

From : Commander J M W Topp Royal Navy (Retired)

A  
SB

Diego Garcia.  
15 March 1996

QEB 264/001/96

The Commissioner,  
British Indian Ocean Territory.

21 APR 1996

*M. Sybil*  
+ few points  
for the PR Mill tables

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24  
B

My visit this year differed from the previous three. Much of my time was spent attending upon the 1996 Chagos Expedition and providing rear link support. I spent a week in the Fishery Patrol Vessel NORTHERN DESIRE/SOUTHERN DISCOMFORT. Lack of transport meant I spent less time exploring Diego Garcia and botanising. Several days were spent on the Diego Garcia Natural Resources Management Program (NRMP).

2. East Point Plantation. Your current Representative, [redacted] has made valuable advances in this area. His interest and enthusiasm have achieved great improvements which you and your Administrator have seen. In particular, [redacted] full time hiring of two Mauritians to maintain the area, paying them through the sale of Plantation passes and [redacted] book, is excellent. He has also managed to find in [redacted] an experienced man who knows and can give names to plants.

3. Museum and Archives. [redacted] has acquired the remaining 6 Display Boards. He has made them up with some of my and some of Don Layman's colour photographs. These Boards are displayed at the Airport, the Police Station, The Turner Club, Library and elsewhere. Suggest these Boards be rotated between sites. The Expedition has taken many photographs and some of these can be used for future displays.

4. Paul Baker is energetically pursuing the Museum plan and has promise of room in BEQ 1 next door to the BIOT Police. This is an ideal solution.

5. Archives are really a matter for the BIOT Administration.

6. Population. The number of people both military and civilian in Diego Garcia is beginning again to decrease. This trend will continue as modern communication facilities are introduced, the USN rationalises its numbers, the civilian contractor both reduces in proportion and increases efficiency to make profits; further reductions will be achieved when the present bureaucratic system of work orders is revised.

7. This reduction of people will be beneficial to wildlife but only if access to parts of Diego Garcia is controlled.

8. Wildlife Disturbance. Wildlife does not enjoy human presence. Birds provide a good example. Before nesting and breeding birds will examine a site very thoroughly. If there are humans around they will not nest. This is why the Restricted Area is so important.

9. The Restricted Area. Access has varied over the years. My predecessors restricted totally access beyond the R and R site and often closed the Restricted Area completely. Before I left in 1986 a few Red Footed Boobies had started to nest south of Barton Point but by 1995 this number had increased, in [redacted] estimation, to several thousand.

10. In the early 1990s the East Point Plantation was cleared and restoration leaped ahead. Later Morale, Welfare and Recreation (MWR) activity expanded into the Restricted Area and with Point to Point races which required the opening of the track from EPP to Barton Point, then improvement to the track to permit vehicles. There are less Red Footed Boobies this year than last.

11. The Commissioner in his letter dated 25 March 1993 instructed his Representative to close to vehicles the track to Barton Point. Currently vehicles are permitted as far as Minni Minni and sometimes beyond.

12. My Report of 1 March 1993 suggested that the Restricted Area should be declared a Special Reserve and the area north of the R and R site a Strict Nature Reserve under Ordinance No.1 of 1970. Legislation has moved on and you have legal means to control access as you wish. Recommend vehicles are permitted as far as the R and R site.

13. Environmental Impact Assessments. These are required in the EC, undertaken in UK, normal procedure in USA. It is high time they were standard procedure in BIOT. This should apply for all construction and MWR activities. MWR in particular has, over the years, pushed ahead with activities without regard for the environment and even without your Representative's permission. A typical example is the SKEET Range where shot and non-biodegradable broken clays litter the land. Suggest ask the USN at the UK/US Talks to obtain Environmental Impact Assessments for all current MWR activities.

need to define more clearly

14. FLORA. The number of alien plants introduced continues to increase. The main sources are 'batch' material of sand and aggregate shipped in insufficiently cleaned and individuals bringing in plants and seeds mainly for ornament. Suggest both these points and especially the former which is contrary to BIOT regulations and US practice are made at the UK/US Talks.

USA ?

15. The natural native flora is probably about 30 species. In 1967, 120 species were recorded and in 1986, 180. Today the number is about 240. This huge increase in a coral atoll is probably unequalled. Most of the introductions are proving persistent and some are pernicious (see Annex A).

16. Diego Garcia Natural Resources Management Plan (NRMP). I spent 4 days examining the first draft of this Plan closely, writing my comments (Annex B) to [redacted] who added his own; I then took both sets of comment and went through the document page by page with [redacted] who is coordinating the island comment. The improved version should be available toward the end of June.

17. Oil Spill Recovery. I attach (Annex C) an update on this programme which is proceeding satisfactorily.

18. Golf Course. I attach (Annex D) the latest move in this perennial subject. What is 'waste ground' to a golfer is *Premna* forest to a conservation consultant. If this proposal is approved and financed by MWR and the USN then the important conservation points to make are the retention of the **current green line between** the existing golf course and palm trees to the east; the retention of a 10 metre green band along the coral road north, north west and west of the proposed extension and clumps of native trees within. This is not a problem for the golfers and if they want more space they can encroach on the palm trees east of the proposed extension.

19. Litter. This is no worse than my last visit which is progress in itself but there is always room for improvement. Drinks cans are still thrown away in the 'scavvy' and broken green glass can be found occasionally on the shore. The number of cigarette filter tips has perhaps increased as people may not smoke inside. This is especially noticeable at bus stops. The amount of litter at the back of PALMSVILLE is horrid.

