

6.0 MANAGEMENT ALTERNATIVES

The team of CSE–S&W–Dewberry has evaluated the accreted land (AL) area of Sullivan’s Island and has described its history, present condition, and expected future changes with respect to the shoreline, dunes and vegetation, as well as the flood potential under 10-year and 100-year storm events. The AL area comprises nearly 190 acres of low dunes and swales that have formed within the last ~70 years. Excess sand supplied by way of littoral transport from Isle of Palms and Breach Inlet accounts for the buildup of the AL area. Average shoreline change has been ~10 ft/yr with the likelihood of continued accretion through 2050 even under probable SLR scenarios (Kana et al 1984, IPCC 2007).

Regardless of the future rate of accretion, the existing land is expected to remain stable (with occasional flooding and inundation during major storm events) and to continue to support a diverse vegetative community. With upward of nine distinct vegetation habitats, from grasslands to forests, there will be a continued shift from pioneering, low species (eg – dune grasses) to shrub vegetation and, ultimately, maritime forest.

The future transformation of the AL can be seen by visiting the east and west halves of the area (Fig 6.1). Land west of the Charleston jetty (referenced as Reach B herein) accreted rapidly between the 1940s and 1970s and is well established today. Its predominant vegetation is early maritime forest with a dense canopy of trees reaching more than 40 ft in height. By comparison, the eastern half of the AL (Reach C – east of the jetty) did not begin accreting rapidly until the 1970s. As a result of its younger age, vegetation tends to be dominated by shrubs and small trees reaching heights of the order 15–25 ft. Pruning along some sections of Reach C has maintained a shrub/tree height of the order 5–10 ft. If left to natural succession processes, Reach C will likely look much like Reach B two or three decades from now.

Nearby undeveloped barrier islands also offer examples of how the Sullivan’s Island AL will look decades from now. Bull Island and Capers Island exhibit densely vegetated beach ridges extending over 1,500 ft inland (Fig 6.2). Both of these islands have been erosional during much of the 20th century (Kana and Gaudio 2008). However, in earlier times, accretion allowed similar vegetation succession. Interior sheltered areas representing former shorelines were transformed from grasslands to maritime forest, and the forest continued to mature long after the accreted shorelines began to retreat. This, of course, accounts for situations where mature trees can be seen perched along eroding escarpments or littering the beach with their exposed root masses (Fig 6.2). In short, the AL is sufficiently wide to provide sheltered interior areas where trees can mature over many years before erosion poses a direct threat to the land.

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FIGURE 6.1. Typical vegetation cover in Reach B (west half of AL) and Reach C (east half of AL) in 2008.



FIGURE 6.2. Aerial photo of Capers Island in 17 February 2007 showing mature maritime forest up to the seaward edge of the island and downed trees littering the active beach. (Photo by TW Kana)

Visual Impacts – While no attempt is made here to illustrate the rate of change in the height of successional vegetation, it is realistic to expect that grassland habitats will typically produce visual barriers of the order 5 ft high; shrubland communities grow to ~20-ft heights; and maritime forest grows to well over 50-ft heights. It should be apparent that views of the ocean are a function of three factors: (1) height of the vantage point, (2) distance to the beach, and (3) height of the intervening landscape. Ocean views will be blocked when the elevation of the vegetation (or dune) equals the elevation of the vantage point. Typical first-floor and second-floor vantage points would be ~20 ft and ~30 ft above mean sea level (respectively). Based on these parameters and the typical AL land elevations of 8–12 ft above mean sea level, shrub vegetation of the order 10 ft or higher is likely to block views from the first-floor level of most existing homes along the oceanfront. Modest-sized dunes with 10 ft or more of relief are similarly likely to block first-floor views even if grass remains the dominant vegetation type along their crests. Forest vegetation, if not thinned or eliminated along broad corridors, is expected to block ocean views from any first- or second-story vantage point.

