Management of Barrow Island

W.H. Butler

Dinara Pty Ltd, 233 Adelaide Terrace, Perth.

Abstract

Barrow Island, the second largest of Western Australia's offshore islands, is a Class A Reserve vested in Department of CALM., and a producing oil field under the control of West Australian Petroleum (WAPET). Because of government agreements the preservation of the island's wildlife values has become the responsibility of WAPET.

A Plan of Management supportive of the compatibility of conservation and development in accordance with the World Conservation Strategy and the National Conservation Strategy for Australia, was developed to implement the preservation of Barrow Island conservation values. A wide range of problems was identified and recognised to interact and thus be compounded or synergistic. The main themes of the Island Management Program were:

workforce education; quarantine, which has effectively prevented any exotic invasions; rehabilitation of all finalised work areas; fire control; disturbance reduction; planned waste disposal in an environmentally acceptable manner; Rattus rattus eradication on adjacent areas; banning of all terrestrial hunting and unnecessary fauna disturbance; strict regulation of marine disturbance and fishing, plus amelioration of the effects of barriers, ecosystem changes, dust, spills and flares.

The success of the program is indicated by the presence of all known vertebrate species being maintained; no introduced species breeding; restoration to original condition of large tracts, and general environmental concern expressed by all workforce.

Special advantages have been workforce training extending into other oil field development areas of Australia; significant inputs deriving from disciplines other than ecological, biological, or conservation, and considerable scientific research and investigation from external bodies carried out under the auspices of WAPET Research Grants.

Regular inspections from concerned government agencies have been carried out and all recommendations deriving from these have been implemented into the Plan of Management. Lessons learned on Barrow Island may have application in other island management situations but it must be recognised that the special significance of islands is reflected in the special requirements of individualised management.

Unlike the majority of delegates to this workshop, I am a private Consultant who works in the area of conservation management including islands. Thus I work with development and conservation requirements in accordance with the principles of the World and National Conservation Strategies. In addition, as an Honorary Wildlife Officer I have some responsibility to the Department of Conservation and Land Management.

In order to understand why Barrow Island is not directly managed by government authorities a brief history of Barrow Island is required.

Although Barrow was sighted by the French in 1803 it was named in honour of a recently retired Secretary of the British Admiralty, John Barrow, by Philip Parker King in 1818.

Minor biological collections were made until 1900 when John Tunney extensively studied the area.

The biological work of Tunney and his predecessors, plus the record of large numbers of Green Turtles breeding on the island, caused the Western Australian Government to declare Barrow Island a Nature Reserve in 1908. This declaration was subsequently raised to Class A in 1910.

Despite various attempts to have this overthrown for developmental reasons no change to that status occurred. Very few people, including scientists, visited the island until 1964 when West Australian Petroleum Pty Ltd (WAPET) was given permission to carry out exploration for oil. This followed its recognition in 1954 by company geologists of an anticline with oil potential.

In June 1964 the Barrow No. 1 well produced oil and led to an intensive exploration and development program which has been continuous up to and including the current time. By June 1985 over 700 wells have been drilled for the purposes of producing oil or gas, water injection, water disposal or water source.

The development following the original discovery was made possible by a special Act of Parliament (Act No. 85 of 1966). This gave the entire development of the oil leases to WAPET on the environmental proviso that there was no unnecessary damage or molesting of fauna and no unnecessary destruction of flora. The leases covered the entire island which effectively made its management during development and operations a WAPET responsibility.

Contrary to what many people believe, developers are not automatically destroyers of alternate resources. Also nonsense is the constant reiteration that environmental and engineering disciplines are not compatible. Modern engineers and environmentalists are involved in communication which is complementary and compatible. Any conflict between engineering and environment derives from individuals who make it so.

Because of an earlier involvement with the company, I was able to provide WAPET with a fundamental outline of procedures to be followed. These were very simple things: no pets, no firearms, no traps, no poisons, no introduced plants, no jetties, etc. These simple principles became an inherent part of the ongoing Barrow Island development. At the same time, using my relationship with the company, coupled with the work of other investigators, I was able to identify that the 23 400 hectare desert island was representative of the almost vanished Pilbara vegetation complex on the adjacent mainland.

