Beach & Dune Guidance Manual for Saugeen Shores

Prepared by
The Lake Huron Centre for Coastal Conservation

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SAUGEEN SHORES

BRUCE RESOURCE STEWARDSHIP NETWORK

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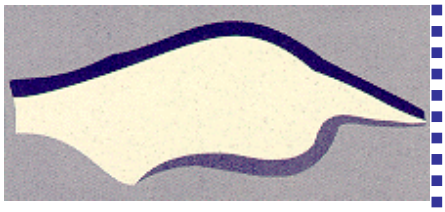

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Introduction

What are Dunes?

A dune may be simply defined as a mound or ridge formed by the deposition of sand. These geologic landforms develop when an abundance of sand combines with wind, vegetation and geography. Dunes in Saugeen Shores have formed over the last 3000 to 4000 years, since post-glacial Lake Nipissing began to recede. Since the composition of dunes is of fine sands, they are particularly vulnerable to erosion—from stormwaves and from wind. People's indiscriminate use of dunes can damage or destroy thousands of years of geologic processes in one instance.

Why Beaches and Dunes?

When we talk about dunes, we're really talking about beaches and dunes as a system. Dunes are reliant on the beach for their ongoing sand supply. Likewise, the beach relies on the dune's sand reservoir during periods of high lake levels and storm events to supply sand to the beach to maintain its form and function. Waterfront management needs to respect beaches and dunes as a system. Understanding that system will help managers make decisions that avoid compromising Saugeen Shores' beach and dune resources.

Dunes in the broader context

Prevailing winds have concentrated dunes along the eastern shores of Lake Huron. There is a lack of dunes on the western shores of Lake Huron. We in Ontario are fortunate, then, to have some of the best beach and dune systems on the lake. However, even on the eastern shores of the lake, dune systems are limited in geographic area.

Pinery/Ipperwash, Point Clark, Inverhuron, Saugeen Shores and Sauble Beach are the main dune systems along Lake Huron. Of these, the largest dune complexes - Pinery (2,532 ha) and Inverhuron (288 ha) - are within Provincial Parks, and so their management and conservation are more straightforward. The other dune systems have little formal management or stewardship arrangements.

What starts to become clear is that in the 'big picture', Lake Huron's dune systems represent an extremely small land mass. Yet these are the areas of the lakeshore that attract thousands of people each summer. All ecosystems have a certain threshold for being able to absorb human impacts. Dunes, in particular, have a very low threshold. Research has demonstrated that dune vegetation is sensitive to damage by human disturbance (Trowell, 1987). Dunes are vulnerable to wind erosion once the anchoring vegetation on them is damaged or destroyed. Without effective conservation measures, we stand to lose an already limited resource.

Dune locations along Lake Huron

Why Conserve Dunes?

Aside from the ecological imperative to protect dunes as critical coastal features and habitats, are there any economic reasons to protect dunes? Consider the following: During the high water levels of 1985-86, millions of dollars were spent to protect coastal properties and municipal waterfronts along Lake Huron. The average cost of an armourstone revetment, for example, was $2000 per linear metre.

Sand dunes have long been known by scientists and resource managers to be nature's shore protection. They outperform their structural counterpart by their ability to give and take with the dynamic processes at work along the shoreline. Using $2000/m as the amount that would be required to replace dunes with conventional shore protection, it becomes apparent that the value of dunes to a community can be great. For example, the Chantry Dunes in Southampton, which are about one kilometre in length, would have a value of about $2 million simply as shore protection. This does not include the aesthetic value of the dunes, important to tourism, or the ecological value of the dunes, important to naturalists and educators. By

conserving its dunes, Saugeen Shores is protecting a multi-million dollar asset.

What makes Saugeen Shores' Dunes so Special?

The bulk of the sand that makes up the beaches and dunes in Saugeen Shores is relic material. That means it was deposited by waves and winds in historical times. Coastal processes research has identified that the Saugeen River does not contribute substantial amounts of sand to the coastal system. It has also concluded that there is no sediment contribution from the north or the south into Saugeen Shores (Reinders, 1986). These relic sands have been held in place by the unique configuration of the shoreline. The headland and bay shorelines that make up the beaches at Port Elgin, Gobles Grove, Miramichi and Eidt's Grove, and the beaches and dunes influenced by Chantry Island in Southampton, are irreplaceable, non-renewable resources.

Some of the plants that have evolved in the dunes of Saugeen Shores are rare dune species. For example, Great Lakes Wheat Grass which is an endemic plant in Southampton's dunes, is globally rare.

Land Use Policies - Zoning Protection for Dunes

In the mid 1990s the Province of Ontario instituted the Provincial Policy Statement (PPS) under the provincial *Planning Act* which included restricting development from areas defined along the Great Lakes as "Dynamic Beach". The PPS recognized that beaches and dunes play important functions, both ecologically and in terms of protecting the shore during high water levels.

New development along the shoreline, under these new policies, have to be located landward of the front dune or "foredune". The PPS restricts 'new' development, and is not intended to address dune stewardship, or best management practices. However, it is one more tool in the dune conservation "toolbox" that municipalities have at their disposal. Saugeen Shores has incorporated dynamic beach policies into its Official Plan and Zoning By-law.

The Beach-Dune System

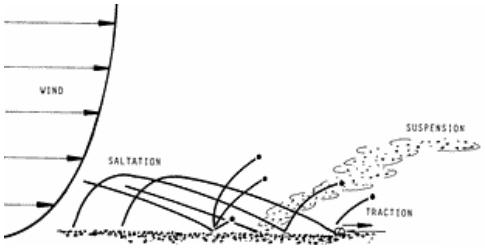
(i) Beach and Dune Processes and Functions

The beaches of Saugeen Shores owe their existence to the topography of the coast. Southampton's large beaches and dunes have formed in the lee of Chantry Island and its shoals. This protective barrier has allowed sand, originating from the Saugeen River, to be deposited in the shadow of the island. The "Long Docks" south of the river have contributed modestly to the form of the beach, but the primary influence is the island. On the other hand, Port Elgin's beach, Gobles Grove and Eidt's Grove formed as "pocket beaches", which form in small embayments or crenulate ('U' shaped) shorelines.

Chantry Island

Sand is continually being eroded and deposited on the shore by waves. Storm waves will erode the beach, taking the sand offshore, and forming a sand bar. The sand bar acts as a temporary protective berm, absorbing wave energy that would otherwise reach the shore causing even more erosion. Once the storm subsides, gentle waves will gradually bring the sand from the sand bar back to the shore and re-attach it to the beach.

Once onshore, the sand is then prone to movement by wind.



Movement of sand by wind

Dunes form when sand is carried by the wind from the beach towards the land. The wind transports the sand in three ways: in ***suspension***, by lifting the smaller, lighter fractions into the airstream and carrying them for long distances; by ***saltation***, as heavier grains are moved in a series of 'hops' and 'jumps' along the beach surface; and as ***surface creep***, in which sand particles are rolled along the surface as a result of wind forces or the impact of descending saltating particles. Although most sand particles are moved by saltation, surface creep may account for 20-25% of the moved sand (Bagnold, 1954). Most of the sand is carried within 0.15 m (6 inches) of the ground surface. The very fine sands light enough to be carried by suspension are usually carried well outside of

the dune system.

