I

Guidelines and Recommendations for Coastal Dune Restoration and Creation Projects

APPENDIX IV

Prepared by the

Bureau of Planning and Project Review

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New Jersey Department of Environmental Protection

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PURPOSE

This pamphlet has been designed by the New Jersey Department of Environmental Protection Division of Coastal Resources to: a) list recommended dune restoration and creation techniques, b) help municipalities plan effective and environmentally sound dune projects, and c) explain what information municipalities should submit to complete their applications for dune funds from the Division. An example of an application is provided at the end to demonstrate how information in this booklet should be used by municipalities.

INTRODUCTION

On March 28-29, 1984, the New Jersey coast was hit by a northeast storm that caused extensive damage to the shoreline. Evaluation by the Division of Coastal Resources indicated that shorefront areas behind sand dunes experienced less damage than other shorefront areas (NJDEP, 1984). The report concluded that dunes are a valuable natural non-structural shore protection feature of the coast.

Because of the damage from the storm, the New Jersey shoreline was declared a Presidential Disaster Area in 1984 giving New Jersey the opportunity to receive federal funds. Although the Federal Emergency Management Administration gave the State some money, little money was provided to repair and restore damaged beaches and dunes. A one time provision of $ 2 million to preserve New Jersey beaches under Section 306 of the Coastal Zone Management Act was drafted by Senator Bradley, passed by Congress, and then signed by President Reagan in August of 1984.

These funds have been passed through to the Division of Coastal Resources and are referred to as the New Jersey Emergency Beach and Dune Restoration Program. The major focus of this program is to assist municipalities in the restoration, repair and enhancement of dunes along their shorelines. Limited funds are available from the Division to assist municipalities in implementing these dune projects. The federal funds provide 80 percent of the project costs, the State will provide a 15 percent match and each participating municipality will be expected to pay 5 percent of the total project costs.

RECOMMENDED TECHNIQUES

Dunes are dynamic features of the shoreline which interact with the beach every day. Essentially, dunes are deposits of sand created through the interaction of wind and vegetation. Dunes and their interactions with the beach are discussed in the "Definitions and Processes" section of the "Assessment of Dune and Shore Protection Ordinances in New Jersey" report (NJDEP, 1984 - attached).

Listed below are some recommended techniques for dune creation and enhancement. They are general and need to be modified when applied to different areas of the coast. These recommendations are based both on the experience of personnel at the Division and the scientific literature.

Dune Placement:

The seaward edge of a dune area usually should be established at least 100 feet landward of the high water line. Dune projects created too close to the high water line will very likely be destroyed by storm waves. However, some of New Jersey's beaches are currently too narrow to successfully maintain support dunes.

Sand/Snow Fencing:

Sand fences are the most commonly used obstacle to trap sand in the dune/backbeach area. A sand fence placed parallel to the shoreline in the dune/backbeach area will cause the windborne sand traveling from the beach into the dune area to be deposited and accumulated along the fence. As sand deposition increases, the sand fence becomes buried and more sand fencing will be needed if the dune is to grow any further (assuming lack of vegetation).

Christmas trees or piles of brush have also been used in the past to build dunes but are not recommended by the Division because the dune area tends to become a dumping ground for piles of dead vegetation which do not readily decompose, become an eyesore if not covered by sand, and present a fire hazard.

Design of Sand/Snow Fences:

Different designs of sand fence placement have been tested to see which design captures the most sand or is the most cost-effective method (minimize the amount of sand fencing used while maximizing the amount of sand collected by the sand fencing). In most cases, a straight line of sand fencing parallel to the shoreline is usually the best design. Zig-zag and shore parallel lines with side spur configurations work just as well at capturing sand, but since more sand fencing is used, the cost of the project increases.

The different sand fence designs, however, produce different shaped dunes as sand is captured by the sand fences (Figure 1). The shore parallel design accumulates a narrow width of sand while the zig-zag and parallel with side spurs produce a wider dune. Therefore, as more money is spent on sand fencing, more dune will be created. As the dune grows and sand fences are continually added, the growth of the dune is dictated by the placement of the snow fences. The location of vegetation will also dictate where the dune will form as sand accumulates.

When the objective of the dune project is to create a new dune on the backbeach area, the Division recommends the zig-zag or parallel with spurs design. This design will initially produce a wider dune than a single parallel design and offers walkthrough and foot traffic control advantages. Posts to hold the sand fencing should be about 10 feet apart and be driven at least 3 feet into the sand.

