SAND MINING IN THE BRITISH VIRGIN ISLANDS - A SECOND LOOK
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British Virgin Islands.

ABSTRACT

This paper discusses the history of sand mining in the British Virgin Islands. Between 1982 and 1996, 13,624 cubic yards of sand were legally mined from the beaches. Josiah's Bay and Fat Hogs Bay were the most heavily mined beaches, the latter beach was almost completely mined out. The Beach Protection Ordinance of 1985 has been used, somewhat unsuccessfully, to control beach sand mining. It is suggested that the Mining Act of 1980, which controls the commercial mining of minerals and specifically addresses restoration and the charging of royalties, would be a better mechanism for controlling sand mining. The paper further suggests that there are adequate sand supplies in the coastal valleys behind the beaches which could supply building aggregate long into the future.

BACKGROUND

"Ironically, developing countries are still repeating the mistakes of the developed nations when it comes to coastal management. Although developed countries are now replenishing beaches, much of the world continues to emulate their economic policies that contributed to beach destruction. Beach sand and gravel mining, followed by the analogous response of building seawalls and groins to solve the resulting erosion problems, is not in the best interest of any national economy. Did technology transfer end in the 1970's? Are sound coastal management policies guarded secrets?" (Neal & Pilkey, 1992).

In 1981 the British Virgin Islands (BVI) was in the middle of a tourism boom and there was a need to assess the status of the beaches, and the impact of sand mining and coastal development. A student intern carried out the first analysis of the characteristics of the beaches of the BVI for the Town and Country Planning Department (Lettsome, 1982). Beaches have been identified as a critical natural resource, as they play an important role in tourism, and in coastal protection. The economics of beaches have been a major driving force in shaping the policies as they relate to beach management and development in the BVI. As the Territory developed, the need to protect beaches as a part of the tourism product, for recreation, fisheries and coastal protection, surpassed the need for mining sand for construction purposes. The short term benefits and long-term cost of sand mining, the increasing value of beachfront property, and the long-term benefits of sound beach management and development for recreation and tourism, all played a part in changing public opinion and tolerance of sand mining.

BEACH MONITORING IN THE BVI

In January 1984 an Amherst College geology team conducted the first study of the geology and characteristics of selected beaches of the BVI for the Town and Country Planning Department (Belt & Foose, 1984). Detailed studies on sixteen beaches on the islands of Tortola, Beef Island, Virgin Gorda, Peter Island, Sandy Cay and Anegada, provided much valuable baseline data and initiated the scientific study of our beaches. Physical and geologic settings, climatological data, mapping, establishing beach profiles, examination of vertical beach sections, composition of sand, textural analysis, grain size analysis, interpretation of the geologic history, calculation of the amount of sand in each beach system, sources of stress, and alternative sources of construction materials, were documented.

In September 1984 the Conservation Office was established within the Ministry of Natural Resources and Labour with beach management and development as one of its responsibilities. In August 1985, the 1961 Beach Protection Ordinance (Cap 208) was repealed and replaced by the Beach Protection Ordinance 1985. This new ordinance for the first time affords legal protection to all beaches throughout the Territory from fouling of the foreshore, mining and removal of any deposit of sand, stone, gravel, or shingle, and the removal of any natural barrier. In 1986 technical assistance was sought from the Organization of Eastern Caribbean States in the areas of review and strengthening of coastal legislation, and administrative guidelines for institutional strengthening for coastal zone management.

In 1989 the Conservation Office and Fisheries Office were merged and the Conservation and Fisheries Department was formed. Beach management and development was upgraded to a full programme area of the new department. In February 1989 the COSALC project was initiated under the beach management and development programme of the Conservation and Fisheries Department. Conservation and Fisheries Department technical report #21 documents the beach changes in the BVI between 1989 and 1992 (Cammers et al., 1993). In May 1994 a joint Amherst College/University of South Florida Geology team revisited the beaches of the BVI. A total of 18 beaches in the Conservation and Fisheries Department monitoring programme on the islands of Jost Van Dyke, Tortola, Beef Island, Virgin Gorda, and Anegada, were surveyed, and a laser-beam theodolite equipped with a computer notebook for rapid automated processing of the data was used to measure the profiles (Belt et al., 1994). Since mid 1994 the Conservation and Fisheries Department has been working closely with the Survey Department and the Town & Country Planning Department to upgrade the beach monitoring programme.

All the reference sites on all the islands, except Anegada, have already been tied to the survey grid and permanent stations have been established. Conservation and Fisheries Department personnel are being trained in the use of the laser-beam theodolite and the database is being established so that profile and other beach survey information can be stored, processed
and used in our geographic information system. Parameters monitored will be expanded to include tidal variations, currents, wind data and wave height, the number of profiles per beach will be increased. In addition, four representative beaches will be chosen and studied in depth with profiling being done weekly. That is the positive side of what we have been doing and are trying to do in the BVI with our beaches.

HISTORY OF SAND MINING

During the period, 1982 to 1996, the BVI legally permitted the mining of 13,624 cubic yards of sand from our beaches. The Development Planning Unit's records showed that 30,000 cubic yards of sand was imported into the Territory annually over the last five years. Sand is being sold for $35.00 (US) a cubic yard as compared to $25-28 per yard for gravel. This underscores the fact that sand is a very important resource and demands appropriate management.

In 1996 as part of the environmental component of the IDP project the Conservation and Fisheries Department carried out a review of sand mining permits issued by the Minister of Natural Resources and Labour under the Beach Protection Ordinance from 1982-1996. An analysis of these finding presents a very disturbing overview of the level of beach sand mining legally permitted in the BVI during this 15 year period. It must be stressed here that the quantities recorded in this presentation are only for permits sand mining activities and do not include or reflect illegal sand mining activities occurring in the BVI. It should be further noted that sand mined by eight dredging operations, and one unlimited beach sand mining permit, are not a part of this total. 13,624 cubic yards of sand were legally mined from the beaches of the BVI from 1982 - 1996, see Table 1 and Figure 1. This averages 908 cubic yards a year.

A total of 15 beaches have been mined, however Josiah's Bay, Fat Hog's Bay, Brewer's Bay and Cane Garden Bay on Tortola and Little Bay on Virgin Gorda have been most heavily mined, accounting for a combined 94.4% of permitted activities. Josiah's Bay was first in mining activity with 10,051 cubic yards or 73.8%. Fat Hog's Bay second with 1350 cubic yards or 9.9%, Little Bay third with 600 cubic yards or 4.4%, Brewer's Bay fourth with 446 cubic yards or 3.3% and Cane Garden Bay fifth with 419 cubic yards or 3%.

