MASTERTON DISTRICT COUNCIL

REPORT ON

DUNE EROSION REMEDIAL PROPOSAL
SOUTH END OF
CASTLEPOINT BEACH

NOVEMBER 1999

PREPARED BY

CONSULTANTS LIMITED

49 Crownhill Street
PO Box 151
New Plymouth

Telephone 06 7512310
Fax 06 7512310
Email: ocel@taranaki.ac.nz

OCEL House
276 Antigua Street
PO Box 877
Christchurch
Telephone 03 3790444
Fax 03 3790333
Email: mail@ocel.co.nz

GENERAL

In 1994/95 OCEL Consultants Limited investigated and reported on options for coastal protection along Castlepoint beach foreshore. In the process of these investigations they observed some of the coastal processes that occur along this shoreline.

A blue grey papa wave cut foreshore platform forms the foundation of the beach and is overlain by a thin and fairly mobile layer of sand. Dunes at the southern end of the beach are perched on top of a distinct erosion scarp in the papa. Periodically the toe of the dunes are eroded during high tides and strong onshore wind and/or heavy seas particularly from the northeast.

The dunes at the southern end of the beach have over a number of years been slowly loosing vegetation and developing blow outs where the wind transports the loose dune sand to the lagoon or beach area behind. The development of the blow out is shown in the attached photographs.

1978 shows a fairly healthy dune in the area but patches of less vegetated areas are visible.

1995 shows a large area of little or no vegetation and considerable lowering of the dune high.

1999 the blow out is very pronounced with major loss of sand, vegetation and dune height.

With areas of reasonably well vegetated dune slightly further north it is considered that the main cause of this dune erosion has been human and vehicle traffic through the area. This activity damages vegetation and associated root systems which capture and hold sand there by forming dunes. Continued vehicle and human movement through the area loosens the sand allowing ready removal by the frequent strong winds and stops regrowth over the denuded areas.

The area will continue to degrade and will lead to additional erosion problems in the future unless remedial work is undertaken.

RECOMMENDATION

To stop further rapid degradation of this area it will be necessary:

1. To ideally stop all human foot and vehicle traffic through this dune area. This can be achieved by signage indicating the area is sensitive to foot and vehicle traffic and asking/directing the Public to please stay out. This should be reinforced by a relatively cheap and quickly erected fence (1 metre high) placed around the perimeter of the area and made from such readily available materials as wooden posts and two or three runs of No 8/No 6 fencing wire. This presents a physical barrier that is recognised and indicates along with the signage that people should not enter, but does not project a highly visual presence to detract from the rugged nature of the area. If foot access is regularly required through the area then it must be controlled/confined to a pathway fabricated for this purpose. Refer to the 'Coastal Sand Dunes' papers.

2. Across the valleys and near the middle of the dune blow out area a 1 metre high section of wind cloth should be stretched on a wire and post fence. This to run parallel to the beach foreshore. The windcloth needs to have its lower edge effectively touching the ground. Cloth to be attached to the wire as per manufacturers instructions. (See Donaghys sheets.) Monitor rate of drop out of wind blown sand at the fence. As height of sand builds up the fence, another wind cloth fence can be built behind or in front of the existing fence to control shape and height of the prograding dune. Refer photocopies of 'Coastal Sand Dunes' papers

3. As the sand builds up it is important to re-establish the natural dune vegetation of the coast to stabilise the sand from wind induced movement and also dune faces from collapse in times of erosion.

4. If possible loose wind blown sand may be taken from another site such as the base of the light house reef and deposited back in the blow out area to help more rapidly re-establish and re-contour the dune system. This allows rapid replanting of new dunes to minimise time of re-establishment. By placing new fences in various positions after each fence has filled, the shape and width of the dune can be controlled to a degree, to fit the natural shape of the adjacent vegetated dunes.

Materials

1) Windcloth

Preferably Donaghys Ulstrawind cloth or Windbreak Plus. Both have a rip stop design, are UV resistant and have eyelets built in that allow easy threading/securing of the windbreak material to the supporting wire. Height of cloth should be restricted to 1 metre to minimise visual impact. Cloth should run continuous past supporting fence posts and be held secure at posts by a flat timber batten nailed on top of the wind cloth and to the post. Cloth should be installed taut with no slack spots.

2) Posts

Preferably timber 75x75 or 100 to 150 half round. Do not need to be tanalized. Posts to be driven into sand or preformed holes in papa. Suggested spacing is 4 metres. Ends of fence need to be guyed back to pegs in the ground to keep fence tensioned. Fences should finish with/against the existing ground contours to ensure no bypassing of sand around fence ends in hollow areas.

3) Wire

Galvanised No 6 or No 8 fencing wire run between posts to hold wind cloth taut and lower edge close to if not at ground level. Some pegs may be needed

to keep cloth close to ground level. Secure cloth to peg with flat wooden batten.

4) Planting material

When fence is established and dune is starting to reform, planting of the site should be commenced. Planting material should be the same as that found in close proximity to the site. Discussions should be held with DOC to determine the most suitable replanting species. A nursery programme to produce suitable plants would be a good community/school project. Suitable fertilisation of planting areas may be required to help plants establish and colonise the area.

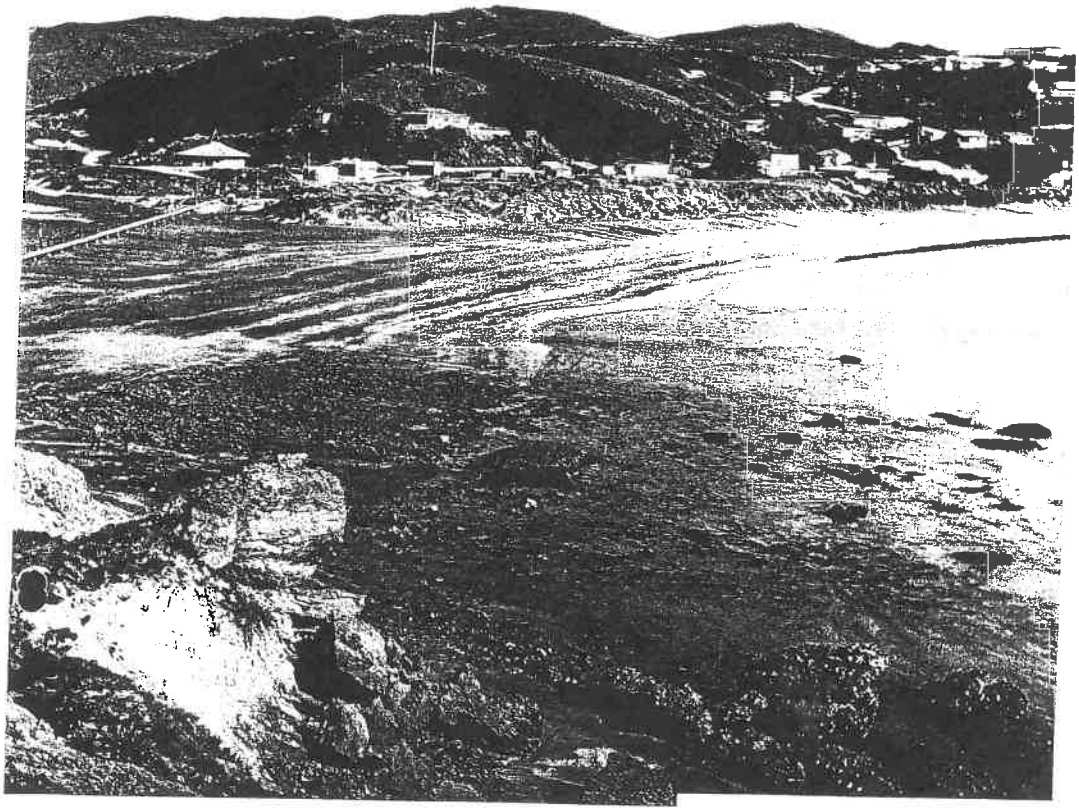
5) People

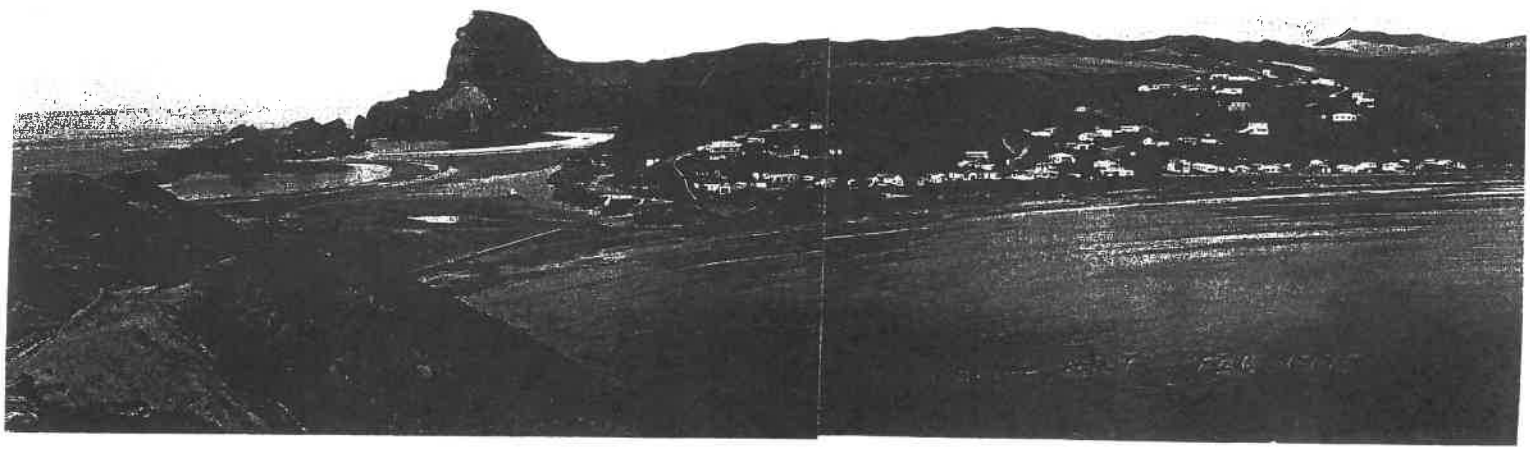
Local residents and in particular children, should be encouraged to participate in the fencing, monitoring and revegetation of the site. Some basic skills such as previous fencing work will help in the construction of the ring and wind fences.