To restore or expand existing dunes, a single parallel line of sand fences should be placed approximately 10 to 15 feet seaward of the existing dune (if there is sufficient beach area) or the placement of zig-zag fences with similar widths (Figure 2).

Observations by Division staff of heavily used oceanfront dune/beach areas indicate that sand fences also act as a barrier to foot and vehicle traffic on the dunes. Therefore, the Division recommends that a sand fence be placed around a majority of the dune perimeter to protect the dune and dune vegetation from these destructive forces (Figure 3). The protective fencing should be placed when the fences that were erected to create or restore a dune have accumulated sand and American beachgrass has been planted. For example, if sand fences are erected in the fall, sand should accumulate during the fall and winter months to form a small dune. American beachgrass planting should occur around March and protective fencing should be placed around the perimeter of the dune and dune vegetation in April or May. If dune restoration or creation occurs in the spring, protective fencing should only be placed once the dune grows sufficiently or after American beachgrass has been planted.

Special attention should be focused on dune areas adjacent to street ends. Overwash of sand down street ends is prevalent during storms because these areas are open access points to beach areas. Pedestrian traffic usually destroys the dune area in route to the beach thereby leaving little or no dune protection. Dunes should be recreated where none exist. In particular, the Division recommends that walkthroughs should be oriented (or reoriented through existing dunes) to the southeast through the use of sand fences and/or wooden walkovers constructed in order to provide protection at street ends from storm washover while maintaining beach access points (Figure 4).