No permits have been issued for Cane Garden Bay since 1986 when 15 cubic yards were taken. Over the last 10 years, Cane Garden Bay has developed into one of the top tourism and recreational beaches in the Territory and sand mining has ceased. As Brewers Bay beach has developed, sand mining has steadily decreased, between 1991 and 1994, 15 cubic yards were permitted and there have been no permits issued since 1994, see Figure 2. At Little Bay, Virgin Gorda a 300 cubic yard permit was issued in 1990 and in 1991. There has been no further mining permitted since 1991. No mining activities have been permitted at Fat Hogs Bay since 1992 because there is nothing left to be mined, Figure 3. The beach has been totally destroyed and over 100 feet of coastline has been lost to erosion. In 1995 a coastal restoration project to reclaim the coastline at Fat Hogs Bay was started and is ongoing.

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Figure 1 Review of Sand Mining Activities (Volume of Sand Mined 1982-1996)

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Table 1 Review of Sand Mining Activities 1982-1996 (Summary)
At Josiah's Bay the entire dune system has been destroyed by the massive amount of sand that has been mined, Figure 4. After over twenty years of persistent sand mining at Josiah's Bay, there is finally a move afoot by the landowners to end mining and restore the beach. Again this is largely due to economics, as Josiah's Bay has been identified as an alternate beach site for cruise ship passengers and a number of development projects geared at servicing the industry have commenced, or are in the planning stages.

One practice has been to mine the ghut or pond mouth area of the beaches. This has been a very bad choice because these storage areas are normally breached by ground swells, storm surge and flood runoff. During this process the sand is put back into the active system and is redistributed on the beach. Therefore mining of the pond and ghut mouth accelerates the erosion rate.

Land ownership is also a problem. Much of the ponds and sandy areas at the back of the beach are privately owned and people feel they have the 'right' to mine their property.

Figure 4 Sand Mining Activities at Josiah's Bay, 1982-1996
THE CASE OF JOSIAH'S BAY

In addressing the management of this very critical resource the physical and the legal issues involved at one important site, Josiah's Bay, will be discussed.

Physical Factors

Figure 5 shows Josiah Bay, a north shore valley on Tortola comprised of 620 acres (25,813 hectares), 134.4 acres of this area is flat. This represents approximately 34 acres of sand with depths of 6 or more feet. It is bounded by hills on all sides except the north or sea side. The 1400 feet long beach is protected by the two headlands and behaves as a cell, independent of other bays except during heavy winter swells or hurricanes when the shelf operates as a continuum.

Figure 5 Josiah's Bay Valley

As a cell the bay is made up of the following parts, see Figure 6:

- the shelf
- the nearshore zone
- the surf zone
- the beach face
- the berm area
- the back beach
- the valley.

Sand is found in all these areas. It extends into the valley for about 1000 feet (350 meters) in some areas. The various parts of the beach are grouped into the following three zone, see Figure 7:

- the active zone,
- the transitional zone,
- the storage zone.

The active zone is comprised of the surf zone and the beach face. Here the water and the wind are active and the sand is affected by them.

The transitional zone is the area of vegetation - on land there are grasses, weeds, grape trees, almond trees and other salt tolerant plants; in the sea are sea grasses and algae. Here the sand is trapped and accumulation begins. This is the stabilization zone which acts as a protector of the beach. This edge with the active zone is critical to recreation. Disruptions in this area make the total system vulnerable to the forces of nature, especially wind and water.

Sand in the storage zone was previously part of the dynamic system. Sand in this area cannot get back to the active zone. Activities in this area have little or no impact on the beach system. This zone is treated as land, it is ready for built development. Once used, the sand resource under it will be sterilized and/or lost to use by man. Figure 8 shows the storage zone at Josiah's Bay.

It is in this area that sand needs to be looked at and its availability for use assessed. There is the need to determine the exact limits of this area with special emphasis on its interface with the transitional zone. Once this interface is identified setbacks from it may be determined and areas identified for built development. Prior to built development measures should be put in place for the mining of usable sand. Limits with respect to depths to be mined and type of material to be used in restoration will have to be determined as they may impact on drainage, aesthetics, etc. These conditions do not however negate the use of sand from the area identified as the storage zone.
Legal Mechanisms

If we examine the legal mechanisms for the harvesting or mining sand we will see that there are two main ones available in the British Virgin Islands:

The Beach Protection Act of 1985 -

2. (l) Subject to section 5, no person shall-

(a) remove or assist in the removing of any natural barrier against the sea, or

(b) dig and take away or assist in the digging and taking away of any deposit of sand, stone, gravel or shingle from land that is part of the foreshore,

in the Territory except under the authority of a permit granted him by the Minister in writing in such form as the Minister approves.

(2) Without affecting the operation of subsection (l), no person shall in the Territory, remove from any land (whether the title thereto is vested in himself or
otherwise) any deposit of sand, stone, gravel or shingle if the removal thereof is likely to result in inroads being made into that land or any other land, by the sea.

The Mining Act of 1980 -

Section 5 (f) No person shall in the British Virgin Islands conduct any reconnaissance for, prospect for, or mine any minerals except under the authority of a licence issued under and in accordance with Part IV.

Nothing in this Ordinance shall prevent -

a) any person from taking, subject to such conditions as may be prescribed by the Minister, building materials for the construction of any dwelling-house, factory, workshop or store including the outbuildings or appurtenances thereof on land occupied by him under any title over or interest in such land;

b) any person engaged in construction of tunnels, roads, dams, aerodromes, and similar public works of an engineering nature or for agricultural purposes, from utilizing such building materials derived from such other sources as the commissioner may from time to time approve.

(Revised Laws of the Virgin Islands, 1991)

The Beach Protection Act as the name implies was created to stop destruction of the beach. Specifically the area referred to here as the active zone. The problem was that persons were removing sand from the beach face, or in such a way as to eventually impact the beach face; and there were immense negative impacts on the affected beaches such as:

a) Coastal erosion,

b) Unsightly scars in beach surface,

c) Loss of adjacent privately owned down stream land by erosion.

In an effort to combat this, the Beach Protection Ordinance was developed. The main point in this legislation is that “no removal of sand was permitted from a beach without a permit from the Minister of Natural Resources.” It failed to address the issue of the commercial user or the supplier, who must fill orders on short notice.

The Mining Act of 1980 addresses mining of minerals, but for some reason sand is not specifically mentioned as a mineral. This raises a question about its applicability to sand mining, although the Act does speak about conditions that may be prescribed by the Minister. The features that makes the Mining Act suitable for any commercial type operation is that it specifically addresses the following:

- An operations plan,
- Restoration after operation,
- Provision for the charging of royalties.

In summary the legislation which is put in place to protect beaches is:

a) Limited in scope i.e. all areas which need to be considered for sand mining are not addressed,

b) Sand mining is not directly included (Mining Act only),

c) Off focus as they appear to be protective, in that destruction of the beach is emphasized, rather than sand mining as a business venture,

d) Negative rather than proactive.

