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A Case Study of the British Virgin Islands

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PREFACE

In 1973 the Island Resources Foundation undertook to prepare a preliminary set of environmental standards for island-based development activity. This effort, which was partially supported by International Union for the Conservation of Nature and Natural Resources (IUCN) based in Morges, Switzerland, resulted in the publication by IUCN of a handbook entitled "Ecological Guidelines for Island Development", by John McEachern and Edward Towle. The "Guidelines" were published with the assistance of the Swedish Development Authority (SIDA) and the World Wildlife Fund (WWF), organizations who shared IUCN's concern with improving approaches to environmental management, habitat protection and endangered species conservation.

The IUCN "Guidelines" were prepared as an experimental set of planning constraints for all small island areas, sufficiently general to apply to diverse types of islands and island groupings in different environments. However, they suffered from a deficient data base drawn from case studies on practical legislative, administrative and ecological considerations for application by island governments concerned with both development planning and environmental quality for a specific island community. Hence, this study, which constitutes both an

intensive case study in the adaptation of the general "Guidelines" to localized insular circumstances and an attempt to narrow the gap between planning and policy, between theory and practice, and between standards and implementation.

The focus of this study has been to collate references and material pertaining to existing legislation and activities that affect the environment of the British Virgin Islands. Where sufficient information has allowed, future legislation and proposed development are discussed also.

As a framework for evaluating the different aspects of each activity area, its impact has been subdivided into aesthetic, ecologic, social and cultural, and economic considerations. Inevitably, the importance of each group of considerations differs according to the activity area under discussion.

With regard to the format of this study, the exploitation of non-renewable natural resources (minerals) is discussed first. Next follows the management of recent man-made resources, such as development and construction, and the disposal of litter, waste and pollutants. The latter group, on first sight, hardly appears to comprise a resource, but, as discussed in the report, it could and should be

considered as such. Management practices concerning the Territory's exploitable natural renewable resources - water, soil, flora and fauna - are then evaluated. Lastly, the conservation of areas of outstanding aesthetic or scientific value, together with the preservation of historic sites and other cultural property, are examined and evaluated. Recommendations for future action are included at the end of each section.

It is self-evident to suggest that the development of a country is reliant at least partially upon the mix of resources it has at its disposal. Equally as important, however, are the political, social and cultural values that characterise an economy, as well as governmental policy regarding future development modes. The structuring of guidelines for development must necessarily account for all of these factors -- in other words, tailored to suit the very individual needs of a country. Uses and abuses of resources accordingly will vary in relation to a country's specific requirements and aspirations.

In the British Virgin Islands, it is the present government's policy to utilize tourism as the major sector for general economic advancement, to be supported by the more traditional agricultural and fishing industries. An holistic overview would therefore suggest that conservation and preservation of resources are called for. Endemic

to each of these sectors, however, lies the seed of disruption for its fellow sectors. A massive revival of agriculture, for example, may make drastic inroads into areas of natural vegetation, which may be so cherished by tourists. The encouragement of hotels and other tourist facilities may not only deny the agricultural and fishing sectors of their best labour force, but also occupy otherwise good farming land. These considerations point most obviously to the need for a balanced, realistic and integrated development of resources, denying the hegemony of any particular sector.

Good management policy essentially entails the maximization of a resource use and the minimization of its abuse. In this context, abuse covers the wastage or underemployment of a resource, as well as deleterious pollution affecting air, water, land -- or even society, in the form of overcrowding and alienation. In small islands, where resources most commonly are severely limited, use/abuse problems must necessarily be considered carefully.

We make no apologies if at times the reader finds that he or she is reading a report of previous reports cited in the bibliography. Several sound recommendations have been propounded in these previous studies, only for the latter to gather dust on shelves. Occasional spring cleaning can only be beneficial.

Although, literally, several scores of people contributed to this report with their ideas and information, we especially wish to express our thanks to the following, in alphabetical order: Mr. Ove Anderson, Mr. Elton Georges, Mr. Tony Mack, Mr. J.R. O'Neal, Ms. Vera Penn, Mr. Arnold Persram, Mr. Elihu Rhymer, Mr. Clive Sears, and with our deep gratitude, Ms. Eugenie Todman-Smith, residents or then residing in the British Virgin Islands.

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0.1. SUMMARY OF GENERAL RECOMMENDATIONS

0.1.1. Many of the existing ordinances, and especially some of those pending, will substantially aid in the effective management of the Territory's resources. Individual ordinances alone, however, no matter how relevant or practical, are insufficient without the existence of an efficient form of administrative process.

0.1.2. The present number of Ministries, Departments, and Authorities responsible for environmental and planning matters inevitably leads to some inefficiency and confusion. First, we recommend, as has been suggested, that a central administrative file be set up for all development applications, including those for mining and quarrying, beach removal, dredging and landfill, and construction and building. Hopefully the existence of such a file would standardize the present system of application procedures and processing, as well as reduce both the time and cost involved. The file should be kept by the Town and Country Planning Department, which would act as a clearing house for application and information.

0.1.3. Secondly, we recommend that more centralization of responsibility be established between both the concerned Ministries and Authorities. The Building Authority and Land Control Development Authority hopefully will soon be amalgamated. However,

it is unfortunate that the responsibilities of 'natural resources' (including land) and the 'environment' (including its development) are divided between, respectively, the Ministry of Natural Resources and Public Health and the Chief Minister's Office. Ideally, responsibilities should be reallocated so that both administrative areas are placed under one Ministry.

0.1.4. In view of the number of reports that have recently been forthcoming, a review committee should be established to evaluate recommendations that the reports may offer.

0.1.5. Some good groundwork has already been undertaken as far as Territorial planning is concerned. In order to prevent an accumulation of ad hoc development however, an inventory of all resources and an integrated comprehensive resource management plan should be undertaken as soon as possible.

0.2. SUMMARY OF SPECIFIC RECOMMENDATIONS

0.2.1. Exploitation of Minerals

0.2.1.1. The Mining Ordinance (1972) should be amended to include all minerals exploited for the purpose of road making, building and/or construction, and the removal of all dredged or beach material.

0.2.1.2. Quarrying

The owner or lessee of the land should be made liable for the restoration on quarried or mined land.

Government revenue from quarrying should portray the loss to the Territory of a non-renewable resource.

0.2.1.3. Offshore Dredging

A study should be conducted to determine the most viable areas for dredging activities within the Territory, with special regard to minimizing environmental damage resulting from such activities.

Based upon the above study's findings, regulations should be introduced stipulating the type of dredging operations to be permitted, the areas where such operations may be undertaken, and the total amount of material to be removed from the designated sites.

The existing Land Control Development Authority (LDCA) Guidelines (1972) and any future regulations should be applied uniformly to all applications, and not on the present ad hoc basis.

0.2.1.4. Removal of Sand from Beaches

An inventory of the Territory's beaches should be undertaken in order to evaluate potential commercial deposits, their normal rates of renewal, and possible reclamation measures - if any - that should be undertaken after beach removal activities.

Removal of sand, gravel and/or pebbles should be licensed for only a few chosen beaches.

The Beach Protection Ordinance (1960) should be amended to include all beaches, and not merely those listed under Orders.

0.2.1.5. Petroleum Mining

In the eventuality that more than a few commercially viable oil sources are discovered, an analysis of the dispersal patterns of surface winds and currents should be made in order to determine the potential pollution risk emanating from each site.

A sliding royalty or 'site tax' could be imposed on each location according to the pollution hazards involved.

0.2.2. Development and Construction

0.2.2.1. A central administrative file should be established for each application for development and/or construction.

0.2.2.2. Administration over both 'land' and 'development' should be placed under one Ministry.

0.2.3. Disposal of Litter, Waste and Pollutants

0.2.3.1. The existing litter ordinances should be more stringently enforced.

0.2.3.2. The more popular beaches should be served with litter receptacles. Those already existing within Road Town should be made more visible by the application of paint.

0.2.3.3. The present concrete litter containers should be replaced with removable steel containers.

0.2.3.4. Litter on private property should be controlled by an amendment to the Abatement of Litter Ordinance (1970).

0.2.3.5. A Customs charge should be imposed on all non-renewable drink containers brought into the Territory, reimbursed to the consumer upon returning the container to central collections points.

0.2.3.6. If the existing Derelict Motor Vehicle (Disposal) Ordinance proves ineffective, either a deposit or permit scheme could be introduced.

0.2.3.7. A solid waste management study is needed for the Territory.

0.2.3.8. Legislation is urgently needed that would prohibit littering and dumping within Territorial waters.

0.2.4. Sewage

0.2.4.1. Very careful control needs to be exercised over the future location of septic tanks, but ideally alternative sewage disposal methods should be introduced, especially in areas with underlying groundwater.

0.2.4.2. Extension of the mains water system should be delayed until the intended recipient areas are served also by a mains sewage system. In areas where neither mains water nor sewage systems are envisaged, large-scale development should be prohibited unless the developers themselves provide adequate facilities at their own cost.

0.2.4.3. A study should be undertaken to ascertain the extent of water reserves both in Virgin Gorda and Anegada.

0.2.4.4. As a precaution against polluting these reserves, a general upgrading of sewage disposal facilities is recommended for Virgin Gorda.

0.2.4.5. Suitable fittings for marina waste pumping dock facilities should be introduced as quickly as feasible.

0.2.5. Water Supply Management

0.2.5.1. The location of any future desalinization plant should be carefully studied in order to minimise thermal pollution.

0.2.5.2. Control over the importation and useage of farming chemicals should be more stringent.

0.2.5.3. The public wells in Tortola and Virgin Gorda should be more fully protected against pollutants (mosquitoes and cattle).

0.2.5.4. The present charge of mains water for consumers should be increased by the introduction of a sliding scale structure, rising steeply the greater the amount used.

0.2.5.5. Maintenance costs of a desalinization plant may be extremely high, but a fixed supply of water is assured, regardless of climatic conditions.

0.2.5.6. The large brackish groundwater deposits could be utilized through the process of reverse osmosis, at a fraction of the cost of desalinization, and without the associated problems

of thermal pollution.

- 0.2.5.7. Some of the presently unharnessed stormwater runoff could be impounded at the bottom of a few chosen valleys and roads (e.g., Joe's Hill Road).
- 0.2.5.8. Rainwater catchment from building and paved roads could be increased greatly.
- 0.2.5.9. Toilet flushing could be accommodated by the use of seawater, although pipe-laying would be expensive.
- 0.2.5.10. Requirements for different size cisterns should be stipulated to serve different demands - not just requirements relating to the square footage of roof catchment areas.
- 0.2.5.11. An overall water management programme is called for that would integrate the several sources of water available to the Territory. Install rain gauges in Virgin Gorda and Anegada.
- 0.2.5.12. Tortola promises little potential of supplying its future needs from additional shallow wells. Rather, emphasis should be placed on the impoundment of storm water run-off; on the increased catchment of rainwater; and on the recycling of waste water. The present programme of earthen dam construction to serve hilltop Tortola should be pursued.
- 0.2.5.13. Virgin Gordians will continue to rely upon shallow wells and roof catchment in the foreseeable future. Studies directed toward the potential of storm water catchment from the Peak, as well as runway catchment, are needed, however - especially with regard to agricultural expansion. A ground water

survey is essential.

0.2.5.14. Anegadians would be served well by the undertaking of a groundwater survey. The potential use of reverse osmosis for the treatment of brackish water should be studied.

0.2.5.15. Jost Van Dyke and the other smaller inhabited islands will continue to be served by roof catchment and springs. Plans for increasing the water supply should await further development.

0.2.5.16. All of the above islands would benefit greatly from the active undertaking of reforestation programmes. Both stormwater runoff and loss through evaporation could be substantially reduced.

0.2.6. Vegetation and Soil Protection

0.2.6.1. Selection of land for afforestation or agriculture should not be based upon economic criteria alone, but also include consideration of environmental conservation and water needs.

0.2.6.2. Long-term stabilization - or better, a reduction - of the small stock population is needed. In the short-term, the impoundment of stray animals should be actively undertaken. If need be, stiffer penalties should be imposed on intransigent owners.

0.2.6.3. As far as practicable, it should be ensured that farmers use erosion preventative measures on sloping land, such as terracing and multi-layered cropping. On very steep ground,

crop farming should be actively discouraged.

0.2.6.4. If Crown Land is leased for agriculture, a careful selection of applicants should be undertaken, so as to help ensure that sound conservation practices are used.

0.2.6.5. The Extension Programme of the Department of Agriculture should be expanded not only within Tortola but other major islands.

0.2.6.6. The construction of all private roads and driveways should be carefully considered before approval and approved storm-water channels be constructed at the applicant's cost.

0.2.7. Wildlife Management

0.2.7.1. The traditional methods of fishing - traps, hand lines and small surface nets - are more practical and economically viable than mechanised operations within B.V.I. waters. In order to help with the fishermen's needs, cooperatives should be established so as to reduce the cost of necessary materials to individuals.

0.2.7.2. The more toxic farming chemicals should be banned from use within the Territory.

0.2.7.3. A moratorium should be placed on the capture of ALL sea turtles. Until that occurs, as a courtesy to visitors, all shops offering hawksbill and other turtle products should be made to prominently display a notice stating the illegality

of importing such products into the United States and its territories.

0.2.7.4. A conservation area for the Anegada iguana (Cyclura pinguis) should be established.

0.2.7.5. Research is needed into the population of the more important commercial fish species, their habitats and reproductive rates, and the numbers presently caught.

0.2.7.6. Spearfishing should be strictly prohibited in all reef areas except by a limited number of licensed local fishermen. The sale of spearguns to tourists within the Territory should be banned. Spearguns sold for local use should be licensed and eventually prohibited.

0.2.8. Preservation of Natural Areas and Historic Sites

0.2.8.1. Clarification is needed over the administrative role of the Ministry of Natural Resources and Public Health (involving 'natural resources') and the Chief Minister's office (involving the 'environment').

0.2.8.2. The National Parks Trust would greatly benefit from the services of a part-time - or preferably full-time - secretary.

0.2.8.3. In order to best allocate what little funding may become available, a list of renovation priorities should be drafted for historic sites and ruins. Consideration should be made of a site or building's historical and archaeological importance, its

present condition and its rate of decay.

With the above considerations in mind, we strongly urge that renovation be undertaken on the Copper Mine, Virgin Gorda, which we consider should be very high on any priorities list.

- 0.2.8.4. Legislation should be passed ensuring that a developer does not purposely or accidentally destroy historic ruins. An Antiquities Act, similar to several now passed in the United States, would require any developer found to destroy historical or archaeological evidence to contribute a small percentage of the construction budget towards salvage operations.
- 0.2.8.5. Any renovation of historic ruins should be carefully supervised.
- 0.2.8.6. The old sugar factory presently housing the Survey Department and Town Planner's Office should be reserved for future use as the B. V. I. Museum. Suggestions that the building utilized by the Tourist Board be converted into a small museum is an excellent initial step.
- 0.2.8.7. We recommend that Marine National Parks encompass the following areas: Horse Shoe Reef, Anegada; Virgin Gorda Sound; Pelican Island Reef; Dead Chest; the Carval Rock - Fallen Jerusalem - Round Rock area; and the vicinity of the Wreck of the Rhone.

0.2.8.8. Both terrestrial and future marine park areas serve as ideal sites for ongoing research, as well as offering potential for an educational programme for B. V. I. school children.

0.3. ELEMENTS NEEDING INVESTIGATION, CLARIFICATION, LEGISLATION OR POLICY DECISIONS

0.3.1. Royalties to Government for use, tenancy or extraction of a renewable or non-renewable resource.

0.3.1.1. There is a need to carry out a comparative assessment of royalty payments as required by neighbouring governments in order to:

(a) evaluate locally derived schedules;

(b) establish a standardized B. V. I. schedule that serves the public interest properly;

(c) reflect both regional "market" considerations and local interests;

(d) properly develop a long term, flexible revenue projection and cost recovery monitoring plan to insure that the B. V. I. is recovering appropriate levels of income to cover both administrative and monitoring costs from the entity or corporate body exploiting the resource in question; and

(e) the above could apply to expatriate fishermen, quarries, sand dredging, timber, minerals (including oil), wildlife,

feral livestock, marinas, etc.

0.3.1.2. In all cases where a local resource is utilized a licensing and royalty (or use fee) should be evaluated and established. Examples might include piers and docks, sea sand and marinas.

0.3.2. There is a need to regularize or standardize "permit terms" including fee schedules and provide prospective applicants with such lists and schedules.

0.3.3. There is a need to establish who is responsible for determining when the terms of permits, especially in relation to environmental constraints, have been met, violated or ignored or exceeded - in other words a formal procedure to determine permittee standards for performance or non-compliance.

0.3.4. Lastly, there is the need for establishing within government an expanded, separately identified supervisory office for (1) environmental matters, (2) for park management and development, (3) for fish and wildlife, (4) and for long range planning. The first three to be situated within the Ministry of Natural Resources and the last, within the office of the Chief Minister.

1. EXPLOITATION OF MINERALS

1. 1. Quarrying

1. 1. 1. Existing Legislation

1. 1. 1. 1. The only mining activity undertaken at present - other than that for sand - is the quarrying of material for road making, building and construction. This activity is not provided for under any existing ordinance.

1. 1. 1. 2. The Minerals (Vesting) Ordinance (1962), places all minerals under the control of the Crown, with the exception of those minerals "used for road making, or for building or construction purposes".

1. 1. 1. 3. The Mining Ordinance (1972) provides for the regulation of mining activities "in, under or upon any lands or under any waters within the Territory". Although pottery clay is included under this Ordinance, other non-metalliferous materials apparently are not.

1. 1. 2. Existing Conditions

1. 1. 2. 1. The only two quarries actively worked, are situated in Tortola, adjacent to Drake's Highway, at Cox Heath and Fish Bay. Several other small quarries lie abandoned, having served their usual purpose of providing road building materials.