The Team's analysis of the AL and review of the literature on barrier island evolution and vegetation succession confirms that the Sullivan's Island situation is not typical of most East Coast barrier islands. However, in settings like South Carolina and Georgia, where there is abundant sediment released from ebb-tidal deltas, prolonged periods of barrier-island accretion have occurred. Accreting beach ridges have allowed maritime forest to evolve and provide a dense cover over the land. The present review confirms that the land and its vegetation will not remain static into the future. This, of course, has direct implications for any management alternative for the area.

6.1 Management Approaches

Drawing on the results of Sections 2–5, the Team outlines four general management approaches as presented in the beginning of the report:

- 1) Do nothing and allow the AL to evolve naturally.
- 2) Continue present practices which include vegetation controls such as pruning to maintain the views (at the discretion of individual property owners subject to existing Town ordinance – Appendix 2).
- 3) Implement more extensive management of vegetation to address goals and objectives of the community.
- 4) Modify the topography for purposes of reducing potential storm damages and implement expanded management of vegetation to address the goals and objectives of the community.

Each of the above-listed management approaches has advantages and disadvantages depending on the objective to be emphasized.

In the following sections, the Team outlines a number of potential impacts of each approach with respect to nine variables including: barrier-island ecology, storm-damage reduction, ocean views, beach access and public safety, fire, pests, property values, relative cost of implementation, and construction requirements. Also described in detail are some specific management alternatives that could be implemented (eg – dune enhancement, fire management, creation of ponds, etc).

While the Team does not believe there is one ideal management approach for the AL, an example natural area from another barrier island illustrates what Sullivan's Island could look like

along the oceanfront with some degree of management. Figure 6.3 illustrates a diversity of habitats along an accreting spit at Hunting Island. This example includes open grassland habitat interspersed with shrub vegetation, an interior wetland and open-pond habitat, and early maritime forest. Compared with the forested beach ridges of Capers Island (see Fig 6.2), this portion of Hunting Island contains a greater diversity of habitats and, therefore, can attract and maintain a greater diversity of wildlife. The Hunting Island example also offers more visual interest to beach goers.



FIGURE 6.3. Example of accreted land exhibiting a variety of habitats in close proximity including forest hammocks, freshwater pond, and grassland habitat backed by mature maritime forest. (Hunting Island, SC – 31 May 2008 – Photo by TW Kana)

Alternative 1 – Do Nothing and Allow the AL to Evolve Naturally

Alternative 1 assumes negligible alteration of the existing AL by artificial means. Paths would be maintained by pedestrian use and minor pruning of overhanging branches along the edge, but would otherwise be left untouched. Existing conditions and habitats would change naturally in relation to the rate of vegetation growth. Over time, the upper-story tree canopy would expand and become the dominant vista across the entire AL. Paths would become sheltered by overhanging limbs of live oak, palmettos, and pines, among other maritime forest species.

Barrier Island Ecology & Habitat Diversity	Nine distinct habitats now will likely transform to predominantly forest habitats as tree canopy expands. Shrubland and grassland habitat area will diminish. Wetland areas will shrink as organic detritus and sediments accumulate and build up substrate.
	Forest species will increase.
	Understory vegetation will decrease.
Storm Damage Reduction	Improved storm surge and wave attenuation due to presence of trees.
	Incrementally reduced potential storm damage to developed property compared with present conditions.
Ocean Views	Continually diminish until eliminated for all oceanfront properties facing the AL.
Beach Access & Public Safety	Access will diminish unless paths are maintained. Expanded tree cover with less understory vegetation will provide hiding places and escape routes for criminal activity and potentially reduce public safety.
Fire	Threat of fire will diminish over time in relation to decreased understory vegetation (see section 6.2 for a detailed discussion of fire threats and management options).
Pests	Rodent problems will decline in relation to decreased understory vegetation.
Property Values	Loss of ocean views is expected to have a negative impact on property values and the local tax base as “oceanfront” homes are compared with interior island homes on other SC beach resorts. Rental rates are expected to be negatively impacted relative to rates for oceanfront property with unimpeded views. Reduction in oceanfront property values (or the rate of rise relative to competing properties on other barrier islands) may adversely impact municipal budgets.
Cost of Implementation	Negligible
Construction Requirements	None

Alternative 2 – Continue Present Practice

Alternative 2 assumes no change in the existing Town ordinance for pruning by individual property owners. Over time, pruned swaths would be flanked by higher stands of forest vegetation. As the tree canopies of unpruned areas expand, they would tend to narrow the ocean vistas across pruned areas.