SAND MINING IN THE BVI - A SECOND LOOK

The Beach Protection Act addresses the active zone of the beach, an area where commercial sand mining should not take place, thereby making its applicability questionable. On the other hand, the Mining Act addresses commercial operations, which are the dominant type of sand mining operation in this country. The situation is - if someone wants to purchase sand they go to an operator/supplier. The supplier delivers the sand to the individual and collects his money. The persons actually mining the sand represent a very small number. Thus a permit specifying the number of loads he can take during a limited period of time is not the most applicable approach for controlling sand mining. A Mining License with respect to a quarry pit with the rights to mine on demand is critical.

There is the need for a number of measures to be put in place if sand mining is to be properly carried out and monitored. As indicated above:

1. The Beach Protection Act is meant to protect beaches and addresses the beach face and the berm area or what has been referred to in this paper as the Active Zone

2. Sand mining, especially for construction material, should not be considered in this zone and the legislation needs to state so explicitly. This position is supported by the Committee on Coastal Zone Management of the United States National Academy of Science, 1990.

The Mining Act is the most appropriate vehicle for the control of sand mining in the BVI, however, this Act needs to be amended to reflect the following:

1. To include provision for sand mining.
2. To detail requirements for domestic and commercial mining.

3. To indicate where such mining should take place, and I am suggesting that it should take place in the area which I have identified as the storage zone.

4. That all proposals for sand mining should include explicit indications of the type of mining to be carried out as well as provisions for restoration.

5. That before any building operations takes place in a sandy area that the sand in the area must be removed. The proposals for the removal of the sand to be detailed and subject to approval of the relevant agencies.

6. That the granting of licenses should be part of a process which includes consultation with all of the relevant agencies - Conservation and Fisheries Department, Town and Country Planning Department, Public Works etc.

7. That any deviations from the above require permission from the Minister and the Development Control Authority.

CONCLUSIONS

The history of sand mining in the BVI has shown that uncontrolled sand mining always causes erosion, it compounds and accelerates the erosive effects of nature. While an effective monitoring programme and good baseline data are essential tools for the initiation and maintenance of a beach management programme, it should be clear that beach sand is not the answer for construction aggregate. No removal of beach sediment should be permitted for any purpose. Enforcement of the Beach Protection legislation is a function of policy, economics and development pressures. It has not protected all beaches from sand mining.

Sand is a very costly resource and as such it should be managed appropriately. Protection Legislation is not a substitute for Mining Legislation with respect to sand. Over the years the application of the wrong tools has aided in the destruction of our beaches and sent the wrong set of signals to an unsuspecting community. The only persons who have benefited from this have been the suppliers of the commodity who have seen the price rise with the apparent scarcity of the resource.

Sand is available in abundance in our various coastal valleys. If the mining of this resource is approached properly it could continue to be an economical source of building aggregate long into the future. We could achieve this without destroying the aesthetics or recreational qualities of our beaches, but if the ad hoc, indirect approach continues, coastal erosion, scars, unsightliness and economic loss by adjacent land owners will be evident. My final words are those of Neal & Pilkey, 1992 “Don’t mine beaches”
SAND MINING IN PUERTO RICO: AN OVERVIEW
Andrea Handler Ruiz
Bureau of Geology.
Department of Natural and Environmental Resources, Puerto Rico.

ABSTRACT

Due to economic and industrial policies, there was a surge in the development of concrete-based construction in the 1960's and 1970's. Peak exploitation from beaches, dunes, and rivers in the coastal zone of Puerto Rico occurred during this time. Mining processes, site restoration practices and the environmental impact of the mining are discussed. Alternative sources, which include manufactured sand, weathered granitic deposits and offshore sand deposits, are outlined. Extraction of the submarine deposits is likely to be the next step, although several environmental factors have yet to be addressed.

BACKGROUND HISTORY

The economic and industrial policies implemented in Puerto Rico between the late 1940's and the early 1950's generated a construction boom that increased demand for aggregate production. During the following two decades the surge in the development of a concrete-based construction industry tapped sand sources that were accessible and easily mined. Peak exploitation of sand deposits from beaches, dunes and rivers occurred during the early-middle 1970's. The coastal zone of Puerto Rico, defined to extend 1 km inland (PR CMP, 1978), succumbed first to the developers need for sand for several reasons (Handler and Salles, 1988):

- Accessibility: Topographically low and level terrain facilitates road preparation and transportation. Low population density allows certain flexibility in site choices.
- Availability: Deposits occur in known accretional environments with economically attractive storage capacities and resource renewal potential.
- Minimum Equipment Requirements: Loose, uncemented deposits (in most cases) facilitate removal, preparation and dispatching (often without a sifting or storage phase).
- Cleanliness: Typically, coastal sand requires only simple sifting techniques for sorting, ranging from a wide fixed mesh to vibrating belt equipment. Water is not employed and there is no need for establishing sedimentation ponds.
- Market: High sand quality (varied grain sizes, low calcium carbonate and humus content) makes it attractive for a wide range of uses that include: the preparation of cement mix, cement blocks and pipes, road asphalt and plastering sand.

EARLY SAND EXTRACTION: NORTH COAST

Figure 1 identifies the three sites on the north coast that were progressively most heavily mined. Before mining, the sites represented a range of different dune types (Nichols, et al., 1987):

- Carolina - a single dune ridge paralleling the beach
- Hatillo - low massive dunes less than 10 m high
- Isabela - high massive dunes greater than 10 m high transgressing landward

Volumetric measurements of dune size along the entire north coast between 1950 and 1980 reveal that of the calculated volume of 27 million cubic meters of available sand, 16 million cubic meters of sand were removed by mining (Castillo and Cruz, 1980 in Nichols, et al., 1987).

OTHER SAND SOURCES

As the market for sand sources grew and as the easily mined deposits were exhausted, new sites had to be identified. The following table lists the sources from which sand has been obtained in different proportions through the years, including the potential offshore deposits that have been identified but not yet mined.

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<th>Where Do We Obtain Sand</th>
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<td>Offshore deposits</td>
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<td>Highly weathered granitic rocks</td>
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<td>Residual</td>
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<td>Manufactured sand (limestone), (gravel, structural wasters, gravities)</td>
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<td>Lagous, reservoirs, barbours</td>
<td>Varied</td>
<td>Maintenance dredging</td>
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<tr>
<td>Import (very rare)</td>
<td>Other Caribbean Islands, silts from Florida, Jamaica, Guadeloupe</td>
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Figure 1 Early Sand Extraction: North Coast
(Nichols, et al., 1987)

CAROLINA:

1950's - enormous quantities of dune sand were mined to construct the San Juan Airport.

1960's - storm waves breached the remnant dune which was totally destroyed; mangrove flooded; 150,000 cu m of sand spread 50 m inland,
later - metal scraps/rocky breakwater,
1986 - dune build-up with river mouth sand, cost: $250,000,
1987 - total washover of dune, restoration lost.