20. Underwater Litter. It is sad to find so much fishing line snagged in coral often just off the beach.

21. If the USN ever feels bored it could remove the metal pipes, buoys and small vessel all dumped just offshore in shallow water between the Seaman's Club and the Marina.

22. Fishing. My reports of 1 March 93 (paras 23-27 and Annex D) and 15 February 94 (para 11) refer to over fishing in Diego Garcia. An initial 2 week survey was conducted by 2 scientists on BIOT contract and this recommended a proper full survey but nothing further has happened. Meanwhile we are probably taking too many top predators out of Diego Garcia as well. Recommend this full survey now be expedited. Attached (Annex E) is an interesting and relevant letter which deserves attention. This subject is now urgent.

23. The 1996 Chagos Expedition. This has gone much according to plan with the exception of a pallet of scientific instruments inexplicably retained by a Store Keeper in the USN Bahrain Warehouse who [REDACTED]. This blew a serious hole in the research and a possible hole in the finances. However, the whole programme was very ambitious and the fact that, say, 10% was lost is not nearly so bad as if it had been 20% of a programme half as ambitious. Likewise, given the circumstances of the Expedition, distances involved, dependence upon just two yachts, little time for much work, complicated change overs of people, difficult communications, minimal finance, weather, nautical hazard, risk of injury especially underwater, illness and general human failure, then the fact that so little, at the time of writing, has gone wrong, is remarkable and the Expedition must be considered a success.

*Ins 402 Ins.*

*we discuss  
the apparent  
report being  
concerning the  
letter (Dr  
[REDACTED] will  
need to be  
consulted  
he is one  
of the people*

*JM*

*JM Torr*

CONSERVATION CONSULTANT

ANNEX A



British Representative  
Diego Garcia  
British Indian Ocean Territory

7 Mar 96

From: British Representative, British Indian Ocean Territory  
To: Commanding Officer, U.S. Navy Support Facility, Diego Garcia  
Subj: ALIEN FLORA

Ref: Discussions [REDACTED] Mr. J. Topp of 5 Mar 96

1. During a recent tour of the island, accompanied by myself, the BIOT Conservation Consultant, Mr. John Topp, observed that a number of Alien species had been accidentally introduced into Diego Garcia in sand and aggregate imported via Singapore from Malaysia. One of these species is highly invasive and has done severe damage to atolls in the Pacific and is a considerable risk to the ecology of Diego Garcia. The plant in question is Mimosa Invisa Mart. ex Colla or Giant Sensitive Plant and is presently localised in the Port Marianne storage area. Mr. Topp has already discussed the problem in outline with [REDACTED] and I would be grateful if steps could be taken to eliminate this species before it has time to spread. A recommended method is by burning to ensure the destruction of seeds. Mr. Topp will be on island until 19 Mar 96 and is available to provide identification and any other assistance.

A large, irregular black redaction covering the signature of the British Representative.

Commander Royal Navy  
British Representative

Copy to:

A thick black redaction bar covering a name.

Mr. J. Topp

A thick black redaction bar covering a name.

From : Commander J M W Topp Royal Navy (Retired)

Diego Garcia  
British Indian Ocean Territory

Commander P C Baker R.N. J.P.,

NATURAL RESOURCES MANAGEMENT PLAN  
DIEGO GARCIA  
COMMENT ON DRAFT

This is a good first draft of a thoroughly worthwhile plan. Inevitably at this stage there are several major and many minor errors. The highlighting of these errors should be seen as constructive comment to make the NRMP for Diego Garcia as good as possible.

The "British side of the island ..." This often used phrase is inaccurate,

[REDACTED]. References to "the British side", "the US Navy side" and variations on the theme must be eliminated. [REDACTED]

[REDACTED] Proper terms to be used include 'the west or east side of the island' or the 'specific' and 'restricted' areas.

FAUNA.

Birds. The section on birds is well researched and makes excellent reading. Incidentally, the Grey Heron is certainly about. First reported in 1899, I saw one with my relief in April 1986 and there are several other verbal reports of recent sightings. The 'reappearance' of the Water Hen ~~which is~~ is fascinating and it obviously finds happy nesting in the bull rush/cattail *Typha domingensis*. It should be realised that in 1985 *Typha* was known at only one small site (the Vehicle Maintenance area). Since then *Typha* has spread hugely as a result of the construction of new water run off areas that favour it. Was the Water Hen here all the time but is now provided with new habitat or is it, as suggested in the NRMP, recently arrived from the Maldives? This should be easy to prove as *Amaurornis phoenicurus* claims sub-species status in the Maldives. Either way the present residence of the bird and the new reports of migratory shorebirds are an opportunity for the world to recognise that in this respect the military development of Diego Garcia has actually **enhanced** wildlife. This is a good moment for FCO to sign BIOT on to the RAMSAR Convention and suggest this be mentioned at the next UK/US Talks in April in London.

Reptiles and Amphibians. Geckos are widespread but unmentioned and how the numerous tadpoles at 'R' and 'C' sites could be missed is surprising. They should be included, especially the tadpoles whose origin in Diego Garcia is undetermined.

Insects. The omission of insects is extraordinary. They are by far the largest group of fauna and arguably the most important in the island terrestrial ecology. It was already established that new species of Flora were entering Diego Garcia at the rate of three a year: it is likely that there are a great many more new species of insects. Insects must be included in the NRMP. This should be easy to do as the PACDIV/NAVFACENCOM [REDACTED], has not only been studying the Diego Garcia insects for some 15 years but is also a distinguished entomologist in his own right.