Barrier Island Ecology & Habitat Density	Continued pruning will prevent maritime forest from developing in these areas. This will maintain altered shrubland habitat and (compared with Alternative 1) preserve a greater number of distinct habitats. Shrubland areas presently not pruned will transform into maritime forest with the result being shore-perpendicular bands of pruned shrubs paralleling unpruned forest (see Fig 1.3).
	Pruned areas will maintain bands of dense understory vegetation as vegetative growth is forced laterally via the pruning process.
Storm Damage Reduction	Pruning will result in a lower shrub cover and incrementally higher storm surge and damaging waves compared with unpruned vegetation (the impact will be relatively small for most storms and only become significant during rare storms such as a 100 year event, as described in Section 5.2).
Ocean Views	Views will be maintained along pruned corridors, but are expected to diminish as adjacent unpruned swaths develop higher vegetative cover.
Beach Access & Public Safety	Pruning shrub vegetation along paths will improve access and leave a dense, understory edge. This may reduce convenient hiding places and inhibit escape from paths, thus increasing public safety. Low vegetation along broad paths will allow users better visibility to see potential dangers and be seen by others, thus leading to a greater sense of security along access paths.
Fire	Threat of fire will remain similar to present conditions because of continued presence of dense, understory vegetation along pruned swaths. (See Section 6.2 for discussion of fire threats and management options.)
Pests	Rodent problems will remain the same or increase because of the expansion of dense understory vegetative cover
Property Values	Maintenance of ocean views across pruned corridors is expected to have a positive impact on property values and the local tax base. However, as adjacent unpruned swaths develop higher vegetation, the artificial character of pruned strips between development and the ocean will become more apparent, possibly adversely impacting property values compared with other barrier-island oceanfront properties.
Cost of Implementation	Present costs are mainly borne by individual property owners. Those costs are expected to increase as sections of grassland habitat become shrubland habitat. Some property owners who have not engaged in pruning, because their vegetative cover is presently lower density, may consider pruning in the future as their ocean views diminish.
Construction Requirements	Same as present with debris removal and disposal being a significant part of the cost.

Alternative 3 – Implement More Extensive Management of Vegetation

Alternative 3 assumes that a “naturalized” landscape plan could be developed for the AL whereby the suite of three broad vegetation communities (grassland, shrubland, and forest) could be maintained with negligible alteration of the topography. Unlike Alternative 2 which would tend to create shore-perpendicular bands of pruned and unpruned vegetation depending on an individual owner’s preference, Alternative 3 would seek to create an interesting diverse landscape, where open grassland areas are interspersed with shrub and forest hammocks (see Fig 6.3). Some areas that are presently early successional forest would be cleared of trees and replanted with grasses, particularly along access trails.

A particular mix of vegetation communities would be defined as the target and specific landscape plans for implementation would be developed. For example, if the target mix is 35 percent grassland, 25 percent shrubland, and 40 percent maritime forest, the present inventory of vegetation communities would allow estimates of how much of each must be removed or added to achieve and maintain the target quantities. Once a basic landscape plan is developed and implemented, annual maintenance would be required.