Because there were no introduced animals or plants, Barrow still appeared to have its full suite of original wildlife. The entire island is limestone, vegetated with 300+ identified plant species which combine into nine important ecosystems. These are:

- *Triodia wiseana* hummock grassland on limestone uplands
- *Triodia angusta* hummock grassland on water courses and lowland loam
- *Triodia pungens* hummock grassland on red or white sand
- *Spinifex longifolius* and *Acacia coriacea* on coastal dune complexes
- A short Forb community on flood out flats
- Salty flats
- Mangrove
- Coastal rock assemblages
- Disturbed areas

A total of 29 subtypes are recognised in the ecosystems of the island as described by Buckley (1983). This combination of ecosystems and habitats supports 13 native mammal species including 8 marsupials; 105 bird species, mostly nomad or waders; 49 reptile species and 1 frog species (Butler 1970, 1975). In addition, it has an incompletely catalogued but rich invertebrate fauna.

Despite the adversary approach of the sixties and seventies which asked "Should wildlife or oil be protected?" "Should conservation or development come first?" it was, and still is my belief, that conservation and development are compatible if properly planned and managed. This is supported by the principles of the World Conservation Strategy which are inherent and basic to the National Conservation Strategy for Australia.

Based on this understanding and assisted by concerned government departments, a philosophy of conservation and development was established from which arose a functional Plan of Management for Barrow Island. Although never completely formalised, this is nevertheless inherent in all Barrow Island development.

The Plant of Management is based on apparently simple factors:

1. To recognise and preserve irreplaceable segments of the natural environment which are key to island wildlife survival.
2. To recognise and preserve representative areas of all recognised habitats and plant associations.
3. To exclude unnecessary impact of the development on the natural environment.
4. To reduce to a minimum those impacts which cannot be avoided.
5. To systematically rehabilitate all utilised areas once completed.

Recognising that problems involved in achieving this may be compounded and synergistic, each had to be isolated and identified and answers formulated to reduce effects. The following were identified as needing specific answers to ensure the validation of the Plan of Management.

(a) Fauna disturbance through the presence of man and his works.

(b) Soil and habitat disturbance through active development.

(c) The loss of cover through fire protection and other developments.

(d) The possibility of introduced species of plants and animals.

(e) The possibility of road casualties.

(f) The effect of gas flares, particularly on phototrophic species.

(g) The potential for toxic or noxious spills.

(h) Dust and associated problems.

(i) Surface runoff dangers through the construction of road, pipelines and other facilities.

(j) Human predation on wildlife.

(k) Food availability changes due to the differential in water and nitrogen contents of regrowth and the availability of waste foods.

(l) Ecosystem balances changed due to selective development of particular areas.

(m) Barrier effects caused by roads, pipelines and other services.

(n) Fire and control.

Management methods to overcome these problems are multiple and involve a wide range of disciplines and people. Of particular importance is the necessity to ensure that such a management plan does not become so prescriptive and solidified that there is no room for improvement and no opportunity for individuals to contribute.

Any individual who wishes to draw the company's attention to apparent errors or omissions does so through a supervisor. No such submissions are overlooked and many have significant long term effects on the implementation of future plans of management.

The basic philosophy that conservation is compatible with development is propounded and detailed in clearly understood terms to all decision makers. By all, I mean senior management in Perth office and individual operators on the island, including all contractors. Most employees and contractors routinely make decisions affecting the environment so decision making is everybody's business, not just senior management's. All decision makers are therefore advised of basic philosophies in environmental care.

A comprehensive program of workforce education is carried out, ensuring that everybody in the company, particularly those on the island, know what they are conserving and why they are conserving it. The 'how' of conservation applies to individual units and sections with particular responsibilities.

Specifically dealing with the problems already outlined, the following were invoked:

(a) Fauna disturbance through the presence of man and vehicle was reduced by alternative areas of development so that no one area has a constant impact. Newly disturbed faunas may move into adjacent areas and repopulate once disturbance is completed.

One side issue of this is that naturally less successful individuals, in particular sub-adult or past-prime, have been forced into areas of constant impact and have acclimatised themselves to regular activity on the island. This is verified by a regular examination of road casualties for comparison with non-road casualties.