Coral. I asked [REDACTED] the leader of the 1996 Chagos Expedition, to correct in pencil the typing errors in the list of corals at pages C-52 to C-56 where he has also deleted four species. All the data is entirely his original work. It is important to note that this list is of the corals of the Chagos not Diego Garcia which is but one island of 55 in the archipelago or one atoll among several.

Fish. The same applies to the list of fish which [REDACTED] prepared from his studies during and after the 1978/9 expedition in the northern Chagos atolls.

FLORA It was fun to read the botanical survey and the two botanists made good use of their time. It was a pity and surprising that they appear not to have consulted Atoll Research Bulletin 313 by J M W Topp, making use instead of an unidentified, incomplete and unauthorised draft. Consequently their two checklists contain many errors and omissions especially of grasses and sedges. Suggest they should now consult ARB 313 and amend their work accordingly.

The new species they found confirm many that I found in 1993 and 1994 and early 1995 and we agree entirely on the introduction rate of 3 a year. I found some they did not and *vice versa*. We have also probably found some the same and given them different names which appears to be a natural hazard of botanical life. Many of these species I have lodged with Kew.

I have made many amendments in pen and pencil and hope they are useful. Nomenclature is always a problem but could the check lists use the very latest agreed names, please, for example Ochrosia, Laurentia, Oldenlandia, Scadoxus and is it not Premna obtusifolia R.Br., Hernandia sonora L. and Achyranthes aspera var. velutina (Hook. and Arn.) the latter being on East, Middle and West islands. But I digress. If the authors wish to correspond with an updated list they can find me as indicated in ARB 313. My current work on the 55 islands of Chagos uses the family order of Brummitt 1992 with Bentham and Hooker and Kew Herbarium family numbers and this is probably too much to ask. It may be useful, however, especially for the layman who will mainly use the NRMP to have one check list of species in alphabetical order.

Some other comments by page number:

ES-2/ES-9 Coral reef dredging. Surely this is already excluded.

ES-3 Legal. We should sign up for RAMSAR.

ES-8 Does not include INSECTS

Does not include containers and Millvans etc.

ES-11 Permanent moorings - where?

Where is the new Marina planned?

ES-12 SCUBA diving. Hitherto this has been banned by USA on grounds of safety and insufficient medical support including when a decompression chamber was on island. Has this policy changed?

What Diving Officer?

Jet-skiing is inappropriate here as are high power motor boats.

A-1 FPC Land Use Plan 1 April 1986. Copy please.

A-2 Memorandum of Conservation 29 April 1985. Copy please.

Final Governing Standards. Copy please.

A-14 e. Seismology. Given that on 30 November 1983 there was an earthquake here measuring 7.6 on the Richter scale and between that date and 1 August 1984 70 tremors of which 37 were 5.0 or more, to say that Diego Garcia is not a highly seismic area seems almost a British understatement.

A-15 g. When did this flooding of the land mass of the atoll last join the waters of the lagoon with the open ocean? I am very keen to know.

h. The "British" side.

A-16 The "British" side.

A-17 The "British" side.

Last para. Wrong. There are endemic fish and coral.

A-18 The "British" side.

Para 3 line 1. Chagos not Diego Garcia.

Seagrass beds dominate in the southern part of the lagoon? Show me. I wish they did. *Thalassodendron ciliatum* is mainly Orient, Rambler bay. Grateful to have a full report of wherever sea grass is.

j. This is a very muddled para. Not "Mauritian". What about the Military cemetery at Pt. Marianne? What about the larger cemetery at East Point?

A-19 The "British" zone.

b. 1). Water. Is Air operations in operation or polluted?

Withdrawal. Better to compare, say, 1985 with 1995 or 1984 and 1994. These figures are easily available and are much more illuminating.

Last para is muddled.

A-20 The "British" side.

2). Sewers. What is the effect on the environment?

A-22 I am all in favour of eradicating the rats and feral cats, and if the USA achieves this God Bless America! Let us not pretend the cats have any significant effect on the rat population. When did you last see a cat kill a rat here? Even the chickens see off the local cats.

B-4 para 4 Add "or seas".

B-6 para 3 'Two'? rifle ranges. What about NSF 25 metre range with the huge safety tower? See B-8 5) which does not agree.

B-8 7) Cemetery Muddled - see earlier comment.

B-9 c. para 2 Add "and their reefs".

para 5 Copies of these Plans please.

B-10 b. line 1 where?

See pencil notes.

B-11 c). Add INSECTS.

B-12 2) a Add new sentence 3. Since USN construction started they have become the dominant visual tree as you enter harbour.

Line 5 . NOT so-the opposite is the case.

See other pencil notes

B-18 There is no evidence to support the contention that rats are kept in check by rats.

Note 1 at bottom. When and by whom?

C-4 and 5. ROPOs to check.

C-9 c). INSECTS.

C-11 The "US Navy side" and the "British" side.

C-22, c\_28, C-34, C-37 and several other pages : pencil corrections.

D-5 This is muddled and wrong. Fig D-2 is wrong. IT IS IMPORTANT to get this right.

D-11 Pencil errors

D-12 Table D-1. What is "periphery of island within lagoon"?

Last line. This DG Inst must be dead, surely? Do we have a Dive locker?

D-14 5)The "British" side.

7)NO WAY.