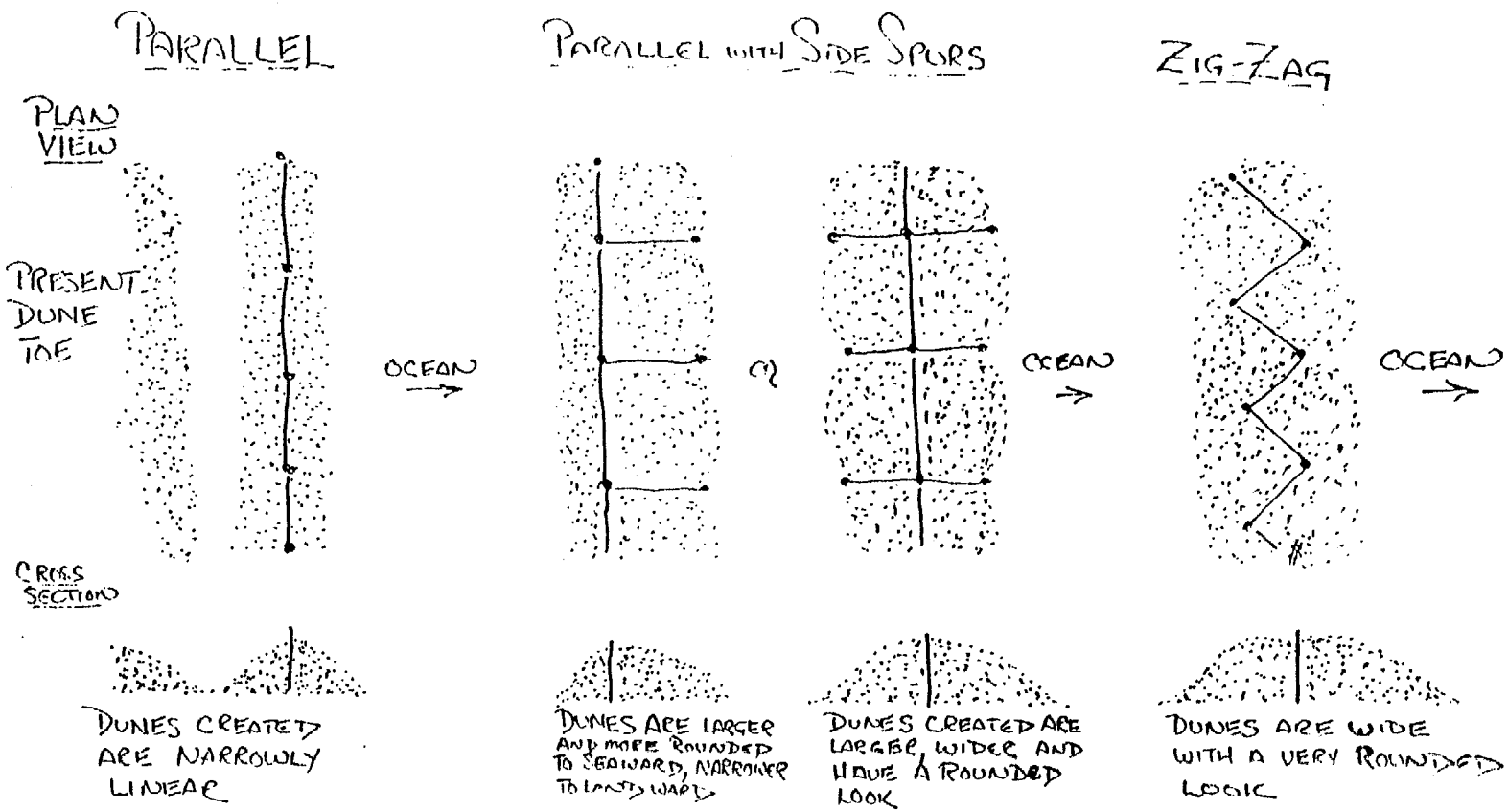


FIGURE 1. VARIOUS SAND FENCING CONFIGURATIONS AND RESULTANT DUNES

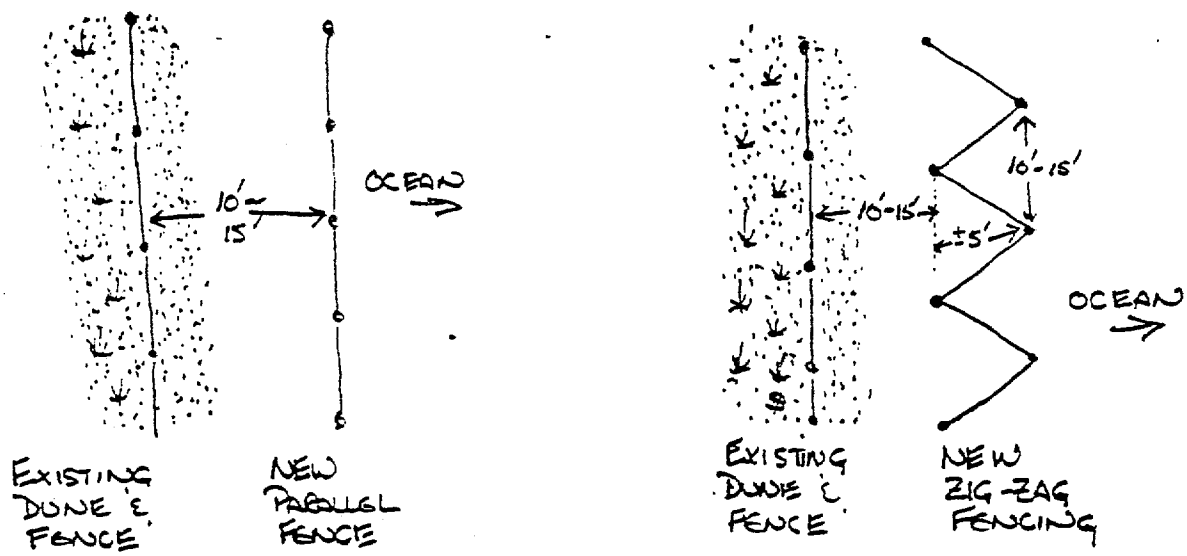