Significant sand movement will take place when the wind speed measured at a height of 1 m (3 ft) above ground level exceeds 12 knots (6 m per sec). Initiation of sand movement occurs at 5m per second. Onshore winds will dry the sand and selectively pick up the smaller grains of sand (0.08 - 0.5 mm) and move them towards the land. Sand grain sizes in dunes are therefore finer than that on beaches. This is important because fine sand deposits have greater water retention capacity than coarse sands and are therefore more suitable for vegetation growth. Moist sand is moved less easily by the wind than dry sand since moisture promotes surface adhesion. The threshold shear velocity (the wind strength needed to initiate movement) is higher for moist sand. In Saugeen Shores, wet beaches predominate in Port Elgin and south during periods of high lake levels. Less wind movement of sand can be expected during high lake levels.

Sand dunes and beaches must be managed as one system. Dunes depend on beach sand for their formation, particularly during low water level periods, and beaches need the sand reserve held in the dunes during high lake levels and storm events.

While wind strength is important, the quantity of sand moved is also influenced by how long the wind is blowing from a particular direction. Wind duration is an important consideration, and knowing the prevailing wind directions at certain times of the year can help with determining management strategies for dune conservation and restoration efforts. Winds with the greatest intensity and duration on the eastern shores of Lake Huron tend to be during the late fall, winter and early spring months.

As well as wind speeds and duration, the prevailing water level plays a significant role in how much sand transportation will take place. During high water levels, more of the beach is submerged and the width of dry beach is less. As a result, less beach is exposed to wind erosion. Conversely, during lower water levels, more beach is exposed and greater wind erosion of the beach is possible. Therefore, periods of dune building tend to occur during lower water levels. Periods of natural dune erosion tend to occur during high lake levels when storm waves erode the base of the dune and carry that sand to offshore bars. What is fundamental to understand is that sand dunes and beaches must be managed as one system. Dunes depend on beach sand for their formation, particularly during low water level periods, and beaches

need the sand reserve held in the dunes during high lake levels and storm events.

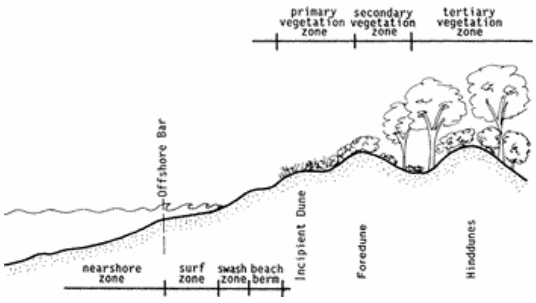
(ii) Role of Dune Vegetation
"Sand dunes need their greens!"

When the wind encounters an obstacle such as a clump of vegetation, the wind speed is reduced and the sand grains fall out under gravity, resulting in sand deposition. As the sand accumulation continues, a dune is formed. Dunes form when there is an adequate sand supply and onshore winds of sufficient velocity to move the sand. As the dune builds, it becomes a major obstacle to the landward movement of windblown sand. Thus, the dune serves to conserve sand in close proximity to the beach system.

Dune vegetation promotes the large scale trapping of sand. The stems of dune grasses reduce the wind velocity near the surface, causing the deposition of sand. Plant roots also serve to bind and consolidate the sand. Dune grasses thrive on incoming sand and accelerate their growth to keep up with the increasing height of the dune (Broome *et al,* 1982). The vegetation cover represents the difference between a mobile pile of sand and a stabilized dune (Salmon *et al*, 1982).

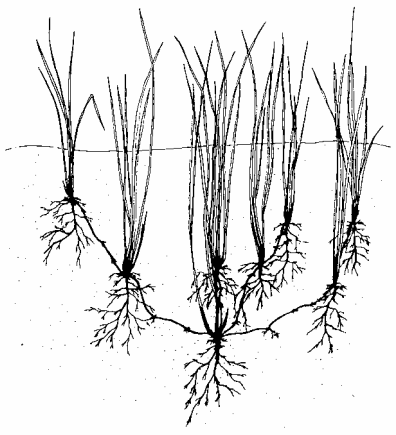
A vegetated and stable dune provides an erodible reservoir of sand that circulates between the first dune (foredune), the beach, the surf zone and the lake bed, according to lake and wind conditions.

Coastal vegetation is itself dynamic. Earlier, simpler plant communities pave the way for a series of future, more complex communities. This process is known as succession and is reflected in the formation of distinct plant communities over time. These communities are usually quite visible to the observer, yet the transition between plant communities can sometimes be difficult to distinguish.



Vegetation zones on a typical dune profile

Pioneer plants trap and hold windblown sand in the foredune and help create conditions which encourage the establishment and growth of other plant communities. All plants, whether they are herbs, shrubs or trees, growing



Growth pattern of American Beachgrass

either singly or in groups, have a role in the development of vegetative cover and together they bring about dune stabilization. Windblown sand trapped in the foredune by vegetation serves as a reservoir of sand for the beach during periods of wave erosion. In the absence of sand-trapping dune vegetation, windblown sand from the beach moves inland and is lost to the beach/dune system. Wind erosion of the beach and unvegetated foredunes results in coastline recession. The above-ground parts of dune plants act as obstructions, increase surface roughness and reduce the surface speed of sand-carrying wind. The reduction in wind movement results in the deposition of sand on and around the plant. There is actually a boundary layer where wind velocity equals zero and it is in this zone that sand is deposited. Bare sand has a small boundary layer, whereas research has shown that when an area is planted with American Beachgrass *(Ammophila breviligulata)* this boundary layer is 30 times higher than the bare surface.

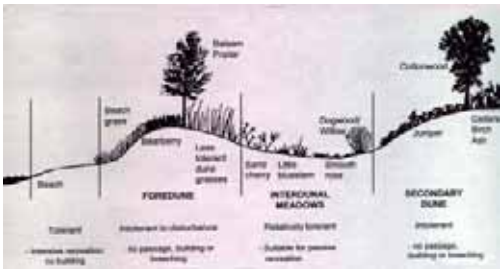
American Beachgrass is the most successful sand-trapping plant colonizing dunes along most of the Lake Huron coastline. It has the ability to grow through accumulations of windblown sand. Cycles of sand deposition and plant growth result in dune formation and build-up.

The development of vegetative cover on newly formed dunes, if undisturbed, will create conditions which suit the colonization and growth of a wider range of plant species. The shade produced by plants keeps surface temperatures lower than on bare sand and, together with reduced wind movement, helps to lower the evaporation rate from the sand surface. Increasing vegetative cover further reduces wind movement, which results in a lower rate of water loss from plant leaves. Dead plants and leaf litter add humus to the sand and act as a mulch. The accumulation of humus results in improved moisture and nutrient-holding capacity of developing dune soils. With lower surface temperatures and increased moisture and nutrient content, the sand can support a greater variety of plants. Thus, the vegetative cover on the dune increases and movement of sand by wind is further decreased.

