

1.0 INTRODUCTION

1.1 Objectives

The primary objective of this document is to help with the implementation of 'environmentally friendly' marinas in the Great Barrier Reef region. Environmentally friendly' means having minimal detrimental impact on the physical, biological, cultural, social and built components making up our environment. This document should generally be seen as complementary to, rather than as a substitute for, 'Australian Standard AS3962-1991, Guidelines for Design of Marinas' (AS3962-1991).

This document is directed at two types of reader: a) staff of the Great Barrier Reef Marine Park Authority and State and Local Government agencies who have responsibility for the assessment of marina proposals and permit applications in the Great Barrier Reef region, and b) marina developers and their agents who desire to establish a marina within the Great Barrier Reef region.

This handbook provides background information on terminology and, for a wide range of specific issues, provides discussion and rationale leading to technical guidelines and recommendations. By so doing, it is hoped this document will assist developers and assessors in appreciating implications of marina development; will provide an overview and appreciation of the role of environmental legislation that affects marinas in the Great Barrier Reef region; and result in incorporation of environmental considerations early in the marina planning process.

This handbook is directed at the siting, design and development of the most common type of marina - commercial marinas for recreational boats up to 20 metres in length. Much of the material provided here has broader applicability, however specialised situations such as fishing vessel moorings, game fishing boat marinas, racing yacht marinas and museum boat marinas may need to encompass other specific considerations such as crowd loadings on walkways, car parking for spectators and specialised maintenance and handling facilities. Those aspects require individual assessment.

The subject matter in this handbook has been made as wide-ranging as possible. However, some aspects of maritime engineering and planning are complex and it is not practicable to present discussion on all subjects in a simple manner. Topics such as breakwater design, structural design of marina components, experimental design for baseline and other monitoring programs and environmental and planning legislation are the domain of qualified professionals, who should be referred to as required.

It is proposed that this handbook will be reviewed periodically and amendments or additions be published. These reviews will cover changes in design philosophy, legislation or technical knowledge.

1.2 Use of this Handbook

This handbook should be the first reference sought by Great Barrier Reef Marine Park Authority staff or developers who are about to embark upon an assessment of, or a concept design for, a marina respectively. For developers, it should be used as a guideline along with other relevant guidelines available from Commonwealth, State and Local governments.

Organisation of this handbook provides the user with a stepwise approach to environmentally sound marina development, with chapters encompassing environmental implications in general, followed by considerations for siting, design, construction and finally, marina operation.

A great deal of the text in this document is presented in a two-column format, with the body of the text in the larger right column and pertinent summary statements in the smaller left column. Those in *italics* are regulations or legislation considered mandatory by the relevant Commonwealth and State bodies. Information on the application and requirements of these legislation should be sought from the relevant administrative department or agency. Statements in the standard type face are considered advisory only.

Appropriate consideration of these guidelines by proponents will be regarded by GBRMPA and State Government as an indication that marina development issues have been earnestly addressed during the planning stages of a proposal. Clear reference should be made in documentation supporting a proposal, to the consideration of these and/or other environmental protection measures. In addition, the marina developer's attention to environmentally sound practices avoiding or minimising adverse impacts of design and construction can help assure the commercial success of the development, since marinas are dependent upon functional, healthy, safe and attractive environments for the recreational services they provide. Minimisation of potential impacts through good planning also reduces the timeframe for approvals, impact assessment costs and monitoring requirements.

The recommendations relating to each subject will be dependent upon individual site conditions, and, to that extent, are a starting point rather than hard and fast requirements. These guidelines or recommendations do not attempt to replace other planning, design and construction regulatory standards in existence for marina developments, but will hopefully complement them, and highlight the environmental implications of some planning and design features. References to appropriate documents are provided for areas that require other regulatory design considerations at a more detailed technical level. Aspects that may require professional assistance are also indicated.

1.3 Definitions

For consistency in the description of marina facilities, the following definitions are adopted in this handbook:

advection

Transport or distribution of material by water over some spatial or time scale. Advection is caused by relatively large scale water movements transporting the given property and thus effecting a local change in concentration.

air curtain

A method for mechanical containment of oil spills and blasting shock waves. Air is bubbled through a perforated pipe, causing an upward water flow that retards the spreading of oil. Air curtains are also used as barriers to prevent fish from entering a polluted body of water and to absorb energy transmitted by blasting shock waves.

anchorage

Area of water, usually protected, in which vessels moor by dropping anchor.

baseline study

A description of the existing ecological conditions and trends in the potentially affected region, providing a reference 'baseline' from which environmental scientists can: (1) predict the effects of the proposed action and recommend alternatives, (2) define appropriate mitigation measures, and (3) design future programs to monitor the accuracy of predictions and the effectiveness of mitigation. A baseline study requires systematic measurements using proven statistical methods and therefore differs from qualitative assessments (e.g. observations) that might be undertaken for preliminary site assessments.