1. 1. 2. 2. The two active quarries are modest in scale, and both are situated on privately owned land. No royalties are paid to the Government.

At the Cox Heath quarry, construction blocks are made in situ.

1.1.3. Future Development

- 1.1.3.1. A further quarry is planned in Virgin Gorda, at Upper Soldier Bay, to start later this year. Unlike those in Tortola, the quarry will be on Crown land, and a royalty of \$600 (US) will be paid per annum for the lease of the 5.4 acres. In addition, a royalty of 50¢ (US) is to be paid for each cubic foot of crushed stone. Since the activity is viewed by the Government as a favourable development for Virgin Gorda, the lessee will not be required to apply for a licence.
- 1.1.3.2. An obvious source for quarried limestone is Anegada, and it seems probable that some mining activity will occur on the island at a future date.

1.1.4. Aesthetic Considerations

1.1.4.1. Although the two existing quarries are situated adjacent to Drake's Channel, and thus are easily visible from the sea, neither are large in scale, and as such afford a limited aesthetic degradation to the landscape.

1.1.4.2. The proposed quarry at Upper Soldier Bay will be situated on the opposite side of the island to the major resort areas, and located in the upper section of the valley. Little aesthetic damage is foreseen.

1.1.4.3. If the quarrying of limestone for export occurs in Anegada, the extremely flat topography will necessitate the alteration of a substantial surface area. Unless replanting of vegetation occurs after operations, a prolonged, if not permanent, scar will be inflicted upon the landscape.

1.1.5. Ecological Considerations

1.1.5.1. Providing that quarrying is undertaken on a modest scale, ecological damage should be minimal. Where a form of strip mining may have to be practised, damage to the environment obviously will be more severe. In such instances, consideration should be given to the protection of areas noted for their flora and/or fauna.

1.1.6. Social and Cultural Considerations

1.1.6.1. Hindrance or damage to existing buildings and public areas should

be minimised. The existing quarries, and the proposed quarry in Virgin Gorda, are well located in this respect.

1.1.6.2. If the occasion of large scale quarrying in Anegada arises, a study should be made of its impact on ground water. At present, Anegada is served by brackish water in the west, and a potable water supply in the central and eastern areas. Quarrying at too great a depth could adversely affect this supply.

1.1.7. Economic Considerations

It appears doubtful whether public revenue obtained from quarrying will remain but slight in the immediate future, unless any large scale activity occurs in Anegada. Of far greater importance is the sector's contribution to the Territory's economy, both in the form of employment and a local supply of material for the construction industry. It should be emphasized, however, that quarried stone is a completely non-renewable asset of the Islands; substantial exportation would be a one-time occurrence and revenue appropriate to the loss of this asset should be derived.

1.1.8. Recommendations

1.1.8.1. The existing Mining Ordinance (1972) contains several provisions for the protection of the environment and social and cultural interests (see Appendix I). Although comprehensive within its present limits, it is recommended that the Ordinance be amended to include minerals

exploited for the purposes of road making, building and construction.

1.1.8.2. If any large-scale quarrying or mining is envisaged, the owner or lessee of the land should be made liable for the restoration of the quarried or mined land.

1.2. Offshore Dredging

1.2.1. Existing Legislation

1.2.1.1. Although no Ordinance exists with regard to dredging, this activity is regulated by the issuance of permits. Approval for a permit is at least partially dependent upon whether the proposed operation satisfies the guidelines pertaining to the section Shoreline Alterations or Modifications of Submerged Lands, within the Land Development Control Guidelines (1972). Except with the written permission of the Land Development Control Authority, applicants are to provide the following information:

- a) a written report of an investigation of the site and adjacent properties, to be conducted by competent professional personnel (preferably with local expertise), covering ecological and hydrological conditions, and predicting probable effect of the operation;
- b) supporting material, such as maps, photographs and profiles, as required by the scope and complexity of the work and site;
- c) an in-depth description of resulting modifications and alterations to the seabed;
- d) a description of the methods and details of supervisory control procedures, and the credentials of the personnel involved in that capacity.

1.2.1.2. Under the guidelines, the permittee is required to suspend operations if the permit terms are deviated from, or if associated environmental damage or water quality degradation is unacceptable to the Land Development Control Authority. The permittee is fully liable for all damages resulting from the operation.

1.2.1.3. As a general rule, only land disposal of spoil from dredging operations is permitted, and must be accomplished with adequate provision for the settling of suspended material and return to the sea of clear effluent.

1.2.1.4. Special fees may be levied on the applicant for the evaluation of the application in the case where data and reports are inadequate or, in the opinion of the Authority, additional studies are required.

1.2.1.5. A permit award is not regarded as a property right and may be terminated after a hearing in the public interest is held.

1.2.2. Existing Conditions

1.2.2.1. Under the present system, the Ministry of Natural Resources and Public Health is responsible for processing any application form. A permit is granted if the Chief Minister's Office, with advice from the Town and Country Planner, approves the application. Any large dredging operation is considered by the Governor in Council.

1.2.2.2. In 1974, three concerns were permitted to begin feasibility studies for the dredging of sand, and one was granted a permit.

1.2.2.3. Royalties of 40¢ (US) per cubic yard of dredged sand are payable to the Government. In addition, a royalty for the use of the seabed is assessed. The formula used for assessment is held confidential.

1.2.2.4. Some of the largest dredging operations in the past have been associated with land fills; during the construction of Wickham's Cay, a total of 800,000 cubic yards of coral sand was dredged from Road Town Bay. Many other small operations occur, some apparently without Government permission, such as those occasionally undertaken by a few hoteliers in Virgin Gorda in an attempt to refurbish tourist beaches.

1.2.3. Aesthetic Considerations

1.2.3.1. The removal of seabed vegetation and its accompanying animal life may be regarded by scuba divers and snorkelers as aesthetic degradation. Of more importance, however, is the ecological impact.

1.2.4. Ecological Considerations

1.2.4.1. Damage caused by dredging can be severe, and extend over a large area. Within the immediate site of the dredging operation, recovery by marine biota is dependent upon the type of operation utilized. Deep hole dredging more than often creates 'dead pockets', which are not reclaimed by biota, whereas shallow dredging appears to present less damaging consequences.

1.2.4.2. Even some distance away from the dredging site, however, reef communities may be destroyed by a resulting reduction in photosynthesis, caused by the suspension of disturbed sand particles, and by the physical smothering of the reefs. The dredging of coral sand from Road Bay, for example, may well have created the impoverished areas of marine flora and fauna in the Slaney area (Richards and Dumbleton, 1972, F10).

1.2.5. Social and Cultural Considerations

1.2.5.1. Dredging operations in the vicinity of Road Town has led to the uncovering of an historical marine wreck and relics (the H. M. S. Nymph)

It is quite possible that other wrecks will be found during future dredging activities.

1.2.5.2. Those reefs that may be damaged by dredging, however, are also part of the society's heritage, and as such should be protected as fully as is feasible.

1.2.6. Economic Considerations

1.2.6.1. The potential of dredged material as a valuable export commodity for the Territory is considerable, both in terms of Government royalties and overseas income. Also, a cheap and reliable source of sand can only benefit the domestic construction industry.

1.2.6.2. The cost to the Government of enforcing any dredging regulations should be covered by the permittee.

1.2.7. Recommendations

1.2.7.1. Although the guidelines pertaining to dredging activities in the Land Development Control Guidelines are thorough and extensive, these should be further enforced by a simple amendment to the existing Mining Ordinance (1972) to include dredged minerals. A provision against the polluting of water, so as to be "injurious to human, animal or vegetable life", exists already in the above Ordinance, and should be construed to include the protection of reef communities.

1.2.7.2. No regulations exist pertaining to the types of dredging that should be allowed, nor in which areas within the Territory should dredging be permitted or prohibited. In the view that some dredged areas will be able to renew themselves naturally, while others will not; that dredging operations in certain areas will be more detrimental to the surrounding marine environment than in others; and that certain types of dredging are more detrimental than others, there is a need for such regulations.

1.3. Removal of Sand from Beaches

1.3.1. Existing Legislation

1.3.1.1. Under the Beach Protection Ordinance (1960), the Governor in Council may declare any beach or seashore in the Territory to be protected. Once protected, no sand, stones, shingle or gravel may be dug or removed without a written permit obtained from the Ministry of Natural Resources and Public Health.

1.3.1.2. The Protected Beaches Order (1961), under the provisions of the above Ordinance, declared 17 beaches to be protected in Tortola and Beef Island, 13 beaches in Virgin Gorda, 3 in Jost Van Dyke, and 1 on Cooper Island. In addition, all the beaches were declared protected in Anegada, Little Jost Van Dyke and seven other smaller islands.

1.3.1.3. By further Statutory Orders, the beaches of Guana Island and Peter Island were declared protected in 1962 and 1963 respectively.

1.3.2. Existing Conditions

1.3.2.1. In the recent past, permits have been granted for the removal of beach material from Brandywine Bay, Camæ Garden Bay, Long Bay (Belmont), Brewer's Bay, and Cappoon's Bay - all in Tortola, and previously declared as protected beaches - and from one in Virgin Gorda near Spanish Town.

1.3.2.2. In practice, however, sand removal ('propping') occurs on both protected and non-protected beaches, with or without permit. Brewer's

Bay beach is rapidly deteriorating through its utilization for local construction activities. Other beaches, where no permits have been granted, display obvious signs of beach removal. One is Josiah's Bay, where in late 1974 the illegal removal of sand for export to St. Thomas was halted by Government action. Again in February 1975, however, reports were made of beach removal from the same location. Sand removal is also notable in the Little Apple Bay area.

1.3.2.3. In Virgin Gorda, the Government has opened up a road to Copper Mine Bay to allow access for trucks to remove sand. The bay is situated on the eastern side of the valley (away from the popular beach areas on the western side), consists of relatively coarse sand, is partly overgrown with vegetation, and cannot be considered an aesthetically outstanding beach.

1.3.2.4. Sand purportedly is taken from Handsome Bay, one of the few other beaches in Virgin Gorda allowing easy access to heavy vehicles.

1.3.3. Future Development

1.3.3.1. Around 1970, an attempt originating within the Government was made to further protect beaches from sand removal. It was not fully agreed upon at the time, however, whether to protect all beaches in the Territory, or whether to protect listed beaches. This dichotomy of approach has still to be finally resolved, and until resolved could hamper future legislation.

1.3.4. Aesthetic Considerations

1.3.4.1. The Territory's beaches undoubtedly form one of its outstanding natural assets. The aesthetic impact of large-scale 'propping' is easily perceived, as is witnessed at Brewer's Bay.

1.3.4.2. Included amongst those beaches for which permits have been issued are Cane Garden Bay and Long Bay (Belmont). Both are probably among the most beautiful beaches in the Territory and both should be 'protected' in the fullest sense.

1.3.5. Ecological Considerations

1.3.5.1. The rate of renewal of beach material is far from uniform throughout the Territory and depends upon several factors - including the speed, intensity and direction of swell and currents, the marine bedrock configuration, and local headland topography.

1.3.5.2. The best beaches within the Territory generally occur on the northern coasts, where beach renewal is the most rapid. Those beaches located along the southern shorelines, where swell activity is less pronounced, experience a far slower turnover - and hence renewal - of beach material. An example is Well Bay, to the South-West of Beef Island Airport. Its beach material was used for the construction of the submarine base in St. Thomas in 1942. Over thirty years later, it remains a coral beach, without having renewed itself. Similarly, it is doubtful whether sand renewal at Copper Mine Bay will occur readily.

1.3.6. Social and Cultural Considerations

1.3.6.1. At present, it is extremely difficult for the Beach Protection Ordinance to be upheld - not only because the Police are understaffed for the task, but also because public help generally is not readily forthcoming; an example is the Josiah's Bay incident in early 1975. As of yet, it would appear that the social long-term value of beaches is outweighed by their short term economic potential.

1.3.7. Economic Considerations

1.3.7.1. The removal of a small amount of sand, free of charge, by a permit holder, probably causes little damage - if any - to the beaches. The amount of illegal 'propping' would appear to be responsible for most of the present damage. Because beach removal is such a cheap and convenient way of obtaining sand, however, it is doubtful whether economic inducements alone will curtail the practice.

1.3.7.2. Although, ecologically, authorized removal of sand from the northern shores would be better (if not desirable) than from others because of more rapid beach renewal, this could well have a serious impact on the tourism trade.

1.3.8. Recommendations

1.3.8.1. Legislation prohibiting the removal of sand from all but a few chosen beaches such as Copper Mine Bay would simplify the present task of

policing, where both legal and illegal 'propping' may occur on the same beach. Where no beach on a particular island meets the criteria of easy access, little aesthetic value, as well as little recreational use, then 'propping' should be severely limited, if not prohibited, on that island.

1.3.8.2. The 1972 Mining Ordinance was cited by the Government in preventing sand removal from Josiah's Bay. Since it is of question whether in fact sand and other beach material are included under the existing Ordinance, the latter should be amended to definitely stipulate such materials.

1.3.8.3. Policing alone will not prevent illegal beach removal. Public support is required, and could be increased by a publicity campaign through the existing media directed against the practice.

1. 4. 4. Aesthetic Considerations

1. 4. 4. 1. If prospecting is successful, some of the oil rigs constructed would be visible from adjacent shorelines, especially those of Anegada.

1. 4. 5. Ecological Considerations

1. 4. 5. 1. An ever-increasing - if not large - risk is incurred over time with regard to oil spillage from offshore drilling operations. The risk of beach pollution would be greater if the rigs were situated to the east of the main chain of islands, because of the prevailing winds and currents (see the section, 'Oil Pollution').

1. 4. 5. 2. It should be mentioned that oil slicks originating from accidental spillages are few in comparison with those caused by deliberate discharge from vessels at sea. Any landing and loading activities at Anegada or any other island would be a pollution risk, however.

1. 4. 5. 3. The Petroleum Mining Ordinance (as amended, 1973) already provides for the establishment of a safety area around any petroleum mining installation erected on the sea bed.

1. 4. 6. Social and Cultural Considerations

1. 4. 6. 1. These are discussed indirectly under subsections IV and VII.

1. 4. 7. Economic Considerations

1. 4. 7. 1. Although little direct employment would result for British Virgin Islanders, general employment in the economy would certainly increase with a major oil or gas find.

1. 4. 7. 2. Compensation for any damage to public or private property and wildlife, as well as for the cost of cleaning up operations that result from mining activities, should be provided for in the Petroleum Mining Regulations.

1. 4. 8. Recommendations

1. 4. 8. 1. Because of the complex and violent geologic history of the region, oil reserves - if found - may be dispersed in several small pockets. Exploitation of these pockets should be tempered by the amount of risk of pollution from each location. In certain zones, the liability of damage to beaches and reefs, in the event of an oil spill, would be greater than in others.

1. 4. 8. 2. It is therefore suggested that if several oil pockets of exploitable size are discovered, an analysis of the dispersal patterns of surface currents and winds be made, in order to divide the territorial waters into zones of pollution hazard to the islands. Mining in a high hazard area could be burdened with a higher 'site tax' or royalty than in a low hazard area. This procedure would not be particularly novel, in that the same

principle of risk accounting is used in all private insurance schemes. In this case, however, the risk to public facilities would be accounted for.

1.4.8.3. In the possibility that pollution emanating from the Territory's activities may affect neighbouring islands, a Petroleum Mining (Oil Pollution Compensation) Bill - similar to the presently pending Merchant Shipping (Oil Pollution Compensation) Bill - could be introduced, setting up an international compensation fund.

1.5. Other Activities

1.5.1. Salt is still traditionally harvested from shallow ponds at Salt Island, and small quantities are sold in the other islands.

1.5.2. A more destructive activity that is undertaken on the larger islands is the stripping of topsoil for sale, primarily to the large hotels for horticultural use. In Virgin Gorda, the topsoil originates from the southern part of the Valley, and is sold for \$16.00 to \$18.00 per cubic yard. This practice not only destroys the protective vegetation, but also would appear to contravene the Government's policy of encouraging agriculture. The Islands hardly have enough soil for it to be abused in this fashion.

2. DEVELOPMENT AND CONSTRUCTION

2.1. Existing Legislation

- 2.1.1. The Building Ordinance (1955) established the Building Authority, to review proposed building plans and give permission for construction. Amendments to the Ordinance (1967 and 1969) provide for regulations concerning the dimensions of a building, its proportion to plot area, and the methods and materials to be used.
- 2.1.2. The intention of the Land Development (Control) Ordinance (1969, as renewed 1974) is to "make provision for the orderly and progressive development of land, whether urban or rural, to preserve and improve the amenities thereof; for the grant of permission to subdivide or develop land and for other matters connected therewith."
 - 2.1.2.1. Under the Ordinance, the Land Development Control Authority is established, from which approval is required for the development or sub-division of any land, other than that for agricultural purposes and forestry; for the display of any advertisement on a building or hoarding; and for certain types of development within stipulated distances from any airfield.
- 2.1.3. In addition, the Land Development Control Guidelines (1972) outline the requirements needed for development permission to be granted by the Authority. Among others, these cover the height and density of buildings, parking spaces, sewage systems, and shoreline alter-

ations or modifications of submerged lands. The Guidelines also establish a land use policy to help determine which types of development should be approved of in different types of areas. (Appendix III)

2.1.4. The Wickham's Cay Development Authority Ordinance (1975) provides for the establishment of an Authority to promote the control and development of the Wickham's Cay Estate, whose assets were taken over by the Government in 1971.

2.2. Existing Conditions

2.2.1. Physical development plans for the Territory have been drafted by the former resident UNDP Town and Country Planner (Mr. Ove Anderson), and include a Draft Territorial Plan, a Master Plan for East End/Long Look, and the Road Town Master Plan, which has been approved by the Government. A Master Plan for the Valley, Virgin Gorda, as well as various 'action area' plans are underway. These plans present a rational and sound mode of development for the Territory, and should be adhered to as closely as possible.

