

7.2.6 ENVIRONMENTAL MANAGEMENT PLAN ELEMENT 6: HYDROLOGY, DRAINAGE AND CONSTRUCTED WETLANDS

Introduction

Hydrological, drainage and related issues are of over-riding importance in the design, operation and management of the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course development. Apart from serving crucial functional and landscape objectives in the context of the development, as indicated on the Comprehensive Development Plan (Figure 1) and in the report on hydrology and drainage by Craigie and Condina (1999), the protection of the downstream saltmarsh wetland is paramount. With excessive freshwater inputs the saltmarsh will degrade irreparably because of lowered salinity, as discussed in the EMP Element 7.2.1.

Craigie and Condina (July 1999) outlined the concept for management of the quality and quantity of surface water including a feature lake system and constructed wetlands. This was supplemented by further comment in response to questions raised by an objector to the development. A brief outline of the work of Craigie and Condina (1999) is given here. They identified what is proposed in new drainage systems on the site, potential off-site impacts and the measures that will be employed to address such impacts. A summary of their report follows.

Two premises are of particular significance in the concepts outlined by Craigie and Condina (1999) and Craigie (1999): (i) Runoff from upstream (presently rural) catchments will be managed by the responsible body – Surf Coast Shire Council, (ii) The proponent, MHY Handbury Joint Venture Pty Ltd, would strongly support Council implementing a policy which maintains existing rural runoff quality and quantity conditions from the upstream catchments after these are developed for urban purposes.

A key component of the development will be the provision of substantial feature amenity lakes along the drainage line. The lakes will provide a focus of the development village and residential areas. Also there will be a series of interconnected smaller lakes and wetlands, the latter designed for water quality treatment as well as aesthetic values. The main amenity lakes should maintain an aesthetically pleasing aspect, and not suffer from water quality and related problems. Water quality conditions will also be a primary design consideration in the other irrigation lakes and open-water segments of the wetlands.

Existing hydrological features of the site are:

Thompson Creek floodplain (Saltmarsh Complex) with Rural Floodplain Zoning under the Planning Scheme with an upper bound estimate of 2.2 m AHD assumed as the 100 year Average Recurrence Interval (ARI) flood level at the east boundary of the development area[†].

[†] The 2.2 m ARI flood level (provided by T. Jones, Floodplain Manager, Corangamite Catchment Management Authority, 21 October 1999) is based on the expected tide storm surge from Thompson Creek estuary. All development floors will be set 300 mm above this level.

Western Catchment (including the bulk of the subject land) with a rural catchment of c. 520 ha (ultimately to be mostly urbanised).

Southern Catchment draining the existing residential Golden Beach (Torquay Sands) and South Beach Estates (c. 20 ha) and rural land (c. 75 ha), totalling 140 ha. This currently drains to a constructed pondage/retarding basin, The Esplanade wetland (Plate 15, Map 1). Water is directed by pump and rising main from the pondage to Deep Creek. During high flow the pondage overflows to the ocean via Whites Cut. Key deficiencies in this system include erosion of the primary sand dunes, safety threats (steep banks), poor water quality treatment, flood threat to existing housing, poor aesthetics and environmental values, and ongoing costs of pump diversion operations.

The c. 6 ha freshwater *Amenity Lakes* will be aligned along the existing watercourse with small flanking wetland areas to treat runoff from the abutting development and an upgraded Esplanade Wetland to treat and redirect runoff from the existing Golden Beach (Torquay Sands) and South Beach Estates.

Management of potential hydrological impacts

- The Golden Beach (Torquay Sands) development is obligated to:
 - control discharges emanating from within its boundaries so that no detrimental impact accrues to properties downstream;
 - provide for passage of all waters from upstream catchments so that no detrimental impact accrues to properties upstream;
 - ensure internal development levels and drainage systems adequately protect the development itself from flooding; and
 - ensure major floods are passed through the site in a safe manner.
- To mitigate offsite impacts of increased stormwater runoff from the Golden Beach (Torquay Sands) site, the drainage systems within the site will provide for flood retardation storage in the airspace above the amenity lakes and the other minor lakes and wetlands
- Excess surface runoff water will be stored on site and consumed directly (e.g. by irrigation) or indirectly (e.g. evaporation). All lakes and wetlands will be fully lined and sealed against leakage to protect against saline groundwater intrusion.
- Water supply to maintain water quality standards and limit drawdowns in lakes will be an issue of major importance.
- With the amenity, minor lakes and wetlands, a total of c. 8 ha of surface water will result, with stored volume at NTWL of c. 140 ML.
- The Golden Beach (Torquay Sands) development will ensure that no significant change occurs to quantity, quality or seasonality of stormwater runoff discharged from within its boundaries as a consequence of its own development. A variation of +/- 15-20% from “natural” conditions would be considered as being within the bounds of practicality. It is a practical impossibility to ensure zero change occurs.