Pioneer plants make up the initial dune vegetation. They are found on the dune nearest the lake, where their survival depends on their ability to establish, grow and

reproduce. They must also tolerate strong winds, sandblasting, temperature extremes and occasional inundation by water. Plants with these characteristics are ideally suited as agents for initial stabilization of dunes.

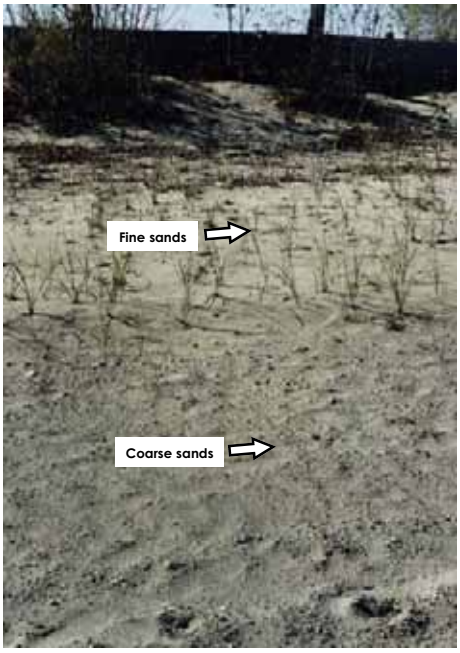
Sand dune grasses are plants which have specifically adapted to the dune environment. The structure of these grasses can resist sand abrasion, wind breakage and water loss. They have adapted to extreme heat (dunes can reach temperatures of 60C in summer!) as well as nutrient deficient soil. Confronted by high winds capable of blowing seeds many kilometres away, these plants have evolved a dual system of reproduction. In addition to the conventional seed production, they send out horizontal stems called 'rhizomes' under the surface to push up new growth short distances away. The massive underground root systems that develop provide the dune with structure, making them far more durable than they would be otherwise.



Generalized profile of the dunes in Southampton

American Beachgrass is a common pioneer plant in Saugeen Shores, but the Provincially rare Long-leaved Reedgrass (*Calamovilfa longifolia*), and the globally rare Great Lakes Wheatgrass (*Agropyron psammophilum*) are other key dune stabilizers in Saugeen Shores. Where American beachgrass can tolerate substantial burial by aeolian sand deposition, both the Reedgrass and Wheatgrass are less tolerant and therefore tend to develop landward of the crest of the foredune where sand deposition is less. Many dune plants require specific conditions to thrive, and so they tend to grow in more or less predictable, shore-parallel zones within the dunes.

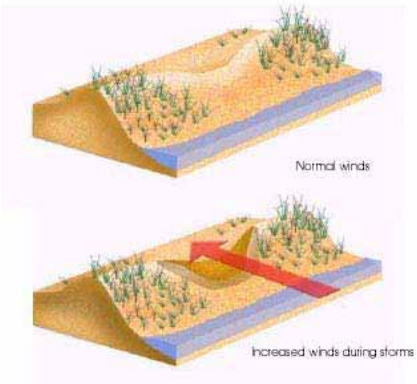
A generalized profile of the dunes in Southampton shows the relationship between plants and landforms, including an assessment of the relative ability of the dune system to withstand human disturbances. The foredune, or most lakeward dune ridge, is the most critical part of the dunal system and is the area least able to tolerate any disturbance or development. Vegetation on the foredune builds up the dunes by trapping wind-blown sand, preventing it from being blown inland and lost from the beach system. The sand-binding plants that grow on the foredune and perform this vital function are highly susceptible to damage through trampling and soil



Fine sands can be eroded away where vegetation is absent

disturbance.

Beach and sand dune vegetation both bind the soil and lower wind velocities causing fine sands to be deposited. This can be observed in beach areas occupied by vegetation and in bare areas caused by human disturbance. Fine sands collect around dune vegetation, while in areas devoid of vegetation, fine sands are eroded away, leaving coarse sands behind.



Blowout formation

(iii) Human Impacts to Dunes
"These Dunes aren't made for Walking"

Vegetation is absolutely critical to the stability of the dune. Without it the dune is vulnerable to erosion by either wind or waves, or both. Research has demonstrated that dune vegetation is fragile to human disturbance and can be killed by fewer than 50 passes (Trowell, 1987).

Dunes are fragile systems and trampling by beach goers destroys the vegetation and results in deterioration of the dune. Destruction of vegetation makes the dunes unstable, increases wind erosion and causes the coastline to recede. As trails are established along frequently used routes through the dunes, the vegetation is destroyed and the wind begins to carry sand from the exposed area. The continual loss of sand deepens the trail. Sloughing away of sand from the trail's sides widens it. As a greater area is exposed to wind erosion, a blowout or washout may develop. As blowouts develop, sand blows inland, often outside of the beach-dune system. When it does this, it represents a loss to the system. This is of great concern because, as discussed earlier, the beach and dune sediments along Saugeen Shores waterfront are relic materials and cannot be replaced naturally. This inland migration of sand can also result in substantial maintenance costs to the town as it forms drifts on the roads, covers lawns and gardens, and clogs storm drains. A blowout also represents a breach of the dunes shore protection capability. This breach can allow storm waves to erode much larger segments of the shore than would otherwise be the case. In any case, blowouts are usually quite costly.

Eidt's Grove dunes

At Eidt's Grove, dunes have been breached in a number of locations in people's attempts to access the beach. Several years ago, an attempt was made to block some of the accesses and fill in the blowout channels by placing boulders in the gaps. The result was even more scouring and a widening of the breaches. More recently the boulders were replaced with boardwalk paths to help focus people's access to the beach while minimizing the wind scouring effects.

Vehicular Impacts

Vehicular traffic on the dunes has an even more damaging effect. Recreational vehicles, like ATV's, should be prohibited from operating in dune areas in Saugeen Shores. Town maintenance vehicles, however, have historically had access to the waterfront to conduct maintenance activities, like the removal of debris along the beach washed in from the Saugeen river during the Spring freshet. In addition , some utilities, like hydro and sewers, are located along the waterfront, and require access. It is important that workers are aware of the sensitivities of the dunes and its vegetation, and take measures to avoid or mitigate damage to the dune.

Beach access roads through the dunes are subject to the same erosive processes and may become channels for wind erosion. In Southampton, specific entry points along the beach have allowed maintenance vehicles to access the beach while minimizing impacts to the dunes. Still, these access points are vulnerable to wind scouring and care must be taken to prevent sand loss through them.

Some conventional beach management practices that include mechanized raking or grading the beach can be destructive and have long range implications for the sustainability of the beach-dune system. In Port Elgin, for instance, where the fine-grained, low gradient beach is often high in moisture content (particularly during periods of high lake levels), raking has the effect of aerating the sand and drying it out, thus making the fine sands vulnerable to wind erosion. Raking and grading also tend to obliterate sand binding beach vegetation which tend to populate the mid and upper beach.