All areas not involved in island development are closed to vehicles excepting for necessary access roads.

Each physical disturbance area was reduced to as small a site as possible.

(b) Soil disturbance through active development was primarily to extract gravels for the numerous well sites, roads, and other use areas plus the gravel pits themselves. Such developments were limited to single areas at any one time with restoration as part of the ongoing pattern of utilisation. Restoration included vegetation and topsoil stripping, compaction relief, erosion control, flood and water runoff control, and final replacement of topsoil and stripped vegetation on the proper horizon.

Rehabilitation is staggered in such a way that at no time does rehabilitation present too much of one age regrowth material.

(c) The loss of cover through fire protection and development relates to firebreaks and the pre-stripping of vegetation prior to working. Initially artificial shelters of drums with mesh and cleared vegetation piled over it, plus some old huts, were utilised. However, once the rehabilitation and regrowth program were established, artificial covers were abandoned as no longer necessary.

In this respect, it was noted that the solid shade and shelter of oil field fixtures replaced cover for some species.

(d) The possibility of introduced species of plants and animals was very high on our list of potential problems. A rigorous quarantine control program was instigated which checked cargoes on aircraft and barges, created washdown points for machinery, and carried out consistent warehouse and store area

checking for introductions. Everything comes on to Barrow Island via landing barges or aircraft and total control is applied.

Pets were totally barred, both introduced and island species.

Oil discharge is operated through a submarine pipeline and no jetty has been built.

Early investigations established that *Rattus rattus* occurred on Double Island, Middle Island, Boodie Island and Pasco Island.

During a Western Australian Wildlife Authority visit in 1983 *Rattus rattus* was located on Boomerang Island, which is connected to Barrow at low water. An immediate eradication program was undertaken accompanied by a live trapping program on the adjacent areas of Barrow Island. No trace of *Rattus rattus* was found in any adjacent areas but only on Boomerang. Further eradication programs have been carried out on Double, Pasco and Boodie Islands while Middle Island will be undertaken in the near future (Morris, this publication).

Following recognition of the need for Barrow Island workforce amenity, government permission was given for eucalypts (excepting *E. patellaris* not of Barrow Island genotype) to be used for landscaping as required on Barrow Island. The trees around the camp site and workshop areas are a result of this.

There have been repeated requests from workforce and island management to include coconut palms, mango, banana and the like. These were refused by the Western Australian Wildlife Authority on the grounds that they may upset food supplies on the island, create dependent species, introduce new faunas supported by the new plants, or run wild. Occasional outbreaks of introduced plants have occurred on the island, mostly during very good seasons, and following contractors coming ashore from the adjacent mainland. In all cases successful eradication programs have been carried out to remove cape weed, blackberry nightshade and the other species which have been involved.

(e) The possibility of road casualties was recognised prior to construction of service and access roads on Barrow Island. On a space basis of the distribution of fauna populations, road casualties would be completely unavoidable among mammals, birds and reptiles.

Larger species mammal casualties examinations indicate that pre- and post-prime animals are almost invariably involved. The suggestion is that prime animals occupy territories away from the disturbance sites and force the less successful animals into contact areas.

The main controls on this aspect were to enforce a speed limit on the island and to reduce night driving. There is essential night driving required for safe field operation, and some night driving because of recreational use of the island. All driving and road use is under constant review and supervision for both safety and environmental protection reasons.

(f) The effect of flares was very difficult to deal with, because flares are a necessary part of the safety requirements of an oil field. The physical size of flares was reduced to limit the effect as far as possible and the flares were turned horizontal instead of vertical, partly for safety, partly to create evaporation of ponded liquid, and partly to reduce phototrophic effects.

(g) The potential for toxic or noxious spills, such as oils, chemicals and salt water, are prevented by good oil field design and maintenance plus contingency plans and specific treatment applied in any affected areas. For example, oil spills are ripped to break up ground compaction and allow oils to volatilise. If oil contamination persists, yeast materials are applied to reduce oil by increasing bacterial ingestion.

In the ballast pond where some entrained oil comes through ballast water, oil ingesting algae were introduced.

Of far greater concern are salt water spills which can only be ripped and left alone to allow natural flushing to take place in due course.