FIGURE 2. RECOMMENDED SPACING FOR RESTORATION OR EXPANSION OF EXISTING DUNES

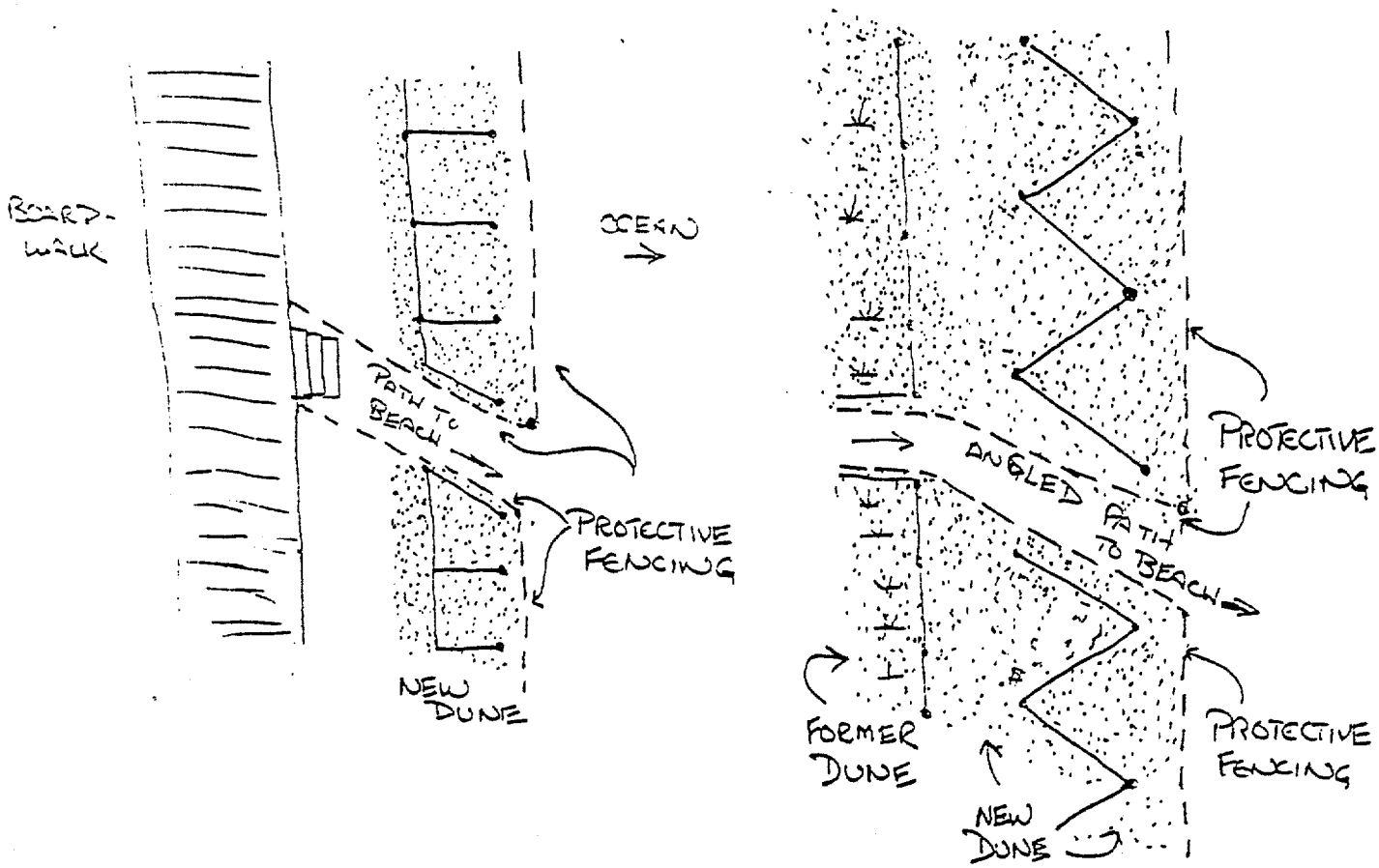