D-15 5) What about Skeet shooting on "their" side of the atoll?

BIOT does NOT have 3 shooting ranges.

D-18 SCUBA. See pencil notes.

D-19 Jet-skis. Get rid of them.



To: [REDACTED]  
From: [REDACTED]  
Subject: Diego Garcia

Date: 02/06/96

- [REDACTED]
- We are working on getting the bioslurper on contract. I expect this will be done within a week.
  - I expect we will be shipping the equipment and piping etc within the next 2-3 weeks.
  - We may start travels around 18 March, with a stop in Misawa included. Do you now if [REDACTED] will be off his leave by then?
  - Also, could you check if Diego Garcia has primer and solvent weld glue for connecting PVC piping. We will use PVC to pipe up the bioslurper liquid ring pump to the wells. It will be easier if we don't have to ship the solvent weld as it is a hazardous material (acetone etc).
  - We plan on installing a 10 horsepower bioslurper liquid ring pump next to the existing oil water separator in the POL yard. The pump will draw a vacuum on a 4 inch PVC pipe coming from 6 bioslurper wells to be placed in the grass area between the pond and the ramp. The vacuum will suck/slurp fuel and water out of the wells and over to the liquid ring pump. The fuel with some water will be dumped into the existing sump basin next to the oil water separator. The sump basin has sump pumps to pump the fuel and water into the oil water separator where the fuel will separate and be piped over to the existing 2000 gallon waste oil tank.

I will be sending you some more info on what we will be doing at Diego Garcia. We will need help from the Navy for:

- a. 460 volt power to the bioslurper liquid ring pump to be located near the existing oil water separator.
- b. Trenching from the existing oil water separator to the grass area between the pond and the ramp. We will place 4 inch diameter PVC pipe in the trench to connect about 6 wells to the bioslurper liquid ring pump.
- c. Auger truck for drilling 6 bioslurper wells (10 ft deep).
- d. Concrete for well boxes and sealing well casings.
- e. Sand for filling around the well screens.
- f. Concrete cutting and core drilling in the ramp for placing about 6 more water monitoring wells. We will try to bring an 8 inch core drill barrel.
- g. Air hammer support to drive well rods. Please see if Jim can find out the type of air hammer and the size of the air hammer anvil (we will bring an adapter for driving our well rods).
- h. Haul fuel that the bioslurper recovers.

Talk to you soon.

Jerry

to pump  
fuel

### SITE VISIT ACTIVITIES

- Took water samples from six wells: S4-11, S3-30, S3-11, S2-29, S2-9, S1-9 (diagram attached).
- These samples will be analyzed at the US Environmental Protection Agency (US EPA) Kerr Research Lab in Ada, Oklahoma. This analysis together with previous USGS works will be used to prepare for more extensive sampling to occur in Sep - Nov 95 timeframe.
- Pumped 15 gallons of fuel from Well C2-1 in one 30 minute period. Well appeared to go dry during the pumping. Ten minutes after the pumping stopped approximately four feet of fuel accumulated in the well. Took a sample of fuel to the fuels lab for analysis to JP-5 spec.
- Obtained information about the on-island trailer-mounted Mobile B-47 drill and the truck-mounted pole auger.

### FUTURE WORKS

- Sep - Nov 95 -- Sampling of all wells near the fuel leak site. Possible soil gas survey and water sampling from under the aircraft parking ramp near the leak. Purpose is to identify the extent of oily phase fuel contamination.
- Oct - Nov 95 -- Test of Bioslurper. The slurper can remove product from small (2 inches) well and at the same time oxygenate the surrounding soil to increase biodegradation of fuel that is trapped in the soil.

### ASSISTANCE FROM DIEGO GARCIA

- Boring 1.5 to 2 inch-diameters holes in the aircraft parking ramp for soil gas and water samples.
- Operation of on-island drill to place additional 2-inch wells.
- Electrical power for bioslurper liquid ring pump (max 10 HP). Generator will be OK during test period.
- ESTIMATE IT IS A 300 - 400,000 GAL LEAK.
- 3-4 YRS TO CLEAN-UP SPILL

## POSITION PAPER

ON

### JP-5 SPILL AT AIR OPS (DIEGO GARCIA)

#### BACKGROUND

- Monthly inventory reconciliation in May 91 revealed a 60,000-gallon loss of JP-5 at South Ramp Air operations in Diego Garcia.
  - Little credence should be placed at this value owing to high volume refueling operation which was going on during that period of time.
- Subsequent excavation uncovered a longitudinal leak of approximately 6 inches long in 18-in product line between fuel pits 48 and 49.
- Amount of product recovered from May 91 to Dec 91 totaled 124,541 gallons.
  - Since that time product recovery to date (30 Jun 95) yielded additional 17,286 gallons of fuel.
- In Apr 92, PACAF took over the responsibility as SAC was deactivated.
- PACAF engaged Pacific Division (PACDIV) of the Naval Facility Engineering Command (NAVFACENGCOM) to cleanup and remediate the site during FY 93 and FY 94 for a total of \$1,251,000.
- PACDIV's contractor, US Geological Survey (USGS) Hawaii District worked on the project however no cleanup and site remediation were accomplished.
- PACDIV's proposal for future work was produced from USGS study.
  - Proposal entails Phase I and Phase II Site Characterization for two years at the cost of \$6,160 K.
- PACDIV's proposal was evaluated by the Air Force Center for Environmental Excellence office of Technology Transfer (AFCEE/ERT).
- AFCEE/ERT is of the opinion that further site characterization may not be necessary, cleanup and site remediation could be performed at a much lower cost than PACDIV's proposal.
- The method of choice is an aggressive fuel removal technology known as **Bioslurper** (detailed description is attached).