2.2.2. The Land Development Control Guidelines are policy outlines only, and not regulations; to a certain extent, this is advantageous in allowing an amount of flexibility in considering applications. At the same time, they do provide justification for accepting or rejecting a development application. The Authority itself has legal jurisdiction to enforce its decisions, and recently upheld an order in court for the removal of a billboard from Wickham's Cay I.

- 2.2.3. Because of the recent inception of the Guidelines (1972), many of the larger development schemes - especially those involving land-fill - were completed without their control; these include Wickham's Cay, Slaney (Prospect) Reef, and Peter Island Yacht Club. The strict guidelines under the section, Shoreline Alterations or Modifications of Submerged Lands (see 'Offshore Dredging') have since been implemented to prevent undesirable land fill schemes, including at least three in the Sea Cow Bay area.
- 2.2.4. The procedure for obtaining development permission has become more complex with the establishment of new departments in recent years. Previously, it was sufficient for an applicant to obtain an Alien Land Holding Licence (if he were a 'non-belonger'), together with a permit from the Building Authority if the proposed development was in Road Town, East End/Long Look, or within 30 feet of a public road.
- 2.2.4.1. i) At present, in order to obtain an Alien Land Holding Licence, the following steps must be taken:
- a) the development scheme is to be submitted to the Town and Country Planning Office and approved by the Land Development Control Authority;
 - b) the land involved is to be registered with the Survey Department;
 - c) clearance is to be given by the Ministry of Natural Resources and Public Health.

2.2.4.2. Once the licence is issued:

- a) the land is to be surveyed by a licenses surveyor, and his plans checked by the Survey Department;
 - b) if subdivision of a land plot is involved, approval must be obtained from the Land Development Control Authority;
 - c) the ownership, location and size of the land is to be filed with the Registrar's Office.
- iii) In addition, approval for buildings and facilities must be obtained from the Building Authority, the Public Health Department, and - if on Wickham's Cay - from the Development Authority.

2.3. Future Development

- 2.3.1. Because of the multiple steps and departments involved for development approval, confusion often arises, especially with regard to the respective roles of the Building Authority and Land Development Control Authority. For six months in 1970, the two were integrated, but then separated. Towards the end of 1975, it is anticipated that the two Authorities will again be incorporated into one.
- 2.3.2. At the end of August, 1974, a Land Policy (Lands) Committee was set up to advise the Government on the future use of Crown Land (including the sea bed), its methods of disposal and rental, and to advise on the prevention of alienation of Crown & private land. Altogether, some 39% of the Territory's land is still vested in the Crown, although the amount varies from island to island: 5% in Tortola, 9% in Jost Van Dyke,

61% in Virgin Gorda, 99.9% (all but 9.5 acres) in Anegada and 100% in many of the smaller out-islands. A report to the Government is expected in the near future.

- 2.3.3. Pending legislation includes the Condominiums Ordinance and the Buildings Ordinance.

2.4. Aesthetic Considerations

- 2.4.1. Most development schemes undertaken are relatively small in scale, and consideration is given to their aesthetic aspects by the concerned authorities.
- 2.4.2. The unsightly development of mobile home parks is prevented under the External Trade (Import Restriction) (Caravans) Order (1969), which prohibits importation into the Territory of any caravan (mobile home) except with a licence and subject to the conditions made.
- 2.4.3. In the industrial sector, some concentration is occurring on Wickham's Cay; these concerns, as well as the new dock facilities at Port Purcell, are generally well maintained.

2.5. Ecological Considerations

- 2.5.1. Of potentially major ecological importance is the practice of land fill ('reclamation') associated with coastal development schemes and garbage dumps. The several land fills in Road Bay - such as Slaney Reef, Drake's highway, Queen Elizabeth Park, Wickham's Cay (approximately 60 acres), the Port Purcell area and Caribbean Service Yachts Marina - have resulted in the near complete removal of a once extensive mangrove area, and with it a sizeable bird nesting and fish breeding nursery area. The declining fish yields experienced by local fishermen must at least be partly contributable to the removal of these mangroves.

The ecological importance of both mangroves and salt ponds is being increasingly realized by the Government, however, and strict enforcement of the already existing guidelines should minimize the adverse impact of future landfill schemes.

2.6. Social and Cultural Considerations

- 2.6.1. A recent and encouraging trend in building has been the incorporation of some of the more traditional architectural styles of the region, such as the use of gable roofs and archways (although the latter are more reminiscent of Cruzan architecture than Tortolan). Some good examples are the newer buildings on Wickham's Cay I, which appear more in sympathy with their cultural surroundings than their predecessors.

2.7. Economic Considerations

- 2.7.1. Although many of the construction materials for the generally high-cost buildings are necessarily imported, a conscious effort - both by Government and private concerns - is being made to produce or process at least some of the needed materials within the Territory. The local manufacture of concrete blocks and furniture is undertaken, and encouraged under legislation (The Encouragement of Industries Ordinance). Almost all of the wooden fixtures used in the largest development presently under way (Prospect Reef) are being made on site by

local craftsmen. This approach should be further encouraged for its obvious benefits to other sectors of the economy.

2.7.2. Landfill operations are relatively low-cost, and produce land ideal for many types of development. They are commonly located central to urban areas and in regions where existing flat or gently sloping land is scarce, and hence expensive. On the other hand, mangrove and other wetland areas traditionally have been regarded as of low - or even negative - value in that they harbour mosquitoes. Although advantageous for construction, however, the gross (rather than net) costs of landfill should be considered, which may include reduced fish yields, damage to reef ecosystems, the destruction of rich wildlife habitats, and reduced access to the sea.

2.8. Recommendations

2.8.1. In an attempt to prevent confusion and departmental overlapping, the Town and Country Planner has suggested procedural modifications for application approval ('Legislation and Administration', Draft Territorial Plan). The Town and Country Planning Department would act as a centre for application and information, and hold a single file for each applicant (instead of the present many files scattered in various departments). The applicant's file would be given to, and returned by, each of the concerned departments. As Mr. Anderson points out,

2.8.1. (cont.)

the use of one comprehensive file system would allow for a continuous check on the course of the application, and each department would be more aware of what the other was doing. We recommend these suggested procedural modifications. (See Appendices IVa and IVb.)

3. DISPOSAL OF LITTER, WASTE AND POLLUTANTS

3.1. Solid Waste Disposal on Land

3.1.1. Existing Legislation

3.1.1.1. Under the Public Health Ordinance (1969), the Central Board of Health was established, and may make regulations for preventing the accumulation of dust, filth, ashes and refuse on premises; for prescribing the type of dustbins or refuse collectors to be used; and for facilitating the removal of house refuse by scavengers.

3.1.1.2. Nuisances listed under the Ordinance include waste receptacles, exposed empty bottles, cans and other litter that may serve as a shelter or breeding place for insects or vermin that carry infectious diseases, and any collection of still water within inhabited areas that is not properly covered or screened, stocked with fish, or covered with a continuous film of oil.

3.1.1.3. It is unlawful under the Abatement of Litter Ordinance (1970) to litter in any public place, except by disposal in the receptacles to be provided for under the Ordinance. Any person transporting litter must ensure that it is not scattered. Also, it is unlawful for a person to allow any accumulation of litter on his premises that may endanger the public health.

3.1.1.4. Under the Derelict Motor Vehicles (Disposal) Ordinance (1970, as amended 1975), the owner of an abandoned or disused vehicle is liable for its removal. If the vehicle is not removed within a stipulated per-

iod after the Public Transportation Commission serves notice, he may be fined, and forced to pay the cost of removal. The Commission has the power to dispose of the vehicle if not claimed.

3.1.1.5. The section Garbage Disposal of the Land Development Control Guidelines (1972) states that all householders, tenants, or owners should provide a suitable garbage bin with cover, and ensure its protection from being knocked over. Wherever feasible, a developer should provide a garbage collection and disposal service, and must provide for a disposal reservation area.

3.1.2. Existing Conditions

3.1.2.1. Improvements in refuse collection have occurred since 1970, at which time one garbage truck and team were responsible for the whole of Tortola with the exception of Cane Garden Bay and Carrot Bay, which contracted privately. In 1971, collection and disposal were undertaken by private contractors for almost all of Tortola and half of Virgin Gorda at a cost of \$109,369.00 to the Territory. Since 1972, the Public Health Department gradually has taken over full responsibility, and there are now weekly services for Virgin Gorda and rural Tortola, with daily collections in Road Town. The other islands have no public collection service.

3.1.2.1.1 Tortola

a) The salt pond at Duff's Bottom serves as the official garbage dump for the island. Although adjacent to Drake's Highway,

the area is screened from view. Many unofficial dumps exist, especially in the ghuts and in wooded wetland areas (such as at Flamingo Pond, away from the road).

- b) Litter receptacles are provided along Main Street, Tortola, but few are located elsewhere in the island. These receptacles and private garbage bins occasionally are knocked over by wandering animals, including nightly foraging donkeys¹. However, the streets in Road Town are kept diligently clean by the employed sweeper.
- c) The haphazard abandonment of derelict vehicles has been a common practice in the past. Useful work of clearing the vehicles has been undertaken both by the Rotary International and Lion's Club. In one area of Road Town (opposite Smith's Store), however, as soon as one derelict vehicle was removed another took its place. It remains to be seen how effective the amendment to the Derelict Motor Vehicles (Disposal) Ordinance will be.

3. 1. 2. 1. 2. Virgin Gorda

- a) Two dumps are presently in use - one at Copper Mine Hill serving the St. Thomas Bay area, and the other at The Bond, serving Gun Creek.

¹The Pound (Amendment) Ordinance (1972), prohibiting owners to allow their stock to stray in public places, is non-effective.

- b) The only litter receptacles existing are those that have been placed by public-minded groups, such as the Boys' Club, the B. V. I. Hotel and Tourist Association, and the Beautification Committee. Unless cleared regularly, however, litter builds up and eventually overflows.
- c) Virgin Gorda is probably the one island that suffers most from the littering of its beaches, especially by visiting yachtsmen, campers, and cruise ship passengers. The only cleaning up is undertaken by a group of concerned individuals at Spring Bay and the Baths. For a brief period before March, 1975, an agreement between the B. V. I. Hotel and Tourist Association and the Tourist Board existed for financing the removal of litter, but this was terminated after it became clear that the former organization was in effect, paying all of the expenses.
- d) The abandonment of derelict vehicles does not pose such a problem as in Tortola, although a few can be seen, such as the one on the Virgin Gorda Peak Road. Derelict boats are found, but these generally are regarded as more "picturesque" than rusted-out automobiles.

3.1.2.1.3. Anegada

- a) Garbage is of a small volume, and some is disposed of in a dumping site near the Settlement. The remainder is scattered haphazardly, serving primarily as goat food, and constituting a health hazard.

3. 1. 2. 1. 4. Other Islands

a) Jost Van Dyke is served by a dumping site near Great Harbour. Garbage on most of the other inhabited islands is either burned, buried or haphazardly dumped.

3. 1. 3. Future Development

3. 1. 3. 1. A Bill pending would regulate camping activities and associated litter.

3. 1. 3. 2. Tentative planning permission has been granted by the LDCA for the establishment of an African kraal-type, permanent camp site in Virgin Gorda catering primarily to younger and/or less affluent tourists. If successful, this development may have a beneficial impact in controlling unregulated camping and littering.

3.1.4. Aesthetic Considerations

3.1.4.1. From comments made by visitors in Tortola and Virgin Gorda, it is apparent that the visual impact of litter is high. Many of the tourists visit the Territory because of its near pristine quality; a deserted but littered beach may be just as off-putting to these visitors as one which is heaving with people.

3.1.5. Ecological Considerations

3.1.5.1. Garbage disposal in a wetland area has the same impact as any other landfill process. See 'Development and Construction' (5.1).

3.1.6. Social and Cultural Considerations

3.1.6.1. Untreated solid waste makes an excellent haven for disease-carrying rodents and insects. Discarded cans and broken bottles in particular are highly suited for harbouring mosquito larvae.

3.1.6.2. In an attempt to discourage littering, public service messages are broadcast over the local radio station. Simple but effective in approach, they are aimed at associating litter with the maintenance of public health, and may meet partial success.

3.1.7. Economic Considerations

3.1.7.1. The disposal of garbage in any small insular system is difficult and costly. Certain ad hoc measures may be taken in order to penalize the pockets of litterers, and these are discussed under 'Recommendations'.

3.1.7.2. The only long-term and comprehensive policy is to regard solid waste as a potential resource of the Territory. A recycling plant, once established, would require little, if any, financial input from the Government. In Alexandria, Virginia, a large plant has been established by a private concern at a cost of \$155,000.00; it can accommodate 100 tons of garbage a day, and make a profit for its owners of \$11.00 per ton of recycled glass, paper and metals. A plant serving the Territory need be far smaller, and hence less expensive to establish.

3.1.8. Recommendations

3.1.8.1. As a member of the Government remarked, legislation is littered with Ordinances that are not enforced. More stringent enforcement of the existing Ordinances is the obvious first step.

3.1.8.2. More litter receptacles - that are regularly emptied - are needed, especially in the vicinity of the more popular beaches. Road side receptacles, to be used by motorists, would also be beneficial. Use of the existing receptacles in urban areas could be encouraged by the application of a bright coating of paint in order to make them more visible.

3.1.8.3. When the Abatement of Litter Ordinance (1970) was being drafted, consideration was given to the control of unsightly waste on private property; unfortunately, this was omitted from the final draft. In order to enhance the beauty of particularly the urban areas, it is

recommended that the Ordinance be amended to include a provision similar to that in the Amenities (Control of Dumps and Ruinous Structures) Act (1950) of Bermuda:

"No person shall cause or allow a dump or ruinous structure to be or to remain on any premises owned or occupied by him in any case where the dump or structure is unsightly and is conspicuous to a material degree in view of persons in any public place in the vicinity."

3.1.8.4. The discarding of drink containers could be reduced by making them returnable. A scheme could be devised whereby a deposit charge is imposed by Customs officers on the wholesaler, which is then passed on to the retailer, and in turn included in the price to the customer. The consumer would be reimbursed upon returning the containers to central collection points, or to a recycling plant if established. The scheme would also encourage the public to pick up already discarded containers.

3.1.8.5. If the recent amendment to the Derelict Motor Vehicles (Disposal) Ordinance proves ineffective, other measures could be taken. One would be whereby the owner of a car pays a deposit at the time of its importation, to be returned only after the car is properly disposed of. If the owner sells the car, his deposit is returned, but the new owner has to pay a similar deposit. An even more effective measure, which would apply to those vehicles already in the Territory, would be to prohibit a person from purchasing a new car until his old one was properly disposed of. Upon disposal, a permit would be issued,

to be shown to the Customs officials before the replacement vehicle was allowed entry.

3: 1. 8. 6. Many hotels and restaurants with a high garbage disposal demand would best be served by a private, rather than public, collection service, which would be financed by the businesses served. Not only would this alternative service lessen the burden placed upon its public counterpart, but also offer a more complete service to the businesses, especially those in Virgin Gorda.

3.2. Disposal of Waste and Pollutants at Sea

3.2.1. Existing Legislation

3.2.1.1. The Harbours and Wharves Ordinance (1955) regulates against "the discharge of refuse and other articles from, and the pumping of bilges by, vessels in harbours". It applies only to harbours that have been declared by the Governor in Council.

3.2.1.2. Under the Petroleum Ordinance (1972), the Governor may make rules concerning the safe mooring of ships carrying petroleum in territorial waters; the lading and unloading of ships with petroleum; and the keeping of petroleum on board motor boats.

3.2.2. Existing Conditions

3.2.2.1. Although a majority of the large number of bare-boat charterers and boat owners act in a responsible manner concerning waste disposal, a few instances of irresponsible action have been reported. The 'Flying Cloud', a Windjammer barquentine, was twice reported in February, 1975 - once for dumping its garbage off Guana Island, and the other for pumping out its bilges between Salt and Cooper Islands. The schooner 'Yankee Clipper' (another Windjammer ship) has been photographed with its crew dumping garbage into the Bight, Norman Island. The 'Gorda Peak' (a locally owned landing barge) while retarring its decks early in 1975, apparently dumped all of the old tar into St. Thomas Bay, Virgin Gorda, as well as pumping out its bilges.

3.2.2.2. The yacht charter concerns have responded strongly to any littering by their clients. They enforce their own anti-litter regulations, are keen to report instances of irresponsible waste disposal, and on a few occasions have been known even to fine those clients who have dumped garbage.

3.2.2.3. Oil pollution of beaches occurs mostly on Anegada, which is in the path of oil-bearing currents. A thick scattering of tar balls is found along the north-western beaches.

3.2.3. Future Development

3.2.3.1. Three Ordinances are pending with relation to oil pollution at sea: the Merchant Shipping (Oil Pollution) Ordinance, the Merchant Shipping (Oil Pollution Compensation) Ordinance, and the Prevention of Oil Pollution Ordinance.

3.2.4. Aesthetic Considerations

3.2.4.1. Since most of the garbage and waste dumped at sea eventually is washed ashore, its impact on a beach may be just as severe as that dumped directly by beach users. A walk along the southern side of Wickham's Cay I is instructive in showing the type of litter, debris and tar that can accumulate.

3.2.5. Ecological Considerations

3.2.5.1. Oil pollution is particularly hazardous to marine life and seabirds, often causing mortality. A build-up of pollutants in marinas and harbours may destroy fragile ecotone communities, which in turn may disrupt the food chain for other species.

3.2.6. Social and Cultural Considerations

3.2.6.1. Of little impact, other than on aesthetic values, and the loss of local marine and other wildlife.

3.2.7. Economic Considerations

3.2.7.1. Because of limited flushing action by the sea in Road Bay, oil pollutants and other waste could increase to a level at which the still remaining mangroves no longer served as fish nursery areas. The impact on fish yields would be as severe as if the mangroves were destroyed. Disruption of the food chain would also cause a declining fish yield.