FIGURE 3: PROTECTIVE FENCING PLACEMENT AROUND NEW DUNES AND ANGLED WALKTHROUGHS

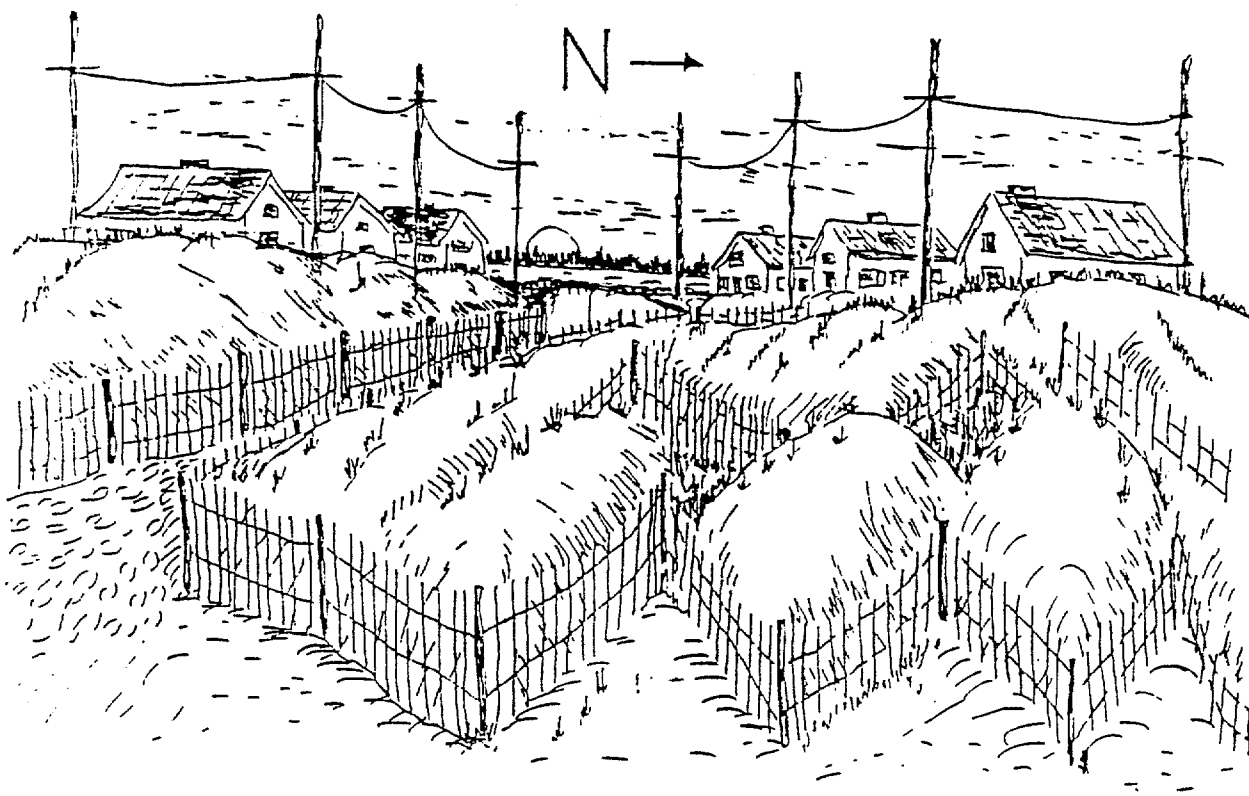
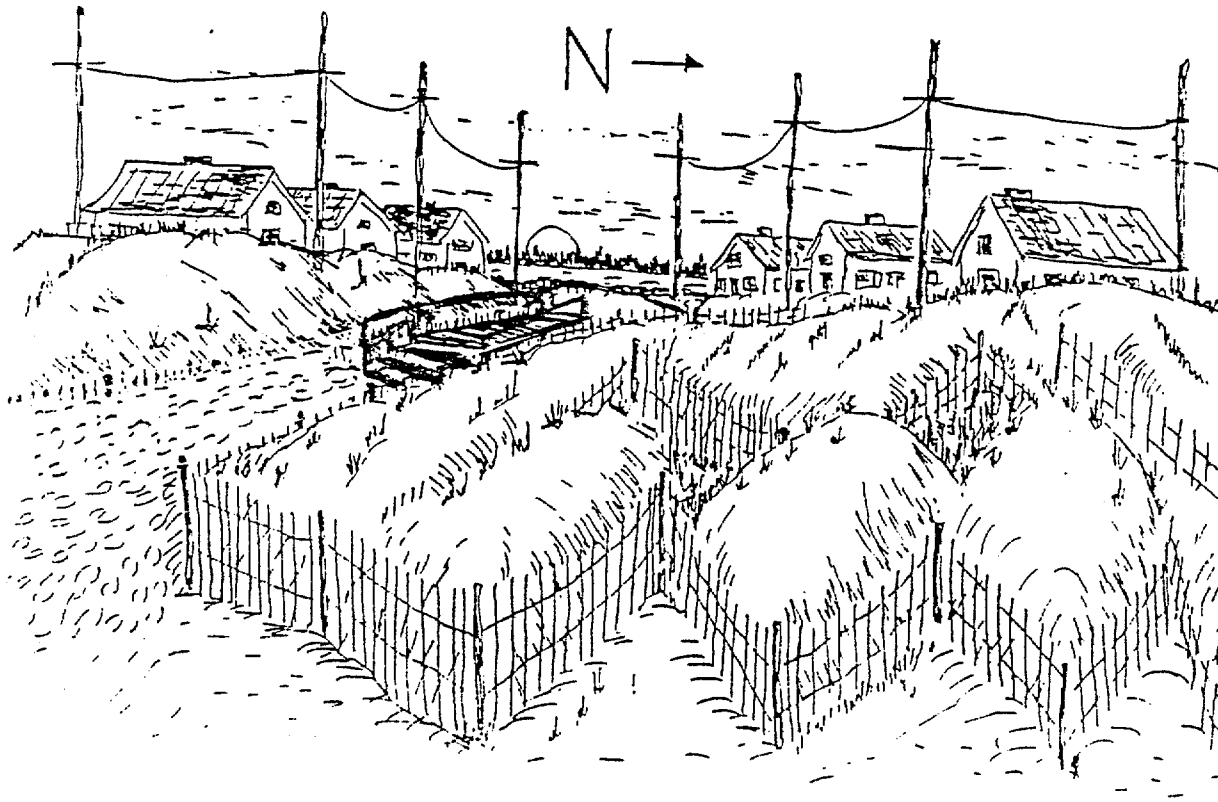