HATILLO:

1960's to early 1970's - intensive mining, broke the integrity of the dune ridge system, inland
mangroves buried by washover sand, extraction holes flooded.

ISABELA:

1970's - removal of over 8 million cubic meters of sand from high, massive dune system
1980's - subsequent overtopping and destruction of remnant dunes
1980's to 1990's - active, intensive mining, some effective restorations

MINING PROCESS

Techniques for coastal zone and floodplain sand mining can range from simple hand
shoveling to complex set-ups involving various types of heavy equipment. In general, the
operations consist of three basic stages adjusted to site locations:

Land preparation: Clearing of the vegetation using a bulldozer or front-end loader and
saving the top soil for later spreading.

Mining per se: Begins with surface raking (usually done with a front-end loader) to
remove material in a relatively uniform manner over the work area up to a maximum
depth of 1 m above the ground water table or mean sea level, whichever is shallower. The
operation may evolve to a dry pit excavation (requiring the use of a bulldozer) or a wet-
pit (needing to employ a dragline). Maximum allowed wet-pit depth is 4 m below the
water table.

During this mining phase two simultaneous substages take place:

Processing - screening and separation of oversize or trash with a portable screening
plant;
Distribution - loading of trucks with loaders (or shovels in the simple hand shoveling
operations)

Site restoration: Backfilling with approved material and raising of land levels (where
needed) to (a) pre-extraction land levels, (b) 1 m above the water table/mean sea level,
or © an intermediate elevation according to site characteristics. Proper grading for surface
and subsurface drainage, topsoil spreading, and planting of the disturbed area with local
proven vegetation are also required. Often, restoration procedures stop, temporarily or
permanently, at one of these steps.

MINING IMPACT

Sand mining operations are necessary in a growing economy dependent on urban,
commercial and manufacturing developments. But, there is an environmental price. Sand mining
does have the following impacts:

* partly modifies or completely changes the local topography and drainage patterns,
* significantly disturbs or permanently alters the ecological systems present prior to mining,
* increases surface susceptibility to erosion,
* increases sedimentation of low lands,
* increases susceptibility to flooding and temporary or permanent ponding,
* increases susceptibility to the overall impact of storm events and other natural hazards

The degree of these impacts will vary depending on the site's topography, lithological/soil characteristics, precipitation patterns, surface/subsurface drainage capacities, degree and type of vegetation cover, and extent of urbanization and development.

Although environmental perturbation is inherent to the mining process, these operations can be done with reduced environmental impact if:

* site conditions prior to mining are evaluated to design adequate mining methods and rhythm, and if
* restoration practices are properly implemented and followed through.

**SAND MINING STATUS**

Since 1968-69 studies and assessments have stated that the construction industry in Puerto Rico will face a shortage of sand in the near future (Christiansen, et al., 1969, Management Aid Center, Inc., 1969). The future has arrived and the increase in sand consumption has accelerated depletion of accessible sources in known accretional environments.

Restrictions in tune with land-use compatibility and conservation/preservation of the island's natural resources have been emplaced in the past and will need to be enforced in the near future. This limits the use of many deposits, some of which are at present recovering from past impact, such as the rebuilding of some stretches of the north coast shoreline.

With the purpose of minimizing extraction impact on beaches and rivers the following have been identified as the major alternative sources of sand:

Manufactured sand: Produced principally from the northern limestone belt, its major environmental drawback is that it causes the destruction of the karst morphology. Accessible deposits are also found on the south coast. Production costs are higher but its use requires less cement, offers superior bonding and smoother termination than natural sands (though, for safety reasons, manufactured sand must be mixed with river sand in road construction) (Cintron, et al., 1984).

Medium to highly weathered granitic deposits: Exploitation and expansion of mining operations have been controlled by the accessibility and limited extent of the deposits.

Submarine sand and gravel deposits: Twenty three potential deposits have been identified, three of which represent feasible commercial sites due to the volume and quality of the available material, and probable physical impact of extraction on nearby bottoms, shorelines, water column, biological impacts and loss of marine productivity. These sites are offshore: Isabela (north coast), Cabo Rojo (southwest coast) and Vieques Island to the east. Relevant information of these sites are summarized in Figure 2. At present, the Cabo Rojo West submarine deposit has been assessed as the best alternative because it represents less environmental risk.

**CONCLUSION**

Extraction of the submarine deposits is likely to be the next step in the sand mining history of Puerto Rico. This is a controversial and complex issue. There has been a tendency to delay the decision to further study the viability of this alternative due to economic and environmental reasons (Cintron, et al., 1984; Forrest, et al., 1995).

Economically, the following factors have to be considered:

* high extraction/transportation costs,
* need of sophisticated equipment,
* accessible harbor,
* adequate ports facility for storage/distribution.

In terms of the environment, three major concerns have to be addressed before any extraction is done:

1. Will the depression created by the extraction act as a sink intercepting sand that would otherwise replenish nearby beaches?
2. Will the depression result in greater wave activity affecting nearby beaches?
3. Will the depression cause the sand from the nearby beaches to move towards the sink, resulting in beach erosion?

Also, the direct consequences to the nearby coral reefs and sea grass beds have to be further analyzed.

The ultimate environmental implications of submarine sand extraction are unknown. Historically, the short term economic gains associated with sand mining operations have generally overshadowed both short and long term environmental impacts.
Therefore, the approach to this issue requires caution and the implementation of management practices that integrate a sound evaluation of product demand, site selection and mining practices with resource replenishment limitations and potential environmental disturbances. Short-term economic gain strategies must be analysed against long-term environmental protection policies to maintain the impact on the natural resources to a minimum.

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BEACH SAND MINING IN ST VINCENT AND THE GRENADINES
AFTER THE LANDMARK DECISION OF 1994

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St. Vincent & the Grenadines

ABSTRACT

Traditionally, beaches and the Baboa Dry River have provided the principal source of
construction sand in St Vincent and the Grenadines. This has resulted in severe beach
erosion, flooding of coastal areas, loss of dunes and other habitats. Following a regional study,
it was decided to import sand into St Vincent from Guyana for use in the construction industry.
This would result in increased construction costs, since beach sand had been considered a 'free
good'. A decision was announced in December 1994 that imported sand would be used for all
Government construction projects starting 1st January, 1995, and that controls would be
instituted on beach sand mining, although no date was set for this action. This announcement
resulted in a massive stockpiling of sand, in two month period the volume of sand mined from
the beaches was 2.5 times the annual volume. This caused serious erosion which was
accentuated by Tropical Storm Iris in August, 1995. It is concluded that the populace may not
be prepared to pay the price of imported sand and that short term gain outweighs long term
national benefit.