# TECHNOLOGY PROFILE: VACUUM-MEDIATED LNAPL FREE PRODUCT RECOVERY/BIOREMEDIATION (BIOSLURPER)

Issue 1

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

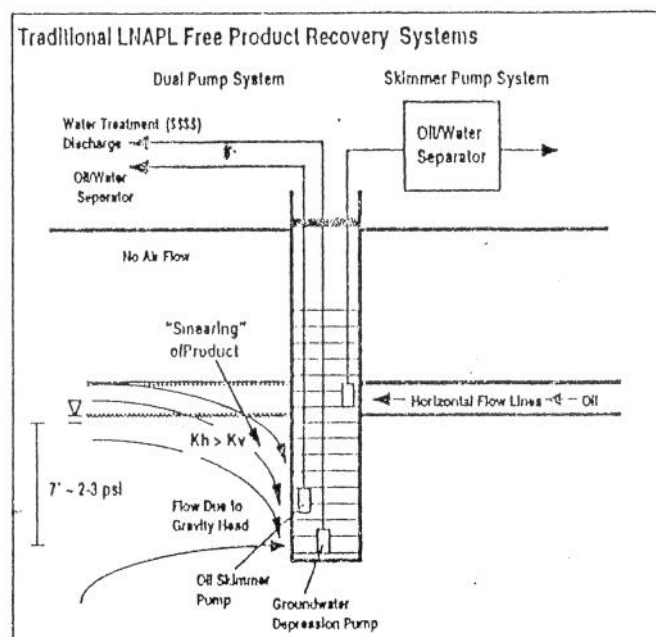
March, 1994

## Applicability: LNAPL Free Product "Floating" on the Water Table

Vacuum-mediated Free Product Recovery/Bioremediation (Bioslurping) is applicable to sites where light nonaqueous phase liquids (LNAPLs) (e.g., petroleum hydrocarbons: gasoline, jet fuels, diesel, heating oils, etc.) form a measurable layer of LNAPL on the water table. All parameters that affect the recoverability of the LNAPLs should be considered in site selection. Major factors include the mass of LNAPL (Is there enough to recover?) and the relative permeability of the subsurface matrix to air, water, and LNAPL. This technology can simultaneously remove LNAPL free product and treat the unsaturated (vadose) zone (via bioventing).

## Contingent Technologies: Skimmer and/or "Dual Pump" Product Recovery Systems

Skimmer and/or dual pump systems are traditional free product recovery technologies. Skimmer pump systems place a product recovery pump directly in the LNAPL layer. Air lift and/or mechanical pumps are employed. Dual pump systems utilize a lower ground water pump to depress the water table in an attempt to create a "driving force" for LNAPL recovery at a second skimmer-type pump. Both these systems rely upon gravity as the only driving force. The ground water pumping and treating equipment of dual pump systems dramatically increase remedial capital, permitting, and operations and maintenance costs. Also, "smearing" of LNAPL product occurs upon depression of the water table. In almost all natural settings the horizontal permeability ( $K_h$ ) is greater than vertical permeability ( $K_v$ ). Thus, the downward movement of product toward a dual pump recovery system is hindered due to lower vertical permeability. Testing of skimmer and dual pump systems will be conducted for "side to side" comparisons.



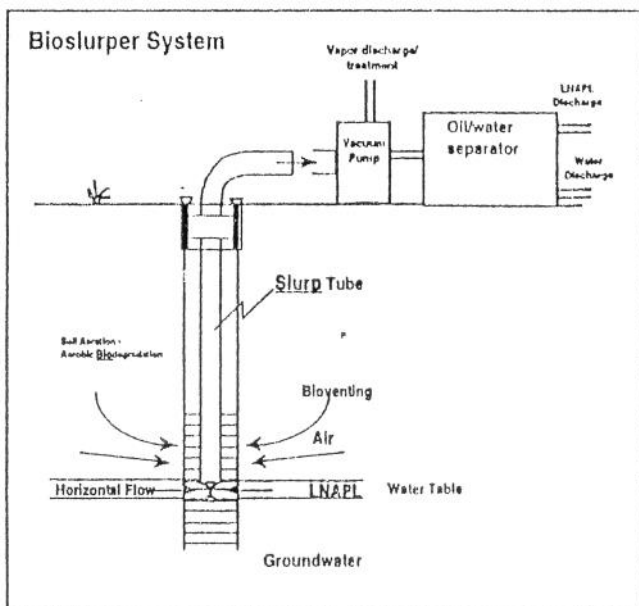
## Background: AFCEE Technology Application Approach

The AFCEE Technology Transfer Division (ERT) focuses on critical environmental restoration areas; and evaluates, demonstrates, and applies cost-effective, "off-the-shelf" technical solutions; and promotes technical and regulatory acceptance of the proven solutions. Therefore, in the same fashion that bioventing has been identified and tested as a presumptive remedial solution to petroleum hydrocarbon contamination in the vadose zone, vacuum-mediated pumping or bioslurping has been identified as a strong and cost-effective solution to LNAPL free product contamination. Using an approach similar to the AFCEE Bioventing Initiative (138 sites at 48 military bases), AFCEE/ERT plans to conduct a multiple site application of the bioslurping technology in coordination with the regulatory community. Cost and performance comparisons will be made to traditional reference technologies.