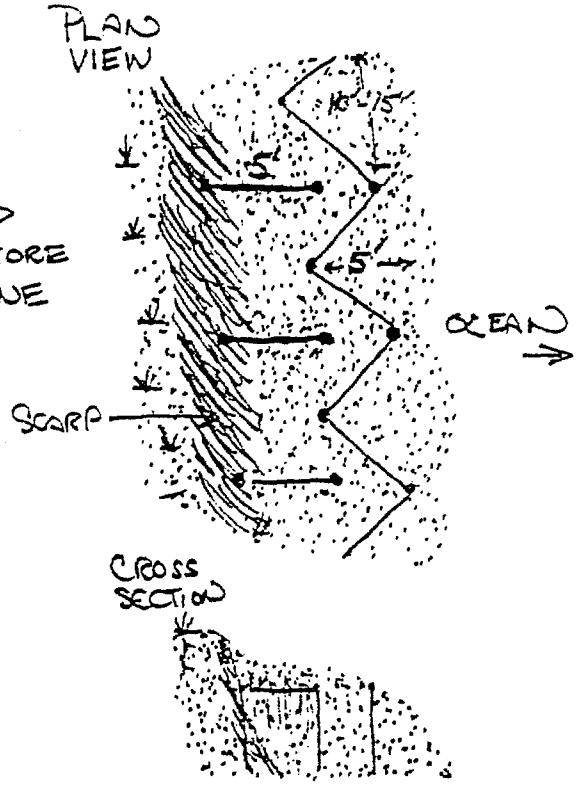
FIGURE 4. RECOMMENDED ANGLED STREET END DUNE PATH (TOP) OR WOODEN WALKWAY CONFIGURATION (BOTTOM).



Repair of Scarped Dunes:

Dunes often become scarped (or cliffed) along our coast. A discussion of the mechanisms which cause this destructive action is included in the attached Dune Report on pages 6-7. The volume of sand removed from the dune by scarping takes a long time to replace if left unattended. Experiments with various sand fencing configurations on scarped dunes by Division staff has indicated that the wedge of missing sand can be replaced in a matter of months by the use of short perpendicular spurs placed into the scarp followed on the seaward side by zig-zag fencing (Figure 5). After the wedge of sand begins to accumulate, American beachgrass can be planted and the dune is then well on its way to regaining its natural sloped profile. Once the scarp is repaired, sand can then be carried up into the dune crest area again.

FIGURE 5.
RECOMMENDED SPACING OF SAND FENCES TO RESTORE A SCARPED DUNE



Vegetation:

Vegetation is planted in dunes to increase the plant cover and stabilize dunes. American beachgrass, Ammophila breviligulata (Cape variety), is the dune plant most frequently planted along the New Jersey coast. Once established on a dune, American beachgrass grows with the dune not only providing cover over the dune thereby stopping the loss of sand from wind action but also binds the dune with its extensive root network.

For the best results, American beachgrass should be planted from October 1 through April 1 as long as the sand is not frozen. Dune vegetation should be protected by sand fencing on heavily used beaches since most vegetation outside of the sand fence becomes trampled by beach users.

Dune vegetation should be planted between 18" (19,000 plants per acre or 62 plants per 100 square feet) and 24" (11,000 plants per acre or 25 plants per 100 square feet) centers. The vegetation will grow over the years to cover the area between the plants. The objective of planting dune vegetation is to provide the dune with a vegetation source which can help to maintain and encourage the growth of the dune. If planting of a dune is to stop erosion of the dune, plants should be planted on 18" centers. The roots of American beachgrass plants should be placed 6 to 9 inches below the surface of the ground.

Fertilization:

During the first year, fertilization of newly planted dunes is recommended to promote good growth and establishment of the plants. Inorganic granular fertilizers are the most effective and least inexpensive. A fertilizer with a nitrogen/phosphorus/potassium ratio of 30-10-0 or 20-10-5 should be used, since nitrogen is a critical nutrient. The rate of application should be 50 lbs. per acre (approximately 1.1 lbs. per 1,000 square feet) per application.

Fertilizers should be applied a few months after the initial planting when the roots have had time to develop. Fertilization should then occur every two months or so for the first growing season. If dunes are planted in early spring (March), fertilization should take place in June and again in late September. Vegetation should not be fertilized after the first year of growth. Fertilizer can be carefully applied by hand through a broadcast method of spreading fertilizer into the dune area.