Private Landowners

While the beach along the Saugeen Shores waterfront is publicly owned, a majority of adjacent lands, which include portions of dunes, are owned privately. In many instances the dunes are shared on both private and public land. There is, therefore, a shared stewardship responsibility with the dunes. This means that citizens may need to be educated about the importance of dunes and how they function. The Town should lead by example in dune conservation efforts, and help to inform its citizens about their roles and responsibilities.

Removal of dunes by a private landowner on publicly owned lands

Sometimes, though, private actions can result in the damage or destruction of dunes, either accidentally or deliberately. When it involves private land, often the only recourse is one of offering restoration advice. If it involves Town property, the Town has more control over the situation and can order a restoration.

Radical site alterations which involve mass removal of vegetation and/or grading beach-dune systems are particularly destructive and can lead to mobilization of sand inland. Sand drifting can result in nuisance and damaging accumulations on adjacent properties over substantial distances.

To retain better control over impacts to the waterfront, the Town of Saugeen Shores may wish to consider requiring a works approval for any private landowner wishing to conduct any site altering activities on Town owned beaches and dunes. A works application process was successfully used in the former Town of Southampton in the 1990s. It ensured that the Town was aware of activities going on along its waterfront, and provided some control over activities.

Beach and Dune Conservation Measures

Best Management Practices for Saugeen Shores

Conserving Lake Huron's beach-dune systems requires using a number of strategies concurrently. No one measure will likely be fully effective. A number of measures are provided below that have been used successfully by the Lake Huron Centre for Coastal Conservation, and others, in the conservation of beach-dune systems. The key to success is acquiring a sound knowledge of the natural beach and dune processes, and working *with* these processes rather than at odds against them.

Dune Stewardship

Dune stewardship is essentially taking care of our beach and dune resources for current and future generations. In the end, our stewardship efforts will not only help to achieve a healthy coastal environment, but help the waterfront-based economy and the community focus of Saugeen Shores.

The Town has a leading role in dune stewardship. It will set the example of how well, (or how poorly), dune conservation efforts proceed into the future. Effective Bylaws, control of works activities, implementation of necessary and sufficient dune conservation strategies, and the day-to-day commitment to excellence in dune conservation are all part of the stewardship imperative for Saugeen Shores.

The citizens of the community also have a key role. People need to be sensitive to the importance of the beach-dune ecosystem and its value (economically, socially and environmentally) to Saugeen Shores and to Lake Huron. As private landowners, efforts can be made to protect or restore dunes on their respective properties. Development plans need to respect dune integrity and landowners need to work within the community's rules for

dune conservation. Landowners living adjacent to dunes need to realize that the lakeshore is a dynamic system where change is the rule. They may perceive a change in dune height or configuration as a problem if it affects their traditional view of the lake. Dune accumulation is part of a natural process, just as bluff erosion and lakeshore flooding are natural processes in other areas of Lake Huron where people have learned to accommodate these changes.

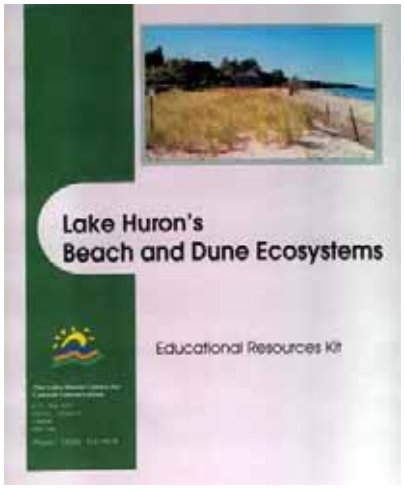
Landowners living adjacent to dunes need to realize that the lakeshore is a dynamic system where change is the rule.

Volunteer Groups

Saugeen Shores has a number of local shoreline groups that have an interest in waterfront conservation. The Southampton Beach Association, Port-Elgin-Saugeen Township Beachers Organization, Eidt's Grove Association are examples of organizations that have been involved in dune conservation efforts in the past. Engaging these organizations in public education initiatives, restoration activities and waterfront decision-making are logical ways to involve the community.

Education and Awareness Building

The long-term success of any beach-dune conservation process involves a concerted effort to educate and build awareness of the importance and vulnerability of beach-dune systems. Education comes in many forms, and involves every aspect of the community (not just in the Town, but all those who have a connection with Saugeen Shores' waterfront).



Formal education in local schools can help a new generation understand and appreciate the lakeshore from an environmental perspective. The Coastal Centre has developed an educational resources kit for elementary schools on Lake Huron's beach and dune ecosystems that contains resources and activities for learning about this coastal environment. It emphasizes field experience where students utilize the dunes as a "living laboratory", learning about species identification, ecological succession and the sensitivities of the dune environment. Ensuring that the schools of Saugeen Shores are equipped with such resources would be an investment into the long-

term stewardship of the Town's waterfront.

Other educational efforts could include public workshops, posters and educational material on the topic of dune conservation. Beach associations could assist in information dissemination amongst their members.

Interpretive signs, like the one in the Chantry dunes, provide an educational tool, particularly for visitors to Saugeen Shores. These types of signs describe a unique feature or aspect of the area people are entering, and ask for cooperation in preserving this special environment.

Education must be an ongoing and sustained program to be effective, but these efforts will pay off positive benefits to the Town in the long run.

Controlling Public Access through Dunes

Beaches are a public resource and access to them is very important. However, in beach-dune systems, people usually have to go across a dune to get to the beach. Where there are no controls or guidelines, people tend to find the shortest route to the beach, often resulting in many pathways cut through the vegetation. The consequence is the formation of many blow-outs, damage or loss of dune vegetation (including globally rare species), loss of sand from the shore system and a loss of dune structure and integrity.

To help minimize this damage, controlling access is essential. This does not mean restricting access. It is a matter of focusing the flow of traffic through the dunes to a few major arteries rather than scores of small ones. To do this, the access points have to be clearly and visibly defined so that people know where they should be walking. For the most part, people will cooperate with using these specific access routes once they understand the reason for using them.

Defined points of access through the dunes help people get to the beach with as little impact to the dunes as possible.

Dune access routes can take a number of different forms depending upon the local characteristics of the beach-dune system. In the Pinery Provincial Park, for example, elevated boardwalks have been used to keep the thousands

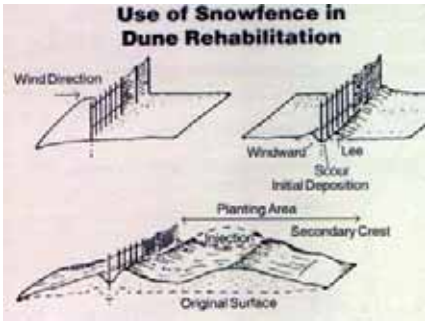
of visitors to the park off of the dunes completely. In Southampton, on the other hand, railed pathways keep visitors on the trail, but they are able to walk directly on the sand. Management decisions like this become a function of scale (numbers of people using an area) and cost (expense of boardwalk systems vs. railed pathways). The important thing is whether the access system being used will meet the dune conservation objectives.