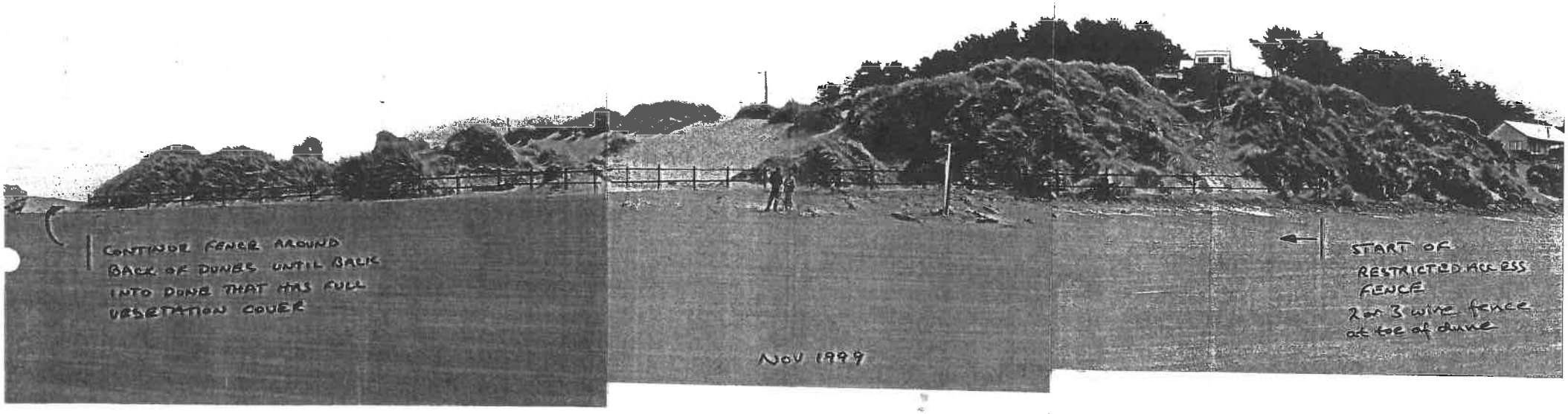
Keith Armstrong

OCEL Consultants Limited

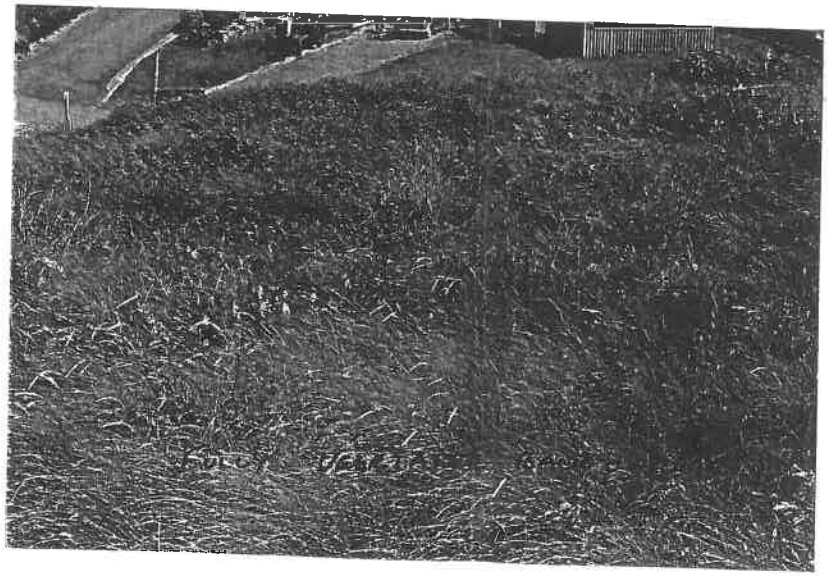
CASTLE POINT 1978

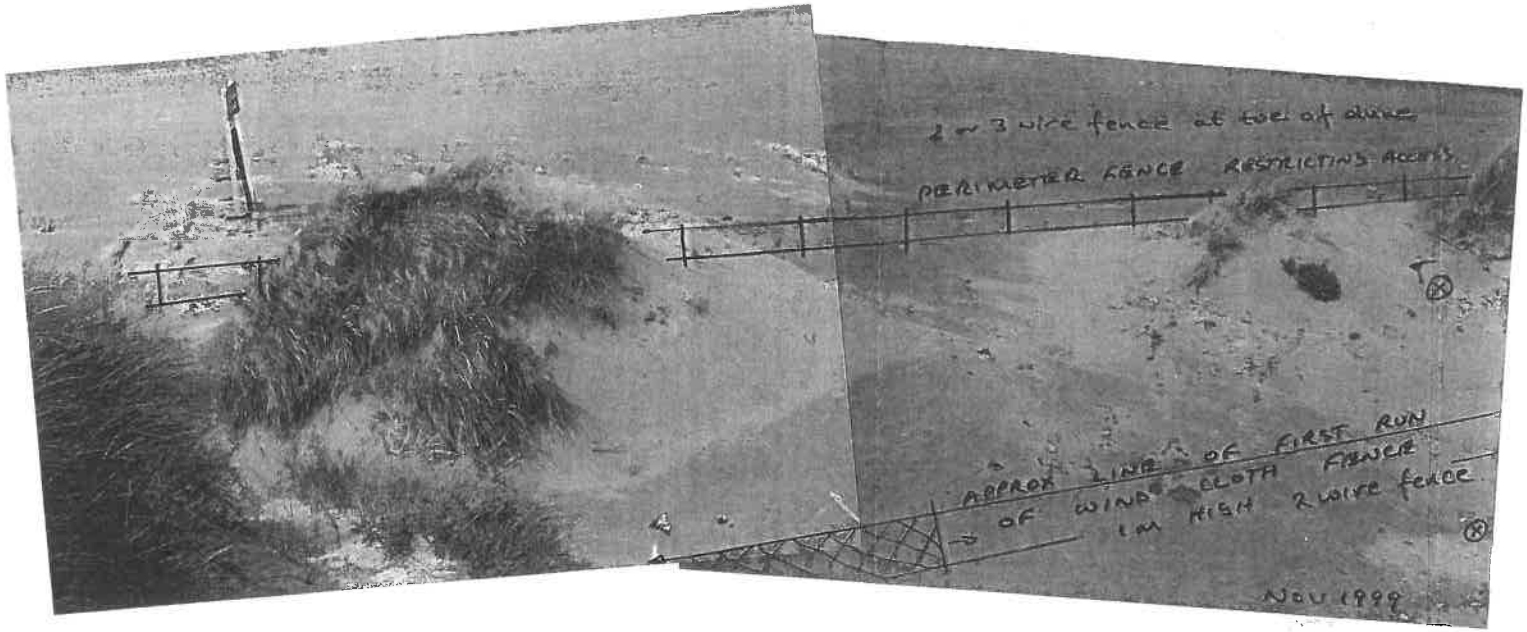




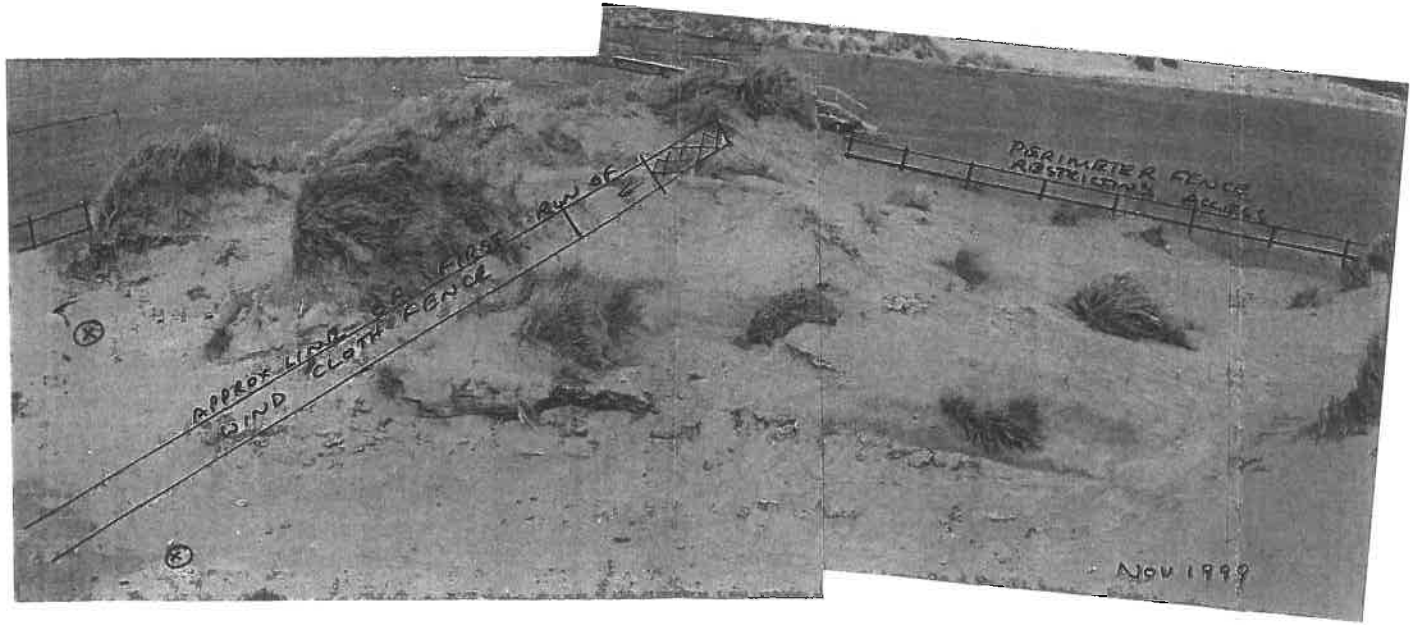


CASTLE POINT NOV 1999 SOUTH END OF DUNES PERIMETER FENCE





⊗ = match up points on photos.



CASTLE POINT NOV 1999 SOUTH END OF DUNES PERIMETER FENCE + WIND FENCE

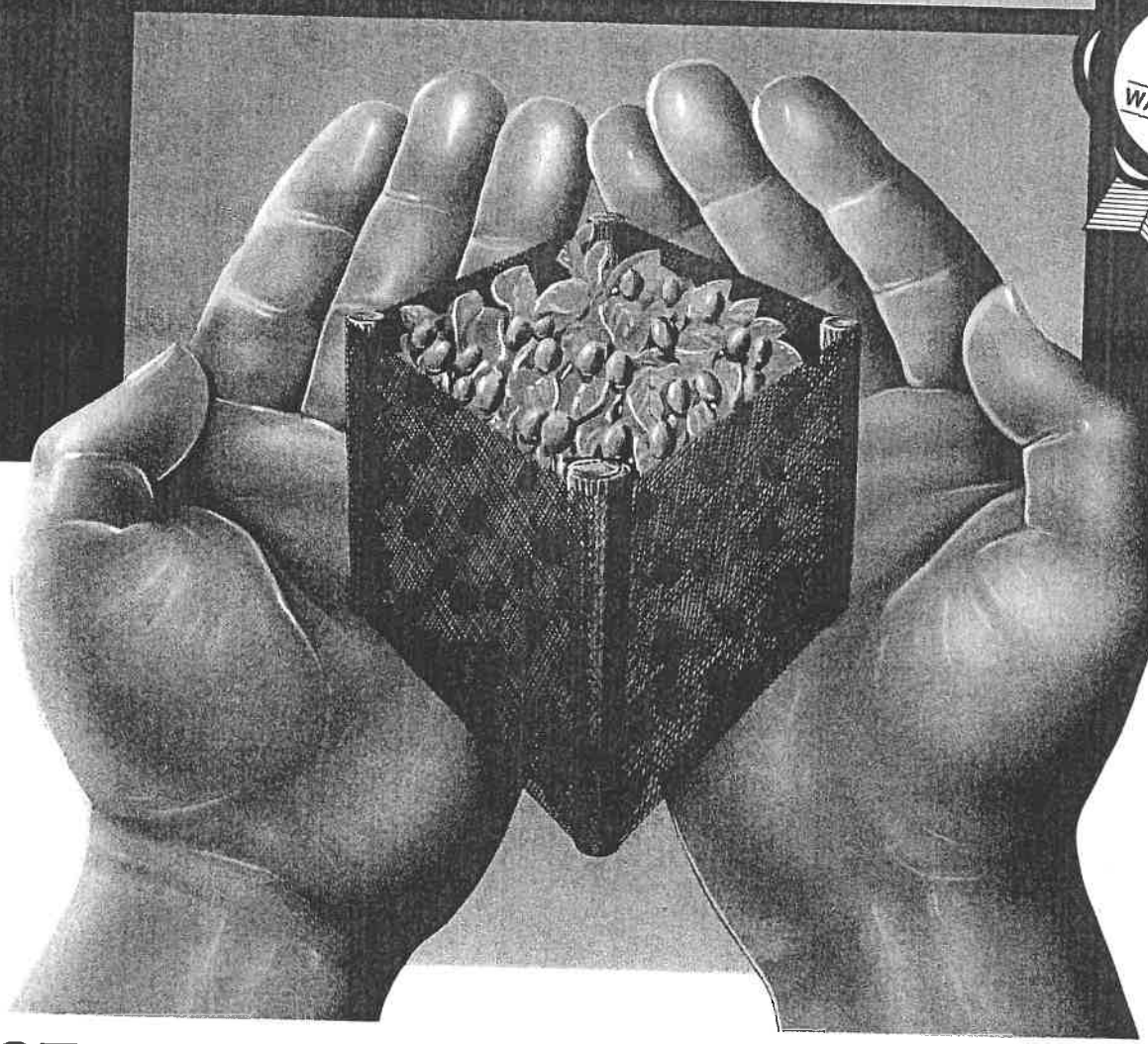
DONAGHYS

WIND SHELTER CLOTHS

ULSTRAWIND · WINDBREAK PLUS · WOVEN WINDBREAK

ULSTRAWIND
WINDBREAK PLUS

10 YEAR WARRANTY*
* CONDITIONS APPLY



PROTECTING THE FRUITS OF YOUR LABOUR

- Ulstrawind Knitted Windshelter has rip stop design.
- Ulstrawind has built in eyelets for easy installation.
- Improves fruit quality and minimises bruising and windrub.
- Unaffected by agricultural chemicals and plant diseases.
- No competition from shelter belt roots for water and nutrients.

DONAGHYS

ULSTRAWIND

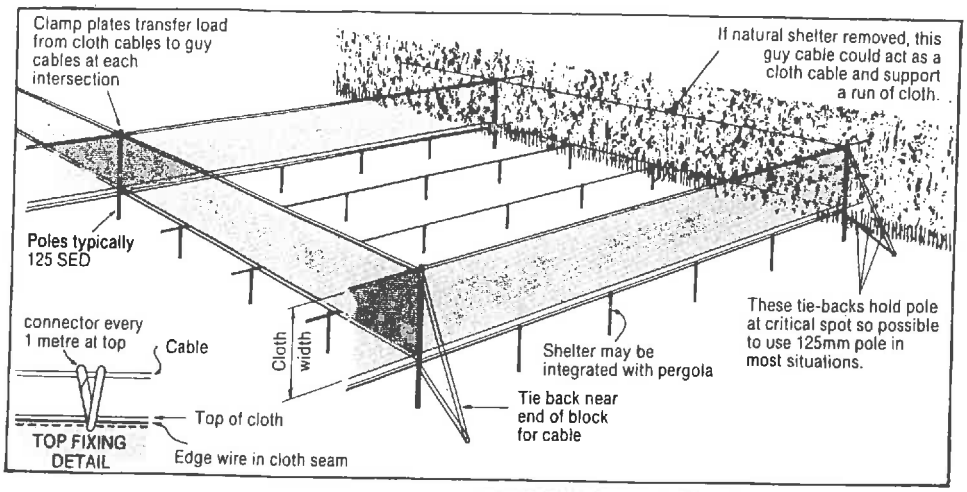
Donaghys Ulstrawind is manufactured from High Density Polyethylene (HDPE) monofilament yarn, which is knitted to prevent tearing.

Ulstrawind is strong yet it can be cut with scissors. It will not fray because it has a rip stop design for long life.