## Background: Site-specific Considerations

This initiative will also address proper methods to characterize and estimate the magnitude of the LNAPL plume. This is a critical area, since it is established that there is not a strong correlation between the amount of LNAPL free product detected in monitoring wells and that which is actually present in the formation. Thus, as outlined in the AFCEE Remediation Matrix - Hierarchy of Preferred Alternatives, apparent versus actual studies are to be performed in order to more accurately estimate recoverable free product mass. The most straight-forward apparent vs. actual study is to hand-bail the well and document the recovery of product into the well. If the product continues to recover into the well, then product recovery appears more feasible. Apparent vs. actual procedures will be developed and tested under this initiative and integrated into a "how-to" manual.

## Technology Description: Vacuum-mediated Free Product Recovery/ Bioremediation (Bioslurping)



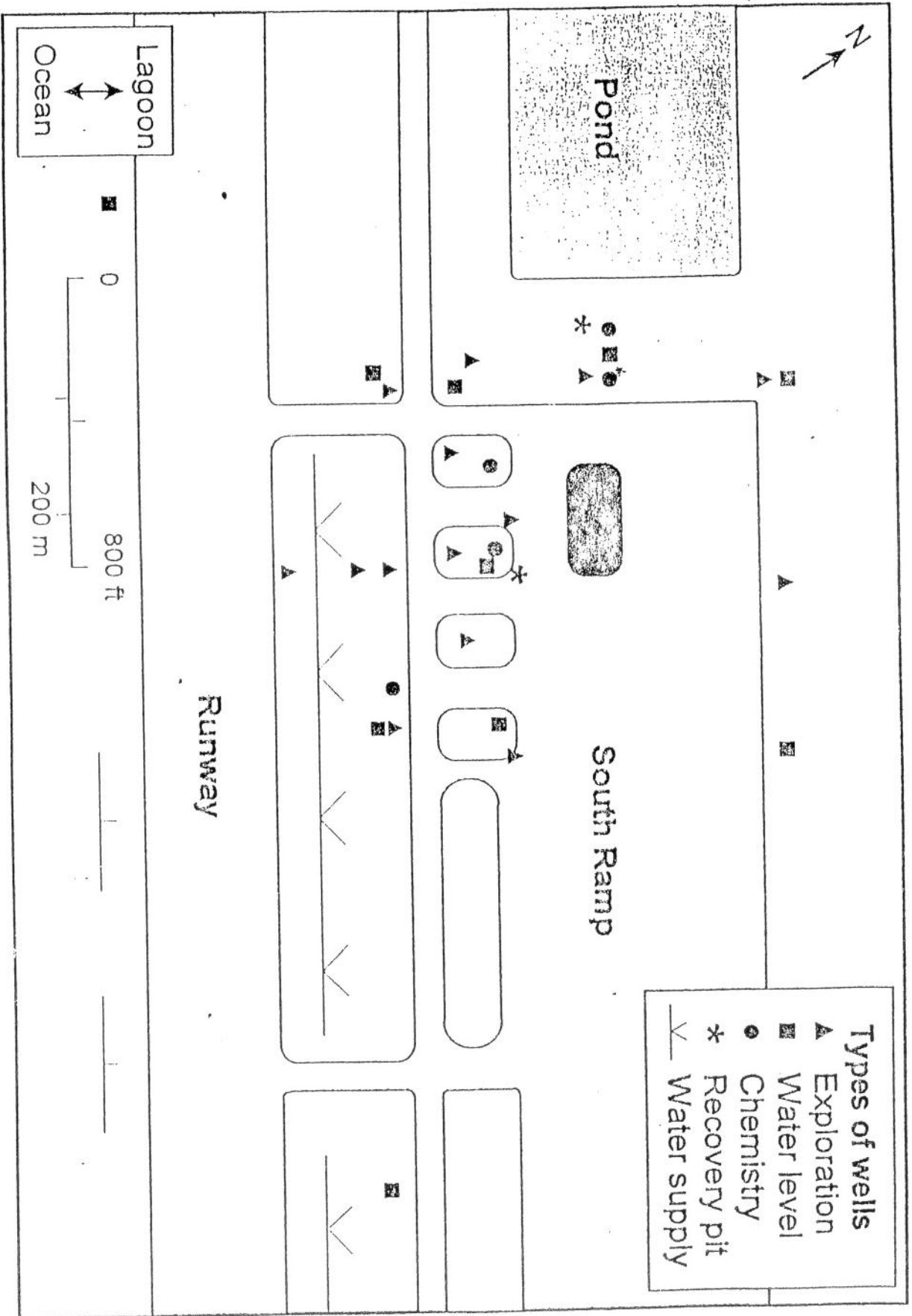
Bioslurping is an approach adapted from the vacuum dewatering industry. A bioslurper system consists of a "slurp" tube that extends into the LNAPL free product layer in the well. Product is drawn into the tube as air