3.2.8. Recommendations

3.2.8.1. The Government is hesitant to legislate for bays and coves other than declared harbours, in that by doing so it may obligate itself to provide extra services. However, further legislation is urgently needed to prohibit littering and other dumping within Territorial waters.

3.2.8.2. The pending oil pollution Ordinances should help to inhibit tanker cleaning on the open sea, as well as provide for compensation for oil slick damage.

3.3. Sewage Disposal

3.3.1. Existing Legislation

3.3.1.1. Under the Public Health Ordinance (1969), every local authority is to ensure the sanitary upkeep of all sewers, privies, urinals and other conveniences, as well as the maintenance of an efficient effluent removal service. Adequate provisions must be made for each building with relation to sewage disposal. Dwelling houses are to be provided with a "sufficient" privy, according to the regulations of the Central Board of Health. Provisions are made in the Ordinance for the filling up of cess pits.

3.3.1.2. The Land Development Control Guidelines (1972) include regulations regarding sewage disposal, but these pertain primarily to planned rather than existing buildings. A waterborne sewage system linked to a septic tank, or a more sophisticated treatment facility, is to be used, except where a comprehensive sewage system already exists. Septic tanks must be located a stipulated distance away from a building, and to be located so as to enable eventual connection to a main sewage system. Technical wastes may require special treatment before discharge. All new sewage disposal plans must be approved by the Land Development Control Authority.

3.3.2. Existing Conditions

3.3.2.1. The prevailing sewage disposal conditions in the Territory can only

be described as unsatisfactory, as has been mentioned previously in the Richards and Dumbleton Report (1972), and reflected by the data presented in the 1971 Medical Health Department Survey (see table below).

TABLE I: SEWAGE FACILITIES, 1971

	(% of buildings)			<u>Virgin Gorda</u> Total
	Road Town	<u>Tortola</u> East End/ Long Look	Island Total	
Served by:				
main sewage system	4	0	1	0
septic tanks	72	44	47	18
sewage pits	13	34	24	49
no sanitary facilities	<u>11</u>	<u>22</u>	<u>28</u>	<u>33</u>
	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

3.3.2.2. Tortola

3.3.2.2.1. The data suggests that a latrine programme, which was incorporated in the Health Programme of 1968, met with limited success. In 1971, among the areas with the highest percentage of buildings served by no sanitary facilities were Carrot Bay (62%), Brewer's Bay (55%) and Can Garden Bay (47%). In such coastal areas, many of the latrines existing discharge directly into the sea within a few feet of the shoreline.

In areas away from the coast, the bush and ghuts are most common in the absence of facilities, although the excrement is usually burned. Most of the excrement dumped into the ghuts eventually is flushed down by stormwater to the alluvial aquifers, and although percolation through the alluvium acts as a natural filter, some contamination of

the groundwater is inevitable (see Mather, 1971, p. 19).

3.3.2.2.2. Road Town

- i) As a result of provisions made at the time of construction of Wickham's Cay, the adjacent properties from Treasure Isle Hotel to the 'Poop Deck' (now renamed 'Friends') are served by the Cay's sewer system. A more comprehensive system was envisaged originally (Neervort, 1967), to extend from Slaney Point to Fort Hill, as well as serving Pasea Hall Estate, Long Bush and Huntum's Ghut. According to Richards and Dumbleton (1972, F.3), "only certain sewers have been laid, and the lines of these have departed considerably from those proposed in the Report".
- ii) The Wickham's Cay facilities have proved a mixed blessing. The large landfill prevented direct drainage to the sea, and some properties continued to discharge their raw effluent to the old shoreline, or what is now the stormwater ghut between Wickham's Cay I and Main Street. Until recently, waste was still dumped into the ghut, and its dredging to below the level of the outfall had resulted in a stagnant, odorous pond. This has now been rectified by the construction of a storm sewage system.
- iii) Sewage from the old Administration Building and Customs House is discharged directly into the harbour without treatment. Richards

and Dumbleton found bacteria in samples from Road Harbour too numerous to count, and concluded that the area in time could become severely polluted. The report recommended chlorination of effluent prior to discharge, and this is presently undertaken.

iv) Septic tanks in the Huntum's Ghut and Long Bush Ghut housing areas are situated directly above the alluvial aquifer. The danger of its contamination by septic tank overflows and crude sewage was increased in 1970, when the Road Town water supply system was extended to the Huntum's Ghut area. Richards and Dumbleton (1972, F.4) commented that:

"typhoid has occurred in the past and on a number of occasions there have been major outbreaks of stomach disorders. Although these could not definitely be attributed to the lack of adequate sewage facilities, this could well have been a contributory factor if not the main cause.... With the provision of an improved and extended water supply system, the present unsatisfactory state of affairs will become critical."

3.3.2.2.3. The near completed Prospect Reef Hotel at Slaney has its own sewage treatment plant and recycling of water.

3.3.2.2.4. East End - Long Look

i) Because as yet no piped water system exists, the danger of ground-water contamination from septic tank overflow is less than in Road Town, but nevertheless present.

3.3.2.3. Virgin Gorda

3.3.2.3.1. As shown in Table 1, about half of the island's buildings in 1971 were served by sewage pits; one-third had no sanitary facilities whatsoever;

and less than one-fifth were served by septic tanks. The hotels of Little Dix and Biras Creek are served by their own sewage treatment plants.

3.3.2.4. Anegada

3.3.2.4.1. Sewage is disposed of by septic tanks and pits. The small amount of effluent percolating into the soil causes minimal contamination to the groundwater. Because sand and porous limestone are poor filters, however, and because of the high water-table, a future increase in the use of existing types of sewage facilities would pose a health hazard.

3.3.2.5. Other Islands

3.3.2.5.1. With the exception of a sewage package plant serving Peter Island Yacht Club, a few septic tanks exist, but more common use is made of sewage pits, the bush and the sea.

3.3.2.6. Marinas and Harbours

3.3.2.6.1. All of the marinas in the Territory have toilet facilities for yachtsmen on shore, and the majority of people use these facilities rather than the heads on their boats. At Virgin Gorda Yacht Harbour, effluent from the toilets on shore is pumped to a treatment plant, and thence to a sewage farm. The treated water is used for irrigating ornamental plants. Similarly, Peter Island Yacht Club has a sophisticated treatment facility, and grey water is used for flushing purposes.

3.3.2.6.2. Some of the marinas have installed a sewage pump-out system for every berth, but as yet no efficient boat fittings are available.

3.3.2.6.3. The effectiveness of natural sea flushing of a harbour depends upon its location with regard to prevailing winds and currents. In Virgin Gorda Yacht Harbour, wind action blows most of the floating effluent out to sea, whereas in Road Harbour, the prevailing onshore winds tend to push effluent back into the bay. Reference already has been made to the high bacterial count found in 1972 (see 2.23 iii)

3.3.3. Future Development

3.3.3.1. The Richards and Dumbleton recommendations have been accepted by the Government for both Road Town and East End-Long Look. The proposed sewage systems are expected to be adequate for demands until at least the early 1980's.

3.3.3.2. The report finds no justification for the expense that would be incurred in building a sewage treatment plant for either urban area at present. Instead, it recommends the use of chlorination and disintegrator pumps. According to the Public Works Department, however, a package plant is planned to be installed for the treatment of effluent carried by sewers in the John's Hole area.

3.3.3.3. Road Town

3.3.3.3.1. The report advocates three phases for development;

- i) Phase I will extend the existing sewage system to include Long Bush and Huntum's Ghut. The existing outfall to the south of

Wickham's Cay I, discharging 300 feet out at a depth of 30 feet, will remain in use.

ii) Phase II will extend the sewage system to Slaney, and the old outfall will be replaced by one at Slaney, to discharge 600 feet away from the shoreline at a depth of 55 feet below mean sea level.

iii) Phase III will extend the system from Treasure Isle Hotel eastwards to include Fort Hill and Baugher's Bay.

3.3.3.3.2. Combined tenders for Phase I and Wickham's Cay remedial works were submitted in April, 1975, but even the lowest bid was substantially higher than the funds allotted by the Government. Unless more funds become available, both the sewage improvement scheme and the remedial works may be subject to modification.

3.3.3.4. East End - Long Look

3.3.3.4.1. The report proposes a mains sewage system for the area. After passing through disintegrator pumps, the sewage will be discharged through a new outfall 1200 feet north of Hawks Nest at a depth of 30 feet.

3.3.4. Aesthetic Considerations

3.3.4.1. Untreated sewage has an unpleasant visual and olfactory impact, especially in the instance of floating effluent in harbours.

3.3.5. Ecological Considerations

3.3.5.1. Although chlorination of sewage undoubtedly is required under the present system, it does have a harmful impact on marine biota.

3.3.5.2. In making their recommendations for the proposed sewage outfalls, it would appear that the Richards and Dumbleton team gave careful consideration to their ecological impact.

3.3.5.2.1. The outfall serving Road Town will be located in an area of already impoverished marine biota. Moreover, sewage generally will be carried away from the shoreline. A possible site at Duff's Bottom was rejected because of the "potential high entrophic conditions on Sea Cow Bay and Nanny Cay reefs and in the mangrove communities of these bays, with concurrent effects of reduced biotic diversity, lowered fish yields, loss of highly productive Thalassia-algal assemblages and reduced water quality" (F. 8)

3.3.5.2.2. Similarly, the Hawks Nest outfall for the East End-Long Look area was selected as "the least likely to cause damage to shore-side or marine biotic communities" (F. 15).

3.3.6. Social and Cultural Considerations

3.3.6.1. It must be accepted that an epidemic risk is associated with the present sewage facilities, which will increase if a water mains system is installed in areas without the concurrent installation of a foul water drainage system. This has occurred already in the Huntum's Ghut area and is particularly dangerous because of its situation above the alluvial aquifer.

3.3.6.2. A polluted harbour or bay has social as well as aesthetic ramifications. Although Road Harbour is by no means as polluted as was Long Bay, St. Thomas, before the installation of a sewage treatment plant, lesser levels of pollution can be a health hazard to bathers.

3.3.7. Economic Considerations

3.3.7.1. The high cost of installing a mains sewage system and treatment plant poses a considerable problem for a small Territory receiving limited outside aid. The sole mains sewage system that exists was constructed by a private developer, but in all probability future development costs will have to be borne by the public sector alone.

3.3.7.3. As mentioned in connection with solid waste, sewage can be conceived of as a potential resource of the Territory. In St. Croix, a small experimental station has been established to process sewage: nitrogen and phosphorous compounds are extracted for use as farm fertilizer, and nutrients to support deep water algae,

which in turn support clams to be used for animal feed. After chlorination, the processed water is placed in ponds and allowed to percolate into the ground to recharge the aquifer. Although this scheme is still in the experimental stage, it shows promise for transforming sewage from a harmful nuisance into a positive asset.

3.3.7.3. As mentioned in the Richards and Dumbleton report, the cost to the property owner for connection to a mains sewage system will be appreciable, and legal action will be required to ensure that such connection occurs.

3.3.7.4. It is possible to successfully treat effluent at the source. In St. Lucia, the building codes have been altered to include 'destructor toilets', which use no water, but instead employ 'flash heat' destruction, reducing effluent to harmless ashes. Installation costs are relatively high (from US \$400 upwards), but operation is cheap (2¢ to 4¢ per flush). Although perhaps too expensive for many property owners, the toilet's use would benefit the community as a whole if employed as an intermediate measure in conditions similar to those of Long Bush and Huntum's Ghut.

3.3.7.5. Another solution for the above areas would be to provide toilets with a holding tank, which could be pumped out at intervals and the sludge transported to a sewage treatment plant.

3.3.8. Recommendations

3.3.8.1. As noted in the Town Planner's Territorial Plan Draft (1973, p. 5),

careful control is necessary over the future location of septic tanks for residences. In areas that are planned to be served by a mains sewage system, it would be wise to delay the introduction of a mains water system until the former is completed. In areas for which neither water nor sewage facilities are planned, large-scale developments should be discouraged, unless the developers concerned provide adequate facilities at their own cost.

3.3.8.2. In view of the possible existence of a largely untapped freshwater lens underlying part of Virgin Gorda, a general upgrading of sewage disposal facilities is needed if this potentially valuable resource is to be exploited in the future.

3.3.8.3. The early introduction of suitable fittings for waste pumping dock facilities is needed especially in Road Town, where in addition to the existing marinas one more is being constructed and one other envisaged.

4. WATER SUPPLY MANAGEMENT

4.1. Existing Legislation

- 4.1.1. By authority given under the Protection of Trees and Conservation of Soil and Water Ordinance (1954), the Governor in Council may declare any land to be a protected water area. Land may be declared as such in order to maintain water supplies within the area or on adjacent land; to maintain supplies in ghuts, springs, streams, watercourses, or reservoirs; to prevent the silting of sources of water supply; or to prevent or reduce the pollution of any water supply. The Water Areas Order (1963) lists six declared water areas, all of which are in Tortola.
- 4.1.2. The Road Town Water Supply Area Order (1958) delimits the area to be served within Road Town.
- 4.1.3. The Water (Market Square Supply) (Control) Regulations (1960) stipulates that no vehicle may be washed with use of the market square water supply.
- 4.1.4. Under the Public Health Ordinance (1969), it is the duty of each local authority to keep all mains water-pipes, sinks, syphons, taps and fittings in a sanitary condition and in good repair. Included as nuisances are houses not sufficiently supplied with fresh water; collection and storage receptacles that are injurious to health; waterworks that are not constructed, protected, placed, cleansed or disinfected

in accordance with the Ordinance; and eaves gutters or downpipes that allow a collection of water.

- 4.1.5. The Land Development Control Guidelines (1972) state that every building intended for human habitation is to be supplied with a storage capacity of 1,000 gallons per 100 square feet of roof catchment area. The developer is required to submit proposals acceptable to the L.D.C.A. for a complete supply and distribution water system, whether or not a treated supply is available, and must bear the costs of such proposals.

4.2. Existing Conditions

- 4.2.1. Rainfall - never copious - has diminished over the last few decades: during the period 1901 to 1950, average annual precipitation was approximately 53", whereas over the longer period 1901 to 1974 the figure dropped to 48".
- 4.2.2. The concept of mean average rainfall is of limited value in the British Virgin Islands, however, since wide fluctuations occur from year to year (94.2" in 1933, and 30.9" in 1973). In addition, monthly distribution is uneven: in 1974, of a total rainfall of 53", 83% fell in the last five months of the year. As a consequence, large fluctuations in ground water reserves occur.

- 4.2.3. Ground water is held in the Cretaceous and Eocene bedrock as well within superficial deposits (Mather, 1971). Within the stratified metamorphised volcanic rocks, ground water occurs only in the fractures and joints. Research undertaken by Jordan (1966) in St. Thomas suggests that water recharge to the bedrock may occur only once or twice each year as the result of a downfall of over 2 or 3 inches within a 24-hour period. Less heavy rainfall is dissipated by run-off, evaporation and soil intake, although alluvial aquifers are partially recharged.
- 4.2.4. There are no rivers in the Territory, but perennial springs occur in the upper reaches of many of the ghuts.
- 4.2.5. Apart from the Road Town area with its piped water system and a private desalinization plant in Virgin Gorda, the Territory is dependent for water upon shallow wells, and roof catchment and storage tanks. The Public Health Department tests the quality of water in all wells not connected to the mains system, as well as private cisterns upon request. Wells used for the Road Town mains supply are the responsibility of the P. W. D.
- 4.2.6. The danger of contamination to the water supply by present sewage disposal practices has been mentioned previously, as well as the risk of extending a mains water system into an area not served by a mains sewage system (see Sewage Disposal). Another source of water contamination emanates from the high saline content of the bedrock, which can result in brackish water during times of drought.

The normal salinity level of the water is permissible, however, averaging 380 parts per million; although this is 130 parts higher than the preferred standard, it is still 120 parts lower than the maximum allowable limit set by the World Health Organization.

4.2.7. Tortola

4.2.7.1. Approximately 65% of the population relies upon cistern water, with the average capacity of the cisterns being about 10,000 gallons. Other residents rely upon wells or water delivered from Road Town. (Draft Territorial Plan, 1973)

4.2.7.2. Richards and Dumbleton found no instance where cisterns were located in close proximity to septic tanks, and generally the cisterns were well protected from external sources of pollution. They concluded from sample testings in Road Town and East End, however, that the water "generally would be unacceptable by international standards" (L. 4-5).

4.2.7.3. The Draft Territorial Plan considers West End, East End-Long Look, Beef Island and 'hilltop' Tortola to be in immediate need of an expanded water supply.

i) West End

a) Local potable water has to be augmented by trucked supplies from Road Town. Although some distance away, a well has been sunk at both Abbey and Harrigan's Ghuts, but each supplies no

4.2.7.3. (cont.)

more than 10 gallons per minute. Vanterpool and Obie Ghuts are nearer the vicinity of West End, but neither promises much potential as a source of water.

ii) Hilltop Tortola

- a) Situated along the ridge from Long Look to Sage Mountain, the area presently relies upon rainwater catchments and springs. An expanded supply of water is needed for both human consumption and agricultural - especially cattle - production. The water requirement of cattle are not insubstantial: at least twenty gallons should be available for each head per day (Anegada Report: Technical Studies, 6-118). A small earthen dam has been constructed in the Fahie district for agricultural purposes, and more are planned by the Department of Agriculture.
- b) Although the Great Mountain - Long Trench - Manchester enumeration district declined in population over the decade previous to 1970, and perhaps is indicative of the ridge area in general, the latter increasingly is becoming the site for luxury houses, using modern, and water-thirsty, facilities.

iii) East End-Long Look

- a) The area expanded its population base by 42% between 1960 and 1970 (from 1,300 residents to 1,850), and as a result the water supply is becoming increasingly deficient. Roof catchments,

4.2.7.3. (cont.)

wells and trucked water from Road Town presently supply the demand.