INTRODUCTION

This paper is intended to provide some information on the nature and extent of the
problems related to sand mining in St. Vincent and the Grenadines, and to discuss the problems
that arose when the Government made the landmark decision to reduce the level of sand mining
in 1994. It is hoped that the lessons learnt from the St. Vincent and the Grenadines experience
will assist other OECS states who may be contemplating the imposition of measures to reduce
sand mining. The paper begins with a general background on St. Vincent and the Grenadines,
then looks at the importance of coastal resources to the national development process, then deals
with Government proposals to reduce the level of sand mining and its impacts.

OVERVIEW OF ST VINCENT AND THE GRENADINES

St. Vincent and the Grenadines is an archipelagic state comprising over thirty islands, islets
and cays, located between St. Lucia and Grenada and to the west of Barbados. St. Vincent is the
main island with most of the population and major settlements including the capital city
Kingstown. The smaller islands in the chain are called the St Vincent Grenadines and comprise
the major inhabited islands of Bequia, Mustique, Canouan, Union Island, Palm Island and Petit
Table 1 Characteristics of the Islands of St. Vincent and the Grenadines

<table>
<thead>
<tr>
<th>Island</th>
<th>Area (sq. miles)</th>
<th>Population 1991</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Vincent</td>
<td>133</td>
<td>98,842</td>
</tr>
<tr>
<td>Bequia</td>
<td>7</td>
<td>4,867</td>
</tr>
<tr>
<td>Mustique</td>
<td>2</td>
<td>4,874</td>
</tr>
<tr>
<td>Canouan</td>
<td>3</td>
<td>739</td>
</tr>
<tr>
<td>Mayreau</td>
<td>1</td>
<td>182</td>
</tr>
<tr>
<td>Union and Palm Island</td>
<td>4</td>
<td>1,928</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4</strong></td>
<td><strong>111,433</strong></td>
</tr>
</tbody>
</table>

St Victoria, which is usually referred to as the "Mainland," is volcanic in origin and is dominated by a central mountain range which is covered in wet forests and a series of radiating spurs which reach down to the coastline. The island is drained by numerous rivers and has many black sandy beaches. The island has an active volcano - La Soufriere - over 4,000 ft. high which last erupted in 1979.

St. Vincent has very fertile soil and agriculture is the major economic activity. Agricultural activity is concentrated on the lands under 2,000 ft above sea level - usually in the river valleys and the steep hillsides where there is intensive farming. Banana is the main cash crop and accounts for over 75% of the total agricultural exports in recent years. Most of the land above 2,000 ft above sea level is undeveloped and is forested and critical for the protection of water catchment and biodiversity.

Presently there is limited tourist activity on St Victoria despite the great potentials for nature tourism. Most of the tourism activity is located in the south near the few white sand beaches. Most of the human settlement activity is also located in the south with 60% of the population living in a 5 mile radius from Kingstown. Most settlements are located on the coast with few settlements being more than 4 miles from the coastline.

The Grenadines, on the other hand, are very small islands, with a series of dry hills, white sandy beaches, clear blue waters and sheltered and extensive coral reef systems. There is limited agricultural activity on these islands since they receive very limited rainfall (40 - 50 inches annually). Most of the agricultural activity is subsistence in nature. Tourism is the major economic activity in the Grenadines as these islands have great tourism potential. There is emphasis on up-market tourism on some of the islands - Mustique, Petit St Vincent and Palm Island are developed as private resorts catering for international rich and famous stars. The Grenadines are renowned for sailing, snorkeling and other marine recreational activities which attract significant numbers of visitors. Traditionally, the local people, who live in very small villages, make a living from the sea - fishing, boat building and by sailing on regional and international shipping lines.

**ECONOMIC BACKGROUND**

The economy of St. Vincent and the Grenadines in terms of Real Gross Domestic Product (GDP) has grown by a remarkable average of 7% annually over the past decade. The main sectors of the economy are agriculture (18%), transport and communications (22%) and government services (14%).

Agriculture remains the key sector of the economy. In 1992 it accounted for 80% of merchandise export earnings and 60% of direct and indirect employment. (Unemployment is estimated to be about 19%). Banana is the chief crop. Government's policy in the transport and communications sector is to improve and maintain the country's infrastructure to facilitate economic growth.

In addition to agriculture and education, tourism has top priority with respect to the development of the country. Government is particularly interested in up-market tourism focusing on eco-tourism.

Manufacturing accounts for 9% of GDP. Government's manufacturing sector strategy is to attract entrepreneurs, both foreign and local, to maximise employment and facilitate skill development.

**Overall Development Strategy of the Government of St Vincent and the Grenadines**

The Government's overall development strategy is to promote balanced growth and to ensure that the development is sustainable.

The Government's strategy for sustained development is aimed at increasing output and improving productivity. The Government recognizes the central importance of the private sector in achieving these growth objectives and views its objectives as those which create the conditions in which growth can take place.

In agriculture, the main policy thrust is to diversify away from bananas which are facing
stiff competition on the European market. In manufacturing and tourism, the thrust is to promote private sector investment through fiscal incentives and provision of infrastructure. For all sectors, human resource development is seen as fundamental for sustained growth.

THE IMPORTANCE OF COASTAL RESOURCES IN THE DEVELOPMENT OF ST VINCENT AND THE GRENADINES

St Vincent and the Grenadines, like all small island developing states in the Caribbean, has limited resources, but fortunately possesses a relatively productive and exploitable coastal and marine area. The small size of St. Vincent and the Grenadines, and indeed all of the OECS states, makes it very difficult to distinguish coastal from non-coastal areas and the whole island is considered the coastal zone/area.

The coastal and marine ecosystems of the islands of St. Vincent and the Grenadines are of considerable value to the national economy and to the quality of life. Most of the central forest areas of these islands must be protected to ensure a reliable quality and quantity of water and to preserve biodiversity. Since European settlement began in the 1660s the littoral area has been the primary focus for development. Today, the coastal areas are the areas of greatest economic and human activity - agriculture, fishing, industrial development, tourism, human settlements, housing, social and physical infrastructure etc.

The multiplicity and intensity of land uses in the "coastal areas" of St. Vincent and the Grenadines is generated by development pressure from an expanding population and the particular style of development adopted by the population. The increase in development pressure is placing greater stress on the interacting terrestrial and marine ecosystems, and the multiple uses of the coastal resources is resulting in serious land use competition and land use conflicts which threaten the potential for sustainable development. In order to ensure that the fragile and limited natural resources of these islands are conserved and developed in a sustainable manner, there is need for implementable and relevant natural resource management systems and practices. The Government of St. Vincent and the Grenadines, like most governments in the Caribbean, is now realising that there is need to protect terrestrial and marine resources for sustainable development. However, the Government lacks the technical, financial and human resources to develop the appropriate natural resource management systems.

As a result, coastal and marine resources are undergoing extensive degradation resulting from many unsound environmental practices including:

- industrial and municipal effluent,
- agricultural runoff,
- excessive fishing,
- destruction of habitats for construction and other development activity,
- bad siting of development activity.