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- *remained*
 - Golden Beach (Torquay Sands) will use much of the water from The Esplanade (Southern Catchment) for golf course irrigation and lake supply, especially in the summer period when no drainage water would naturally flow to the saltmarsh. The balance of all overflows are intended to be passed through the lake and wetland system and then on to the saltmarsh, but only after satisfaction of irrigation diversion and storage requirements. This will necessitate the building of a pipeline between the Esplanade wetland and the main lake in Golden Beach (Torquay Sands). The system is to ensure there is no occurrence of stormwater overflow through the Whites Cut sand dune system.

Wetland treatment to ameliorate water quality

- No free discharge of surface water will occur from any part of the development, without such water firstly being processed through grass filtration and/or wetland treatment and lake storage systems. All stormwater generated from development areas (roads, condominiums, houses, hotel) will be stored on site, treated in wetland systems and diverted to supply the main amenity lakes and other minor feature lakes and golf course irrigation systems.
- The water treatment wetlands will be sized to treat all flows from the residential and commercial areas of the development and from non-irrigated golf areas, to achieve approximately 80% suspended solids removal and removal of 50% of the incoming total phosphorus and total nitrogen, as recommended in the Best Practice Environmental Management Guidelines for Urban Stormwater (EPA 1999).
- The total area of "treatment" wetlands will be at least 1.2% of the contributing developed catchment area. This will also satisfy related criteria that the wetlands achieve a 90% hydrologic effectiveness and detain pollutants for a sufficient period to provide the required treatment.
- The inlet portions of each wetland serving urban areas will incorporate a zone of coarse particle sedimentation and litter trapping. Up to 80% of the surface area of the wetlands will be composed of a mix of ephemeral area and shallow marsh areas up to 0.6 m deep, which will feature emergent aquatic vegetation. Open water zones (free of significant stands of emergent vegetation) within the wetland will be limited to about 20% of the surface area.
- The lakes are primarily open water bodies with gently sloped verges and shallows to suit establishment of a diverse community of fringing aquatic vegetation. Up to 80% of the surface area of the lakes is intended to be open water, free of significant stands of emergent aquatic vegetation. The lakes form an important component of the water quality treatment train, with long-term settlement of fine particulates and ultraviolet disinfection being the primary processes.

- Shoreline treatments, e.g. rock boulders, retaining walls, boardwalks, jetties and sand or gravel beaches, can be incorporated to suit a variety of landscape and recreational objectives; suppress wind-driven wave action; prevent uptake of fine particulates and clays through dispersion processes; and mitigate turbulent resuspension of settled materials.
- The design of edge treatment, choice of wetland plantings and recirculation measures will aim to mitigate the risk of nuisance conditions, such as mosquitoes or algal blooms.

Golf course runoff (irrigated areas)

- A mix of treated wastewater (from Black Rock Sewerage Treatment Plant) and treated stormwater is proposed for most golf course irrigation. The treated wastewater will only be added as necessary to make up for deficiencies in supply of treated stormwater from the irrigation storage system. Treated stormwater will be the prime ongoing irrigation supply. With expected higher nutrient loadings by comparison with urban stormwater runoff, all rainfall runoff from the areas of the golf course irrigated with the mixed water will be kept separated from that arising from the non-irrigated areas (and areas irrigated with stormwater only) and the urban stormwaters.
- Maximum opportunity for mechanical filtration and biological uptake through extended detention is a key to effective treatment of the runoff from irrigated areas of the golf course. All such rainfall runoff is to be contained on site in a series of depressions draining to terminal storage systems.
- As far as practicable, these systems will be protected from entry of runoff from both non-irrigated areas on the course and external catchments. They will be designed as ephemeral wetlands with small open water areas acting as landscape features and evaporation surfaces. In times of significant runoff the open water areas will increase until such time as preset overflow levels are exceeded and discharge will occur to terminal irrigation dams from whence recycling of water will occur to the main irrigation storage.
- The design of the ephemeral wetlands will aim for removal of up to 60% of total nitrogen and total phosphorus. To achieve these performance criteria, the total area of “treatment” wetlands provided will be at least 2.5% of the contributing irrigated catchment area in the golf course.

From their investigations Craigie and Condina (1999) conclude that:

- major benefits will accrue for Whites Cut and the existing pondage area at the end of The Esplanade as a planned outcome of the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course development;