Finally, public access routes should be clearly marked if the route is not obvious to people. Some routes may be well known to residents of an area, but not obvious to visitors. Clearly identified routes can minimize incidents of people wandering off-trail, or onto private property.

Dune Restoration

Where dune vegetation has been damaged or destroyed leading to blow-out conditions, or where radical site alterations have obliterated part of a dune system, a restoration intervention may be necessary. This can involve the planting of dune vegetation, the placement of wind altering sand fencing, or a combination of both. Public education is essential in any restoration effort.

Sand Fencing



Sand fencing is installed to slow onshore wind velocities allowing sand to collect behind the fence

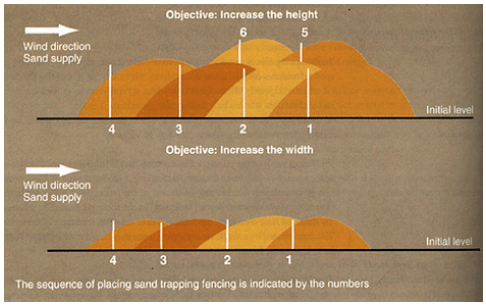
Sand fences are used worldwide in beach and dune erosion control efforts. The fencing ideally requires a 40% to 50% porosity for optimum sand accumulation. Typically, wood slat snow fencing is used. Plastic snow fencing has also been used, but it tends to be more prone to vandalism as it is easy to cut.

The basic premise behind the use of sand fencing is that it slows onshore wind velocities, thus allowing sand to collect behind the fence. The general "rule of thumb" is that all significant sand deposition will occur in an area about eight times the height of the fence (Carter, 1993). For a typical one meter high fence, then, one should expect sand accumulations as far back as eight meters from the fence.

Sand fencing can be left up year round, but in high tourist

locations, like Saugeen Shores, it is probably desirable to remove the fencing during the summer season. This is quite acceptable since the high winds, and sand erosion, usually occur in the off-season. It is important, though, that the fencing be re-established by mid-autumn. If sand fencing is used, it should be installed no later than the Thanksgiving Day weekend in mid-October.

Sand fencing can be used to control sand accumulations. If the objective is to increase the height of the sand deposit, the fencing can be built on existing deposits as the dune grows taller. To minimize height, fencing is gradually moved shoreward as accumulations develop.



The sequence of placing sand trapping fencing is indicated by the numbers.

While sand fencing is useful initially at accumulating sand, the accumulations are loose sand particles still vulnerable to wind erosion. In most cases of beach and dune restoration and erosion control, sand fencing is used in combination with planting dune vegetation. Fencing acts as a temporary barrier for accumulating sand, but it is the dune vegetation that provides the structure and stability of the dune over time. Generally, sand fencing is used in the first two to three years of a restoration project, until the dune vegetation has become well enough established to function as the primary sand trapping mechanism. In a planting program, the fence also aids with keeping people off the planted area. Unless it is intended that the fencing is to become completely buried, it is advisable that the fencing be removed before it gets 25% buried. It can then be reinstalled on the new dune profile.

Vegetation Planting

Dune vegetation offers a far greater superiority in beach-dune 'stabilization' than sand fencing. It functions in the same capacity as sand fencing in slowing wind velocities and allowing wind borne sand particles to collect. Their growth produces a surface roughness which decreases the wind velocity near the ground, thus reducing wind erosion at the sand surface. The plant stems and leaves above the sand surface greatly interfere with sand movement by saltation and surface creep (Woodhouse, 1978). It also, by its massive root structure, gives the developing dune some structure. That is why

Culm of American Beachgrass for planting.

Southampton's foredunes, for example, can have a near vertical face when high lake levels erode the sand from the dunes. Dune vegetation is also able to regenerate naturally, providing a permanent cover and requiring no ongoing maintenance.

American Beachgrass (*Ammophila breviligulata*) is perhaps the most commonly used dune species in dune restoration, but its applicability is limited to areas where large amounts of sand accumulation are expected (e.g. beach and foredune). The Beachgrass cover will continue to trap sand even as it gets buried with sand, as the plants are stimulated to grow by the deposition of sand around them.

Beachgrass will fill in after 3-4 years. Sand fencing is often needed until then, as an initial sand collector, but also to help keep people off the planted area. Breaks are incorporated into the sand fencing where access pathways occur.

In restoration projects involving other physiographic areas of the dune, other species would be more applicable. Also, care must be taken in selecting locally derived plants in order to maintain genetic diversity. The Coastal Centre should be consulted in regard to particular species selection.

In all cases, dune restoration planting should occur in late autumn, once the restoration plants are in their dormant state. Fall planting increases the survival of these plants dramatically because they are planted into cool, moist sand, have the following moisture-rich spring to begin establishing roots, and are in a much better state to withstand the rigours of the hot, dry summer ahead. Spring planting is possible, but the success rate drops by 25% or more.

It typically takes a species like American Beachgrass about three to four years to become fully established and begin to fill in the planted area.

History of Beach and Dune Conservation in Saugeen Shores

Chantry Dunes

In 1992, the Southampton Beach Association, in partnership with a number of community groups and agencies, initiated a project to protect and restore the Chantry Dunes between Beach and Bay Streets in Southampton. The dunes were particularly stressed due to human impacts. Trampled vegetation led to the formation of numerous blow-outs. In addition, the dunes were viewed by some as a cheap and ready source of fill material, and front-end loaders could be seen on occasion taking bucket loads of sand from the foredune for use in construction projects.

Post-and-rail pathways to control access through the dunes at Southampton.

The Chantry Dunes project sought to restore some of the degraded portions of the dunes, control access through the dunes and embark on a public education program to educate the community about the importance of the dunes to Southampton. Funding was secured from a number of sources to obtain the materials necessary to carry out the project. The implementation of the project, which included plantings, construction of post-and-rail pathways and the installation of interpretive signs, was carried out by community volunteers. Close to one hundred community volunteers participated in various stages of the project.

Beachgrass plantings occurred along the foredune in blowout areas. The blowouts were the result of trampled vegetation as people crossed the foredune to get to the beach. About 20,000 plants were used in this effort. Additional plants (endemic trees, shrubs and groundcovers) were planted around the pump station on Beach Street. These were more for aesthetics than functionality.

Access control was a critical aspect of the project. Controlling pedestrians was important, but so too was controlling access by Town works crews and others who routinely brought heavy equipment through the dunes to

access the beach. Post-and-rail fencing was installed around the perimeter of the dunes to eliminate vehicular access. As it was important for Town crews to maintain some access to the beach, specific point locations were agreed upon where vehicle access could occur.

A local playground at the foot of Beach Street had equipment scattered throughout the dunes. The equipment was redistributed to a smaller, focused area adjacent to the washroom facilities at Beach Street. The area was then fenced to contain the playground area.