berth

An area of water allocated for the wet storage of boats attached to a structure and allowing for walk-on access. Known also as a **pen**. Boats at marinas generally occupy single or double berths, where a single berth accommodates one boat between finger floats or piles and a double berth accommodates two boats between finger floats or piles.

boom

An extendable or deployable floating device usually used to contain spilled oil or other floating material.

breakwater

A solid barrier constructed in the water to create a sheltered area for boats.

bund wall

A barrier constructed temporarily to enclose and protect a region during

construction. Bund walls are often established to enable water to be pumped from a site so that excavation can occur 'in the dry'.

channel

An unobstructed waterway which allows the movement of boat traffic. The entrance channel enables boats to move between the marina and the main waterway (river, bay, etc.) and interior channels within the marina allow boat movement between the entrance channel and the fairways.

channel depth

Depth of water in channel at Chart Datum (usually approximately MLWS but must be checked for each locality).

channel width

Width available for navigation at nominated channel depth (as opposed to width at the water surface, which may be much greater but cannot be utilised by deep draft vessels).

deck freeboard

The vertical distance between the deck of a platform structure and the water surface.

designated development

Development which by its activity, location, or by Local Authority policy, is designated as requiring mandatory environmental impact assessment pursuant to the Local Government (Planning and Environment) Act.

dissolved oxygen

The extent to which oxygen occurs in solution in water or waste water; usually expressed as concentration, in parts per million, or percentage of saturation.

disturbed land

Land that has been altered physically, biologically or chemically by the action of people e.g. land on which excavation has occurred or upon which overburden has been deposited.

diversion ditch/channel

Channel constructed across sloping land for the purpose of intercepting surface runoff, thereby changing the accustomed course of all or part of a stream. Also, a ditch or canal by which water is diverted from one stream to another.

drainage basin

Land surface occupied by a waterway drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

dredged basin

An excavated area of a river or harbour deeper than the surrounding waters.

dry storage (dry stack)

Storage of small to medium sized (up to 9 m) boats, generally in a multi-level rack system. Boats are conveyed to and from the water by a fork lift, crane or other device.

ebb flow

The period of receding tidal flow between high tide and the succeeding low tide.

estuaries

Waterways and areas where fresh water meets salt water (e.g. bays, mouths of rivers, salt marshes and lagoons). Estuaries are delicate ecosystems, serving as nurseries, spawning and feeding grounds for a wide variety of marine life and providing shelter and food for birds and other wildlife.

exceedance probability

Probability of a prescribed water level being attained in a specified time period due to extraordinary events e.g. cyclones, storm surges, etc.

fairway

Unobstructed waterways between rows of berths which allow movement between interior channels of a marina and individual berths. A navigable deep-water channel in a river or harbour or along a coastline.

finger

A floating structure connected to the walkway which provides pedestrian access both to and from a berthed boat.

flood flow

The period of advancing tidal flow between low tide and the succeeding high tide.

flotation freeboard

The vertical distance between water surface and the top of the flotation chamber of the pontoon.

flushing time

The measure of the time required to transport a conservative pollutant from some specified location. The volume of the estuary divided by the water flux rate; a useful figure for assessing load capacities.

groyne

A rigid structure, usually rock, built at an angle (usually perpendicular) from the shore to protect it from erosion or to trap sand. A groyne may be further defined

as permeable or impermeable depending on whether or not it is designed to allow sand to pass through it.

hardstand

An open paved area, used for the storage of boats and for maintenance activities such as painting, anti-fouling and repair work.

heavy metals

Metallic elements of high atomic weight, generally toxic to plant and animal life in low concentrations. Such metals can often become residual in the environment and exhibit biological accumulation. Examples are mercury, chromium, cadmium, arsenic and lead.

impact

An environmental perturbation that occurs in an ecosystem as the result of a disturbance. The term 'positive impact', in relation to the natural environment, refers to the improvement or re-establishment of a previously degraded environment. In relation to the social environment positive impact refers to an 'improvement' of a social situation, such as poverty or deprivation, but must always be used with caution.

jetting

Use of blasts of water and/or air injected in sediment to facilitate placement of pilings and blocks.

land use patterns

Natural or imposed configurations resulting from the spatial arrangement of the different uses to which various plots of ground are put at a particular time.

leaching

Extraction of dissolved or suspended materials from a solid by a liquid.

locked-harbour

Marine harbour that is, or can be, separated from adjacent waterways by a mechanical device such as a lock or tide gate.

marina

Shoreside facilities for mooring and servicing recreational boats, and including water-based as well as land-based facilities for boats and boat-users. Water-based marina facilities include moorings and berths for boats, as well as jetties and pontoons. Land-based marina facilities include the dry or rack storage of vessels, ship chandlery sales, areas set aside for ship repair and maintenance, sail lofts, slipways and hoists (which are both land and water-based), as well as areas for food and boating sales. Small boat harbour or boat bases providing dockage, supplies, and services for small pleasure craft.