We are so confident in Ulstrawind we provide a 10 year warranty* against product failure due to Ultra Violet degradation.

Although ideally suited for use with ULS (Ultra Long Span) structure systems, it can be used on conventional windbreak structures.

Ulstrawind has built in eyelets allowing for easy installation. Simply thread the wire through the eyelets.



Specifications – Ulstrawind

Porosity 50% effective porosity.

Roll Dimensions

1m wide x 50m long
1.83m (6ft) wide x 50m long
2.74m (9ft) wide x 50m long
3.66m (12ft) wide x 50m long
4.1m (13ft 6") wide x 50m long

Benefits

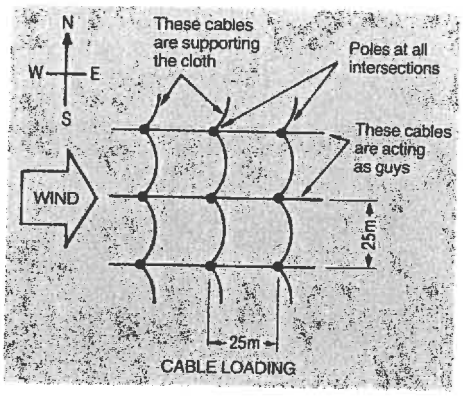
- Protects crops without creating turbulence zones.
- Tested, tested and approved by M.A.F., [illegible].E.I. and Auckland University Mechanical Engineering Authorities.
- Instant wind shelter, no long establishment periods.
- Improves fruit quality and minimises bruising and windrub.
- Doesn't harbour pests.
- Unaffected by agricultural chemicals and plant diseases.
- No competition from shelter belt roots for water and nutrients.
- Increases temperatures in sheltered areas through reduction of windspeed.
- No ongoing trimming required.
- Ulstrawind knitted design has built in rip stop design and eyelets for installation.