- b) In the immediate vicinity, Long Swamp has some potable water reserves, but these are not sufficient to be of significance. Three boreholes have been made at Spring Ghut, one of which yields brackish water, while the other two supply a combined total of 12 gallons of potable water per minute. Since ground water in this region apparently is in hydraulic continuity with the adjacent sea water, overpumping could cause saline water intrusion. Two wells have been sunk at Grey Ghut (Josiah's Bay), but both provide water of poor quality. With regard to all of the existing wells, only an upper layer of two to three feet can be tapped, below which is brackish water.
- c) Richards and Dumbleton advised the construction of a 200,000 gallon reservoir, but this recommendation has been discarded because of insufficient water in the area to fully utilize such a reservoir.
- iv) Beef Island
- a) Ground water is brackish in nature, and no reserves of potable water have yet been discovered. The situation is not serious at present, but will become so if planned tourism and housing developments actually occur.

4.2.7.3. (cont.)

v) Road Town

- a) The area from Slaney to Baugher's Bay is served by the sole mains water supply system of the Territory. Water is extracted from four wells in the Long Bush/Huntum's Ghut area, producing a safe maximum of 200,000 gallons per day (based on a 40" annual rainfall). Rainwater catchments supplement the mains supply.
- b) In 1970, the Road Town water supply system was extended to include Treasure Isle Hotel and Huntum's Ghut. In the same year, a new 125,000 gallon reservoir was completed in the Long Bush area, to augment the already existing 100,000 gallon reservoir to the rear of Peeble's Hospital. By 1972, of the then 536 houses in Road Town, 325 were connected to the public mains. In 1973, the distribution system was again extended to serve Purcell, Free Bottom and Baugher's Bay Public Works Department depot. At the same time, non-return valves were installed on all water connections in order to prevent feed-back of cistern water to the mains water.
- c) It has been proven doubtful whether the water supply from the aquifer can be increased to any great extent, owing to the total reserves available and the danger of saline contamination. Of the initial eight wells supplying the mains water in the late 1960's, two were abandoned because of increasing salinity. In 1972, new

construction of Wickham's Cay, and replaced by artificial channels following an altered course. These have proved inadequate for carrying the stormwater discharge flowing down the recently paved Joe's Hill Road. Since the flooding, remedial drainage work on the road has been accomplished. The existing stormwater gully is to be replaced in Phase I of the sewage scheme.

4.2.8. Virgin Gorda

4.2.8.1. With the exception of a small desalinization plant serving Little Dix Bay Hotel and the Yacht Harbour, shallow wells and cisterns are relied upon. Most of the wells produce less than one gallon per minute. In 1971, of the 297 buildings inspected, 58% possessed cisterns.

4.2.8.2. The water supply of the island is generally regarded as insufficient. In addition, there is the risk of contamination from effluent discharge, the practice of burying bodies on private ground (there is no public burial ground), and from the use of wells by both humans and cattle.

4.2.9. Anegada and other Islands

4.2.9.1. Although brackish ground water is found in the western part of Anegada, the Settlement and eastern portions are served by a potable water supply. It is doubtful whether demand has increased since 1972, when Richards and Dumbleton estimated that no more than 6,000 gallons per day were being used.

On the Territory's other islands, water is gained from catchment facilities and a few shallow wells.

4.3. Future Development

- 4.3.1. A Ground Water Ordinance is presently pending, which would vest ground water in the Crown. No person would be able to sink a well below ground water level, or to a depth greater than 20 feet below ground level, without first obtaining a licence from the Water Board. A licence would be needed to extract water, and would be issued only if the water source was not contaminated, and did not affect existing users of the water source. Natural drains or ghuts could not be diverted without written approval of the Board. Also, the Governor in Council could declare any area to be a catchment area, and thus be afforded protection.
- 4.3.2. In their report, Richards and Dumbleton recommended the construction of an additional 125,000 gallon reservoir at Johnson's Ghut, and one of 10,000 gallons to serve Port Purcell. The Government hopes to construct a new reservoir at Fort Hill to support an extension of the distribution system to Baughers Bay and beyond. Two future wells - one in Baughers Bay and the other in Road Town - are hoped to supply the reservoir.
- 4.3.3. The report considered that sufficient potable water existed for the needs of Road Town and East End-Long Look up to 1975, after which

time a further source of water might be needed. This prediction has proven to be correct, especially in light of the opening of the Prospect Reef complex later this year, which will increase demand perhaps as much as 15,000 gallons a day when fully utilized, unless full recycling of waste water is achieved. This amount, when added to the 1975 first quarter consumption level, would place demand above the danger level of 200,000 gallons per day.

- 4.3.4. The report further predicts that by 1980, as much as 825,000 gallons will be needed for Road Town, and 433,000 gallons for East End-Long Look - a fourfold increase over the present demand. The figures are based on a daily per capita consumption of 75 gallons; this amount would appear to have been already surpassed.

4.4. Aesthetic Considerations

- 4.4.1. Of little impact, apart from the future siting of desalination plants and other facilities.

4.5. Ecological Considerations

- 4.5.1. In the eventuality that desalination plants are constructed, careful consideration should be given to their location. The thermal pollution and increased salinity level associated with such plants can severely upset the ecological balance of the surrounding marine and coastal area.
- 4.5.2. As with sewage, chlorinated water, when discharged into the sea, can adversely affect marine biota.
- 4.5.3. Apart from posing a danger to plant pollinators (bees, butterflies, etc.), certain farming chemicals are potential water pollutants. A build-up of nitrites in the soil, for example, can be transmitted by run-off to the water supply. With the encouragement of agriculture in the Territory, steps should be taken to improve control over the importation and usage of fertilizers, fungicides and pesticides presently used, which include malathion, sevin, methaldehyde and aldrin.
 - 4.5.3.1. In Bermuda, since 1972, only those pesticides that are specified in the Gazette may be imported. All chlorinated hydrocarbon pesticides, such as D. D. T. and Dieldin Chlordane, have been banned, as well as some of the more potent 'soft' pesticides such as Parathion. A similar scheme could be introduced in the British Virgin Islands,

preferably relating to all farming chemicals, and not merely pesticides.

4.6. Social and Cultural Considerations

4.6.1. Many of the public wells recently inspected in Tortola and Virgin Gorda had no protective covering (as provided for under the Public Health Ordinance, 1969), nor were they stocked with larvivorous fish or coated with a film of oil (as required under the Mosquito Control Regulations, 1960). Also, cattle were often found clustered around the wells. None of these factors is conducive to public health.

4.6.2. The danger of contamination by sewage of the water reserves is discussed under the section Sewage Disposal.

4.7. Economic Considerations

4.7.1. The cost to the Territory of increasing the potable water supply in the future will vary according to the type of scheme undertaken. Some of the alternatives are mentioned below. Of more immediate concern, however, are measures that could be taken to reduce the present demand.

4.7.2.1. The periodic distribution of water prevents wastage through leaky faucets but, unless voluntary restraint is shown, does not greatly reduce consumption. (It is a simple matter to fill up water containers during hours of distribution.)

4.7.2.2. Fiscal measures would be far more effective in reducing demand. The present charge of 15¢ per 100 gallons of mains water for domestic users appears to be too low, especially when compared with the up to 2.5¢ per gallon charged in the U.S. Virgin Islands. The low cost of water is reflected in the amount used. No industry exists within Road Town uses an appreciable amount of water; thus, almost all of the 190,000 gallons per day is consumed by private households. Even if all cistern water is discounted, and a number of 2,500 consumers served by the Road Town mains system is used, this necessitates each person using 76 gallons per day - an amount that is greater than the one Richards and Dumbleton envisaged for 1980.

4.7.2.3. An increased price for water, steeply rising the greater the amount used, would not only reduce water consumption, but also provide the Government with much needed finance to improve water facilities.

4.7.3. Considerable attention has been given to the possibilities of desalination. When requesting funding from the Foreign and Commonwealth Office in May, 1974, for a major plant to serve the Road Town area, the Chief Minister was advised to wait until further technological advance had been made in the field. It is certainly true that maintenance costs may be exceedingly high: in St. Thomas, after the first two years, these were equivalent to half the original cost of the plant. Richards and Dumbleton estimated that a 750,000 gallons day plant for Tortola would cost about \$1 million (at 1972 prices). The cost per gallon, using the Virgin Gorda plant as an example, would approximate 2¢. Desalination is an expensive process, but it does offer the advantage of producing a fixed amount of water irrespective of climatic conditions.

4.7.4. Treatment by reverse osmosis could remove most of the undesirable mineral content found in the large amounts of exploitable brackish water. Similarly, storm water could be treated for potable consumption and waste water reclaimed - at least for the purposes of flushing, laundry, and industrial and agricultural use, and possibly for potable

use as well. It should be noted that the reclamation of waste water often costs a fraction of the amount needed for desalinization, and has the additional advantage of negating pollution damage caused by untreated or chlorinated discharge, as well as by discharged heated water.

4.7.5. Untreated storm water could be harnessed to serve many of the purposes mentioned above, although some problems are associated with its collection. In the steep valleys of the more rugged islands, as Mather (1971, p. 8) has pointed out, even high dams would contain a comparatively small amount of water. Also, the near vertical disposition of the bedrock might result in major leakage. Because of these reasons, Mather did not consider storm water dams to be practicable for serving coastal settlements.

4.7.5.1. It should be feasible, however, to construct impoundment dams at the foot of a few chosen valleys or roads. In Road Town, for example, the construction of a dam near the vicinity of Joe's Hill Road would serve the dual purpose of controlling floodwater from the road, as well as preventing its waste. Although initial costs for the purchase of land and construction would be relatively high, maintenance costs would be low. Treatment to upgrade the water to potable standards would prevent the cost of introducing a secondary grey water distribution system.

4.7.6. Much cheap, potable water could be obtained by increasing rainwater catchment from buildings and paved areas. Studies undertaken by Mr. Persram of the Public Works Department indicate that with a 40" annual rainfall and 100% run-off, about 324,000 gallons could be collected from the Port Purcell building, discounting the surrounding paved area; 516,000 gallons could be collected from the High School; and 6.6 million gallons (over 18,000 gallons per day) from the Beef Island airstrip.

4.7.7. The use of sea water for flushing is practical and cheap, and occurs in three major urban areas of St. Thomas and St. Croix. Some difficulty has been experienced on these islands because of the corrosion of pipes; this may be prevented, however, if plastic piping and neoprene fittings are used.

4.8. Recommendations

4.8.1. The provision of a rainwater catchment and storage tank for planned inhabited buildings is mandatory under the existing Land Development Control Guidelines (1972). It is recommended that the Guidelines are amended to include commercial and industrial buildings as well.

Secondly, measures should be taken to tap the rainwater run-off from the existing larger buildings.

4.8.1.1. The Guidelines stipulate that a planned building for inhabitation must be provided with a storage tank having a capacity of 10 gallons per

square foot of roof catchment area. Under this provision, a two- or three- story apartment block need be served with the same size storage tank as a single family unit of the same ground dimensions. Since the former will obviously require a large supply of water, some consideration should be given to the occupancy rate of a building in determining the storage tank capacity to be provided.

- 4.8.2. At the time of both the Wickham's Cay landfill and the paving of Joe's Hill Road, local expertise and advice concerning the inadequate drainage facilities went largely unheeded. In all probability, had this advice been acted upon, the frequent flooding of certain areas in Road Town would not have occurred. It is strongly recommended that local advice be solicited and carefully considered before future schemes of a similar nature are embarked upon.
- 4.8.3. For water supply to be sufficient for the Territory's future demands, the successful implementation of an integrated, overall management programme is called for, that will both save on water consumption as well as increase supply. Reliance should not be placed upon one means of procuring water, but rather on a combination of several sources, which would differ in each island according to local conditions.
- 4.8.4. In Tortola, expansion of the potable water supply by additional shallow wells promises little potential, unless the large reserves of brackish water are treated. The impounding of stormwater and increased catchment of rainwater would substantially increase the water supply,

albeit on a seasonal basis. In Road Town, the need for a treatment plant to recycle waste water would appear to be of more value at the present time than a desalinization plant, which could well be more expensive as well as adding to the pollution in Road Harbour. In hill-top Tortola, the start of an earthen dam construction programme is a promising development and should be pursued.

- 4.8.5. In Virgin Gorda, an increased water supply could be forthcoming from shallow wells, and a study to evaluate the potential of this source should be undertaken.
- 4.8.6. Water supply in the eastern portion of Anegada appears to be adequate for the present demand. Should tourism or large-scale agricultural development occur, the brackish reserves of the western part of the island could be treated for use or a carefully located desalinization plant constructed. Since the limestone bedrock is porous and fractured, it acts as a poor filter, and the disposal of waste water and sewage will have to be disposed of carefully, or better, recycled.
- 4.8.7. In Jost Van Dyke and other small hilly islands, the water supply - although limited - appears to be adequate for the present. Increased rainwater catchment should be able to accommodate any small development that occurs.

4.8.8. Reforestation programmes and conservation of natural vegetation are an important part of good water management, and prevent excessive run-off. (See Vegetation and Soil Protection).

5. VEGETATION AND SOIL PROTECTION

Preliminary Considerations

Because vegetation, soil and water conservation are so closely interrelated, this section may be regarded as an extension of the one concerning water supply management.

The process of increased aridity described below has reached its ultimate stage in many parts of the world, where deserts have replaced previously existing forests. Major climatic changes are not always the sole reason for this transition; rather, the creation of certain of the world's arid areas are attributable to man and his short-sighted, resource, mis-management practices.

Within a natural forest ecosystem, water resources are protected in several ways; the multi-layered canopy of trees prevents excessive evaporation by the sun and desiccation by the wind; ground leaf litter acts as a natural mulch, maintaining soil moisture, ; and rapid run-off of water is prevented by natural vegetative barriers, allowing gradual percolation into the soil. The soil itself is maintained by a recycling of its nutrients through the decay of leaf litter and wood.

When man clears a forest area for cropping or pasture, this nutrient cycle is broken down. The soil becomes exhausted after a few crops, and must be turned over to fallow. Overcropping or overgrazing (by either cattle or small stock) seriously damages the soil

Preliminary Considerations (cont.)

structure and vegetative ground cover becomes minimal. Because of the lack of shade and natural mulch and desiccation by the wind, evaporation increases. Water percolation into the soil becomes less as run-off increases. On sloping land, the soil layer is removed, and gulleying occurs, making it extremely difficult - if not impossible - for future cropping.

The resulting exposed rock and dried-out leached soils support only the hardier thornbushes and scrub. Continued overgrazing by goats - generally considered to be the most destructive of domesticated animals - will prevent the renewal of even these hardy plants. At this stage, the local rainfall amount may decrease, as the cooling effect on moisture-bearing winds being forced to rise over a land mass (resulting in precipitation) is offset by the effect of warm air currents rising from the heated, barren ground. (In this sense, it is partially true that forests, acting as an effective insulator between the sun's rays and the ground, can 'attract', or 'make', rain.)

Even if the natural renewal of vegetation is permitted by the prevention of small stock grazing in the area, an appreciable length of time is required for a natural vegetation climax to derive. The original climax vegetation of an island system may never recur; if it did, it would take centuries. With adequate remedial action by man, however, reclamation of the land for useful purposes may be accomplished in

Preliminary Considerations (cont.)

a relatively short period.

5. 1. Existing Legislation

5. 1. 1. The Protection of Trees and Conservation of Soil and Water Ordinance (1954) provides for the Governor in Council to declare any area to be a forestry, protected, or water area. Water areas discussed in the preceding section (1. 1).

5. 1. 1. 1. In a protected area or forestry area, injury to trees is prohibited, as well as fires and livestock in the latter area.

5. 1. 1. 2. A forestry area of approximately 90 acres in the Sage Mountain district was declared in 1955. This area approximates to the boundaries of the present National Park.

5. 1. 2. Although the Mining Ordinance (1972) provides regulations for the felling of timber and disturbance of cultivated land, it applies only to certain mining activities which presently are not undertaken in the Territory.

5. 2. Existing Conditions

5. 2. 1. A detailed soils study of the Territory has never been undertaken. With the exception of Anegada, the soils have generally been described as shallow, friable and permeable brown loams, with frequent outcrops of bare rock. Anegada is endowed with very little soil but with extensive limestone outcrops and sand deposits. The Territorial Report (1973, p. 54) describes the soils as "young, immature and

probably the rockiest and stoniest in the world."

- 5.2.2. The poor soils now existing, however, once supported large xerophytic forests that covered most of the islands. Indiscriminate felling for charcoal, clearing for pastures and exploitation for timber have resulted in the almost complete removal of the original forests, with only a very small remnant at Sage Mountain, and isolated Bursera, Pisonia and Lonchocarpus trees remaining.
- 5.2.3. Forest removal even in the recent past has been rapid. In 1954, less than 100 acres of the original xerophytic forest (only a small part of which was virgin) remained in the Mount Sage area, whereas less than a decade previously apparently 300 acres were reported to have existed (Wadsworth, 1954). In 1968, only about 13 acres of virgin forest remained, although there were also a number of patches of thicket regrowth (Nobles, 1972?). Because of its protection, the forest area since then has stabilized, and thicket regrowths are possibly expanding.
- 5.2.4. In the drier rocky areas of the Territory, scrub and cactus occur. When cultivated land is abandoned, croton bushes (Croton rigidus) initially form; in moisture areas, the exotic Leucaena glauca generally appears (Territorial Reports).

5.2.5. The Government's policy towards soil, water and vegetation protection has been to:

5.2.5.1. supervise previously declared water areas along water courses and springs;

5.2.5.2. establish orchards adjacent to water areas;

5.2.5.3. encourage tree planting on steep slopes or land suitable for general agriculture; seedlings of mahogany and red and white cedar have been made available to the public, and over 14,000 mahoganies have been planted in the Mount Sage National Park;

5.2.5.4. in addition, a programme of agricultural terrace construction has been under way since the 1960's, but its results do not appear to have been widespread.