Three major pedestrian arteries were identified amongst the scores of smaller pathways used to cross the dunes. Post-and-rail fencing was installed to establish these as the beach access routes that the community would use from this point on. A smaller pathway was fenced as a "nature trail" that would still allow access to the dunes for viewing and aesthetic enjoyment. The path was placed at the leeward base of the foredune. Halfway through the nature trail, a viewing platform was installed.

Fundamental to the Chantry Dunes project was public education. Factsheets, newsletters and a trail guide were produced and distributed to the community. In addition, a number of interpretive signs were placed at dune entrances and along the nature trail to introduce visitors to important features of the dunes, their sensitivities, and the need to respect the trails that had been established.

The Chantry Dunes project helped to establish a dune conservation ethic in the former Town of Southampton.

Beach erosion control at Southampton using planted plots of beachgrass placed at strategic locations along the beach.

Southampton Beach Erosion Control

With the success of the Chantry Dunes project, the Southampton Beach Association led another community partnership in 1995 by undertaking a project that involved the main beach at Southampton, just north of the Chantry Dunes. Here, the beach, through a regular program of mechanized raking and grading was a flat expanse of sand beach devoid of vegetation or dunes. Consequently, there was no physical impediment to eroding sand, and sand was being blown inland and out of the beach-dune system. The objective of this project was to use a combination of

sand fencing and beachgrass at strategic locations along the beach, and begin a process of dune restoration.

Southampton's main beach measures about one kilometer in length. The project's objective was to plant two to three 50 meter plots of beachgrass at each of five street terminus points (i.e. the points where streets terminate at the beach), as these were areas where blowing sand could flow and accumulate. There was some measure of ongoing maintenance required to clear accumulations from roadways.

Taking the opportunity to incorporate education into the implementation of the project, local school groups volunteered to come out and plant the beachgrass plots. The volunteers included Grade 2 students from Southampton and Port Elgin. At the same time that the students were learning some rudimentary coastal geology and plant biology, their participation in the planting brought a personal connection with this conservation effort.

Volunteers planting beachgrass in late November.

Each plot of beachgrass was bordered by a post-and-rope barrier on three sides of the plot and a sand fence installed on the lakeward side of the plot. The post-and-rope barrier was designed as more of a visual barrier than a physical one, as people could easily get around the fence if they felt compelled to do that. More importantly, the barriers were designed to keep vehicles used by the Town and utilities from crossing onto the planted areas.

Placement of the plots were set approximately 15 meters lakeward of the waterfront sidewalk to accommodate a vehicle path for utility maintenance.

Utility maintenance pathway between grass plots and sidewalk.

Approximately three years after planting, the grasses began to spread throughout the plots filling in the voids. Five years after the planting, other dune species were observed in the plots. The biological diversity of the plots is anticipated to increase with time.

Management of the Southampton Waterfront

Chantry Dunes

Breach in the foredune exposing the viewing platform to sand burial.

One of the challenges with dune conservation is that, because of the sensitivities of the foredune and its vegetation to erosion, people must be kept off of the foredune feature. After the Chantry Dunes project was completed, some people still continued to cross the foredune at locations that had been closed off and re-planted. The result was a continuation of the breach in the dune leading to blowout conditions, and mass mobilization of sand through the breaches.

Extensive sand accumulations have occurred onto the viewing platform and adjacent trails. Summer student work crews, in 2000 and 2001, attempted to uncover both the platform and the trails, but accumulations have been too extensive to dig out by hand. It may be possible to run a small payloader through the trail to dig out the accumulations on an "as required" basis. Alternatively, another post-and-rail fence could be superimposed over the buried one. In any case, the first step would be to address the breaches in the foredune to slow the accumulations of sand and eventually restore the foredune.

Sand mobilization through the dune blowout has led to extensive accumulations on the viewing platform and adjacent trails

In 2002, a permanent sand fence was installed lakeward of this breach in the foredune. This fencing is intended to provide a barrier to sand movement, as well as a barrier to people trying to access the beach at a non-designated location. Beachgrass planting in these blowouts will help to repair the damage to the foredune that has persisted over the last number of years. Once the breaches have been repaired, the problem of sand accumulation on the viewing platform and the nature trail pathway should be manageable.

In 1999, as part of a cooperative species recovery project between the Coastal Centre and the University of Western Ontario, a number of endangered plant species propagated from seed at Western's nurseries, were introduced into the

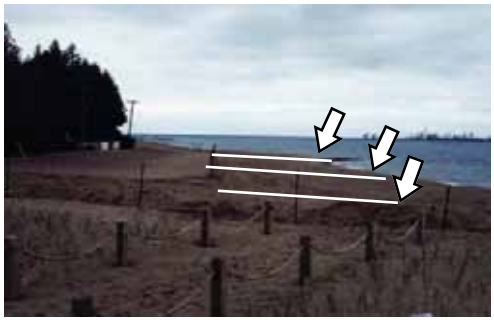
Chantry Dunes. Fifty Pitcher's Thistle (*Cirsium pitcheri*) were planted throughout the dunes to help reinstate this plant back to the shores of Lake Huron, and prevent its extirpation from the Great Lakes. This plant compliments several rare plant species possessed by Southampton's dunes. The rare species types and diversity of plant communities along Southampton's shores, underscores the need for careful approaches to working within this environment.

Southampton Beach Erosion Control

Since the completion of this project, some of the planting sites have received extensive accumulations of sand. The annual installment of sand fencing each fall has greatly aided this process.

At some locations the access pathways have accumulated sand beyond the height of the post-and-rope fencing. This can create a problem for people accessing the beach as they are put in the position of having to negotiate large sand drifts, and may choose a less onerous pathway through the planted dunes. In most cases the access pathways were designed wide enough to allow for a small payloader to dig the drifted sand back to the original grade. The dug sand is then re-distributed onto the beach.

Some of the large drifts, in areas where they are not desired, can be minimized by the strategic use of sand fencing, and the design of its placement. For example, at Wellington Street, large drifts have tended to occur on the south side of the washroom building on the access pathway. This access pathway is oriented towards the southwest which is a dominant wind direction for the transport of beach sand by the wind. The orientation of the beach is such that wind traverses about 3-400 meters of beach before it reaches Wellington Street. A substantial amount of sand can drift over that distance.



At locations like Wellington St.,placement of fences perpendicular to southwest wind

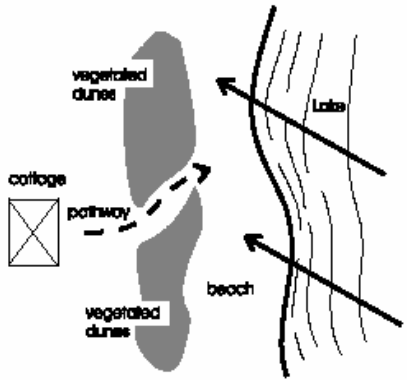
The strategy, then, is to systematically 'cut up' the wind velocity by using successive runs of sand fencing. Using the rule of thumb that a substantial amount of sand will be deposited 6 to 8 meters leeward of the fence, spacing of the fence lines should be done accordingly. Starting from the Wellington St. access and placing the fencing in lines

perpendicular to the southwest winds, install 3 to 4 lines initially and test to determine whether or not additional lines might be needed. More lines will likely be necessary during periods of low lake levels as the expanse of dry beach will be wider. Conversely, fewer lines may be needed during higher water levels.