THE PROBLEM

The principal sources of sand for construction have been the beaches of St Vincent and the Grenadines and the Rabacca Dry River. The demand for sand for building and construction purposes has been increasing rapidly over the years. In St Vincent and the Grenadines, sand consumption figures are not recorded or easily available. Consumption levels for sand were estimated (Atkins, 1993) as a function of the demand for cement. Table 2 shows the estimated consumption of sand for the years 1982, 1986 and 1990.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cement</th>
<th>Sand (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>15,240</td>
<td>38,000</td>
</tr>
<tr>
<td>1986</td>
<td>22,673</td>
<td>56,000</td>
</tr>
<tr>
<td>1990</td>
<td>39,036</td>
<td>96,000</td>
</tr>
</tbody>
</table>

According to Atkins (1993), 62% of the sand consumed was obtained from the Rabacca River. This sand is of variable quality, coarse grained and contains gravel sized pebbles. This type of sand is suitable only for concrete and pre-cast structures. Another 30% of the sand consumed was obtained from the Brighton/Diamond dune system and other beaches in St. Vincent and the Grenadines. This beach sand is fine grained and is used in plastering and rendering work. 8% of the sand consumed was derived from crushed rocks.

The removal of sand from the beaches is creating serious problems, including:

1. loss of scenic value,
2. destruction of dunes with their interesting and rare biological habitats,
3. destruction of turtle nesting areas,
4. loss of beach land which is a major recreational attraction,
5. blighting of mined beaches by illegal dumping,
6. flooding of coastal lowland area,
7. increased coastal erosion and destruction of coastal properties (land and buildings).
If beach sand mining is allowed to continue at its present pace, and in such an unsustainable manner, the potential for the development of the tourism and fisheries sectors would be greatly reduced and the country would be unable to supply and ensure adequate income, employment and essential social services to all its citizens.

In addition, beach sand is contaminated with salt which leads to the spalling of concrete and corrosion of steel reinforcing bars, which reduces the structural integrity and lifespan of concrete structures.

The Government considered it necessary to cease beach sand mining and to develop alternative supplies. Within the country there is no viable source of sand and the Government decided to pursue the option of sand importation.

Recognizing the commonality of the sand mining problems among OECS Member States and the advantages of bulk purchasing and bulk transportation of imported sand, the Government spearheaded efforts at the OECS level for jointly exploring the possibilities of importing sand from Guyana for all the OECS States.

The OECS Secretariat secured funding from the European Union and the consultancy firm of W.S. Atkins Ltd, was commissioned to undertake the OECS-Guyana Sand Supply Study on behalf of the OECS States and Guyana. The final report of the study was submitted to the OECS Governments in February 1993. The major findings and recommendations of the study were:

1. Beach sand mining in OECS States results in grave environmental damage and the high salt content of the sand produces poor quality concrete structures.

2. OECS States need to import sand for construction purposes and the white sand deposits along the Demerara River in Guyana would be the best place to secure high quality sand.

3. It is essential to establish a Caribbean Sand Mining Company (CSMC), a private enterprise organization with a substantial minority share holding taken up by the OECS Member States which could be responsible for:
   
   (a) sand mining operation in Guyana;
   (b) transportation of sand from Guyana to the OECS States in 10,000 tonne barges.

4. Within each Member States of the OECS, a sand importation facility should be developed by a private sector company to off load, stockpile and distribute sand for national consumption.

5. The importation of sand from Guyana is financially possible and environmentally sound, but needs the commitment of all OECS States to develop and efficiently enforce a ban on beach sand mining.

6. The imported sand will be more costly than beach sand in most states, and transportation costs will make sand in the northern OECS States more expensive than sand in the southern OECS.

7. The imported sand will be of a higher quality and give more value per dollar than local beach sand.

8. Importation of sand will conserve critical fisheries and tourism resources and so ensure sustainable development in the OECS.

Sub-regional activity and reaction to the OECS/Guyana Sand Supply Report have been very slow. To date there has been little sub-regional response. It is believed that some states are not willing to pursue the importation of sand since the increased cost of sand may lead to serious political implications for the ruling party. The Government of St Vincent and the Grenadines, like the Government of St Lucia, recognized that joint action by OECS Member States was not forthcoming and so decided to develop a national initiative. The Government's position was clearly articulated by the Prime Minister, who stated that the problems of sand mining are too grave to sit and wait on other OECS States and that the Government is intent on proceeding with the importation of sand and to 'go it alone' if necessary.

THE GOVERNMENT'S INITIATIVE

There was great private sector interest in St Vincent and Guyana in the development of the sand importation trade. A Guyana mining company offered to supply sand at USD 14 CIF or ECS 10 per tonne. In addition, a group of Vincentians formed a company "The Sand Piper Company", and acquired a barge and was willing to supply sand from the cheapest external source to meet national demands. The Sand Piper Company offered to supply sand at ECS 40 - 45 CIF per tonne.

The Government, after a series of in-depth studies and analyses, decided that it was going to facilitate a sand importation programme under the following arrangements:

1. Government will develop a sand landing and storage facility at Lowmans Bay for use by private operators. This site will be leased to a private operator through a tendering process. The lessee will operate at his commercial risk.

2. The Government will recoup the expenditure for the development of the jetty, ramps etc. at the sand leasing facility through lease/rental payments from the lessee.

3. The lessee will not be given a monopoly to import sand and he will not be entitled to exclusive rights to use the site. Other persons will be permitted to import sand and a specified rate of payment will be charged by the lessee for use of the facility.
4. The purchasers of sand have the right to determine the trucking arrangements for the sand. The lessee may provide trucking services to purchasers only at the purchasers’ request.

5. No Government projects will use beach sand and the Government will purchase imported sand through the sand importation facility.

6. Persons or firms receiving concessions from the Government for construction and development projects will be required to use imported sand.

7. Government will embark on a geographically phased programme of reduced sand mining, key elements of this programme are:

   (a) Persons in the south of the island defined as south of the Columbine and Cumberland Rivers will be required to use imported sand since sand mining will be prohibited in the south. Persons in the Grenadines had to use imported sand as beach sand mining was prohibited on all beaches.

   (b) Persons in the north of the island will be permitted to use beach sand. However, sand mining will be controlled and managed. Sand in the north of the island will now be sold at the same price as the imported sand at the landing site.

   (c) Sand mining the Rabacca River will be controlled and fees similar or a little below the cost of imported sand imposed.

8. The development of strong enforcement mechanisms to ensure sand mining is carried out in keeping with the stated policy.

**Implications of the Government’s Proposal**

The proposal by the Government for the importation of sand and reducing the level of sand mining will impact on the price of sand and the cost of construction in St Vincent and the Grenadines.