5.2.6. In recent years, there has been a trend for cattle production to give way to small stock production, because of increased returns for the farmer in terms of time and money. The number of cattle decreased from approximately 6,000 in 1962 to 2,000 in 1973, while sheep increased from 2,500 to 6,900, and goats from 10,000 to 10,500 during the same period. There is reason to believe that the increasing numbers of small stock in combination with the declining rainfall of the Territory could cause damage to the environment.

5.2.6.1. Tortola

i) Untended goats and sheep have successfully thwarted an ornamen-

tal planting programme on Wickham's Cay I. The Pound (Amendment) Ordinance (1972), making it "lawful for a designated or authorized person to shoot or otherwise destroy any goat, sheep or swine which may be left untended in any public place within Road Town" or within a perimeter of $1\frac{1}{2}$ miles of the town, has been ineffective. A stern notice addressed to farmers in May, 1975, warned that untended stock on Wickham's Cay would in the future be impounded or shot.

- ii) Small stock, however, are not the only culprits in the island, since many of the smaller mahoganies planted at Sage Mountain have been badly injured by cattle.

5.2.6.2. Virgin Gorda

- i) Although private pens exist, many goats and sheep roam freely on the island. During a dry spell, when ground forage is exhausted, the owners cut down branches from certain trees and taller bushes. In moderation, this practice inflicts no long-lasting damage to the plants. With an increasing small stock population, however, and especially with less rainfall over the past few decades, the island's carrying capacity for small stock may soon be reached, if it has not already been surpassed. Any upgrading of the rather sparse vegetation in the Valley area would require a large reduction in present number, as well as the prohibition of small stock in public areas.

5.2.6.3. Anegada

- i) At the beginning of 1974, it was estimated that there existed as many as 2,000 goats on the island, as well as about 900 sheep and 250 head of cattle.
- ii) Few of the goats are under control, and "most are as wild as deer". Many of the cattle also are more or less wild, and roam at will. The sheep are better controlled and remain close to the Settlement (Bond, Technical Studies, 1974).
- iii) According to the Technical Studies report (1974), much damage to the vegetation has been inflicted by cattle and goats, the latter having had a concentrated impact on the eastern third of the island. The sheep population inflicts damage only in the vicinity of the Settlement. In addition, wide-ranging donkeys have contributed to the destruction of vegetation.
- iv) The stretch between Loblolly Bay and East End was singled out in the Technical Studies report (6.26), where the dune crests appear to be under stress from grazing and trampling by animals.

5.2.6.4. Other Islands

- i) In Jost Van Dyke, vegetation comprises mostly shrub thickets, intermixed with open grassland pastures and scattered small trees. The shrub thickets probably have formed because of over-grazing by goats, or shifting cultivation (Little, 1969).
- ii) A few goats and cattle exist on Peter Island and the other smaller inhabited islands, but damage to the vegetation appears to be relatively minimal.

- 5.2.7. Well constructed agricultural terraces occur in some parts of the Territory, particularly in upper Tortola, but with some of the more recent clearings no erosion protective measures have been taken, even for those located on steep slopes.
- 5.2.8. No regulations exist pertaining to private road construction. Apart from the aesthetic impact of a scarred landscape, concrete roads often act as impermeable water courses in times of rain, allowing very rapid run-off but not allowing percolation of water into the ground.

5.3. Future Development

- 5.3.1. A Plant Protection Bill is presently pending.
- 5.3.2. In the 1960's, several animal pounds were in use, run by authorized private citizens. Because of the small financial return to these people, all but one (situated in Tortola) have closed down. The Pound (Amendment) Ordinance (1974) is intended to encourage the reopening of the animal pounds, by increasing the amount payable by the offending stock owner to the pound keeper. The stock owner is also liable on conviction to a fine of \$10.00 for each animal impounded.

5. 4. Aesthetic Considerations

5. 4. 1. Tree protection and reforestation programmes should not be considered for their environmental value alone. Some of the more established forest areas in St. John, for example, have an extremely high aesthetic value. The establishment of similar areas would do much to enhance the beauty of the Territory.

5. 5. Ecological Considerations

5. 5. 1. Many of these have been discussed previously under the sub-section Preliminary Considerations. An example of the adverse effects arising from the felling of timber in Tortola is cited by Frampton and Biggs (1955):

" A good spring visited in 1952 was found to be drying up in 1957. The reason was clear - the trees around the natural catchment area were being cut down quite indiscriminately and rain water which used to penetrate the soil and replenish the spring now runs over the eroded surface of the land into the ghut and so out to sea. "

5. 5. 2. It thus appears that subsurface water has declined not only because of a declining rainfall in recent decades, but also because an increasing proportion of the potentially available water is being lost to the Territory as a result of haphazard vegetation removal. In a time of increasing demand for water, this development is extremely unfortunate.
5. 5. 3. The greater quantity and velocity of run-off water not only increases

soil removal, but also may be detrimental to offshore reefs.

because of an interruption in polyp photosynthesis caused by suspended soil particles.

5.6. Social and Cultural Considerations

- 5.6.1. If the Government is to encourage the expansion of agriculture, it should also ensure that farmers are at least aware of the importance of erosion preventative practices. Although admittedly hard work, terracing is the most effective way of building up a good soil depth on stony slopes. The only possible beneficiary of a cleared, unterraced slope is the lowland farmer below, who gains washed down soil deposits. Equally likely, however, his crops may be ruined by the inundation of sediment-laden storm water. Both prospective and practising farmers should be made aware of the implications of their actions on the society in general.
- 5.6.2. The Sage Mountain forest represents a living cultural heritage of the Territory. Forests that are now planted in turn will play a similar role for the benefit of future generations of British Virgin Islanders.

5.7. Economic Considerations

- 5.7.1. Any widespread reforestation programme inevitably will result in some contention between the Government and owners of affected

marginal lands, primarily over reduced agricultural income.

The difference in the return between vegetable and tree cropping is not as great as is commonly supposed, for an estimate of the true annual productivity of the former must take into account the fallow periods, when no crops are harvested (Wadsworth, 1954).

In contrast, tree crops may be harvested every year. Some compensation may be needed, however, during the initial period of tree growth.

- 5.7.2. For purely conservation purposes, natural forest growth is completely adequate. To ensure a greater financial return, either fruit trees or lumber trees could be planted. The former probably would be more popular with landowners, as mentioned by Wadsworth (1954), because of their earlier and often greater financial return. Almost all of the following fruit trees, which have been suggested as suitable, are presently grown in the Territory: mango (Mangifera indica), mamey (Mammea americana), avocado pear (Persea americana), soursop (Anona muricata), guava (Psidium sp.), pawpaw (Carica papaya), Barbados cherry (Malpigia glabra), breadfruit (Artocarpus altilis) and sugar apple (Annona squamosa). In addition, citrus fruits are grown on Peter Island; with careful management, they may have potential in other islands. The existing local demand for tree fruits is nowhere near satiated by domestic produce, and much profitable expansion could occur in this sector.

5.7.3. Lumber trees, with careful harvesting, could also be exploited successfully for use in the domestic building industry and for furniture and local crafts. Among the trees suggested by Wadsworth (1954) that produce high-quality cabinet woods are broadleaf mahogany (Swietenia macrophylla) and Spanish elm (Cordia alliodora), suited to the ghuts and more humid slopes; small-leafed mahogany (Swietenia mahogani), for use in the drier coastal and rocky exposed areas; and teak (Tectona grandis) and petitia (Petitia domingensis) on bare lands. Also mentioned have been the blue mahoe (Hibiscus elatus) and a fast-growing pine, (Pinus patula). Because of the relatively long-term investment involved and of the careful lumbering required, Crown lands would be most suitable for the growing of these trees.

5.8. Recommendations

5.8.1. The Government deserves much credit for its programme of afforestation. An active publicity and education campaign has and is being undertaken, which includes the celebration of Arbor Day, and the distribution of seedlings through the school system. The nursery at the Old Agricultural Station is serving a useful purpose in supplying fruit tree seedlings. In addition, the National Parks Trust has done much valuable work in the Sage Mountain area, and will be aided by the approval of a grant in late 1974, allowing - among other things -

for the fencing of the area (see 'National Parks').

- 5.8.2. Much is still to be done, however. In his excellent report, Wadsworth recommends that the types of land best suited for trees are the ghat areas and steep slopes, dry areas along the coasts, stony areas inland, and farm boundaries and yards. If these recommendations are followed, however, or the guidelines he cites that are used in Puerto Rico (all slopes steeper than 50% should be planted with trees, and any areas receiving less than 40" should be utilized for trees or pasture), they would necessitate afforestation of the great majority of the Territory's land. Whether or not this is desirable, it obviously will not occur with the present active encouragement of agriculture. The selection of land for afforestation or agriculture should not be based upon economic criteria alone, however, but should also include consideration of environmental conservation and water needs.
- 5.8.3. Livestock are commonly regarded by their owners as a form of walking bank, to be used when the necessity arises. This is a wise policy, but as for any bank, it should be locked up. The Pound (Amendment) Ordinance (1974), in providing for heavier penalties, may be successful in reducing the number of untended animals, providing that the scheduled sixteen pounds come into existence. If they do not, then stiffer legal action may be necessary. In the long-term,

the small stock population should be stabilized, or better reduced.

- 5.8.4. An attempt should be made to ensure that erosion preventative measures are taken by farmers, especially on steep slopes. Apart from terracing, a multi-layered system of intercropping is also advocated, where the taller plants afford shade for lower-level and ground crops. Not only is productivity increased per surface area, but protection of the soil from the elements is maximized.
- 5.8.5. If, in the opinion of the Lands Committee, certain Crown Lands are to be leased for agricultural purposes in the future, then careful selection of the lessees should be made in order to safeguard against unwise agricultural practices.
- 5.8.6. The extension programme of the Department of Agriculture is in need of expansion, since the present number of three field workers is not sufficient to adequately serve the Territory as a whole.
- 5.8.7. Some control over the construction of private roads and driveways is required, especially in the probability of an increasing number of these being built in the future; amendment to the existing Land Development Control Guidelines should suffice. As a long-term measure, the possible eventual construction of a mid-altitude road, serving clustered developments, would prevent the need for individual roads and driveways.

6. WILDLIFE MANAGEMENT

6.1. Existing Legislation

6.1.1. Wild Birds

6.1.1.2. The Wild Birds Protection Ordinance (1959) provides for the year-round protection of 22 species, together with their nests and eggs, as listed under Schedule 1.

6.1.1.3. Nine species under Schedule 2 are protected during a close season, lasting from February 1 to July 15.

6.1.1.4. Certain methods of killing or taking wild birds are prohibited, unless in the interests of public health, agricultural practices or the preservation of other creatures.

6.1.1.5. The Wild Birds (Bag Limit) Order (1953), limits the number of birds to be killed each day during the open season.

6.1.1.6. Eighteen areas within the Territory are designated as bird sanctuaries under the Bird Sanctuaries Order (1959), as listed in Appendix VII. Stiff penalties are imposed on any person caught damaging a bird, nest or egg within these areas.

6.1.2. Turtles

6.1.2.1. All turtles, with the exception of the 'trunk' (leatherback), are partially protected under the Turtles Ordinance, 1959. It is illegal to catch turtles weighing less than 20 pounds or to take or be in possess-

ion of turtles or their eggs during the close season (July 1 to August 31). The taking of 'trunk' eggs is also prohibited during this period. Upon conviction, an offender is liable to a fine and forfeiture of the nets and other equipment used in the offence.

6.1.3. Marine Wildlife

6.1.3.1. No legislation presently exists pertaining to the harvesting of fish, lobsters and other marine biota.

6.2. Existing Conditions

6.2.1. Wild Birds

6.2.1.2. The hunting of wild birds, mainly by off-islanders, was prolific until late into the 1950's. In such fly-over areas as Devil's Bay, Virgin Gorda, hundreds of birds were senselessly shot and allowed to lie - so much so, that a moratorium on bird shooting was declared for five years. In addition, a common local practice was the collection of brown booby eggs for consumption and sale.

6.2.1.3. Both of these practices have now abated. It is doubtful whether the ensuing legislation was the cause of the decline; rather, it appears that both bird shooting and egg collecting merely have gone out of style.

6.2.2. Turtles

6.2.2.1. Little heed is paid to existing regulations. Turtles weighing less than 20 pounds are caught, and the collection of eggs during the close season occurs.

6.2.2.2. Both the green and hawksbill turtles are listed in the IUCN Red Data Book of endangered wildlife species. In respect to the conservation of the hawksbill, it is unfortunate that a Handicraft Centre, initiated under the auspices of the International Labour Organization and funded by the United Nations Development Programme, has taught local aspiring artisans to manufacture ornaments from hawksbill carapaces. These ornaments presently are sold in at least two Tortolan establishments. Although the Endangered Species Act of the United States prohibits the importation of hawksbill products into the country, few American visitors are aware of the potential illegality of their purchase.

6.2.2.3. Although reliable statistics are non-existent, it is generally accepted that the number of turtles found in the Territory's waters have declined over recent decades. The killing of females before they can lay their eggs has been cited as one reason for the decline.

6.2.3. Fish and Other Marine Biota

6.2.3.1. The 1960 Census recorded that 163 persons were employed in fishing, but this number undoubtedly has decreased over the interim period. At present, only a small number may be regarded as full-time fishermen, although as many as fifty or sixty are engaged part-time. The usual method of fishing is by pots, which are checked every two or three days after being placed. Most of the local boats are small and open, and suited only for near-shore fishing. Only about five

or six boats in the Territory are used for full-time, offshore fishing.

6.2.3.2. In addition, deep-sea sports fishing and reef spear fishing are undertaken.

6.2.3.3. As with the case of turtles, little reliable data exists on the populations of fish, lobsters and conch, but yields of all these species appear to have diminished. With regard to pelagic species, such as bonito and hardnose, these may have been reduced to a partial extent by modernly equipped, commercial fishing operations based in neighbouring islands, such as the Japanese fleet that worked from St. Martin. Long-line fishing used by these fleets can also adversely affect deep-sea sports fishing. In the instance of lobster, conch and reef fish, local over-exploitation would appear to be the main reason for their decline. The removal of mangroves can also be partially blamed for the reduction in lobster and several fish species.

6.2.3.4. Some of the Territory's reef purportedly have suffered from excessive spear fishing. The hard stand of the B.V.I. Hotel and Tourist Association against this practice, (except when undertaken by commercially licensed fishermen), has been successful in dissuading many shops from selling spearguns. Only one establishment - Little Denmark in Road Town - presently sells this equipment.

6.3. Future Development

6.3.1.A Fisheries Ordinance, drafted in 1964, is still pending. Under the Ordinance, the Governor in Council may make regulations for prescribing a close season for any fish (including cetacea, crustacea and mollusca), for controlling the size, condition and quantity of any species caught, for regulating the method, apparatus and appliances used in taking fish, and providing for the inspection of any ship, vessel or aircraft suspected of carrying fish.

6.3.2.A Marine Advisory Committee was established early in 1973, to advise the Government on all matters relating to marine conservation. A Marine National Parks Ordinance was drafted, but this subsequently has been incorporated into the Protection of the Environment (draft) Ordinance, and is discussed under the section 'Conservation of Natural Areas and Historic Sites'. The above Ordinance, if passed, will have particular bearing on reef fishing.

6.4. Aesthetic, Social and Cultural Considerations

6.4.1. The diversity and richness of both avian and marine wildlife are of high aesthetic value, and comprise an important, living, cultural heritage of the Territory. The reef areas especially are considered by experts to be among the most outstanding in the world. As mentioned previously, however, spear fishing by visitors already has impoverished several of these areas.

6.5. Ecological Considerations

6.5.1. The importance of preserving mangrove areas as rich wildlife habitats is discussed elsewhere ('Development and Construction', 5.1 and 7.2).

6.5.2. Ecological niches of island species are more fragile and less extensive than their continental counterpart, and are thus more susceptible to disturbance and damage. Because of their insular character, islands frequently possess rare species that do not exist elsewhere; an example in the British Virgin Islands is the Anegada iguana (Cyclura pinguis). In addition, the isolation of oceanic islands may inhibit the replenishing of a species by natural migration from other sources outside of the area.

6.6. Economic Considerations

6.6.1. In contrast with the fish populations of the more northerly latitudes, those of the Caribbean are more diverse in nature but smaller in

number. This, together with the prevailing uneven and reef-pocked nature of the seabed, generally precludes mechanised bottom fishing operations. Rather, the traditional method of using traps, handlines and small surface nets appear to be more practical and economically viable.

- 6.6.2. Large pelagic fish are sparsely distributed. They are of sufficient quantity to provide the basis of a sports fishery in shelf-edge areas, but overexploitation by a growing industry should be prevented.
- 6.6.3. Any commercial fishing industry is plagued with the problem of ciguatera. Among the areas least prone to ciguatoxic fish is Anegada, but even here fish poisoning has occurred. No cheap, reliable method has yet been established to test freshly caught fish, and this shortcoming has obvious implications for the economic success of any commercial concern.
- 6.6.4. The cost of materials for the manufacture of fishermen's pots has risen substantially in recent years. The setting up of a cooperative to buy such materials in bulk has often been advocated, and should be proceeded with.
- 6.6.5. With the growth of snorkeling activities, the diversity and richness of the Territory's reefs are becoming an increasingly important economic asset and should be maintained in as pristine a state as feasible.