Monitoring and Maintenance:

One very important aspect of any dune creation and restoration project is monitoring and semi-annual maintenance activities. Monitoring dune projects will reveal successful restoration and creation techniques, specific problems which need immediate attention such as a recently disturbed dune area, and dune areas which do not need any further work. Maintenance of dunes should be done in a timely manner after field inspections so that specific trouble spots can be identified and steps taken to corrected the problem. Maintenance can also be performed to increase the growth of the dune.

The Division will assist local municipalities with dune/beach monitoring and maintenance programs. This type of approach will allow the Division to evaluate various dune projects along the coast, recommend maintenance activities to local municipalities, and help protect everyone's investment made to create and restore valuable dunes.

Please! Keep Off The Dunes signs:

Signs should be placed frequently along dune areas and at street end access points to instruct people not to walk in the dunes. The Division is currently preparing a "Please! Keep Off The Dunes" sign which will be available to municipalities (see cover).

PUBLIC EDUCATION AND PARTICIPATION

One important aspect of the establishment of a dune program is to educate members of the general public about the program and the advantages to the community of having a good dune area. The Division will assist municipalities to educate residents and visitors and encourage the participation of local residents in the dune program. Volunteers could be encouraged to plant dune vegetation or erect sand fencing under the supervision of the dune project manager. Pamphlets about the dune program and associated municipal laws could be handed out with beach tags. The local press is also helpful in covering programs such as this.

EVALUATION OF THE SHORELINE AND DUNE AREAS

In order to determine where dune projects should be performed, the shoreline must be inspected and evaluated to identify dune areas which need restoration and enhancement. These areas can be identified by knowing where waves washed sand into street ends during the March 1984 storm, where dunes were scarped (cliffed) or destroyed by the storm, where dunes are

severely impacted by beach users, and where dunes do not presently exist. Staff members of the Division will assist the municipalities in evaluating their coastline and suggesting dune projects to be performed in specific areas. Municipalities should note that all dune work funded by the State must be performed on publicly owned land.

Different areas of a municipality's shoreline should be identified which require different dune projects. For example, one section of the coastline may only need dune planting and street end access point reorientation while another section may need extensive sand fencing and dune planting. Each of these sections will have different costs associated with the restoration of the dune area depending on the method(s) used.

INFORMATION AND PLANS REQUESTED BY THE DIVISION

After field visits with staff members from the Division and identification of potential dune restoration areas, municipalities should submit the following items to the Division (if not already submitted):

1) Map of the municipality identifying distinct shoreline areas where potential dune projects will be performed. The map should show all different sections of the shoreline and identify specific dune projects, with a priority level (critical, high priority, priority) assigned to each section with a dune project.

2) Estimated project costs for each section of shoreline (identified in item #1 noted above) and dune project. The estimated costs should include sand fencing, dune vegetation, fertilizer, labor, etc...

3) Information about the municipalities' ordinances and zoning as related to the Division's policies on Dunes, Beaches, Erosion Hazard Areas, and Public Access to the Shorefront. Tax assessment information for any areas zoned beach/dune/ conservation (or public open space) should also be included.

   Municipal ordinances must comply with the State's policies on Public Access to the Shorefront, Beaches, Dunes, and Erosion Hazard Areas to be eligible for funding, or the municipality must make a commitment to revise their ordinances for compliance with the State's policies within one year after receiving the State Aid contract.

****** EXAMPLE ******

Listed below is an example of how a municipality should evaluate their dune areas and shoreline, and then submit the information and plans requested by the Division when applying for dune funds. The area used in the example is not real but is typical of many coastal areas in New Jersey.

1. Evaluate shoreline of Sand City.

   a. Northeast storm damage
      - washover at street ends
      - dunes damaged at northern section

   b. Field visit and inspection with Division
      - street ends and walkover design discussed
      - dune creation project at northern section
      - large dune area unvegetated along southern section but snow fences and small dune form present.
      - other specific dune problems discussed

2. Identify problem sections (listed in order of priority: critical, high priority, priority) and suggest dune project for each section:

   - overall: reorient street end access areas
     place "Please! Keep Off The Dune Signs" near access points

   - northern section: place snow fences in winter and plant dunes in spring if sand has accumulated. Place snow fences around perimeter of dune area after planting to keep people out of dune areas. Apply fertilizer at proper times during first growing season.

   - southern section: plant sections of unvegetated dune. Apply fertilizer at proper times during first growing season. Place snow fences around perimeter of dune area after planting to keep people out of dune areas.