Alternative 3 (continued)

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Barrier Island Ecology & Habitat Diversity	Maintain or increase habitat diversity by converting some shrubland to grassland and some forest areas to shrubland, thus inhibiting development of continuous maritime forest over the majority of the AL.
	Possibility of creating maritime forest hammocks interspersed with shrubland and grassland habitat in close proximity which would attract a greater diversity of animal species.
Storm Damage Reduction	Any reduction in vegetation density increases the storm damage potential. However, the effect is relatively small for most storms and only becomes significant for large storms such as 100-year events. (See discussion in Section 5.5.)
Ocean Views	Views through corridors between maritime forest hammocks would be maintained. Maintenance of broad paths flanked by strips of grassland habitat and pockets of shrubs would provide visual interest for pedestrians accessing the beach.
Beach Access & Public Safety	Open pathways would improve emergency access and general access while increasing public safety by reducing hiding areas for criminal activity.
Fire	Potentially lessens risk of fire by reducing the areas of dense understory vegetation and flammable species such as waxed myrtle. Provides fire breaks along grassland strips and wide pathways.
Pests	Reduces rodent problem by reducing areas of dense undergrowth.
Property Values	Maintenance of ocean views and a variety of vistas associated with a mix of forest, shrub, and grassland habitat would likely have a positive impact on property values. However, the relatively great distance to the ocean, regardless of vegetation cover, adversely impacts property values in comparison with traditional oceanfront property set back lesser distances from the beach.
Cost of Implementation	Would require initial removal of extensive areas of woody vegetation and replanting with grassland areas. Some minor earthworks would be required for efficient removal of root mats where there is dense understory or altered shrubland at present.
	After initial vegetation removal to leave hammocks of forest and shrub habitat flanked by grassland habitat, ongoing maintenance would be required.
	Cost of implementation will depend on the number of acres of land that require vegetation modification to achieve the goals and objectives of the community.
Construction Requirements	More extensive than present practice because of the initial work to convert some forest areas to grasslands or shublands.
	Heavy equipment would be required for initial work and tree removal. Subsequent maintenance would be accomplished with small, less obtrusive equipment.

Alternative 4 – Modify Topography & Implement Expanded Management of Vegetation

Alternative 4 assumes that a “naturalized” landscape plan includes modification of the topography. Such modifications are assumed to include at least one continuous dune ridge paralleling the shoreline, which provides improved storm-surge protection. The degree of surge and wave height reduction is simply a function of the scale of the dune feature. Other topographic modifications are assumed to include limited excavation of existing swales for purposes of creating open-water ponds to add habitat for waterfowl, provide an attractive amenity for the community, reduce the mosquito population associated with existing wet areas, and improve ocean vistas (see Fig 6.3). Initial costs would include earth moving, tree removal, and replanting of altered areas (similar to Alternative 3). After the initial landscape is developed, it would require ongoing maintenance similar to Alternative 3.

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Alternative 4 (continued)

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Barrier Island Ecology & Habitat Diversity	Same impacts as Alternative 3.
	Provides interest in the form of greater topography.
	Addition of open-water ponds expands the suite of habitats and wildlife, thus increasing diversity.
Storm Damage Reduction	Addition of a continuous dune ridge of any dimension, superimposed on existing topography, improves storm-surge protection and reduces potential storm damages. The degree of storm-damage reduction is significant even with a dune crest at 14 ft above mean sea level (see Section 5.5). The impact of increased dune elevation on storm-surge attenuation is much greater than the effect of higher vegetation.
Ocean Views	Same impacts as Alternative 3.
	Offers new views over ponds for a greater variety of vistas
Beach Access & Public Safety	Same impacts as Alternative 3.
Fire	Improved impacts compared with Alternative 3 because of the addition of ponds, which form a natural barrier and water supply in the event of fire.
Pests	Same impacts as Alternative 3.
Property Values	Improved impacts compared with Alternative 3 because of added storm-surge protection and the added amenity of ponds, which enhance the landscape.
Cost of Implementation	Vegetation changes would entail similar costs as Alternative 3.
	Alteration of topography involves earth moving, which could be limited to construction of a simple low dune (see Section 5.5) or could involve more extensive sculpting of the land and construction of multiple dune ridges. Excavation for ponds could provide the sand for dune construction, thus minimizing transportation costs.
	Accreted shoals along the beach are another potential sand source (subject to federal and state permits). Earthworks landward of state jurisdictional lines would involve less time and expense in securing necessary approvals.
Construction Requirements	Modification of topography would involve excavation and filling along with vegetation removal and replanting.
	Ponds and dunes could be constructed entirely using land-based equipment with the major work occurring during winter. Projects involving dozens of acres and 100,000–400,000 cy of earthworks could be accomplished in a relatively short time frame (1–3 months).
	Replanting and establishment of grass vegetation could be accomplished in 1–2 growing seasons.