6. 7. Recommendations

6. 7. 1. Owing to the decline in bird shooting and the creation of bird sanctuaries, the avian population would appear to be safeguarded from excessive predatory activities. With the increase in agriculture, however, certain bird species could become threatened by residues of the more potent insecticides and pesticides, such as aldrin, which are presently used in the Territory. As previously noted ('Water Supply Management'), the more toxic chemicals should be barred from use in the Territory.
6. 7. 2. A moratorium should be declared on the capture of all turtles. However, enforcement would be a major difficulty. Although it is illegal to catch turtles in the U. S. Virgin Islands, firm evidence points to the fact that poaching still continues. It is hoped, however, that legally barring such practices would discourage turtle catching to some extent. It should also be mentioned that turtle poaching in the U. S. Virgin Islands can only be encouraged by the existence of a legal market for such items as hawksbill carapaces in the British Virgin Islands.
6. 7. 3. A conservation area for the Anegada iguana should be established before any development on that island occurs.
6. 7. 4. Research is needed into the population of the fish species, their habitats and reproductive rates, and the numbers presently caught, before

any sound legislation can be passed. It is always tempting to introduce ad hoc legislation from other countries; this may not be the most beneficial approach in the long-term, however, and any such legislation should be modified to suit local conditions. In Bermuda, for example, a close season on the harvesting of lobster is strictly enforced, but in the warmer waters of the British Virgin Islands the seasonality of breeding is not as marked.

- 6.7.5. Spear fishing should be prohibited in all reef areas, except by licensed fishermen. The licences granted should be limited for any particular area. Not only is haphazard spear fishing wasteful and destructive to a valuable resource, but it may also pose a danger to nearby swimmers and snorkelers.

7. CONSERVATION OF NATURAL AREAS AND HISTORIC SITES

7. 1. Existing Legislation

7. 1. 1. The National Parks Ordinance (1961) established a Trust, whose duty it is to preserve any historic buildings and plant life of designated National Parks. In addition, it is to encourage and control the provisions of facilities for persons visiting the Parks.
7. 1. 2. In 1964, three areas donated to the Government by Laurance Rockefeller were proclaimed as National Parks: Spring Bay and Devil's Bay of Virgin Gorda (55 and 20 acres respectively) and Sage Mountain (89 acres). The old Cholera Burial Ground in Road Town became a National Park in 1966, and presently is used as a forest nursery. Virgin Gorda Peak (450 acres), Fallen Jerusalem (52 acres) and West Dog (31 acres) were declared as National Parks in 1974. In the same year, a small area (0.7 acres) adjacent to Road Bay below MacNamara became Queen Elizabeth Park. Sandy Cay is maintained as a private protected area.
7. 1. 3. Under the Receiver of Wrecks (Amendment) Ordinance (1968), any wreck in Territorial waters that is not less than 25 years old is deemed to be an historic wreck and vested in the Crown, together with any of its contents. Unless he obtains permission from the Receiver of Wrecks, no person may dive within the vicinity of an historic wreck, nor interfere with it in any way.

7.2. Existing Conditions

- 7.2.1. With both limited manpower resources and capital, the accomplishments of the National Parks Trust are noteworthy, especially with regard to the Sage Mountain area. Although a body corporate, the Trust was provided with no administrative branch, and the time allotted by its private citizen members has necessarily been limited. The money constraint has been major; funding for the first two years of the reforestation programme on Sage Mountain amounted to \$4,500. In normal years, the Trust has received an annual Government subvention of \$3,000. This year, however, a development aid grant from the British Development Division of \$42,000 has been given for the maintenance and improvement of National Parks. In addition, a further \$3,000 is allotted for a Parks Ranger, if and when the post is filled. The major part of the grant is to be spent on the Sage Mountain area, Queen Elizabeth Park, Spring Bay and Devil's Bay.
- 7.2.2. At present, the Trust is able to afford little manpower for the upkeep of the Parks, but has been helped to some extent in the past by private bodies and individuals. In the Virgin Gorda Peak area, Laurance Rockefeller donated funds for the clearing of five nature trails by U.S. Park Rangers. Concerned individuals employ a man to clear up at both Spring Bay and the Baths.

- 7.2.3. Because of the limitations of funding, the Trust as yet has been unable to protect and restore any historic building. It is keen to acquire a well-preserved windmill tower in the Mount Healthy area, but must await for sufficient funding in order to purchase the privately owned land. The same problem arises in relation to buying the Baths area, which is one of the outstanding aesthetic and geologic areas of the Territory.
- 7.2.4. An Historic Association, composed of private individuals residing in the Territory, was established with the aim of studying historic aspects of ruins of the Islands, and perhaps perserving a few structures, but it presently is dormant. An Association concerned with conservation and perservation is presently planned.
- 7.2.5. Several Amerindian archaeological sites have been discovered and partly excavated in Virgin Gorda. In Tortola, a site has been found and twice excavated across the bay from Road Town; another has been found at Cane Garden Bay, as well as a potential site on Sage Mountain, but no excavation has yet been undertaken. In Anegada, apart from the known Amerindian site at East End, several other areas are worth investigation. In addition, artifacts have been discovered on Peter and Guana Islands, and a site excavated on both Great Camanoe and Mosquito Island. Archaeological excavation reportedly has occurred on Beef Island and Thatch Cay.

7.2.6. An area of major concern is the protection of the Territory's historic wrecks. Although persons intending to dive within the vicinity of wrecks are legally required to apply for a licence from the Receiver of Wrecks, none have been requested, even though frequent trips are made to such areas as the Wreck of the Rhone by scuba diving concerns from both the British and American Virgin Islands. It is known that some of the Territory's artifacts have been removed and sold in the United States. The problem confronting the Government is one of enforcement, as the one existing customs boat is woefully inadequate to regulate scuba diving activities.

7.3. Future Development

7.3.1. As discussed under subsection 3.2 of 'Wildlife Conservation', a Marine National Parks Ordinance was drafted, but has subsequently been incorporated into the pending Protection of the Environment Ordinance.

7.3.1.2. The latter Ordinance provides for the establishment of a Parks and Cultural Properties Trust, to administer the designation and maintenance of historic buildings and Marine Parks. The National Parks Trust is to remain in existence and be responsible for terrestrial national parks. The Advisory Committee of the newly formed

Trust is to comprise a member of the Legislative Council, an architect, the Town Planner, and two members of the public.

7.3.1.3. The Trust is to prepare a list of special buildings worthy of preservation and conservation, and suggest areas of special control ('control districts'), to be approved or rejected by the Governor in Council. Right of appeal by the building's owner is provided for within the Ordinance. Once a structure is declared a special building, it is an offence to alter its exterior appearance without approval from the Trust, as well as from the Building Authority and Public Works Department. Permission to develop a listed building may be given, albeit with conditions, unless the Legislative Council buys the land or provides funding for the maintenance and repair of the building. If a special building, which is not listed, is threatened by demolition or alteration, the Trust may serve a "building preservation notice", to be valid for six months, during which time the Governor may decide whether or not to include the building on the list.

7.3.1.4. Any person who discovers cultural property (see Appendix VIII for definition) and has not been issued a licence is to give notice to the Secretary of the Trust. After the date of commencement of the Ordinance, the Governor is to have the right by warrant to acquire any cultural property discovered in the Territory.

Compensation is to be paid to the finder, unless the latter was acting in contravention of any provision of the Ordinance, or the Trust is of the opinion that the cultural property should remain in situ. No search for cultural property may be undertaken except as provided for under licence, which will be granted only to persons possessing adequate scientific competence and having sufficient funding to secure satisfactory results on archaeological grounds.

- 7.3.1.5. The Trust may recommend areas to the Governor to be declared Marine Parks. These areas may include any adjoining land or swamp which together with the submarine area form a 'single ecological entity'. No person shall dive or swim in the sea forming any part of a Marine Park, nor remove any object or damage flora or fauna except in accordance with any Regulations to be made.
- 7.3.1.6. The duties of the Advisory Committee will be to preserve and enhance the natural beauty of Marine Parks; to protect all of their flora, fauna and wrecks; to provide and control public facilities; to promote scientific study and research in Marine Parks; and to employ such persons as may be necessary.

- 7.3.1.7. Regulations pertaining to Marine Parks are to provide for the prohibition or restriction of entry; the charge for entry; the control and management of the Parks; the licensing of vessels and guides working within the Parks; and the recovery of compensation.
- 7.3.1.8. Under the Ordinance, the Governor is to establish a Government Preservation Fund.
- 7.3.2. Other pending legislation includes National Parks Regulations, National Parks Trust Regulations, and a Plant Protection Ordinance.
- 7.3.3. It is hoped by the Government that additional Customs boats will be acquired in the near future, thus allowing - among other things - the greater surveillance of historic wrecks.
- 7.3.4. The Government hopes to establish an omnibus committee that would draw its members from all bodies concerned with conservation and preservation in the Territory.

7. 4. Aesthetic Considerations

7. 4. 1. With the eventual inclusion of selected coastal sites and adjacent waters for protection, the Territory will have achieved a fairly comprehensive programme ensuring that areas of natural beauty will be preserved for the enjoyment of future generations. It is commendable that the Government is acting, and has acted, propitiously before irreversible damage has been inflicted on areas of outstanding beauty.

7. 5. Ecological Considerations

7. 5. 1. Many of these considerations have been discussed previously under the sections 'Wildlife Management' and 'Vegetation and Soil Protection'. The Sage Mountain Forest is unique in certain respects; the development and grant will allow sufficient fencing of the area to protect not only the newly planted trees but also the few saplings of the rarer bullet wood (Manilkara bidentata) and bastard gri gri (Buchenavia capitata (Vahl.) Hichl.).

7. 6. Social and Cultural Considerations

7. 6. 1. The establishment of a 'control district' (similar to that in Charlotte Amalie, St. Thomas, which has existed since 1968) will greatly help in maintaining the architectural style and integrity of certain

urban districts. Main Street in Road Town, with its distinct character and individuality, would be an obvious choice. Major development of this area is unnecessary, since ample - albeit expensive - building space is afforded on neighbouring Wickham's Cay. The scheme for a pedestrian mall along the southern part of Main Street is a sound one, and should be implemented. As far as the physical appearance of the buildings is concerned, a carefully applied new coating of paint would be a great improvement, and need not wait until some of the buildings are declared of cultural value.

7.6.2. Several historic ruins have been altered and incorporated into modern private dwellings and hotels. Although some developments, such as Sugar Mill Hotel, are in empathy with the ruins, others have displayed a total disregard in this respect. An unfortunate example of the latter is the fairly extensive and sound ruin at Long Bay Hotel, which has been added onto with raw concrete blocks.

7.6.3. Some of the 'preservation' measures undertaken have been deleterious rather than beneficial. Expansion of the mortar used in filling up the cracks of the Fort Recovery guntower is causing severe structural stress. In contrast, a good example of private maintenance of an historic building is Little Mountain House on Beef Island. It is also gratifying to note that the ruins of St.

Philip's Church, in the Kingstown area of Tortola, although not maintained nor renovated, still serve their original purpose as a religious meeting place.

7.7. Economic Considerations

7.7.1. The costs to the Government of purchasing private land for use as a National Park and of maintaining any historic ruins that may be situated on the land are not insignificant. With a limited budget at its disposal, the Government may be forced to rely upon external funding in order to create some of the Parks that are advocated. What limited local funding that exists, however, should be channelled according to some type of priority listing. The latter should be drawn up with regard not to the intrinsic beauty of an area; the possibility of development as well as the rate of deterioration of historic buildings should be considered also.

7.7.2. Admittance fees to National Parks and historic monuments will at least offset some of the costs of their maintenance. If need be, such fees could be waived for belongers, and visitors charged only; it is doubtful, however, whether any person would be seriously handicapped by paying a small fee. With regard to Marine Parks, especially those surrounding offshore wrecks, fee collecting may be a major problem.

7. 8. Recommendations

7. 8. 1. Although the National Parks Trust falls under the general jurisdiction of the Ministry of Natural Resources and Public Health, some clarification is needed over what constitutes 'natural resources' and what constitutes the 'environment', which falls under the responsibility of the Chief Minister's Office. Secondly, if funds become available, the duties of the National Parks Trust would be greatly facilitated by the hiring of a full-time secretary.
7. 8. 2. It would appear to be a good opportunity for the existing Lands Commission, which presently is considering the disposal and use of Crown Lands, to recommend areas - and historic ruins within those areas - for incorporation into the National Parks' or the future Parks and Cultural Properties' system.
7. 8. 3. Although such sites as the Baths and Mount Healthy Tower are privately owned, other potentially ideal sites for National Parks are situated on Crown Land. An obvious example is the famous Copper Mine in Virgin Gorda, which remains unprotected under law. Restoration work is urgently needed, since rapid deterioration of the buildings has occurred in recent years. The buildings should be stabilized as soon as possible to prevent further decay, and an archaeological investigation undertaken to map the whole site. A long term aim should be to reconstruct the buildings to

their past state utilizing the materials that were originally employed. The area is one of great geologic interest, with copper and molybdenum nodules still found in abundance. It would be inexcusable to allow this site, already a tourist attraction, to deteriorate further. Wisely, the Government has so far turned down proposals from private concerns to mine the molybdenum deposits.

7.8.4. Other historic ruins worthy of consideration include those of a two-storied sugar mill and distillery at Lormer Bay, the small distilleries near the Fahie settlement and Brewers Bay, the Quaker cemetery at Fat Hogs Bay, the Dungeon at both Pockwood Pond and Long Bush Ghut, Fort Charlotte, the gun platform and walls overlooking both Buck Island and Hodges Creek, the picturesque ruins in upper Huntum's Ghut, the sugar mill at both Smuggler's Cove and Green Bank, and the Lettsume House on Jost Van Dyke. Other ruins are in a very poor state of disrepair, such as St. Michael's Church above Cane Garden Bay and Fort George overlooking Port Purcell, but are still noteworthy.

7.8.5. Unfortunately, many of the sites mentioned above are on private land, and it is extremely doubtful whether sufficient funding will allow for the purchase of even some of the more important ruins in the near future. Measures can be taken by the Government, however, to ensure that development does not destroy these ruins:

careful consideration should be given to any proposals, such as that for the development of the Dungeon area at Pockwood Pond, before approval is granted. In the United States, an Antiquities Act requires that any construction which would destroy or is found to destroy historical or archaeological evidence must contribute approximately 1% of its construction budget toward salvage operations by recognized professional persons, societies or organizations. A similar Act for the British Virgin Islands is recommended.

- 7.8.6. Renovation of historic ruins should be carefully supervised, and preferably professional advice from such bodies as the U.S. Virgins Archaeological Society sought after.
- 7.8.7. At present, no publicly owned museum exists, although a few individuals have established small museums to which the public is welcome. An ideal site for a future public museum is the sugar factory, now housing the Survey Department, at Pasea Estate, Road Town. The building itself is of historic interest, with part of the old machinery still intact. The original 1905 engine is rumoured to be still on the island and could be reinstalled in situ.
- 7.8.8. Among the areas that should be incorporated into Marine Parks include Horse Shoe Reef, Anegada; Virgin Gorda Sound, extending

from east of Mosquito Island to Pajaros Point, Virgin Gorda;
the reef areas surrounding Pelican Island, Dead Chest and Carval
Rock; the Fallen Jerusalem - Round Rock area; and the vicinity
of the Wreck of the Rhone.

- 7.8.9. Each Park area, whether terrestrial or marine, ideally should
have its own research and education programme designed to examine
the problems characteristic of its own particular environment.
Some of these programmes should be included as part of the B.V.I.
educational system for school children.

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APPENDIX I.

Mining Ordinance (1972)

Without prior consent of the Governor:

- a) no mining may occur within 100 yards of the limits of any reservoir or catchment area;
- b) no cultivated land may be disturbed by mining, without consent of the occupier or owner of the land;
- c) no mining may be undertaken along the coastline;
- d) no natural or artificial watercourse, spring, reservoir, filter bed or well may be diverted;
- e) no water may be polluted;

In addition, under the same Ordinance, the Governor may make provisions to regulate:

- a) the cutting down and use of timber;
- b) the disposal of any poisonous or noxious products resulting from prospecting or mining;
- c) the disposal of sludge and tailings;
- d) the safe and sanitary undertaking of prospecting or mining operations;
- e) the protection of areas held to be sacred, and any tree or other thing which is the object of veneration;
- f) the protection of land for any public purpose, as well as the vicinity of that land;
- g) the safety, welfare, health and housing conditions of any persons employed in mining operations.