Woven Windbreak

Donaghys offer an economy option for windshelter in woven windbreak.

Woven windbreak is manufactured of HDPE tape and is woven as opposed to rip stop knitted design.

It is available in 50m rolls in widths of .91m (3ft), 1.83m (6ft), 2.74m (9ft) and has an effective porosity of approximately 45%.



Windbreak Plus

Donaghys have developed an economy knitted windbreak for non commercial applications. Windbreak Plus is a superior product to woven windbreak as it is manufactured from HDPE monofilament and incorporates the rip stop design of Ulstrawind.

Windbreak Plus is available in 50 metre rolls in widths of .91 metre (3ft) and 1.83m (6ft).

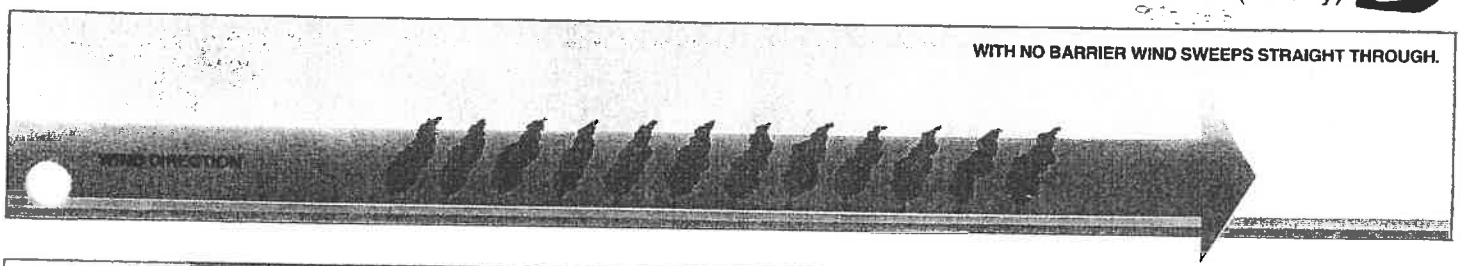
Other Donaghys Environmental Protection Fabrics

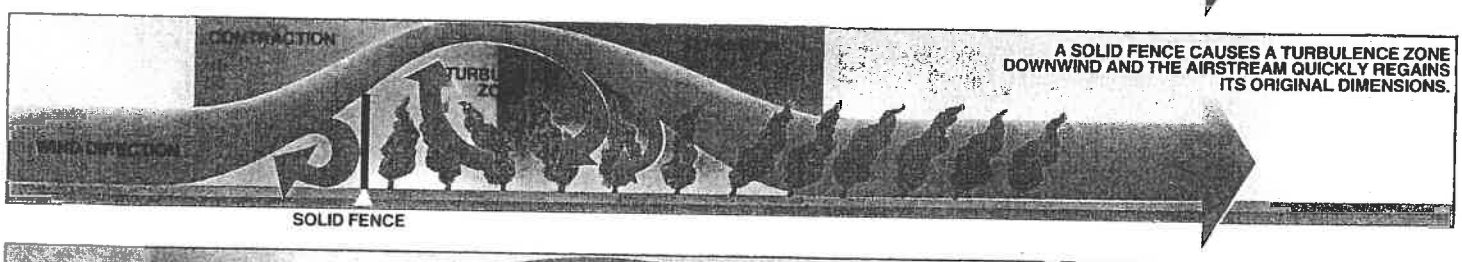
Birdtex GP – bird protection for grapes.
Supashade and Koolshade – sun protection.
Weedtex – weed control.
Soiltex – soil stabilisation.
Hailnet – hail protection.

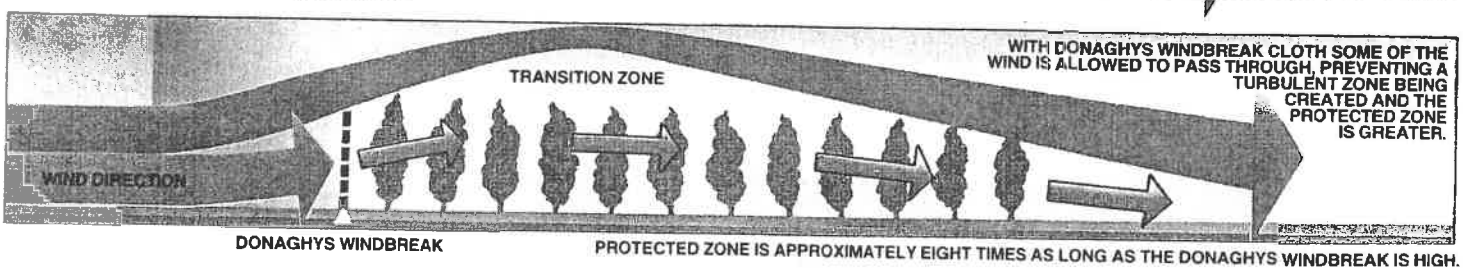
Donaghys Offices
Christchurch
179 Pages Road, PO Box 15007
Aranui, Christchurch, New Zealand.
Phone 0-3-388 6186 Fax 0-3-388 4748.
Auckland
24 Bancroft Crescent, PO Box 69071
Glendene, Auckland, New Zealand.
Phone 0-9-818 7019 Fax 0-9-818 7973

*10 year warranty against product failure due to Ultra Violet degradation applies to HDPE monofilament only, not HDPE tape. For full warranty conditions please see the product label or contact Donaghys Industries Ltd.

FREEPHONE 0800 652 006 (NZ only)







Your distributor.

DONAGHYS

Beach Protection Authority of Queensland.

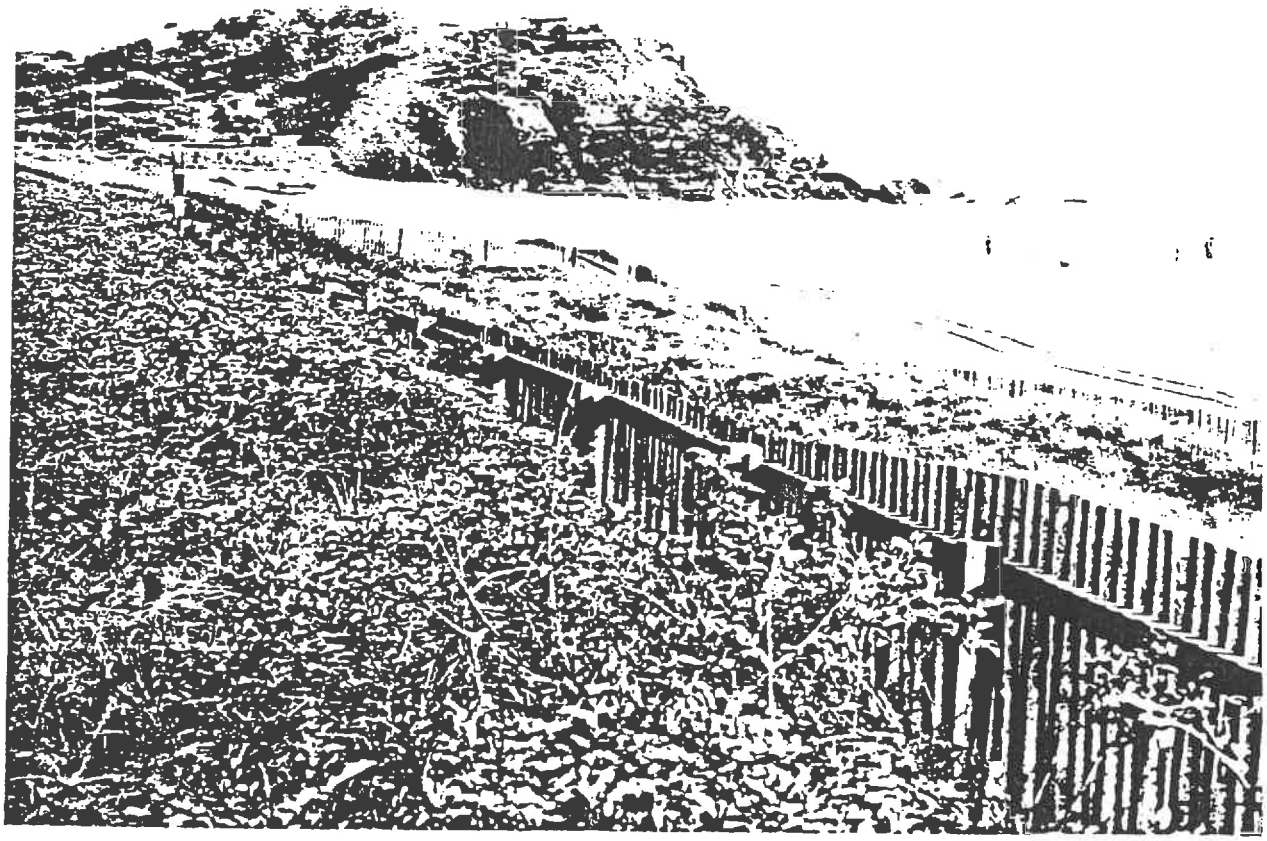
Coastal Sand Dunes

their Vegetation and Management

MANAGEMENT GUIDELINES FOR DUNE USAGE.