flows up the tube toward the vacuum extraction pump. Product is drawn up the tube in the form of a column, slugs, droplets, vapor, and/or a film. Product can be drawn up the tube as a solid column, provided that the product flows into the well fast enough and the depth below the ground surface does not exceed roughly 25 feet below the ground surface. Otherwise, the product is "slurped" up the well through entrainment. Recovery of product is enhanced over conventional methods because as opposed to gravity alone, the vacuum provides a driving force. Product flow proceeds along a horizontal flow path which reduces product entrapment or "smearing" typical of dual pump systems. In addition, as vapor is extracted from the subsurface, oxygen, in the form of air, promotes aerobic biodegradation (a.k.a. Bioventing) throughout the affected vadose zone and capillary fringe. Another advantage is that minimal ground water is extracted which normally increases the costs significantly due to above ground treatment and permitting requirements. The liquid stream extracted from the bioslurper well flows through to the vacuum pump to an oil/water separator and vapor discharge/treatment point. Internal combustion engine systems will be employed at numerous sites as energy conservation equipment. Although different configurations will be evaluated, these systems can serve as a vacuum pump, vapor/product treatment unit, electrical power generator, "air stripper", and/or water pump. An objective of the AFCEE Bioslurper Initiative will be to develop a configuration that will be as self-sustaining as practical and to minimize the amount of waste requiring further treatment or off-site disposal, unless the recovered product is appropriate for recycling. After product recovery is complete bioslurper systems can be easily reconfigured into full-time bioventing systems to focus remediation on residual vadose zone contamination.

### Point of Contact:

[REDACTED]  
AFCEE/ERT

[REDACTED]  
COM: [REDACTED]  
DSN: [REDACTED]  
FAX: [REDACTED]



**Types of wells**

- ▲ Exploration
- Water level
- Chemistry
- \* Recovery pit
- ∨ Water supply

Pond

South Ramp

Runway

Lagoon

Ocean

0 800 ft

200 m

## GOLF CLUB DEVELOPMENT REQUIREMENTS

### Current position:

The golf course and club house as they stand are self help projects. The course is maintained by a small number of enthusiasts with MWR giving much help in getting the grass cut for golf tournaments via Annex 6. The club house has been taken over by MWR at this time.

Maintenance is a full time job to keep the course in constant reasonable repair and presentation. The current coral sand greens require raking and brushing everyday to have them keep playability. Annex 6 are currently contracted to cut the *driving range only* once a month. The golf course is not in any consistent state of repair or maintenance due to the large amount of time and effort required to do this.

The availability of any golf course is not published in DG joining literature. Many golfers, as a result, do not bring their clubs.

*Interest and participation in golf is currently much suppressed.*

Course expansion as per the attached diagram will provide for a full and standard 9 hole layout with minimal expense.

The Brit Rep has been physically shown the planned expansion area. He has intimated that since the land is designated *sanitary land fill* no objection to clearing the bush scabioli and non-ironwood would be made from his office. Indeed the improvement to the area would be welcome.

An estimated 300-500 palm trees will be planted to help delineate fairways.

A three phase project to produce a decent 9 hole golf course is set below. The closer these phases can be run together the more imminent a finished project will result.

An initial proposal has been submitted by the Recreational Services Manager to the MWR Director covering all phases. This was submitted as a result of a Q.O.L. committee request. The Diego Garcia Golf and Country Club strongly supports the RSM's suggestions and recommendations.

### Phase 1:

Requirements:            2 full time men to work on the present course and expansion area in phase 2.

Water and electric run to club house

Continued driving range attendant for operation of club house, ball and club hire.  
Present hours are 1600-1900 each day. Extend as necessary.

Annex 6 to provide tractor mower for grass cutting once a week.

Golf and Country Club to get club house back for their operation.

Benefits:

Strong improvement to island facilities.  
Course in constant good order.  
Clubs and balls available for all island personnel  
Revenue from club hire and balls etc.

Phase 2:

Requirements:

Clear extended area. 4 weeks of D9 bulldozer.

Golf Club to design new layout of holes, green locations and supervise work.

Seed new area with grass seed. 40lbs of Bermuda grass seed per acre. approx 12 acre total. (Current course was never seeded, it is all natural grow back.)

Begin planting of palm trees to help delineate fairways.

Build new greens. Excavate 6"-9" down, fill with screened top soil to 6" above ground level, roll and compact, sow seed and water. Greens ready for play in about 12 weeks.

(note: Main cost of golf green construction is in setting up the drainage. Here on D.G. we have perfect natural drainage through the coral and therefore do not require anything more than mentioned above.)

Water bowser to provide water when insufficient rainfall occurs. Watering to be done by maintenance men.

D.G. receives 102 inches of rain per year. Rain or drizzle falls 296 days of the year. (Grass around the downtown area receives no additional watering.)

Phase 3:

Requirements:

Snack bar and attendant.

Supervisor/starter to replace the attendant in phase 1.

Professional for golf shop and giving lessons. (Many island residents will take their year on D.G. as an excellent time to take up golf - a notoriously time consuming sport).



ANNEX E

28 JANUARY, 1996

SEVERAL MONTHS AGO WE HAD A BRIEF DISCUSSION REGARDING BILLFISH CONSERVATION. I ALLUDED TO A MANDATORY CATCH AND RELEASE PROGRAM FOR ALL BILLFISH IN THE AREA AND YOU SUGGESTED I PROPOSE A WRITTEN STATEMENT FOR YOUR CONSIDERATION. LAST WEEK'S TROPICAL TIMES COVERAGE OF THE 400LB MARLIN PROMPTED ME TO PUT PEN TO PAPER BEFORE ANOTHER BILLFISH IS NEEDLESSLY SLAIN ON DIEGO GARCIA.