Historically beach sand has been a "free good" and nationals went to the nearest beach and took unlimited amounts at no cost. There is still the perception in some quarters that it is God’s sand which is provided in unlimited supply.

Presently beach sand is virtually free as the consumer will pay only the trucking cost from source to the point of consumption. The cost therefore varies from place to place and is a function of the transport cost from source to consumption point. Table 3 shows the cost of sand mined from Brighton, the major sand mining site on St Vincent.

<table>
<thead>
<tr>
<th>Place</th>
<th>Cost ECS per Truck Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingstown</td>
<td>110</td>
</tr>
<tr>
<td>Arnos Vale</td>
<td>100</td>
</tr>
<tr>
<td>Prospect</td>
<td>80</td>
</tr>
<tr>
<td>Mesopotamia</td>
<td>130</td>
</tr>
<tr>
<td>Layou</td>
<td>160</td>
</tr>
<tr>
<td>Barrouallie</td>
<td>250</td>
</tr>
<tr>
<td>Chateaubelair</td>
<td>300</td>
</tr>
<tr>
<td>Georgetown</td>
<td>200</td>
</tr>
</tbody>
</table>

Table 3 Cost of Sand from Brighton/Diamond in 1994

The table shows that persons closest to Diamond will pay lower costs and persons furthest away will pay the highest costs. In practice, however, persons who are distant from the Brighton/Diamond area avoid using sand from the Brighton/Diamond area given the high transport cost, and mine sand from the nearest beach.

If imported sand is landed at Lowmans Bay at ES$ 40 per tonne, and a truckload of sand is the equivalent of 6 tonnes with a 30% increase provision for profit, handling and other operational costs, a truck load of sand will cost approximately ES$ 300 at the landing site. When transport costs are included, an interesting cost comparison between local and imported sand emerges as is shown in Table 4.

Table 4 shows clearly the use of imported sand will increase the cost of construction which will impact primarily on the housing sector and create greater difficulties on the efforts of low income groups to house themselves. In addition, the cost of public sector infrastructure projects, especially roads and other unit works (where sand and aggregate account for 30% of the total cost), will increase by a greater margin.

The overall effect of imported sand and reduced sand mining could increase unemployment, and lead to a slowdown in the economy in which the construction sector is the second biggest contributor to the GDP. The Government, in its proposal, adopted a phased approach, which would try to reduce total cost of sand by trying to minimise the transport distance of sand from source to consumption point. Using this approach, the cost of sand would not have exceeded ES$ 450 per truck load at any point in St Vincent.
Table 4 Comparative Cost of Local vs. Imported Sand at Various Locations in St Vincent and Potential Impact on Construction Costs.

<table>
<thead>
<tr>
<th>Place</th>
<th>Cost of Sand from Diamond</th>
<th>Cost of Imported Sand at Lowmaxs</th>
<th>Transport Cost from Lowmaxs</th>
<th>Total Cost of Imported Sand</th>
<th>$ Difference in Cost, Local vs Imported</th>
<th>% Increase in Construction Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingstown</td>
<td>110</td>
<td>300</td>
<td>80</td>
<td>380</td>
<td>245</td>
<td>2.5</td>
</tr>
<tr>
<td>Arnos Vale</td>
<td>100</td>
<td>300</td>
<td>100</td>
<td>400</td>
<td>300</td>
<td>3.0</td>
</tr>
<tr>
<td>Prospect</td>
<td>80</td>
<td>300</td>
<td>130</td>
<td>430</td>
<td>437</td>
<td>4.5</td>
</tr>
<tr>
<td>Mesopotamia</td>
<td>120</td>
<td>300</td>
<td>160</td>
<td>460</td>
<td>283</td>
<td>2.6</td>
</tr>
<tr>
<td>Layou</td>
<td>160</td>
<td>300</td>
<td>100</td>
<td>400</td>
<td>150</td>
<td>1.5</td>
</tr>
<tr>
<td>Barrouallie</td>
<td>220</td>
<td>300</td>
<td>130</td>
<td>430</td>
<td>95</td>
<td>1.0</td>
</tr>
<tr>
<td>Chateaubelair</td>
<td>300</td>
<td>300</td>
<td>220</td>
<td>520</td>
<td>73</td>
<td>0.7</td>
</tr>
<tr>
<td>Georgetown</td>
<td>200</td>
<td>300</td>
<td>200</td>
<td>500</td>
<td>150</td>
<td>1.5</td>
</tr>
</tbody>
</table>

With respect to the Grenadines, the proposal had varying impact on the price of sand and the cost of construction. Over the last eight years, there has been limited sand mining on the islands of Bequia and Mustique. These islands imported sand from St Vincent at approximately $800 per truck load. Importation of sand directly to Bequia by barge was possible and results in a near 60% decrease in the cost of sand as a truck load of sand at consumption point would have been priced at a maximum of $400 ($300 at landing site, $100 maximum for trucking cost). Mustique is expected to receive lower sand costs as Bequia for similar reasons.

However, Union Island, Carouane and Mayreau have a very small sand demand and it has been uneconomical and very difficult to entice suppliers for these small markets. The residents of these islands are therefore placed in a situation in which there is a ban on sand mining and no viable alternative provided. It was hoped that the developers of major tourism projects who were importing sand will provide sand for purchase by local residents.

The Announcement of the Decision to Ban Sand Mining

The Government declared the 1990's as "The Decade of the Environment" and the issue of alternatives of provision of sand for construction was in debate since 1990. During the preparation of the National Environment Action Plan (NEAP), the issue was hotly debated. At the national consultation of the NEAP which was attended by over 150 persons from near 80 organizations, it was decided that sand mining should be discontinued and that arrangements should be made for sand importation. The Vincentian public therefore had some knowledge of the expected action.

In August 1994, the Government passed regulations under the Town and Country Planning Act which attempted to control the use of beaches and restricting certain activities on beaches without permits. These activities included sale of goods, noise, mining of sand and coral etc.

In early December 1994, at the opening of a regional Coastal Zone Management Workshop sponsored by the United Nations Development Programme, the United Nations Centre for Human Settlements, and the OECS Natural Resources Management Unit, the Director of Planning announced to a largely foreign audience that it was the intention of Government to institute controls on sand mining in 1995. The Director of Planning's speech was later aired on radio and television.

The Hon. Prime Minister and Minister of Planning in presenting his budget address for the 1995 fiscal year in mid December 1994, informed the nation that with effect from 1st January, 1995, the Government would not be using beach sand for Government construction projects and would instead be using imported sand for all construction projects.

A great deal of the budget debate was centered on the sand mining issue with the opposition laying claims that there was a covert plan to ban sand mining on all beaches from 1st January, 1995, and that the impacts would be grave on all low income persons and the economy as a whole. The opposition pointed to the planning regulations on beaches and the announcement by the Director of Planning to support its claim. In addition, they quoted figures of a truck load of sand to cost over $1,000.