3. Information and plans to submit to Division

   - Map of municipality showing different sections of shoreline and associated dune project (Figure 6)

   - municipality ordinances and zoning related to State policies

   - estimated cost of dune projects associated with different sections and assign priority levels of each section of the shoreline.

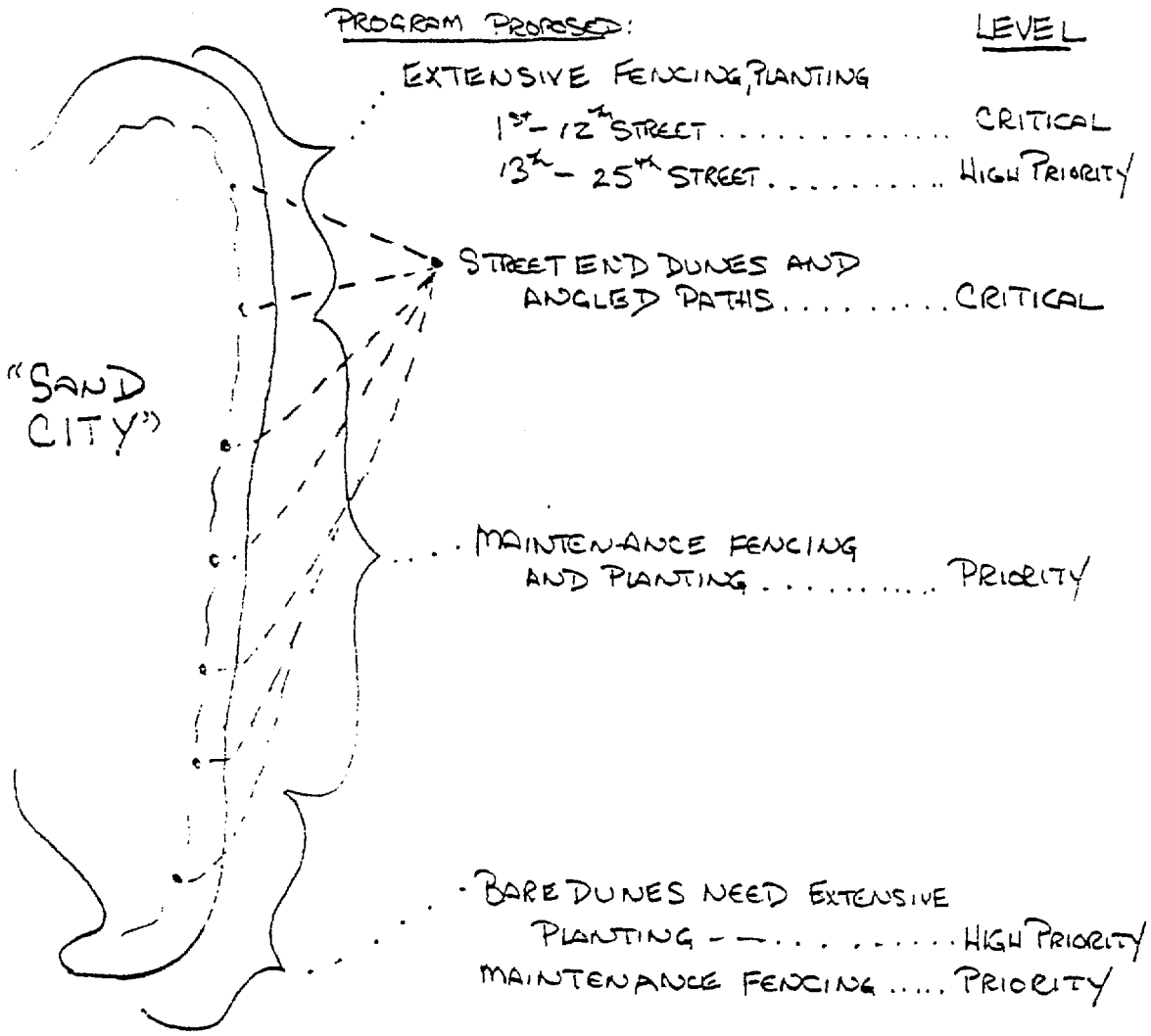


FIGURE 6. EXAMPLE OF A MAP OF "SAND CITY" SHOWING SECTIONS OF SHORELINE WITH PROPOSED PRIORITIZED DUNE PROGRAM.

REFERENCES

Assessment of Dune and Shore Protection Ordinances in New Jersey, 1984. New Jersey Department of Environmental Protection, Division of Coastal Resources.