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6.2 Specific Management Elements

To assist the community in evaluating the advantages and disadvantages of the four broad alternatives, the Team offers the following discussion of certain specific management elements: fire control, pest control, bird habitat enhancement, vegetation removal, and dune construction. Some background information is included as necessary to aid the discussion.

Fire Control

Fire has played a major role in determining the distribution of plants and animals in the southeastern United States. Some communities, such as the longleaf pine-wiregrass habitat, require periodic fire to survive. The natural occurrence of fire from events such as lightning results in upland burns every three to five years. Barrier-island maritime forests may burn less frequently. However, the basic premise of fire ecology is that the fire is neither innately destructive nor constructive. It is an agent of change.

Change is a biologically necessary component of a healthy ecosystem. Early man learned to use fire as a tool for hunting and clearing land for crop production. Today's resource managers have learned to use fire to manipulate change to meet the needs of plant and animal communities. Its prudent use can achieve a variety of habitat changes depending on the timing, frequency, and intensity of the fire. Man's use of fire as a tool is referred to as prescribed burning.

A single prescribed burn can produce multiple impacts. The fire can be used to reduce wildfire hazard by reducing the fuel load on the ground. The same fire can also improve access in woods and improve wildlife habitat. Proper use of prescribed fire requires knowledge of how fire affects vegetation, wildlife, soil, water, and air. Burning techniques can be varied to achieve different results.

Fire may injure or kill part or all of a plant depending on how intense the fire is and how long the plant is exposed to high temperatures. Bark thickness and stem diameter will influence a plant's susceptibility to damage. In general, small trees of any species are more easily damaged by fire than large ones. On average, hardwood trees are more susceptible to fire damage than pine trees. The thicker bark and better insulating qualities of pine trees have adapted to a presence of fire and provide protection for them. Pine trees with a diameter of three inches or more usually have enough bark to protect them against damage from most prescribed fires. The needles however are very susceptible to temperatures above 135°F. Pine needles will survive temperatures of 130°F for about five minutes.

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Fortunately, the high temperatures generated by the forest floor fuels cool rapidly from the flame zone. Adequate wind can help dissipate the heat before the needles are scorched. Southern pine will usually survive complete crown scorch as long as the terminal bud is not damaged. A dense layer of needles surrounds the terminal bud to prevent its loss during fire. Severe needle scorch, while not killing the tree, may retard growth for a year or more and can make it more susceptible to drought and beetle attack.

Resource managers can use the kill and scorch qualities of fire to achieve a variety of results. Understory vegetation can be kept low with frequent fires, and some species can be removed from the stand by burning during the growing season. Mast-producing species can be maintained close to the ground where they are more available to wildlife. Longleaf pine seedlings are often stimulated with fire to grow from the grass stage into saplings. Invasive non-native species are often fire-intolerant and can be controlled effectively and inexpensively with prescribed burns. In addition, many rare and endangered species of plants are fire-dependent for a portion of their reproductive cycle. These species can be reintroduced into an area and maintained with the correct timing and frequency of fire. Prescribed burning is also a very effective practice used in marsh and moist-soil management. Prescribed burning accomplishes several objectives (Whitman and Meredith 1987), including:

- Maintaining successional stages so that desirable annuals are more abundant than herbaceous perennials and woody species.
- Removing matted vegetation produced in previous growing seasons and releasing nutrients, thereby encouraging the germination of valued food plants.
- Increasing seed availability in dense vegetation.
- Facilitating and improving the effectiveness of mechanical manipulations.

Prescribed fire can also be used to discourage weeds or invasive plants from taking over, by killing off their early growth and giving native plants a chance to compete. Cattails occasionally spread aggressively and can completely choke a wetland. A winter or early spring burn following a drawdown can reduce cattail cover in a pond, temporarily creating an open-water area. However, by the end of summer the cattails will have returned unless the burned area can be flooded with 3-4 ft of water during spring and early summer.