Re-Establishment of Dunes: A Basic Approach

The re-establishment of frontal sand dunes involves the physical replacement of a mass of sand of appropriate size, shape and location to provide the required protection against storm waves. This must be followed by stabilisation of the sand mass so that it will not be reshaped or relocated by wind action.



Re-established and fenced frontal dune supporting a good cover of dune stabilising vegetation.

Although the methods used in individual locations may vary, the following steps are common to dune re-establishment programmes:—

1. The construction of the dune to its designed size, shape and location, using one or more of the following methods—

(a) the collection of wind blown sand by sand trapping devices such as brush matting or semi-permeable fences which lower wind velocities so that sand in transport is deposited where required;

(b) the importation of sand from remote locations, usually by truck;

(c) hydraulic dredging of sand from adjacent estuarine or offshore sources;

(d) the re-shaping of sand from immediate hind dune or beach sources using earthmoving plant.

2. The immediate temporary stabilisation of the constructed dune to prevent its deformation by wind action (using methods described in Leaflets V-03.5 and V-03.6) until such time as a vegetative cover can be established.

3. The establishment of a vegetative cover to prevent wind erosion of the dune, encourage further sand deposition and to provide a means by which the dune is capable of natural regeneration after storm damage.

4. The protection of the vegetative cover by physically excluding people, stock and vehicles and preventing fire, all of which cause localised or general destruction of dune plants, and result in wind erosion. Unpreventable damage requires repair, as outlined in (1), (2) and (3) above, if natural regeneration is unable to make good the damage.

An undisturbed frontal dune system is in a complex state of dynamic equilibrium and its stability, shape and position at any time are a result of the interplay of the effects of wind, waves, tides and vegetation. Returning the dune to a natural, undamaged condition provides a degree of flexibility that allows the vegetation line to retreat under wave attack and advance during calmer weather conditions. The achievement of such a situation is the main objective of good dune restoration, and results in a decrease in the extent of erosion of the beach. Failure to trap wind blown sand in the dune results in significant, long term and permanent erosion of the beach / dune system.

In any dune restoration programme it is therefore important to appreciate that the sand dune is designed to be eroded during storms, with inevitable losses of vegetation, walkways and fences. A further important objective of good restoration practice is to minimise maintenance commitments by providing vegetation which regenerates naturally and by using flexible or expendable structures which can accept storm attack or be replaced at minimum cost.

Beach Protection Authority of Queensland.

Coastal Sand Dunes

their Vegetation and Management

MANAGEMENT GUIDELINES FOR DUNE USAGE.

Re-Establishment of Dunes: Sand Dune Design

Frontal sand dunes are protective structures designed by nature to act as a buffer against wave attack and overwash. They also provide a reservoir of sand to "feed" the sea during periods of erosion.

Prior to construction or re-establishment they need careful design as does any other structure required to afford protection from the sea. The following broad criteria should be considered by the designer:—

1. Material.

The sand used should be free of clay or other binding materials which could adversely affect dune drainage.

The median grain size of the sand should preferably be at least as large as existing beach sand sampled at about mid-tide level. If its median grain size is smaller, the sand will erode at a faster rate during storms and more sand must be used for equivalent protection. Rapid wind erosion of the dune can also occur if the sand used in its construction is too fine.

If median grain size is too large then nutrient losses and poor retention of moisture can prevent plant growth; establishment and maintenance of vegetative cover can be extremely difficult under these conditions. When the median grain size is too coarse it is necessary to design the dune so that the top 300 mm of dune surface consists of sand capable of supporting plant growth.

Dredged or beach sand has high salinity levels. If this material is to be used in dune construction then salinity levels can present problems in the establishment of vegetation.

2. Cross-sectional area.

Design for full protection requires a frontal dune containing a sufficiently large volume of sand so that the dune and adjacent beach can accommodate erosion during a major cyclone season. This volume can be determined readily by a number of current computational procedures provided that beach, dune and adjacent seabed topography and wave climate data are known. Alternatively, it can be assessed by an examination of coastal behaviour using pre and post cyclone survey techniques. Cross-sectional area and sand volume are also determined by the height and width requirements for the re-established dune.

3. Height and width.

When a dune is overtopped, accelerated erosion, sand overwash and inundation of hind dune areas can occur. For these technical reasons height and width of the frontal dune in developed areas should ideally be sufficient to prevent overtopping and breaching of the dune by waves occurring during a major storm. Dune heights within the range of 5 to 7 metres above Australian Height Datum are commonly adopted to provide for all but the most severe conditions likely to be encountered during a cyclone.

Other criteria such as aesthetics, loss of ocean views and cost considerations may favour a lesser dune height or width and these must be balanced against the increased risk of over-topping, erosion and coastline recession.

4. Slopes.

At the construction stage maximum slope will be dictated by the safe working capability of equipment used for dune formation and surface treatment. Slopes should permit ease of vegetation establishment and long term maintenance of the stabilised dune.

Some subsequent re-shaping of the dune can be expected as a result of wind and sea action, and natural dunes in the area should be examined to obtain an indication of stable dune shape.

The initial dune should have an aerodynamic shape with a seaward slope about 1 in 5 and a landward slope about 1 in 3 (see diagram).

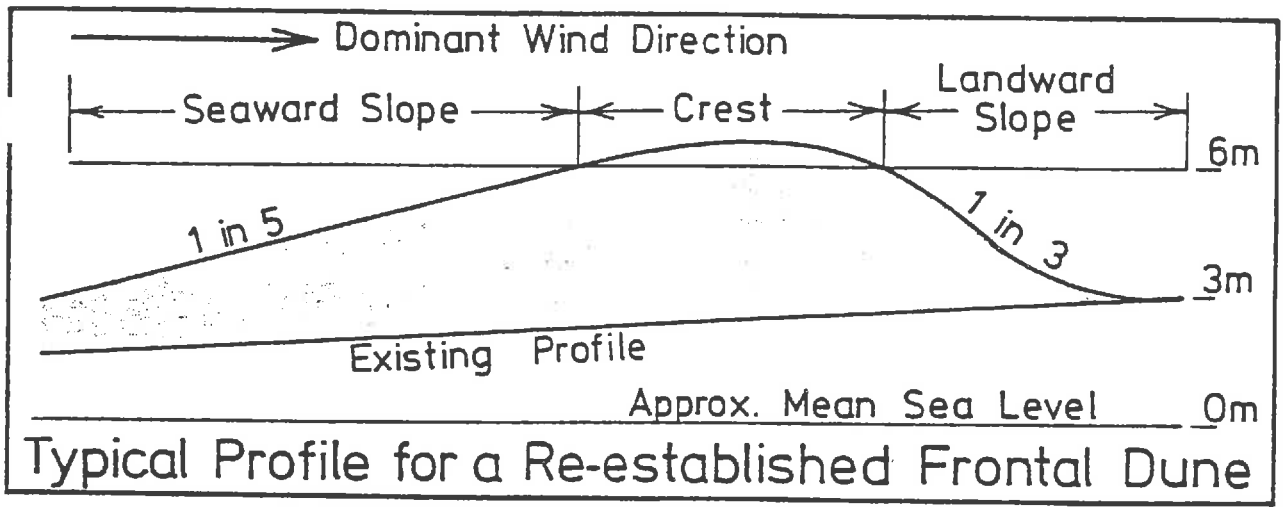
5. Location.

Dune location in plan is often determined by the fixed location of capital assets which it is designed to protect.

Locating a dune seaward of the natural dune line will result in early failure unless artificial beach nourishment has raised the beach level sufficiently to prevent premature wave attack on the newly constructed dune.

6. General.

A reasonable first approach is to design the dune so that it approximates the natural dune system if one can be found in the area. Natural dunes have achieved dynamic stability under the action of wind, wave and tidal forces and normally behave in a predictable and effective manner. When designing sand dunes it must be realised that the surface of the re-established dune must be stabilised against wind erosion, planted with suitable native dune vegetation and maintained in a stable, well vegetated state.



Typical Profile for a Re-established Frontal Dune

Frontal sand dunes should be designed to approximate existing naturally stable dune systems.

Beach Protection Authority of Queensland.

Coastal Sand Dunes

The Vegetation and Management

MANAGEMENT GUIDELINES FOR DUNE USAGE.

Re-Establishment of Dunes: Methods of Dune Construction

Having decided on dune design using the criteria outlined in Leaflet No. V-03.3 then the dune can be constructed using one or more of the four methods described in this leaflet.

In most cases the sand used in dune construction should be obtained from source areas remote from the dune being repaired and these source areas should be located where sand removal will have no deleterious effect on beach processes.

1. Importing sand.

Where there is no local supply of sand the dune can be constructed using sand brought in by trucks from another source. The imported sand should have median grain size similar to that in the natural dune to allow normal establishment and growth of vegetation. Sand of coarse grain size does not hold moisture or nutrients satisfactorily and plant growth is usually poor. Rapid wind erosion of the dune can result if the sand is too fine. The imported sand is placed at the appropriate dune location and earthmoving equipment used to construct a dune of the required size and shape.

This method can be used where rapid repair of the dune line is needed owing to localised damage caused by overwash and wind or wave erosion.

Beach and dune in the early stages of being rebuilt by dredging sand from the nearby estuary.