BILLFISH STOCKS (BLACK, BLUE, STRIPED MARLIN, SAILFISH, SWORDFISH, AND SPEARFISH) ARE DECLINING AT AN ALARMING RATE WORLDWIDE. AS AN ACTIVE MEMBER OF THE BILLFISH FOUNDATION (TBF), AN INTERNATIONAL NONPROFIT US BASED ORGANIZATION, I FEEL MORALLY OBLIGED TO ENCOURAGE BILLFISH CONSERVATION ON DIEGO GARCIA. CONSERVATION IS ESPECIALLY CRUCIAL IN AN AREA LIKE DIEGO GARCIA WHERE OUR FISH STOCKS ARE PLENTIFUL. WE CANNOT AFFORD TO WAIT 10 OR 15 YEARS FROM NOW WHEN THE AREA IS SENSELESSLY 'FISHED OUT' AND WE HAVE REALIZED ALL TOO LATE THE DAMAGE IS IRREVERSABLE. THERE ARE STRICT FISHERIES LAWS THROUGHOUT THE CHAGOS REGARDING COMMERCIAL FISHING -- WHY NOT INSTIGATE RESTRICTIONS FOR RECREATIONAL SPORTFISHING ON ISLAND? WE ALREADY HAVE LAWS PROTECTING COCONUT CRABS AND LAND CRABS, LIVE SHELLS AND CORAL, PROTECTING BILLFISH WOULD DO NOTHING BUT ENHANCE THE ENVIRONMENTAL STABILITY OF DIEGO GARCIA AND ASSIST IN BILLFISH POPULATION GROWTH WORLDWIDE.

I CAN ASSURE YOU A BILLFISH PROTECTION/RELEASE LAW WOULD IN NO WAY HINDER THE MWR SPORTFISHING PROGRAM. BILLFISH GENERALLY ARE NOT OUTSTANDING TABLEFARE, THEIR MEAT BEING QUITE TOUGH AND GAMEY. WE HAVE A PLETHORA OF EXCELLENT TASTING REEF FISH IN THE LAGOON AND A MULTITUDE OF PELAGIC SPECIES OCEANSIDE (TUNA, WAHOO, DORADO, . . .) TO SATISFY THE HUNGRY ANGLER.

THE PRIMARY REASON BILLFISH ARE SLAIN HERE IS FOR THE PHOTOGRAPHIC BRAG SHOT OF 'THE BIG ONE THAT DIDN'T GET AWAY'. A 400LB MARLIN SOUNDS QUITE IMPRESSIVE BUT DUE TO LACK OF EDUCATION MANY ANGLERS DO NOT REALIZE THAT FISH HAD NOT EVEN REACHED HALF ITS POTENTIAL SIZE. BLACK AND BLUE MARLIN TIP THE SCALES AT OVER 1,000LBS FULLY GROWN.

ONE CAN MANAGE IMPRESSIVE PHOTOGRAPHS AT THE TRANSOM ONCE THE FISH HAS BEEN LEADERED TO THE BOAT, PRIOR TO RELEASE. ALSO, BY APPROXIMATE LENGTH, GIRTH, AND BILL SIZE, ONE CAN DETERMINE AN AMAZINGLY ACCURATE WEIGHT OF THE FISH WITHOUT KILLING IT.

THE MARINA ALREADY OFFERS A FREE FISHING TRIP FOR THE RELEASE OF A BILLFISH. AN ADDITION TO THAT INCENTIVE WOULD BE TO PARTICIPATE IN TBF'S RELEASE CERTIFICATE PROGRAM. I AM ABLE TO OBTAIN A SUPPLY OF RELEASE NOTIFICATION CARDS FROM TBF. FOR EACH BILLFISH RELEASED, THE ANGLER RECEIVES A RELEASE CERTIFICATE FROM TBF RECOGNIZING THEIR EFFORTS. THE PROGRAM COSTS NOTHING TO PARTICIPATE AND I WOULD GLADLY BE RESPONSIBLE FOR THE DISTRIBUTION OF NOTIFICATION CARDS AND RELEASE CERTIFICATES (OR ASSIST MWR IN INITIATING THIS PROGRAM). FURTHERMORE, TBF OFFERS A TAGGING PROGRAM WHICH IS ESSENTIAL IN TRACKING THE MIGRATORY HABITS AND GROWTH PATTERNS OF BILLFISH THROUGHOUT THE WORLD. THIS VITAL PROGRAM WOULD BE IDEAL FOR US TO PARTICIPATE IN DUE TO OUR REMOTE LOCATION IN THE INDIAN OCEAN. FOR A NOMINAL FEE, WE (MWR) COULD PURCHASE TAGS AND INITIATE A TAG AND RELEASE PROGRAM AS WELL.

CONSERVATION IS AN EVER GROWING CONCERN WORLDWIDE. OFTEN WE REALIZE TOO LATE OUR EFFORTS TO 'SAVE' AN ENDANGERED SPECIES ARE FUTILE DUE TO LACK OF FORESIGHT, PLANNING, AND EDUCATION. CONSERVATION PROGRAMS NEED TO BE IN EFFECT PRIOR TO THE DEPLETION OF OUR STOCKS. AND THEY NEED TO BEGIN HERE AT HOME WHERE OUR SPECIES ARE PLENTIFUL. A MANDATORY RELEASE LAW WOULD INVOLVE A SMALL EFFORT FOR OUR ANGLERS BUT MAKE AN ENORMOUS DIFFERENCE IN THE WORLDWIDE BILLFISH POPULATION. I THANK YOU FOR YOUR PROMPT CONSIDERATION REGARDING THIS ISSUE AND LOOK