Part of the ongoing management program is water retention across the island drainage system. The small earthen dams and banks will pond and contain accidental runoff so that downstream effects are reduced. At the same time the program ensures aquifer recharge while reducing environmental damage from violent storms. All toxic or noxious materials used in the oil field are bulk handled as far as possible, with resultant lessened risk. A toxic chemical inventory is available at all times to ensure that all toxins are accounted for.

(h) Dust and associated problems are handled to some degree by the ongoing program of sealing roads. Dust also offers considerable problems to some areas of the field, such as workshops, as well as creating a safety hazard to users. Examinations of dust effects caused by Barrow Island traffic led to the conclusion that dust enhances roadside plant growth. Among the reasons for this enhancement is that dusted vegetation is less palatable to grazing fauna and that dust helps

to increase nutrient build up and lessen water loss in road verges.

(i) Surface runoff changes are basically handled by engineering culverts and diffusion drains to ensure continuation of original runoff patterns.

As previously mentioned a deliberate program of runoff recharge was instigated on all waterways. Since most gravel comes from stream beds, the clearing of vegetation prior to gravel extraction led to areas where water velocity could build up with no inhibition. By creating ponds, this velocity was checked and the area became a silt trap as well as an aquifer recharge.

Another result is a greatly lessened storm silt load running into the sea which has extra positive value in marine environmental preservation. An examination of the adjacent mainland, where pastoral extremes have caused desertification to a considerable degree, shows rivers discharge significant silt load which causes marine organisms to be inundated and stifled.

(j) Human predation on wildlife was effectively prohibited by the banning of any taking of fauna or flora on the island. Stringent fishing rules for offshore areas were enforced, in many cases the Barrow Island laws being more severe than the State laws. Fishing rules control the taking of specimens, such as molluscs and corals, limit the catch number and size, and declare areas where fishing is totally prohibited.

(k) Food availability changes due to the differential in water and content of regrowth, plus waste disposals, were controlled. Ecosystem change was through a systematic pattern of restoration, so that at no time would there be a greater amount of regrowth than could be found periodically in an undisturbed ecosystem following a natural disaster such as a fire or cyclone.

This became a major principle in dealing with environmental issues on Barrow Island. It is recognised that each ecosystem and its components has both genetic and individual survival capacity evolved over a period of time to survive local extremes of natural catastrophe.

In the case of Barrow Island, natural catastrophe includes cyclones, floods, drought, fire and periodic heat and cold levels. Species that could not cope with these became extinct long before the oil field existed.

The prime target of environmental management was to restrict the effects of oil field development so that island species resilience would allow repopulation from stable unaffected stocks.

Natural catastrophe records include a 1962 photographic record of a wildfire which affected approximately 90% of the island, numerous cyclones, and the variable weather records of the past century.

Waste disposal food availability was reduced by incinerating all waste with a food potential. Inert wastes are disposed of by earth fill in borrow pit areas.

Toxic wastes are disposed according to authority requirements, that is back to the mainland, as are toxic waste containers.

(l) Ecosystem balance changes due to selective development of particular areas particularly applied to creek beds which were used for gravel extraction. By alternating rock crushing as a gravel source, and by determining the sensitivity of proposed gravel sites, material can be obtained from least sensitive areas. A rigid control program over development of gravel pits and fill areas ensures that no new development takes place until rehabilitation is complete on a similar area of a similar ecosystem.

(m) Barrier effects caused by roads, pipelines and other services are of significance. It was decided that to bury pipelines on Barrow Island would create more environmental damage than to lay them on the surface, thus all flow and product lines on Barrow, with very few exceptions, are surface lines.

All flow lines are pre-welded into suitable lengths, and hydrostatically tested. Line lengths are dragged by a rubber typed machine across existing vegetation without clearing. Field welding is done over fire mats, thus reducing fire risk or necessity of clearing at welding points.

Road crossings and culverts established for drainage flow also reduce the road barriers.

Large lay-down areas and other impervious areas are rehabilitated as soon as possible within the framework of the overall program.