2. Using sand from the beach or hind dune areas.

Earthmoving equipment is used to push sand up from the beach or from hind dune areas and then to construct a dune of the required size, shape and location. Where beach sand has been used for dune construction, planting of stabilising dune vegetation can be done as soon as salinity levels drop sufficiently to allow establishment of Sand Spinifex Grass (less than 400 parts per million of chloride ion). Sand samples could be analysed for salinity by arrangement with the local fertilizer company representative or by government agencies.

3. Hydraulic placement of dredged sand.

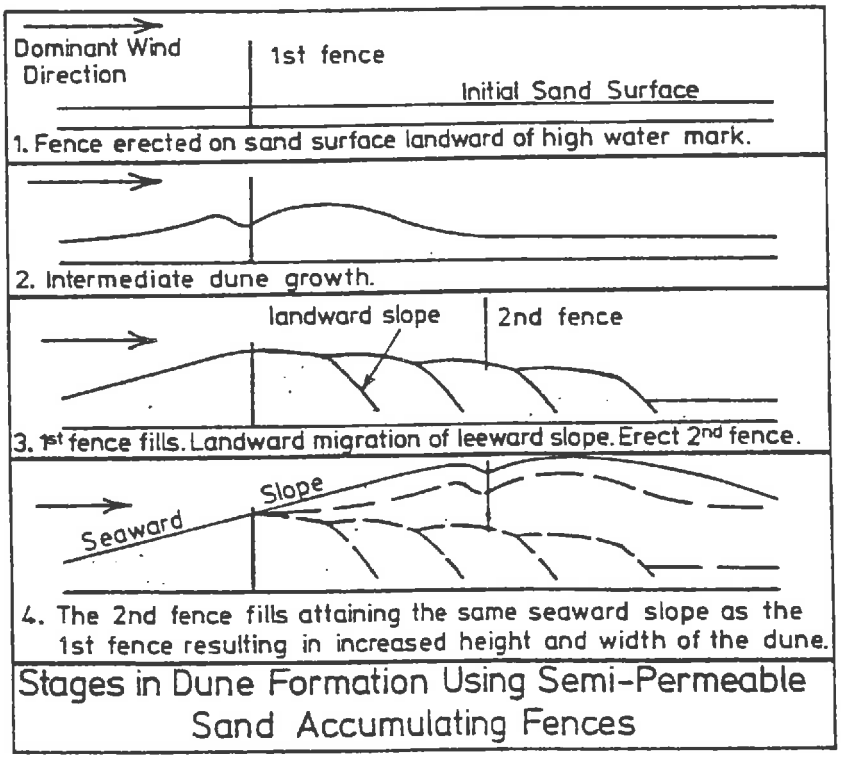
This method of dune construction involves the placement of sand at the required dune location by pumping it from offshore or estuarine dredging sites. Dunes of the required size and shape can then be constructed using earthmoving equipment. This is a quick but expensive method of re-establishing a dune line, and is used when rapid repair is needed owing to severe erosion problems. The sand used should have median grain size, similar to that in the natural dune, to allow establishment of vegetation. Salinity is again a problem with sand placed by hydraulic methods, and planting of vegetation should be delayed until rainfall has lowered the salinity level to that specified above.

4. Sand accumulators.

Sand accumulators used for dune construction are generally of two types:—

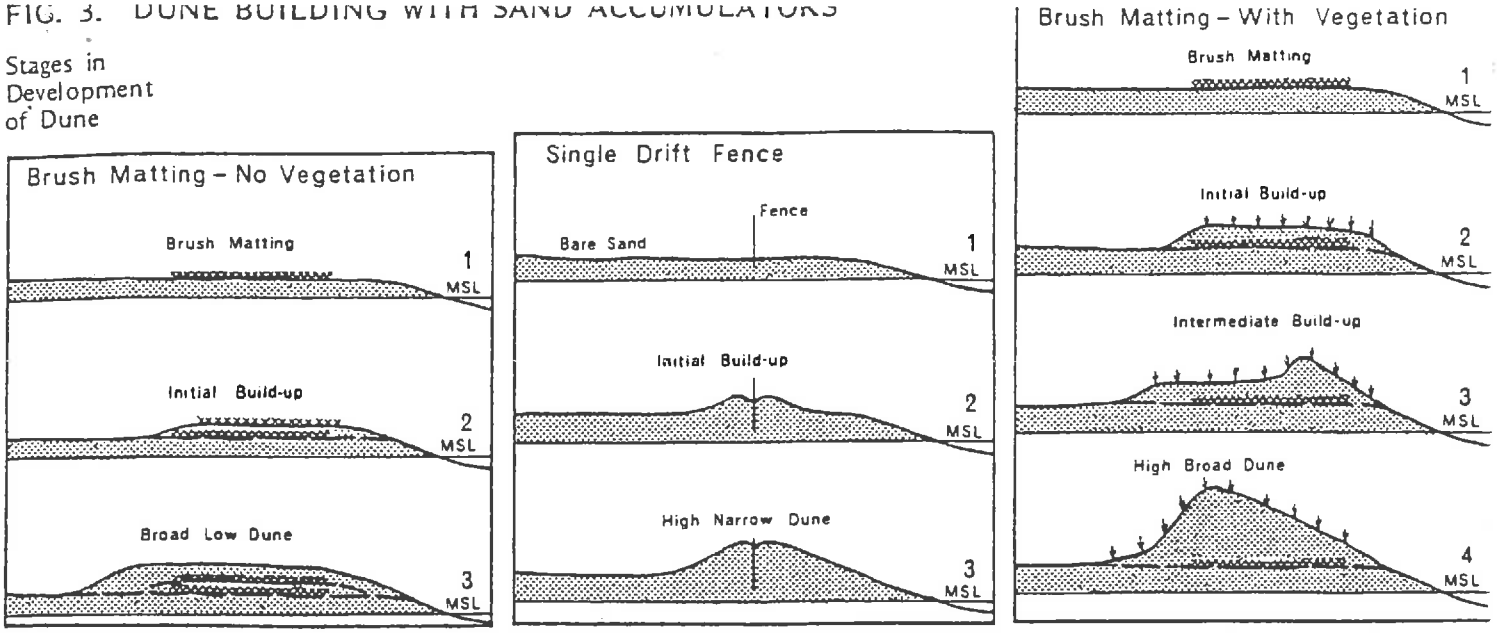
(a) Vertical structures such as semi-permeable fences or driftwood barriers which accumulate sand in a narrow band adjacent to the structure. Wind blown sand is trapped on both the windward and leeward side of the structure forming an artificial dune. These structures can be used to repair gaps in the frontal dune, initiate rebuilding of an eroded dune line or to protect planted areas from wind blown sand until vegetation is established. For further information on these types of sand accumulators see Leaflet No. V-03.5.

(b) Surface "roughgeners" such as brush matting which accumulate wind blown sand over a wider area but to a shallower depth. Pieces of brush placed flat on the surface trap wind blown sand which eventually covers the brush. More brush is added to that previously covered, and so on, until a dune of the required size and shape is obtained. This type of sand accumulator is also used for surface stabilisation and is further described in Leaflet No. V-03.6.



Stages in Dune Formation Using Semi-Permeable Sand Accumulating Fences

FIG. 3. DUNE BUILDING WITH SAND ACCUMULATORS



	Brush Matting – No Vegetation	Single Drift Fence	Brush Matting – With Vegetation
PROS	1. Produces a wide based dune. 2. A very efficient sand accumulator.	1. Crest height increases rapidly. 2. Establishing vegetation on leeward side is protected.	1. Produces wide based dune of sufficient height 2. Vegetation easier to establish
CONS	1. Produces a low dune. 2. Shortage of brush in some areas.	1. Narrow steep dune produced. 2. Vegetation on dune slopes may be difficult to establish.	1. Needs to be protected from people and stock 2. Shortage of brush in some areas.
TYPES OF USE INDICATED	1. Where wide low dune is required. 2. Where brush is available.	1. Repairing blowouts in dunes. 2. Where rapid accumulation is anticipated.	1. Where wide dune is required. 2. Where a naturally shaped and vegetated dune is required.

Secondly, a barrier which builds up sand, ceases to function as a sand trap as soon as it is covered.

Reliance on slat, dead brush or mesh fences and dead brush or mesh as ground cover will therefore necessitate periodic complete replacement after destruction by storms or when covered with wind blown sand.

In practice, inert materials are very suitable for initial dune establishment and for short term use. However, in the long term, growing vegetation is the most effective means of building up and stabilising sand dunes against wind erosion.

DUNE VEGETATION CAN

- PREVENT WIND EROSION by decreasing wind speed at ground level
- BUILD UP SAND DUNES and thus REDUCE THE EXTENT OF RECESSION PRODUCED BY A STORM
- REDUCE WAVE EROSION CAUSED BY OVERWASH where dense vegetation exists
- REGENERATE NATURALLY AFTER STORM DAMAGE – where dune management allows
- TOLERATE A HOSTILE ENVIRONMENT – of high winds, salt spray, sand blast, covering by sand, sandy soil and little water
- ACCEPT MASSIVE MOVEMENTS OF THE DUNES both vertically and horizontally
- FUNCTION AS A SELF SUPPORTING COMMUNITY where plants are mutually dependent for protection and nutrient supply

DUNE VEGETATION CANNOT

- PREVENT DIRECT WAVE EROSION – dune sand is not strongly bound by roots under wave attack
- SURVIVE DIRECT WAVE ATTACK – much of the seaward vegetation will be destroyed in a storm
- TOLERATE EXCESSIVE PHYSICAL DAMAGE – caused by people, stock or vehicles
- TOLERATE MISMANAGEMENT such as:–
- MOWING: which destroys some species and juveniles of others
- TOPSOILING: which prevents free drainage and is unsuitable for growth of many natural dune species
- OVERFERTILIZING: which can be toxic to some species
- INTRODUCTION OF UNSUITABLE PLANT SPECIES: some undesirable plants displace natural vegetation – others such as palm trees do not reduce wind erosion and accelerate wave erosion when they fall.