The Prime Minister in winding up the budget debate, presented the Government's thinking on the matter as highlighted above and stated clearly that no implementation date was set for this programme, but that Government wanted to lead by example and so Government would use imported sand on all its projects from 1st January, 1995.

The Aftermath

The issue of sand mining became most topical from December 15th, 1994 among the populace. The people were confronted with much conflicting information on the price of imported sand, implementation dates etc. There was little that the Government could do to explain their contention.
Panic stepped in and there was a mad rush to stockpile sand among the truckers, contractors and would-be house builders. From the period 18th December, 1994 to the end of January, 1995, there was non-stop sand mining and stockpiling of sand on private properties as well as on roadsides. Heavy equipment operators worked 18-22 hours on Christmas Day and all public holidays during that period. Sand mining took place on all beaches. The volume of sand mining undertaken during that period at the main sites, (Brighton/Diamond) is estimated to be over 2.5 times the volume extracted on an annual basis. It has been reported that even some Government agencies were involved in the sand rush and were directed to return the sand stockpile after 1st January, 1995 to the beaches.

From 1st January, 1995, the Government commenced the use of imported sand on Government projects and Cabinet appointed a Committee, which consisted of Government Ministers and senior civil servants, to advise on the problems of sand mining. To date, no follow-up action has been taken on the implementation of the Government’s proposed plan.

The stockpiling of sand created major problems in the early months of 1995. Most of the sand that was stockpiled on private properties was never utilized in construction. The sand created serious problems:

- It was left to be blown away and create a serious nuisance in residential communities;
- It created major traffic hazards, especially for cyclists, as it was left on the surface of most roads;
- It clogged drains and gullies and led to serious disruption of the drainage systems.

During the first six months of 1995, there was extensive non-government organization (NGO) consultation and discussions on the issue with the public generally denouncing the "sand rush of December 1994", and recommending that Government pursue the importation proposal at minimum cost to consumers. The Government, however, appeared quite silent on the issue and awaited a report of a survey on the beaches which was undertaken by senior civil servants.

In August 1995, St Vincent and the Grenadines suffered the effects of Tropical Storm Iris. Most of the beaches were severely damaged and there was significant damage to coastal properties. In addition there was extensive flooding at the Brighton/Diamond sand mining site. The back shore area of this major mining site is now permanently under flood waters. The issue of sand mining is again a major talking point, with criticism being leveled at the Government for not being forceful and resolute in its plan to ban beach sand mining and facilitating the importation of sand for the entire country.

The major lessons learnt from the St Vincent and the Grenadines attempt at instituting alternatives to sand mining are:

1. The issue of environmental management is critical to sustainable development of island states and must be addressed from a long term perspective rather than the ad hoc and short term basis as presently obtains. Costs and benefits of development activities must therefore incorporate the long term dimension.

2. It is relatively easy to identify the major environmental issues facing small island states and to propose technical solutions to these problems. However, implementation of these proposals is very difficult as there are many social, political and economic implications which must be addressed in detailed.

3. The process of consultation and consensus building may be critical to the process of developing alternatives to sand mining, but in the final analysis, stakeholders may defend their selfish interests rather than the broader national interest.

4. Political will of the Government and opposition is critical in the implementation of alternatives to sand mining. It is very difficult to get political consensus on this issue. The Government must ensure that the opposition parties are interested and committed to sustainable development as it relates to the sand mining issue. If there is not consensus and opposition support, the effort may be futile as the opposition parties may oppose the proposed strategy simply for political mileage. Maturity of political parties and their ability to support issues from a national viewpoint, rather than from a narrow political partisan perspective, is therefore critical.

5. The social benefits of developing alternatives to sand mining may be great, but at the end of the day, the private costs or disadvantages as expressed in monetary terms will determine if beach sand mining will continue.

6. Strong resistance and/or failure on the part of Government to institutionalize a ban on sand mining makes it very difficult and almost impossible for the Government to make a second attempt at restricting sand mining.

7. Public information flow on contentious issues like restrictions on sand mining must be clear and well organized. Government agencies must develop an effective public awareness programme with designated personnel to inform the public in a coherent manner on the policy. Different messages from different public officers leads to distrust and scepticism on the part of the public.

8. The announcement of commencement dates in advance of a sand mining restriction policy may be very detrimental, since it may lead to excessive sand mining and stockpiling of sand.

9. There is need for an effective and efficient enforcement capacity that is fully functional and operational prior to establishing and announcing policies related to a cessation of sand mining.
CONCLUSION

Sand mining remains a major problem for St Vincent and the Grenadines, and most of the OECS Member States. Attempts at developing alternatives to beach sand for construction have been hindered largely by the prevailing perception that sand is a 'free good' and by short term cost considerations. Government's success in the importation of sand as an alternative to beach sand mining has been confined to public and private sector projects which received concessions from Government and to all construction activity on the islands of Bequia and Mustique. The present level of sand importation will reduce the level of beach destruction but will not significantly reduce the level of uncontrolled sand mining and beach destruction at the major mining areas. The populace may not be prepared to pay the price of imported sand, but increasingly state funds are being budgeted and utilized to pay for remedial works. These include sea defenses, coastal rehabilitation, beach renourishment programmes and protection of threatened roadways, all as a result of sand mining and man's action in the shoreline area.

REFERENCES


SEEKING SAND SOURCE ALTERNATIVES: AN ISLAND CASE STUDY

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ABSTRACT

At present rates of demand, onshore sand reserves in Anguilla will be depleted within one to two years. The present reserves are provided from the only licensed quarry mining operation. Evaluation of the alternatives provides the following options for Government planners:

1. Back to the beaches: this alternative is not acceptable to Government, who are attempting to prevent further damage to beaches, dunes and coastal environments, given their critical importance in national economic development.

2. Sand imports: to satisfy island sand demand of about 20,000 cubic meters per year, this option will require a substantial increase in sand imports over those previously brought to the island. There are a range of sources for this material, all of which would need to be shipped in.

3. Offshore sand: geophysical and geological investigations identified three large pockets of sand on the shelf close to the north coast. Each pocket contains several million cubic meters of sand, more than enough to satisfy demand for the foreseeable future.

It is technically feasible to mine the offshore sand. Assessment of this operation from an engineering, environmental and cost/benefit perspective suggests that one of these deposits, located off the northwest coast, has a good overall profile as a sand source, and potential impacts associated with extraction can be mitigated. This sand could be shipped to the site of the existing active quarry for washing and stockpiling. Both the imported and shelf sand sources require resolution of potential land use conflicts in the context of the Draft National Land Use Plan. However, for a twenty year sand supply, shelf sand could be mined and stockpiled at approximately 50% of the cost of imported sand, with a net saving of foreign exchange, allowing for the costs associated with mitigation measures and washing to remove salt.

(This paper will shortly be published by a peer reviewed journal).