mitigation

Specific procedures to reduce or avoid potential adverse impacts.

mixing zone

Zone of initial dilution in the immediate area of a point source of pollution.

monitoring program

A study program for measuring specific parameters designed to detect changes in environmental conditions and to differentiate between natural and human induced conditions. The program often includes extensions of certain aspects of the baseline study program selected for their ability to detect alterations in local ecosystems caused by the project of interest. Monitoring programs are often subdivided into construction, operation and post-operational phases and may be both quantitative and qualitative.

mooring

A detached or free standing structure to which a boat is moored. Several types of mooring exist, including:

Fore and Aft Mooring	anchors or piles to which boats are attached by both bow and stern lines.
Island Mooring (Star)	a floating structure secured by an anchor or a pile to which one or more boats may be moored.
Swing Mooring	an anchor or pile to which a boat is attached to allow alignment with wave, wind or current.
Trot Mooring	a system for the fore and aft mooring of several boats in rows.
Buoy Mooring	single point mooring attached to a floating buoy to which a vessel may be attached.

open marina

Marina designs consisting of piers and/or docks extending into coastal water with minimal protective impermeable barriers.

outfall

Structure extending into a body of water for the purpose of discharging an effluent (sewage, storm runoff, cooling water etc).

pen

See 'berth'.

point source

A stationary emitting point of a pollutant, e.g. a discharge pipe; in contrast to an area source or a diffuse source.

reactive monitoring

Monitoring done to allow control of the level of an impact, such as the level of introduced sediment in water (as opposed to monitoring done to confirm the presence or magnitude of predicted and accepted impacts).

rehabilitation

The process of converting a disturbed environment to its former or other productive uses. The process of making a site habitable to organisms that were originally present or others that approximate the original inhabitants.

recruitment

Addition of individuals to a biological species population through reproduction and immigration.

residence time

The measure of time required before a pollutant is transported from some specified location.

revetment

A sloped facing of stone or concrete built to protect existing land or newly created embankments (breakwaters, bund walls) against erosion by wave action, currents, or weather.

riprap

Larger facing, or protective mounds of rock placed on embankments and breakwaters to prevent erosion, scour, or sloughing of structure or embankment. (See revetment)

seiche

A long period oscillatory wave motion in an enclosed or semi-enclosed body of water which is dependent on the geometry of the basin, reflecting characteristics of surrounding walls, wave period and resonance.

sewage pump-out facility

An installation to pump out on-board sewage holding tanks in vessels. They are usually connected to the main sewage system, often via a small pumping station.

silt curtain

Floating wall of filter material weighted to the bottom which encloses dredging or dumping operations to limit the escape of turbid waters.

straddle-lift

A hoist designed to vertically lower or lift boats in and out of the water and to carry them to maintenance or storage areas.

substrate

Seabed, floor of the ocean.

turbidity

A measure of the optical clarity of water, dependent upon the light scattering and absorption characteristics of both suspended and dissolved material in the water column.

water quality

A term used to describe the chemical, physical and biological characteristics of water in respect to its suitability for a particular use.

water table

The upper surface of the ground water or that depth below which the soil is saturated with water. It is defined by the level at which water stands in wells that penetrate the water body just far enough to hold standing water. In wells that penetrate to greater depths, the water level will stand above or below the water table if an upward or downward component of ground water flow exists.

weep holes

Drainage hole in a structure allowing release of groundwater to prevent a build up of water behind the structure.

wind rose

A diagram depicting the percent occurrence of wind speed and duration from all directions on a monthly or annual basis for a particular location.

1.4 Abbreviations

A	Walkway width
AHD	Australian Height Datum
B	Average beam of boats
bmax	Maximum beam of boats
BOD	Biological Oxygen Demand
C	Finger walkway width
Cd	Drag co-efficient
CEPA	Commonwealth Environment Protection Agency
COD	Chemical Oxygen Demand
DEST	Department of the Environment, Sport and Territories
E	Clear space between walkways
EIS	Environmental Impact Statement
EMMP	Environmental Monitoring and Management Program
EP(IP) Act	Environment Protection (Impact of Proposals) Act
F	Fairway width
F _D	Drag force due to current
F _d	Drag force due to wind
FIRB	Foreign Investment Review Board
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
HAT	Highest Astronomical Tide
IAS	Impact Assessment Study
L	Length of longest boat
L _{av}	Length of average boat
Lb	Length of berth
LOA	Length overall of boat
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLW	Mean Low Water
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
MSL	Mean Sea Level
PER	Public Environment Report
Pz	Design wind pressure
QDEH	Queensland Department of Environment and Heritage
QDHLGP	Queensland Department of Housing, Local Government and Planning
QDPI	Queensland Department of Primary Industries
QDT	Queensland Department of Transport (Marine and Ports Division)
TOR	Terms of Reference
V	Wind Velocity
Wb	Width of berth
Wdb	Width of double berth