Coastal Sand Dunes

Their Vegetation and Management

MANAGEMENT GUIDELINES FOR DUNE USAGE.

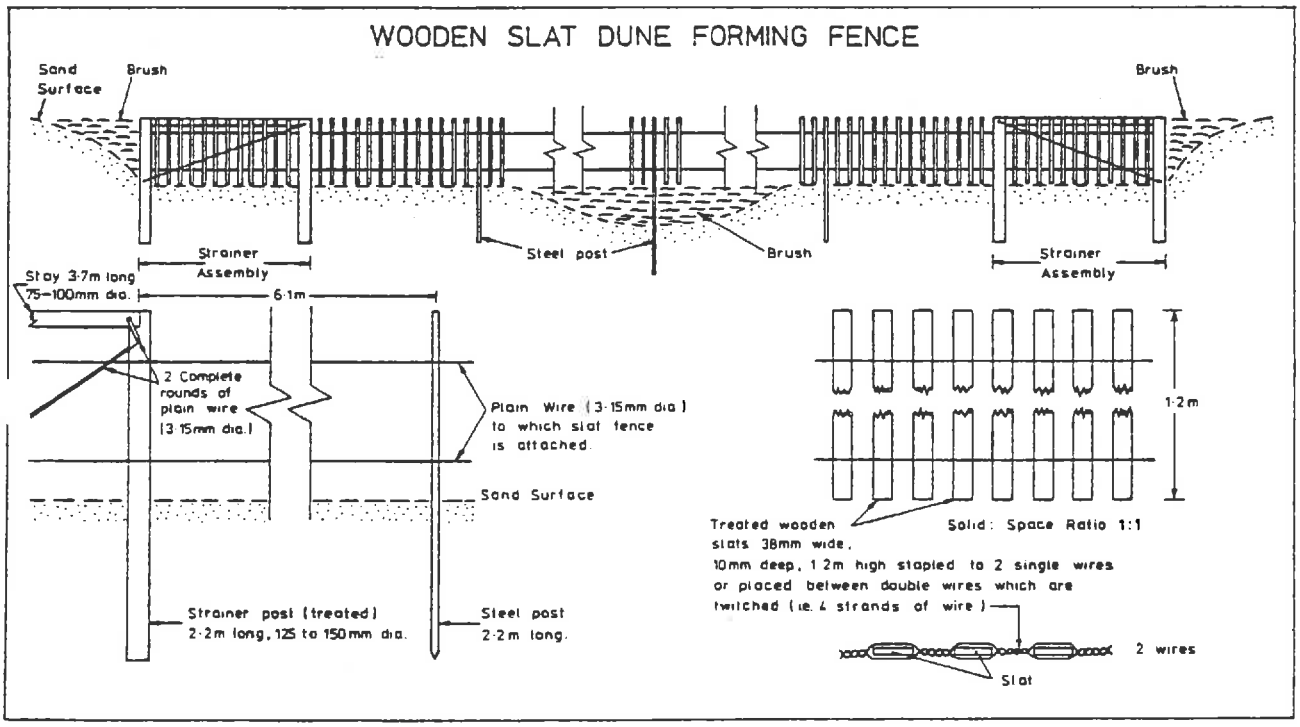
Sand Accumulators: Semi-Permeable Dune Forming Fences

Dune forming fences are constructed by attaching wooden slats, brush material or plastic or nylon mesh to a wire strand fence for the purpose of trapping wind blown sand. The fence should be semi-permeable and it is generally found that porosities from 40 to 60 per cent are the most favourable for trapping sand.

The wind in front of the fence is slowed down causing sand to settle forming a windward slope in front of the fence. Sand passing over and through the fence is deposited in the area of reduced wind velocity behind it. If the sand is fine (0.1 — 0.25mm diam.) the fence may fill rapidly but it takes longer with coarser sand (up to 1mm diam.).

The capacity of dune forming fences to accumulate sand depends on:—

1. the amount of sand blowing across the beach or dune which is determined by wind speed, wind direction, surface slope, grain size and sand moisture content;
2. the number, position and height of fences;
3. fence type and porosity



A single fence is usually sufficient to build the required dune line. Wider or higher dunes can be built by placing a second fence above and parallel to the first fence after it has filled with sand. More than two fences can be used if necessary.

Correct positioning of the fences is essential and position should be related to dominant wind direction. Fences are placed along the required dune line subject to there being sufficient sand movement across this line. Sharp changes in fence alignment should be avoided. The fence line should be located above high water mark and far enough landward to avoid frequent damage by storm waves and high tides.

The fence must be well stayed to prevent overturning either through the forces exerted on it by strong winds or by the weight of accumulated sand.

The dune constructed using this type of sand accumulator should be stabilised to prevent wind erosion and planted with dune vegetation.

The main types of dune forming fence to be considered are:—

1. Slat fences.

These are constructed of rectangular wooden slats and can be either machine or hand made. Slats about 38mm wide and 1m high have proved efficient in trapping wind blown sand. Lower fences (about 50 cm high) have been used to raise the level of back beach areas where salinity prevents the establishment of vegetation.

Slat fences are usually less prone to vandalism than those constructed using plastic or nylon mesh.

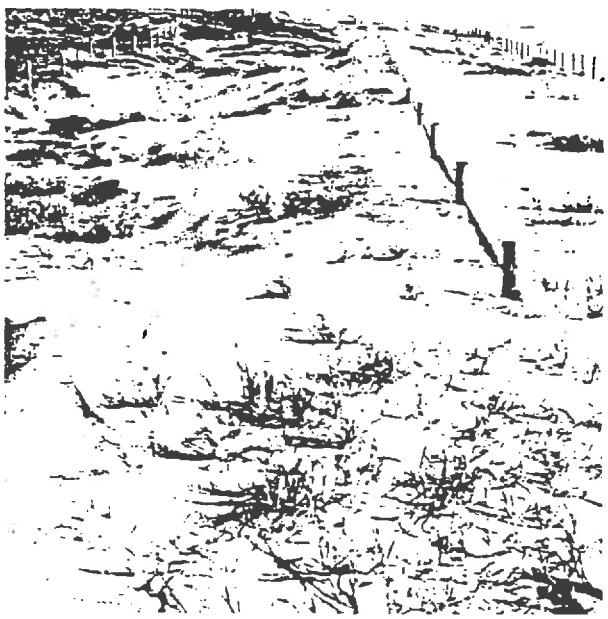
2. Plastic or nylon fences.

These types of fence are easy to erect as the mesh is light, easily handled and can be quickly attached to the supporting fence wires. Moulded or woven plastic or nylon mesh can be used.

3. Brush fences.

Brush fences are efficient sand accumulators but labour costs involved in their construction are high and their use is limited by the availability of brush.

Experimental dune forming fence placed above high water mark, parallel to the beach along the required dune line and across the dominant sand shifting wind.



Frontal dune re-established using a dune forming fence and the new dune colonised by Sand Spinifex Grass.

Beach Protection Authority of Queensland.