APPENDIX II

Protected Beaches Order (1961, as amended 1962, 1963)

Tortola:	Banghers Bay Belmont Bay Big Apple Bay Brandywine Bay Brewers Bay Cane Garden Bay Cappoon's Bay	Fish Bay Josiah's Bay Kingstown Bay Lamberts Bay Little Apple Bay Long Bay Pockwood Pond
Virgin Gorda:	Baths Deep Bay Handsom Bay Little Trunk Bay Mountain Trunk Bay Nail Bay Plum Tree Bay	Robins Bay Saddle Bay St. Thomas Bay Spring Bay Valley Trunk Bay White Bay
Beef Island:	Conch Bay Long Bay	Well Bay
Jost Van Dyke:	Great Harbour Sandy Bay	White Bay
Cooper Island:	Manchioneel Bay	
All beaches of:	Anegada Guana Island Little Jost Van Dyke Peter Island Prickly Pear Saba Rock	Salt Island Sandy Island Sandy Spit Scrub Island St. Eustatia

SCHEDULE OF USES (APPENDIX III. LAND DEVELOPMENT CONTROL GUIDELINES, 1972)

	<u>Rural Agriculture</u>	<u>Living Areas</u>			Commercial	<u>Working Areas</u>			<u>Recreation Areas</u>		
		R1	R2	R3		Religious/ Social	Industrial	Public Space	Open Space	Private Open Space	Recreation, Golf, etc.
Detached, semi-detached or terraced housing	C	P	P	P	C	C	X	X	C	C	
Apartment block, guest house	C	C	P	P	C	C	X	X	X	X	
Hotels, condominiums	C	C	P	P	C	C	X	X	C	C	
Public entertainment	C	C	C	C	C	C	X	C	C	C	
Public buildings: civil government, social, religious	C	C	C	C	P	P	X	C	C	C	
Businesses, supermarkets	X	C	C	C	P	C	C	C	C	X	
Warehouses, workshops, industry	X	X	X	X	C	X	P	X	X	X	
Petrol station	C	X	X	X	C	X	C	X	X	X	
Commercial oil storage	X	X	X	X	X	X	C	X	X	X	
Commercial quarrying	X	X	X	X	X	X	C	X	X	X	
Educational	P	C	C	C	C	C	X	C	C	C	
Non-residential recreation or social club	C	C	C	C	C	C	X	C	P	P	
Commercial horticulture or agricultural building or storage	P	C	C	C	C	C	X	C	P	C	
Commercial livestock unit	C	X	X	X	X	X	X	C	C	X	
Minor or ancillary buildings, public utility buildings	C	C	C	C	C	C	C	C	C	C	
Garbage disposal areas	C	X	X	X	X	C	C	C	C	C	

P = Approved
C = Subject to consent
X = not permitted

R1 = Residential zone, average 6 houses per gross acre
R2 = Resort residential zone, average 3 houses per acre
R3 = Hotel zone

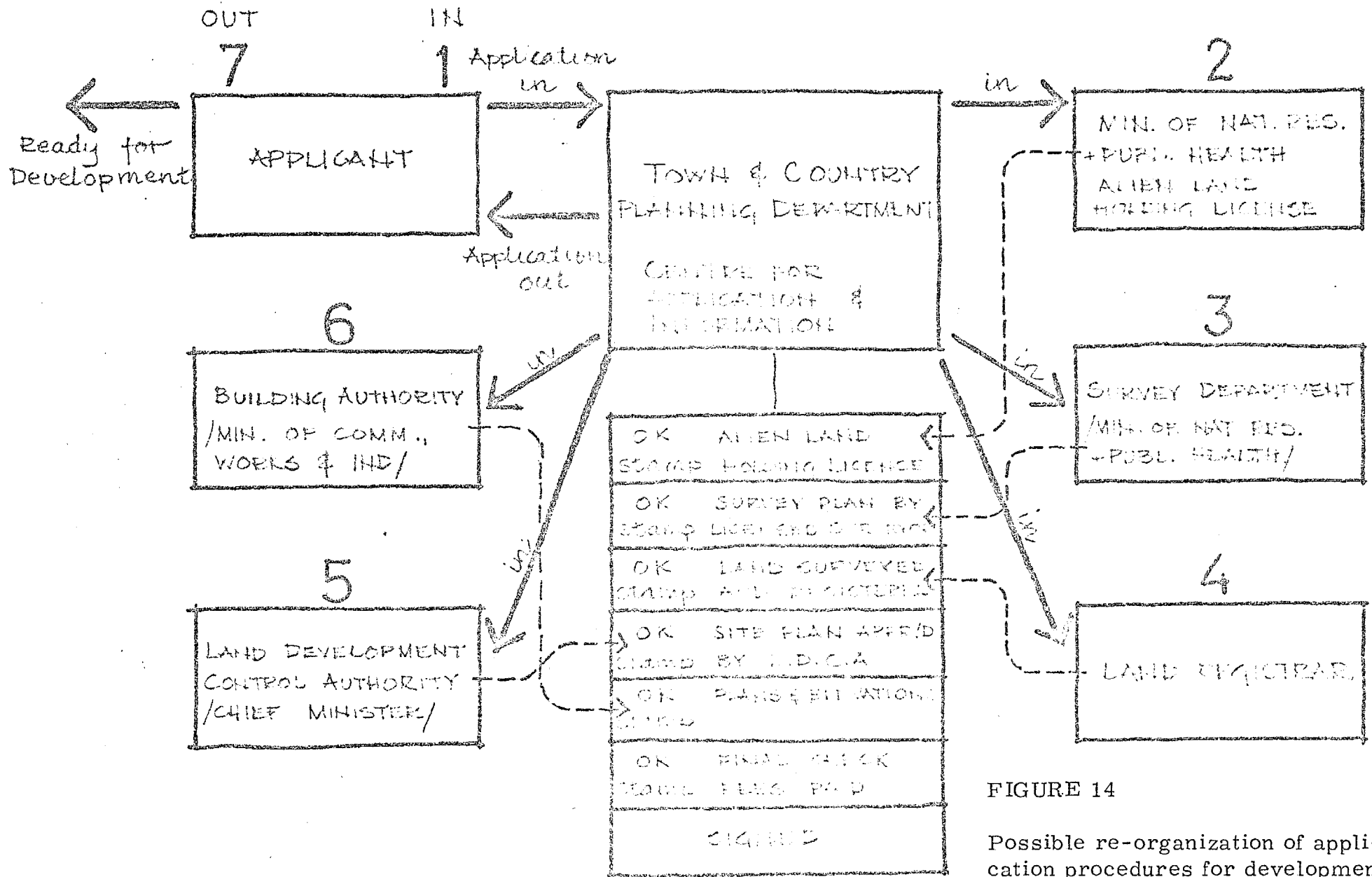


FIGURE 14

Possible re-organization of application procedures for development and planning.

Town & Country Planning Department 4 October, 1973

TOWN & COUNTRY PLANNING DEPARTMENT

Application For Permission To Develop Land
(to be submitted in duplicate)

A TO BE FILLED OUT BY APPLICANT

APPLICANT NAME & ADDRESS					CONSULTANT RESPONSIBLE FOR PLANS:	
PROPOSED DEVELOPMENT					COMMITMENTS (ALHL)	
LOCATION - ACREAGE						
APPLICANT IS: <small>(UNDERLINE APPROPRIATE)</small>	OWNER	LESSEE TERM: YEARS	TENANT	PROSPECTIVE PURCHASER	OTHER	
ESTIMATED COST OF DEVELOPMENT OF LAND						
SIGNED by Applicant or Agent for Appl.				DATE		

B FOR OFFICIAL USE

APPLICATION PROCEDURES	REC'D ON	CONSIDERED BY LDCA ON	EXTENSION AGREED	DECISION SENT	FILE NO
DATE:					NO / YEAR / BLOCK NO / PLOT NO
APPLICATION HAS BEEN CONSIDERED BY THE LDCA. DECISION:					CROSS REFERENCES
1	APPROVED IN PRINCIPLE				
2	APPROVED OF PHASE OF DEVELOPMENT				
3	APPROVED SUBJECT TO:				
4	DEFERRED PENDING				
5	REJECTED. REASON:				
LDCA'S COMMENTS:					
ALIEN LAND HOLDING LICENCE NO					DATE SIGN
SURVEY PLAN NO			APPROVED BY: CHIEF SURVEYOR		DATE SIGN
ENTERED IN LAND REGISTRY NO					DATE SIGN
PLOTTED ON DATE SHEET		SECTION	SHEET NO	PLOT NO	DATE SIGN
BUILDING AUTHORITY APPROVAL GIVEN				YES <input type="checkbox"/> NO <input type="checkbox"/>	DATE SIGN
DEVELOPMENT COMPLETED					DATE SIGN
ADDITIONAL COMMENTS & REVISIONS.					

APPENDIX V

Wickhams Cay Marina

Use of Marina

The use of the area designated Wickhams Cay Marina is limited to those persons who have entered into an agreement or lease with Wickhams Cay Development Authority or to such persons as those individuals have designated such right within the terms of their original agreement or lease or to those persons given permission direct by the Authority. All users of the marina will comply with the following regulations in addition to any specific regulations created by persons or companies who have the right to lease or hire their berthing facilities.

- 1) The owner of any boat is to indemnify the Authority against any damage or destruction of any property by whomsoever caused as the result of any act or default or omission of the owner his or their crew, passengers or other guests and also against all claims made against the Authority in respect thereof.
- 2) The boat shall at all times be at the sole risk of the owner and the Authority shall not be responsible for injury, death or damage to the owner his or their crew, passengers or guests, the boat or any property of any kind thereon or otherwise belonging to the owner his or their crew, passengers and guests including motor vehicles and howsoever caused whether by the state or condition of the property of the Authority or otherwise.
- 3) The owner is to insure for all Third Party Risks and damage to an amount of not less than \$100,000 for any one accident and will during the owners continuing use of the marina keep the boat so insured and further that he will produce to the Authority on demand the insurance policy and the latest premium receipt.
- 4) No boat or vessel may be berthed or anchored in the Marina in any place other than in the berth allocated from time to time by the Authority.
- 5) The owner will move the boat as and when required by the Authority to any berth which the Authority may allocate except where an agreement or lease is in force containing specific covenants regarding the use of certain allocated berths which will be outside the intention of this clause.

- 6) No boat or vessel shall be careened in the Marina nor shall the bottom of the boat or vessel be cleaned in the Marina except with express permission of the Authority.
- 7) All craft shall navigate with due care and attention under power at a speed not exceeding 6 knots.
- 8) The use of dinghies or small boats for pleasure under sail or power is forbidden in the Marina. Rowing of dinghies or small boats will be permitted subject to there being no interference with the movement of larger vessels which will have priority at all times.
- 9) No person shall cause obstruction on any jetty or shore line to the Marina or leave or deposit any equipment, dinghies or rubbish thereon.
- 10) The banks and jetties are to be kept clear, clean and tidy and all garbage and rubbish should be placed in suitable receptacles for collection, and arrangements entered into with the Authority for their clearance. No rubbish or waste material may be thrown overboard or deposited in the Marina.
- 11) In the interest of hygiene lavatories on board vessels should not be used while the vessel is in the Marina.
- 12) No washing lines may be put up ashore.
- 13) No fishing is allowed from the banks of the Marina except by special arrangement.
- 14) Radios, record players and musical instruments of any kind shall only be played below deck of any vessel and such instrument shall be kept at low volume at all times.
- 15) All vessels must be maintained in a seaworthy condition.
- 16) All pets and domestic animals must be kept under proper control.
- 17) Caravans or tents may not be stationed or erected in the car parks or elsewhere on the Authority's land.
- 18) The storage of all boat trailers and boat cradles is to be by agreement with the Authority.

8th July, 1975.

Water Storage Cistern Capacities
Required for all Buildings
to be erected on Wickhams Cay

The following table has been prepared in the light of conflicting recommendations in various technical data and is an attempt to arrive as a reasonable assessment of the varying requirements of residential, commercial and industrial buildings on the Cay. It also considers the varying times that the buildings are occupied and every attempt has been made to make the requirements reasonable.

Note: All volumes are Imperial measure. All lavatories and bathrooms are calculated on the basis of incorporating a wash hand basin. Amounts given are calculated for 2-3 months supply.

SHOPS (Including Banks, Travel Agents, etc.)

2160 gallons for each flushing lavatory.

3600 gallons for each bath/shower.

OFFICES

1800 gallons for each flushing lavatory.

3000 gallons for each bath/shower.

MARINA FACILITY

3250 gallons for each flushing lavatory.

3600 gallons for each bath/shower.

1500 gallons for each sink unit.

or if the marina facility is divided into shop/office or other accommodation that accommodation may be used as a basis for the calculation.

PUBS/BARS

3250 gallons for each flushing lavatory.

1500 gallons for each sink unit.

HOTELS

2500 gallons for each bed.

LIGHT INDUSTRY

1800 gallons for each flushing lavatory.

or 180 gallons per employee whichever is greater.

YACHT CLUB, CULTURAL CENTER, PUBLIC RECREATION

3250 gallons for each flushing lavatory.

3600 gallons for each bath/shower.

1500 gallons for each sink unit.

RESIDENTIAL

8000 gallons for each one bedroom unit.

10000 gallons for each two bedroom unit.

12500 gallons for each three bedroom unit.

15000 gallons for each four bedroom unit.

APPENDIX VII.

Wild Birds Protection Ordinance (1959)

Schedule 1: species protected year-round

Banana bird	Flamingo	Pea whistler
Barbados blackbird	Frigate bird	Pelican
Blacksmith	Gaulding	Soursop bird
Black witch	Heron	Tern
Booby	Humming bird	West Indian canary
Chitty bird	Kingfisher	West Indian robin
Coo-coo	Loggerhead	
Crane	Man o' war bird	

Schedule 2: species protected by close season

Coots (red and white seal)	Quail
Ground dove	West Indian Thrush
Mountain dove	
Partridge	

Bird Sanctuaries Order (1959)

Areas specified as bird sanctuaries:

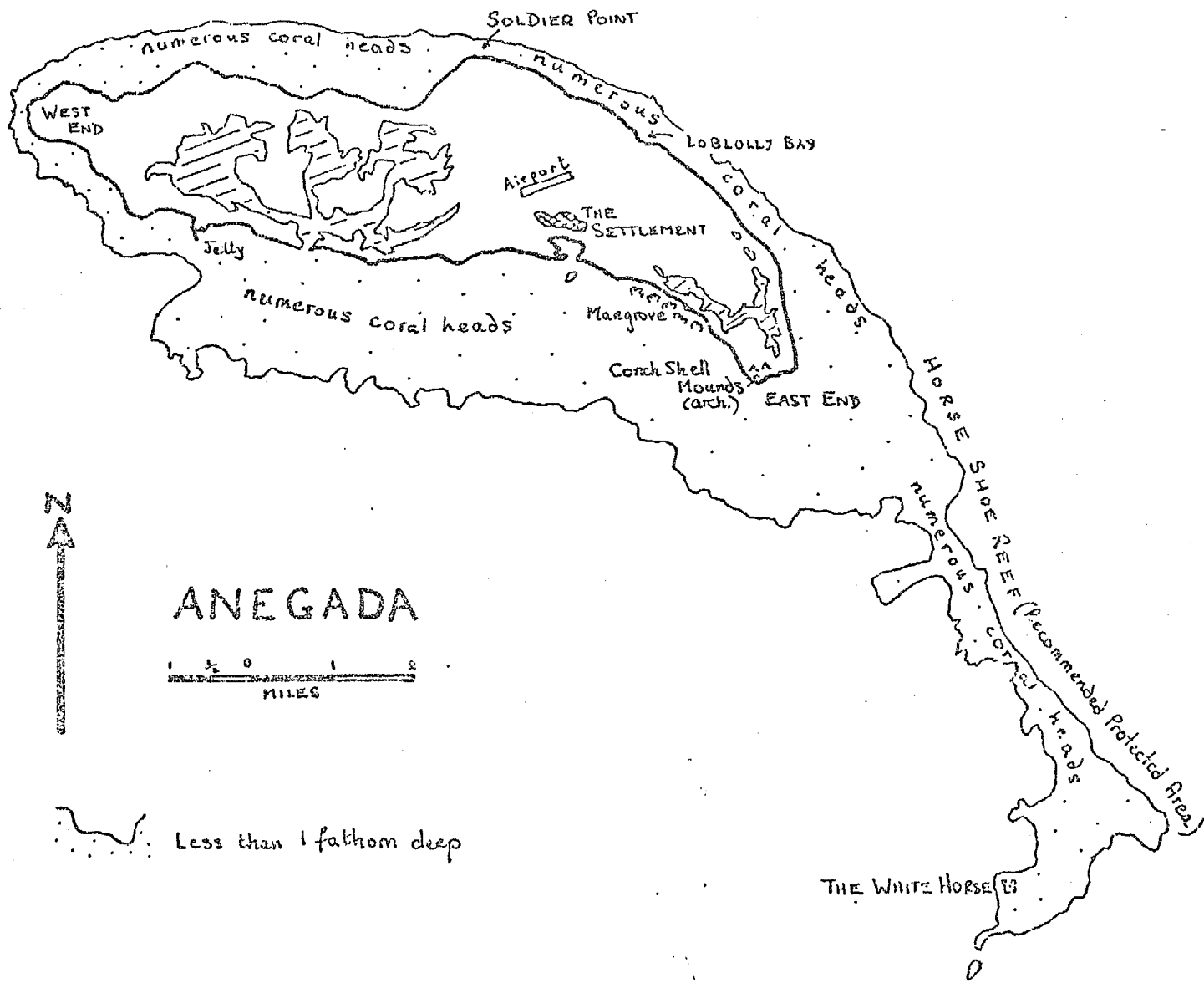
Cockroach	Great Dog	Prickly Pear
Cooper	Great Tobago	Round Rock
Deadman's Chest	Little Tobago	Saba
Fallen Jerusalem	Mosquito	St. Eustatia
George Dog	Necker	Salt
Ginger	Peter	Seal Dogs

APPENDIX VIII.

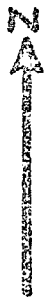
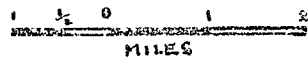
Protection of the Environment (Draft) Ordinance

'Cultural property' is to include:

- a) immoveables, such as archaeological, historic or scientific features, structures or other features of historic, scientific or archaeological value, whether religious or secular, including groups of traditional structures, historic quarters in urban or rural areas, and the ethnological structures of previous cultures still extant in valid form.
- b) immoveables constituting ruins above the earth, whether on dry land, or on or within the seabed.
- c) the setting of the property described in a) or, b) above.
- d) moveable property of cultural importance including that existing in or recovered from immoveable property and that concealed in the earth or on or within the seabed, which may be found in archaeological or historic sites or elsewhere whether or not any such property is owned publicly or privately.

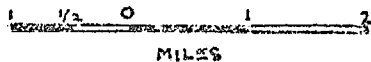


ANEGADA



Less than 1 fathom deep

THE TOBAGOS



BRITISH VIRGIN ISLANDS (SOUTHERN SECTION)

MARINAS : (M) Existing (P) Planned

NATIONAL PARKS : (P) ~ (1) Sage Mountain
 (2) Fallen Jerusalem (3) Devil's Bay
 (4) Spring Bay (5) Gorda Peak
 (6) West Dog (7) Sandy Cay (privately protected)

RECOMMENDED PROTECTED AREAS : //

ARCHAEOLOGICAL SITES : A ~ o Excavated ; o Not Excavated

HISTORIC SITES : ■ 1. Fort Recovery
 2. The Dungeon
 3. Fort Charlotte
 4. Cemetery
 5. Fort Shirley
 6. St. Philip's Church
 7. Little Mountain House
 8. Copper Mine