As the beachgrass has grown and developed, it has begun to spread outside of the original rectangular plots. This is a positive occurrence and shows how well the plant has adapted to this area. In some instances, though, Works Crews have reported that beachgrass has grown in to the pathways causing sand accumulations to occur and creating a situation where people have difficulty traversing the pathway. As mentioned before, these pathways can be cleared to a suitable grade, and beachgrass can be carefully transplanted to other parts of the beach-dune area where sand accumulation is needed.

Where sand accumulations are perceived to be getting too high in a particular area, fencing and beachgrass plantings can be arranged further toward the west, or lakeward, of the existing dune accumulations. This will help promote accumulations to occur adjacent to the area of concern. The objective is to contain sand on the beach and not lose it from the shore system.

Extension of access routes, or the development of new ones, in Saugeen Shores need to be designed with care. Whether they are public access routes or private pathways, their design can mean the difference between having an ongoing erosion problem and securing beach access while at the same time minimizing the formation of blowouts and dune stranding. Angled pathways that are perpendicular to the prevailing wind direction can be a very effective approach to prevent problems related to sand erosion. The main objective is to minimize the amount of bare sand exposed to the wind that could ultimately lead to a blowout of the foredune.



Strong winds off the lake blow sand inland. Small angled pathways through the foredune can prevent winds from eroding a blowout into the dune.

Management of the Port Elgin Waterfront

Port Elgin consists of a small crenulate beach contained between the marina structures to the north and a headland to the south. The sands are generally fine textured and quite prone to wind erosion. During high lake levels the beach is usually damp, and as a result, beach erosion decreases. During low lake levels, the beach is not only more expansive, but the sand is drier and tends to become mobilized during windy periods.

Clouds of sand blowing off the beach at Port Elgin.

The Town has traditionally graded this beach mechanically for purposes of aesthetics and to fill in holes left by children playing in the sand. The grading also had the effect of aerating the sand and causing it to dry out more quickly, thereby contributing to the increased likelihood of sand erosion. Given the nature of the beach at Port Elgin, mechanized grading contributes to the beach erosion issue.

In 1999, a request was made from the Town of Saugeen Shores to the Coastal Centre to advise as to what could be done to substantially eliminate sand erosion from the beach, as eroded sand had become a maintenance issue and a nuisance to some local residents. In addition, substantial amounts of sand have blown into the marina basin, to the north of the beach. The Centre evaluated some options and came to the conclusion that if erosion of the beach was to be effectively controlled, then a combination of sand fencing and dune vegetation was going to be the most effective. A plot of vegetation was suggested adjacent to the beach promenade. Lakeward of the vegetation, sand fencing could be installed seasonally to slow wind erosion.

The community was divided on the issue of planting on the beach. The local Beachers Organization were in favour of planting the beach to help reduce erosion. However, some members of the community were concerned that by planting beachgrass, the vegetation would cut down the useable area of the recreational beach. This was a valid concern because Port Elgin's beach is typically used by thousands of recreationists each summer. Another, though

less effective, solution was to use sand fencing exclusively to control erosion of the beach. This solution relies on a number of measures that must be followed to be effective.

- Fencing must be installed no later than mid-October.
- The appropriate number of lines of fencing must be installed at the appropriate intervals.
- One line of fence year-round is recommended. Educational signs indicating the purpose of the fence would be useful.

This approach, while not as effective as dune vegetation, should provide a sound measure of erosion control if implemented in a correct manner.

Permanent sand fencing on Port Elgin Beach parking area is designed to aid in trapping sand as well as assist the flow of traffic and parking.

Adjacent to Port Elgin's recreational beach is an expansive parking area, which is essentially a continuation of the beach inland.. This wide area of exposed sand and its susceptibility to wind erosion has been a concern for a number of years. To help mitigate sand erosion in this area, a permanent sand fence program was initiated in 2001. This involved the construction of a sturdy sand fence structure designed by the Coastal Centre to aid in optimal sand trapping capacity, and also to help in traffic flows and parking. By its design, accumulated sand can be redistributed on the beach.

Management of the Eidt's Grove and Gobles Grove Waterfront

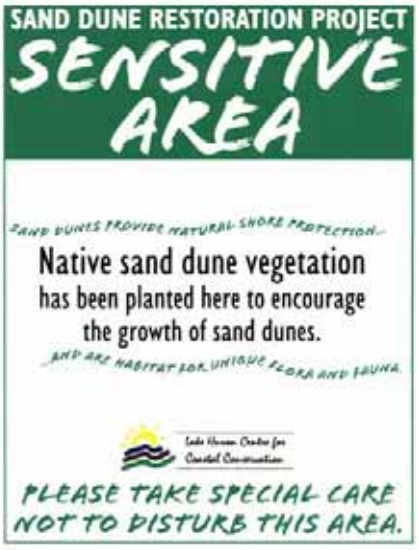
South of Port Elgin's beach is Gobles Grove, a cottage community where dunes are largely on private lands. One exception is the area immediately south of Port Elgin where a local cottage group has taken the initiative to restore a degraded portion of the public waterfront in front of their cottages. Beachgrass plantings were initiated and signs were installed. These community volunteers are currently interested in pursuing managed access points through the restored area of the waterfront. Efforts like this should be encouraged in the Town, as those who volunteer their time to do this kind of work, take 'ownership' of the project and become the long-term stewards of the Town's waterfront resources.

Eidt's Grove dunes have been bisected by the local shore road. Parking has traditionally occurred on the leeward side of the foredune.

Eidt's Grove is a cottage community at the far south end of Saugeen Shores' waterfront. It resided in the former Saugeen Township prior to municipal amalgamations. It is a beach-dune system comprising a foredune about 2-3 meters in height and a relatively natural interdunal meadow to the interior. The foredune and meadow complex are, alas, bisected by a shore road which runs parallel to the foredune. As discussed earlier, access to the beach has resulted in numerous blowouts to the foredune. Consequently, sand erosion and drifting has been an ongoing problem to local traffic as drifts cover the roadway. The shore road was situated in an unfortunate location since it is directly within the active foredune where sand deposition normally occurs.

The former Township had placed large boulders in the blowouts in an attempt to stop people and vehicles from using the gap in the dune to access the beach. The boulders only aggravated the situation by redirecting wind patterns and causing further scouring. Some of the boulders have been removed since that time. All should be eventually removed in the interests of dune conservation.

In 1997, the former Saugeen Township proposed to build a parking area in the area of the dune meadow located to



Dune signs need to convey to residents and visitors that their activities can have a negative impact if they are not careful.

the east of the roadway. Local residents opposed this proposal because of the environmental damage that was foreseen by building a parking area in a sensitive dune area. The Coastal Centre was retained to investigate and provide the Township with alternatives to disrupting this dune area. It was recommended that a dune stewardship plan be developed for the Eidt's Grove area in an effort to accommodate future use of the area without compromising the integrity of the dunes. While this recommendation was never acted upon, some measures were taken to help mitigate sand erosion.