Coastal Sand Dunes

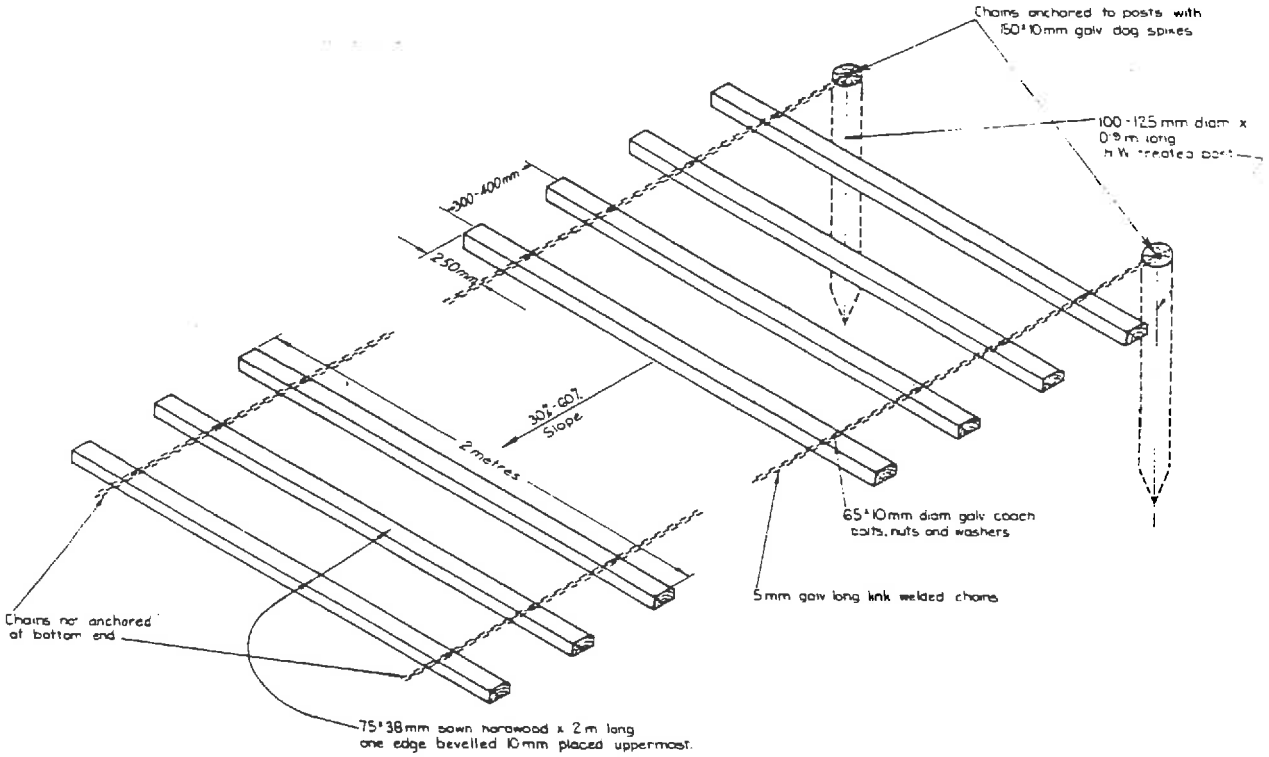
Their Vegetation and Management

MANAGEMENT GUIDELINES FOR DUNE USAGE

Board and chain walkways, steps, advisory signs

Board and chain walkways

Board and chain walkways are placed at the beach end of access tracks where frontal dune slopes are between 30 and 60 per cent (17° – 31°). Their use prevents lowering of the dune and the development of blowouts which result when pedestrian traffic is concentrated at one spot on the dune. Properly constructed and installed boardwalks improve the ease of access to and from the beach.



BOARD AND CHAIN WALKWAY DOWN FACE OF A FRONTAL DUNE

The standard width for board and chain walkways is 2 metres. Other widths may be considered e.g. for surf boat launching and vehicle access.
Boardwalks can be constructed using 2m x 75mm x 38mm sawn hardwood fixed at spacings ranging from 300–400mm along a pair of 5mm long-link, galvanised, welded chains. Boardwalks wider than 2 metres require an additional centre chain. The spacing between boards depends on dune slope — the steeper the slope the greater the spacing.
The boards should preferably have one edge bevelled about 10mm deep and this edge is placed uppermost during construction. The boards are attached 250mm from each end by means of 64mm x 10mm galvanised bolts, washers and nuts. The chains are attached at the top end by driving a galvanised dog spike 150mm x 5mm through the chain into the end of a 0.9m length of treated fence post (100–125mm diameter) buried to its entire length in the ground. The bottom end of the board and chain walkway is left free to allow it to be lifted when sand accumulates on it. Repair and maintenance of the boardwalks should be carried out as required.

Steps

Steps should be used for beach access when the seaward face of the frontal dune has a slope greater than 50 per cent (26.5°). Where the frontal dune has been destroyed and boulder or concrete retaining walls have been constructed steps are usually used for beach access.

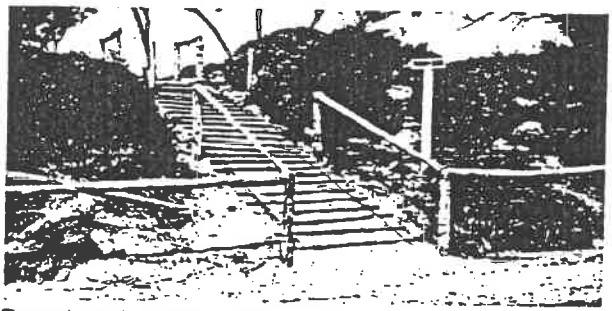
Suggested specifications for beach steps:—
- Width: not less than 600mm between handrails.
- Slope: no greater than 45°.
- Risers: should not exceed 18 per flight.
- Steps: 1m x 305mm x 50mm hardwood.
- Height between steps: 150-220mm.
- Stringers: 230mm x 50mm hardwood.
- Handrails: 100mm x 50mm hardwood.

Steps should be firmly anchored using at least 100mm x 100mm timber sunk at least 1 metre into sand especially at the lower beach end.

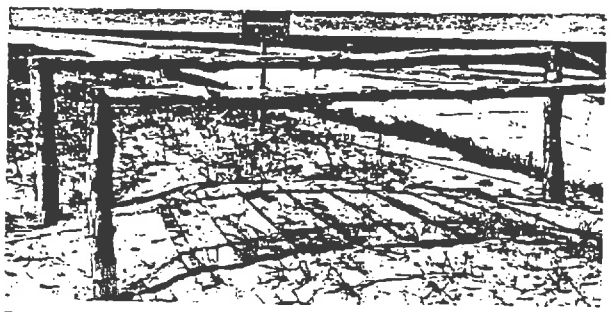
Advisory signs

Suitably worded signs advising the location of access tracks, boardwalks and steps, should be provided as required and placed in prominent positions.
Suitable signs can be made using 14 gauge (or its metric equivalent) marine grade aluminium. The size of the sign will depend on the purpose for which it is used. Signs 457mm x 356mm are suitable for use with access tracks, board and chain walkways and steps. The wording for each sign can be printed in large letters on a white or coloured background.
The signs are bolted to a galvanised post 2.4 metres long (60mm outside diameter) concreted at least 500mm in the ground. The bolts, washers and nuts should be heavily galvanised to prevent corrosion.

Steps providing access to and from the beach.



Board and chain walkway & access track to beach

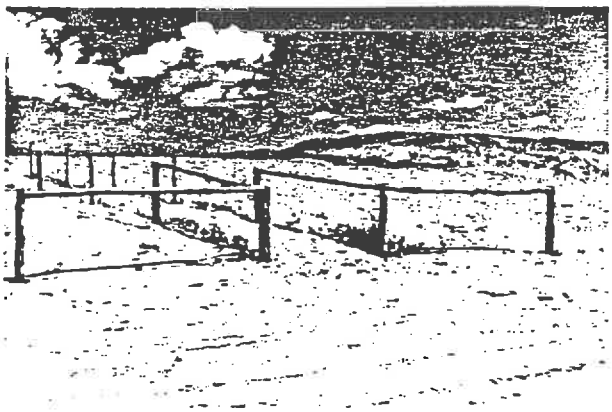


Board and chain walkway and advisory sign

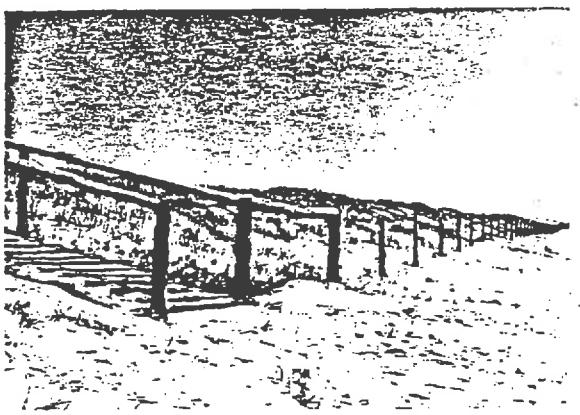
Access tracks

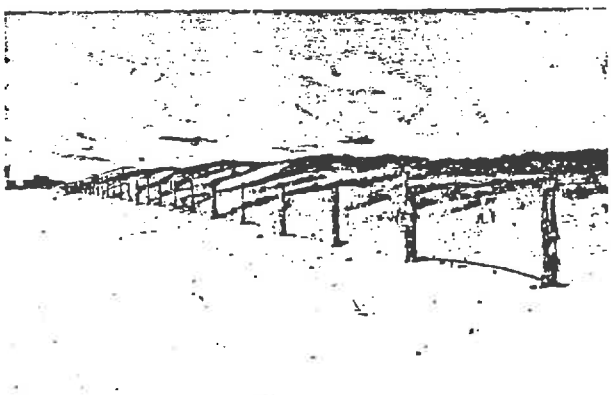
Where large numbers of people walk over the dunes to the beach fenced access tracks are required to prevent damage to dune vegetation. Dunes and the vegetation they support are also being damaged by off-road vehicles, beach buggies and trail bikes.
The tracks must be conveniently placed so that they will be used by the public. In most cases it is necessary to treat the surface of the access track so that it is not susceptible to wind erosion. This usually involves surfacing the access track with gravel and bitumen and installing board and chain walkways or steps at the seaward end of the track. Access tracks should be straight, if practicable, and narrow so that sand blown from the beach does not accumulate in them to any great extent. Access tracks are usually set at right angles to high water mark.

Pedestrian access tracks should be about 2.4 metres wide and located where dune slopes are no greater than 30 per cent (17°). Wider access tracks (5 to 6 metres) should be used for surf boat or vehicle access.
The surface of access tracks can be stabilised against wind erosion, and erosion by surface water run-off, by using a compacted base layer of gravel at least 150mm thick with a light seal of fine aggregate and bitumen. The centre of the sealed access track should be at least 50mm higher than the edges to enable it to shed heavy rainfalls quickly. The use of an unsealed 150mm layer of well-compacted gravel may be suitable for vehicle access tracks in some circumstances. Where wind erosion is not a problem and the sandy soil is free draining it may be possible to leave the access track in its natural state.



Access track over the frontal dune to the beach.





Pedestrian control fence placed along the seaward toe of the frontal dune.