions and wire strikes.