(n) Fire and Fire Control are critical in establishing safety factors in hydrocarbon fields which seek the complete prevention of fire. On the evidence that Aboriginal people did not occupy or utilise Barrow Island plus the evidence of stumps and burned ground material, it appears that fires on Barrow were infrequent and catastrophic, normally arising from lightning strikes. Photographic evidence of a 1962 fire which affected approximately 90% of the island's surface is available. Prior to that in December 1864 a Captain Jarman explored Barrow Island and recorded it as "the most unpromising looking spot we have seen in the north west country ... we fired it from end to

end making a splendid sight in the strong breeze blowing at the time, which caused a perfect sea of flame to traverse the island at a most astonishing pace."

From these two experiences it is apparent that significant wild fires occurred on Barrow and that the fauna and flora were capable of recovering from such fires.

Thus the no-fire oilfield policy was reinforced by the evidence of the fire history of the island before the oilfield.

Despite the most rigorous care occasional fires can and do break out accidentally and a number of such have occurred in the twenty one years of WAPET occupation. These have derived variously from burning rubbish, vehicle accidents, welding sparks and other industrial naked flames. In all cases the policy was total containment. Current investigation into alternate methods of fire control is underway to seek a cost effective, environmentally sound system.

Needless to say, a complete fire training program exists on the island and all necessary equipment including a fire engine is available at all times.

Because of fire rarity, careful monitoring of burned areas has been carried out to determine speed of regrowth and extent of change in vegetation that may persist. Following a fire adjacent to a main road,exclosures were established to keep out large grazers. It was found that there was no difference within or without the exclosure. Later work, using finer mesh which excluded rodents, showed significant difference and it is my belief that more grazing pressure on Barrow Island is applied by rodents than by large herbivores.

Through the application of these techniques implementing the policies of the Plan of Management, Barrow Island has become an area where, although individual animals and plants may be temporarily disturbed of destroyed, sufficient stock of all species in sufficient representative habitats of all ecosystems have been preserved. As a result, regeneration and repopulation are automatic from the resources. Approximately half of the island not directly involved in the oilfield development is totally closed to operations apart from the necessary service access roads passing through. As stated, these undisturbed areas are essential in maintaining a major re-population source and we ensure that they contain representation of all the habitats on the island.

As Consultant to WAPET, I am responsible for overall environmental management planning of the total oilfield program, including abandonment procedures. By deliberately not having an environmental department, all workforce on the island regard environment as their personal responsibility at all times. Thus environmental care and protection is both individual and collective workers' responsibility - and it works remarkably well!

A major asset of the overall program has been the education of ten thousand men in the twenty one year period of the field. These have learned the fundamental philosophies of conservation working in harmony with development. They have carried the pragmatic observation of those philosophies to other projects in other parts of Australia. Feedback is beginning to emerge as the principles are being applied in other parts of Australia and the world.

A word of warning, however! Although the basic concepts developed on Barrow Island have been applied successfully to other projects, there are no absolute answers to environmental preservation. Each project needs specific input to meet its specific need in its particular environment.

Philosophies may be constant, but technologies and methods must vary from place to place and time to time. The basis of conservation on Barrow Island is the preservation of habitat, i.e. air, water, soil and vegetation. Species protection in this instance is seen to be less important than ecosystem protection. We are very little concerned with aesthetic appreciation and protection because we do not believe that wildlife has an aesthetic appreciation. The evidence on Barrow is that fauna will occupy places that humans regard as unaesthetic areas as well as those which are regarded as highly pleasing.

By preserving the habitat in all its forms, the survivors of thousands of generations of natural selection adapt to the short term intrusion of man and his works provided that intrusion is not of a greater or more diversified impact than has been imposed on the area by nature. In addition, such intrusion must be actively and professionally managed. Without such management, even minor man-made perturbations could be a major catastrophe in the fragile ecosystems of Barrow Island.

REFERENCES

Buckley, R.C. (1982). The flora and vegetation of Barrow Island, Western Australia. *Journal of the Royal Society of Western Australia*, Vol. 66, Part 3, 1983 : 91-105.

Butler, W.H. 1970). A summary of the vertebrate fauna of Barrow Island, W.A. *The Western*

Australian Naturalist, Vol. 11, No. 7, August 7, 1979: 149-160.

Butler, W.A. (1975). Additions to the fauna of Barrow Island, W.A. *The Western Australian Naturalist*, Vol. 13, No. 4, 1975 : 78-80.