Various national wildlife refuges (NWR) – such as Mackay Island NWR in northeastern North Carolina and southeastern Virginia, Lee Metcalf NWR in Montana, and Arthur R. Marshall Loxahatchee NWR in Florida – are just a few NWRs that utilize prescribed burning in their moist-soil management practices.

Selecting the proper size, frequency, and timing of burns is crucial to the successful use of fire to improve wildlife habitat. Experienced, prescribed fire managers should be able to predict the changes that will occur in the vegetative composition of the stand. Prescriptions should also recognize the biological requirements such as nesting times of the preferred wildlife species.

Proper planning is not only important when considering fuel hazard reduction and vegetative manipulation but also is crucial to controlling the detrimental effects of fire, such as the reduction in air quality from smoke. Wind direction and speed are critical to maintaining control of the intensity and duration of the fire as well as determining the direction and impact of smoke. Potential off-site impacts, such as downstream water quality, should also be carefully considered as well as on-site impacts to soil and aesthetics. Public opinion must also play an essential role in the wise use of fire. The general public is concerned about the deterioration of the environment, and wind speed, smoke lifting conditions, surrounding road systems, urban areas, and health facilities make smoke management a primary concern of the fire manager.

Control of the limits of the fire's extent is generally accomplished through the careful and planned placement of firebreaks. Permanent firebreaks can be used as access roads and wildlife strips, especially if they are seeded with wildlife food. Weather conditions must also be monitored prior to and during the fire. Wind direction and speed are critical to maintaining control of the intensity and duration of the fire as well as determining the direction and impact of smoke. Humidity levels and fuel moisture levels are crucial to determining how hot the fire becomes and how much fuel is consumed. Low humidity levels can create "spot-over" problems that may lead to fire-control issues. Postfire weather conditions must also be monitored to avoid problems of flare-ups and smoke settling on highways or urban areas because of an inversion.

Prescribed fire is one of the most valuable and cost-effective, forest management tools available. It is a tool that must be understood and carefully implemented. However, its benefits are substantial to the aesthetics, health, and protection of the ecosystem.

Fires on barrier islands are ignited naturally by lightning strike; however, humans have been setting fire to the natural community for more than 5,000 years (Bellis 1995). Much maritime vegetation has adapted to fire and may play only a small role in the vegetation community dynamics on barrier islands (McPherson 1988). Typically, closed-canopy maritime forests have a dense canopy with a moderately dense shrub layer and a sparse herbaceous layer. These conditions tend to retain ground moisture. With high moisture levels, forest fires tend to be low, cool, and smoldering. Crown fires are rare (Bellis 1995). Conversely, pine-dominated forests tend to be drier and contain better quality fuels, resulting in intense, fast-moving fires which often crown.

The overstory within the AL study area at Sullivan's Island is dominated by hardwood species, not pine. Therefore, under normal conditions, forest fires would be low, slow, and should pose minimal threat to public safety. Prescribed fire would be an effective management tool for the AL area and could be safely applied. Periodic prescribed burns of the maritime forest would reduce understory vegetation, improving views into the forest. On the north end, where shrub vegetation dominates, fire would also reduce shrub growth, improving views of the ocean for front-row residents. Periodic burns would reduce hazardous fuel loads.

However, fire is often feared and misunderstood by the general public. During a prescribed burn within the Sullivan's Island AL area, flames and smoke would be easily seen from residences, and smoke would be present for several days following the burn. For several months following the burn, the area would appear black and charred, which may be unappealing for residents. Given these drawbacks, the use of fire at Sullivan's Island should be considered carefully and may necessitate the full support of island residents before undertaking. Controlled burns are one management alternative that should be considered by the community before finalizing the Accreted Land Management Plan.