A beachgrass planting initiative was undertaken by local elementary students who planted American Beachgrass in front of the foredune at the main beach access. This work was fairly successful in that the plants developed well and spread locally. Dune signs were installed to advise people that the area was part of a restoration project. In addition, boardwalk pathways, constructed at grade, were installed as pedestrian access routes in some of the blowouts. These combined efforts have not only been helpful in mitigating erosion, but also in creating awareness of the importance of dune conservation in the Eidt's Grove area.

The community at Eidt's Grove have expressed an interest in conserving the beach-dune system here, and it would be useful to include them in the ongoing management of the Eidt's Grove waterfront. Opportunities for community conservation projects and volunteer stewardship should be encouraged.

Town maintenance activities in this area should include monitoring sand migration patterns, particularly sand drifting on the roadway. In areas where drifting is a consistent occurrence, efforts can be directed towards erosion mitigation. Sand fencing should be installed west of blowouts in an effort to slow sand funneling through the gaps in the dune.

Consideration should be made to installing a post-and-rail fence, or other barrier, on the landward side of the foredune on the west side of the roadway. This would help to direct pedestrians to specified beach access routes. It would also help to discourage vehicles from parking too close to the dune.

Due to the gentle gradient beach and relatively high water table in this area, the beach tends to have a high moisture content. Beach vegetation along Eidt's Grove, and the neighbouring Gobles Grove to the north, reflects the wet nature of the beach. Large rush *(Juncus spp.)* communities take advantage of the ready access to moisture. These plants are good sand binders and prevent sand erosion, particularly during low lake levels when the top layers of sand can become dried out and prone to wind erosion. Periodically, members of the community will request the removal of these plants as some perceive these plants as 'unsightly' or a nuisance to recreational activities. These plants, however, are critical components of this type of beach and any large-scale removal would be ill-advised.

Conclusion

The Town of Saugeen Shores has become a leader in dune conservation in the Province of Ontario. Their role is unique as dune conservation in an urban setting presents many challenges that other coastal communities have found difficult, or have ignored in favour of short-sighted approaches. These short-sighted approaches, where beaches are considered simply an economic resource to be exploited, have compromised natural systems and have led to a loss to the community, in environmental, social and economic terms.

Effective waterfront stewardship is a function of balancing environmental, social and economic interests. Often in the past, the environment was left out of the equation.

The wealth of beach-dune resources in Saugeen Shores and the efforts being taken to conserve them, will be a benefit to the Town long into the future. The information contained in this guidance is intended to help those involved in the day-to-day management of the town's waterfront to better understand the environmental requirements of the beach-dune system so that these requirements are not ignored in favour of economic ideals. Effective waterfront stewardship is a function of balancing environmental, social and economic interests. Often in the past, the environment was left out of the equation.

Dune conservation is most effective when the community is actively engaged. This includes permanent and seasonal residents working together. There are many in Saugeen Shores who are interested in waterfront conservation and a number who have volunteered their time, effort and resources in various shoreline conservation projects. Others, with a conservation interest, have expressed an interest in volunteering to participate on the Town's Waterfront Committee. Utilizing community volunteers to assist the Town in beach-dune conservation should be encouraged as much as possible.

Community education about the beach-dune system and the special care required to maintain it is integral to the success of a conservation program. The Town has a key role in this regard, not only in providing appropriate information, but in the way it carries out its work along

the waterfront. The example the Town sets will set a strong direction for its citizens. The Coastal Centre has had extensive experience in dune education and the Town may consider accessing this expertise to assist in waterfront education activities.

Strong policies and regulations concerning activities on Town owned dunes will help to establish consistency in managing the waterfront. Provincial Policies currently incorporated into the Town's Official Plan and Zoning Bylaws restrict future development related activities. Similar Town policies restricting other activities that could impact dunes on public land would provide a more consistent approach.

This guidance manual is intended to assist beach-dune conservation efforts in the Town of Saugeen Shores. As a guidance document it cannot be expected to answer every question involving the protection of the coastal environment. It does, however, provide the user with essential information for understanding the physical nature of the waterfront, its sensitivities and how to avoid negative impacts to the system.

Consult with the Coastal Centre for developing approaches to specific challenges to your waterfront.

Glossary

Aeolian: pertaining to wind.

Alien plants: Exotic plants which are not endemic to the local ecosystem.

Biodiversity: an array of different animals, fish, waterfowl and plants in nature.

Blow-out: a term used to describe that portion of a dune which has become mobile, or active, due to the absence of vegetation to stabilize it. It can be induced by natural processes, but commonly is a result of human impacts.

Climax community: the community of plants which is the last stage in a succession of plant communities from pioneer stage through a number of intermediate stages. The climax community may be a woodland or herbaceous (grassland) community depending upon available water.

Coastal Ecosystem: an ecosystem which is found specifically within the coast or shoreline region.

Coastal Processes: Natural processes (e.g. Littoral drift, dune accretion, erosion) which occur within the coastal environment.

Dune: ridges or mounds of loose, wind-blown material, usually sand.

Dune Stranding: refers to the ongoing process of aeolian sand migration outside of the natural shore system. Sand becomes stranded outside of the shore system such that waves are no longer able to reclaim the material. Stranding can occur in areas of relic beach and dune deposits.

Foredune: the first dune feature landward of the beach, which exhibits some stabilization due to vegetation growth. Storm wave action may reach inland far enough to erode some or all of this feature.

Headland: an erosion resistant point of land, either man-made or natural, extending into the lake; embayments often form between adjacent headlands (e.g. McNabb Point between the Mirimichi and Horseshoe Bays).

Invasive plants: species which possess aggressive reproductive qualities that enable them to displace endemic plant species. Examples: Garlic Mustard, Purple Loosestrife (also see Alien

Plants).

Lake Algonquin: post glacial lake which existed about 11,000 years B.P. The remnant bluff of Lake Algonquin is a prominent feature from Point Clark to Saugeen Shores.

Lake Nipissing: post glacial lake which existed about 6,000 years B.P. The remnant beach ridges left by Lake Nipissing are still evident west of the Algonquin bluff.

Nearshore: an indefinite zone extending from the shoreline to just beyond the breaker zone. This is the area where wave energy has a profound influence on the lakebed. This is in contrast to the Offshore, where waves do not impact the lakebed.

Reach: a length of shoreline with fairly uniform onshore and offshore physical features and subject to the same level of wave energy.

Relic deposit: sand deposits which are remnants of a post-glacial lake (e.g. Nipissing).

Secondary dune: the dune landward of the foredune. It has, through succession, developed a more diverse plant community, more advanced soil structure and generally has a more sheltered climate than the foredune.

Shoals: offshore areas which are more shallow than the surrounding depths.

Strandline: the line of organic matter that is deposited by wave action along the upper part of the beach. (Also called the 'wrack zone').

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