- there is ample scope to store the necessary volumes of floodwater within the site to ensure that offsite discharges from the Golden Beach (Torquay Sands) Residential Lakes and Golf Course development are maintained to present conditions;
- the water storage and water quality treatment systems within the development boundaries can be designed to effectively mimic the existing seasonal regime of surface water discharged from the site area to the saltmarsh wetlands in Thompson Creek estuary/floodplain;
- all external catchment floodwaters will be passed through development areas along designated paths (primarily through the amenity lake system). Velocity and depth of floodwaters in all floodways will conform to contemporary standards for safety as set out in Melbourne Water Corporations' *Floodway Safety Guidelines*;
- an upper bound estimate of 2.2 m AHD has been assumed as the 100 year ARI flood level at the east boundary of the site;
- all stormwater generated from development areas (roads, condominiums, houses, hotel) will be stored on site, treated in wetland systems and diverted to supply the main amenity lakes and other minor feature lakes and the golf course irrigation system. The water treatment wetlands will be designed and sized to treat all flows from the residential and commercial areas of the development and from the non-irrigated golf course areas, in accordance with recommendations in the Best Practice Environmental Management Guidelines for Urban Stormwater (EPA 1999);
- there is no evidence of acid-sulphate soils being present on the site in significant quantities;
- leakage of surface water to groundwater from proposed waterbodies will be minimal owing to very low clay soil permeabilities and proposed use of synthetic liners.;
- the clay soils are slightly to moderately dispersive and will require protection from water action on the edges of all waterbodies;
- treated wastewater from Black Rock STP is proposed to be imported for golf course irrigation. Due to expected higher nutrient loadings by comparison with treated urban stormwater runoff, all rainfall runoff from areas of the golf course that are irrigated with water mixed with treated water from Black Rock STP will be kept separated from that arising from the non-irrigated areas and the urban stormwaters; and

- all rainfall runoff water from irrigated parts of the golf course will be separated from the urban stormwaters and contained on site in a combined water quality/water quantity management system. This will take the form of a series of depressions draining to terminal storage systems which will be designed as ephemeral wetlands offering maximum opportunity for mechanical filtration and biological uptake of pollutants through extended detention. Overflows from these wetlands will be captured and recycled in the irrigation system. The design objective for the system will be to harness all golf course drainage water for recycling in irrigation and to remove up to 60% of total nitrogen and total phosphorus.

Further studies are required to:

- detail requirements and operating characteristics of all flood storages utilising the RORB hydrologic model;
- confirm operational requirements to achieve the design objectives for offsite discharge, irrigation supply and makeup supply needs for both irrigation and the main amenity lakes; and
- refine the design of edge treatments, wetland plantings and recirculation measures and to ameliorate potential nuisance conditions (e.g. mosquitoes and algal blooms).

The following EMP element broadly addresses the means of achieving the stated objectives; it is to be considered in conjunction with the water quality component of the EMP (Element 7.2.5).

PLAN ELEMENT 6	Hydrology, Drainage and Constructed Wetlands	Responsible Parties	Timing or Frequency
Objectives	<p>To ensure effective drainage and disposal of stormwater runoff from the development area and catchments to the west and south-west.</p> <p>To protect the downstream saltmarsh from excessive freshwater inputs i.e. to maintain inputs at or near current levels with similar seasonality of flows.</p> <p>To protect the downstream saltmarsh from silt and accidental spills, particularly during construction. (Refer Element 15)</p>		

PLAN ELEMENT 6	Hydrology, Drainage and Constructed Wetlands	Responsible Parties	Timing or Frequency
	<p>To enhance landscape values in a residential and golf course context with a feature lake system and associated wetlands, which allows for passive recreation.</p> <p>To achieve a design for the drainage and wetlands systems that will be operationally sound, cost effective, and result in no adverse impact on the saltmarsh, by thorough investigation and testing of options.</p> <p>To employ water quality amelioration (stormwater) in wetland treatment systems and separation of treated effluent from stormwater and protect the quality of water entering saltmarsh;</p> <p>To ensure that no adverse impacts arise during construction</p>		
Implementation Actions	<ul style="list-style-type: none"> Pending further investigations to finalise the Surface Water Management Strategy (SWMS), Implementation Actions are not detailed here. Further studies (e.g. hydrological modelling) undertaken by specialist consultant appointed by the Owner will resolve design and function issues for the system. The Section 173 Agreement specifically addresses (points 8.6 – 8.9, 8.12 and 8.13) obligations of the Developer and the Golf Course Manager in respect of hydrology, drainage and maintenance of water quality. Satisfactory resolution of all these matters will be required prior to Council issuing stage approvals for the systems and the numerous details that follow. 	<ul style="list-style-type: none"> Developer / Golf Course Manager 	<ul style="list-style-type: none"> SWMS to be completed by Aug 2001
Follow-up and Ongoing Actions	<ul style="list-style-type: none"> As detailed in design and surface water management strategy documentation. 	<ul style="list-style-type: none"> Developer / Golf Course Manager 	<ul style="list-style-type: none"> As detailed in design and surface water management strategy documentation
Performance Measures and Monitoring	Additional performance measures need to be developed after design of the systems has been finalised. These will be addressed in the Surface	<ul style="list-style-type: none"> Developer/Golf course manager 	<ul style="list-style-type: none"> SWMS to be completed by Aug

PLAN ELEMENT 6	Hydrology, Drainage and Constructed Wetlands	Responsible Parties	Timing or Frequency
	<p>Water Management Strategy.</p> <p>Performance standards for all wetlands should include:</p> <ul style="list-style-type: none"> • 80% suspended solids removed • 50% TN, TP removal (urban drainage areas) • 60% TN, TP removal (mixed treated wastewater/stormwater reuse irrigation areas) • mean annual surface runoff from Golden Beach (Torquay Sands) to be within +/- 15-20% of existing conditions. 		2001