Pest Control

The principal pests in the AL at present are mosquitos and rats. Mosquitos generally require standing stagnant water to propagate. Therefore, elimination of isolated puddles, standing water in oil drums, and so forth, will reduce infestations. Existing swales between dunes (maritime interdunal wetland and maritime hardwood depressions) create more sites suitable for mosquito breeding. If these isolated depressions can be linked to open-water ponds, they will tend to drain and become less attractive to mosquitos. Open-water ponds are not suitable for mosquito breeding because there is too much water motion. Alternative 4 would have the greatest impact on mosquito reduction. Alternatives 2 and 3 provide a measure of relief by creating more open-grass areas. Mosquito populations are generally very high in maritime

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forests on undeveloped barrier islands (like Capers Island) because of the presence of numerous pockets of standing water. This condition would persist and likely worsen under Alternative 1.

Rats have been an increasing nuisance within the AL according to informal communications with residents. While the Team did not observe rats during the surveys, their presence is not surprising, given the large areas of dense understory vegetation which provides shelter from larger predator animals. Public use of the AL also introduces food scraps and related litter which attract pests. Various baits (pesticides) are available for control, but this approach may be harmful to other wildlife. As Section 6.1 outlines, present management practices (Alternative 2) tends to increase the potential for rodent problems because of the maintenance and expansion of understory vegetation. Alternatives 1, 2, and 3 would all tend to reduce the rodent problem by way of reducing the amount of understory vegetation.

Bird Habitat Enhancement

The AL is an attractive bird habitat because of its diversity of vegetative communities. With habitat diversity comes bird diversity, ranging from shorebirds utilizing open beach and grassland areas to forest species (eg – painted buntings). Any alternatives which maintain habitat diversity will have a positive impact on the bird community. Alternative 1, therefore, would be the least likely to expand the diversity of bird populations. Alternative 4 would likely offer the greatest increase in bird species because open-water ponds would attract ducks and other species that utilize pond habitat.

Vegetation Removal

Land clearing is disruptive to existing habitats, but short-lived in its impacts. Replanting, combined with natural propagation of seeds from adjacent plant communities, quickly re-establishes vegetative cover over any land sheltered from direct effects of ocean spray. All, but Alternative 1 involve some form of vegetation thinning or removal. Thinning and pruning is a recommended management technique which promotes healthy growth of plants. The activity could be implemented in such a way as to recycle chips back to the soil or be used as mulch along paths to inhibit regrowth. Where shrubs and trees have to be removed (Alternatives 3 and 4), heavier equipment such as bulldozers and mulching machines would facilitate the work.

Dune and Pond Construction

Dunes along the oceanfront represent a primary line of defense during storms. As discussed throughout this report, existing topography over the AL is low relief with few areas exceeding

12 ft above mean sea level. With average land elevations around 8-9 ft, the AL would provide significantly improved storm-surge protection if even a low dune were constructed. Scenario 1 in Section 5.5 described the potential impact of a dune 75 ft wide at the base with a crest elevation at ~14 ft above mean sea level. Such a dune would require the equivalent of about one-half dump truck load of sand per foot of shoreline or ~100,000 cy total if it is placed along an existing low ridge. Volumes of this order are presently available as attached shoals (sand bars) along the beach. An alternative sand source could be low areas within the AL. Excavations of low areas could be configured to leave shaped ponds within or adjacent to maritime interdunal wetlands or hardwood depressions. Assuming the optimum excavation depth for open-water ponds is a couple of feet below mean sea level, removal of 100,000 cy could create ponds totaling ~8–12 acres. Obviously, greater excavation volumes could increase these totals while offering a larger protective dune. Costs of earthmoving for projects of this nature are typically in the range of \$5–\$10 per cubic yard.

6.3 Funding Sources and Community Assistance Grants

As part of the Team's work for the Town, funding sources and grants were investigated that may be available to the Town in connection with management of the accreted land (Appendix 11). Some funding sources are associated with wildlife enhancement. An idea that the Team is developing includes establishment of an Audubon-sponsored nature/interpretive center near the western end of the AL area. Given the number of bird species observed in the area and the strategic location of the AL along the East Coast flyway, a nature center would be an asset for the Charleston region as well as for the town of Sullivan's Island.

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