

Cattle Bay Marina Water and Wastewater Servicing Strategy

1 INTRODUCTION

Eden Resort Hotel Pty Ltd has commissioned Royal HaskoningDHV to undertake water and wastewater servicing investigations for a new development in Cattle Bay, NSW.

The site is located approximately 1 kilometre west of the Eden town centre on the NSW south coast, in the Bega Valley local government area. The site adjoins Cattle Bay Road to the east and encompasses part of Cattle Bay to the south. Refer **Figure 1**.

The development involves a new marina and temporary land facilities.

This study has been prepared to define the water and wastewater servicing strategy for the new development and includes investigations of the following elements:

- Development description, refer Section 2.
- Study area, refer Section 3.
- Planning context (references to Local Environmental Plan, development consent), refer Section 4.
- Identification and assessment of the water demands and servicing options, refer Section 5.
- Identification and assessment of the wastewater loadings and servicing options, refer Section 6.
- Conclusion, refer Section 7.

2 DEVELOPMENT DESCRIPTION

Plans of the proposed marina are presented in **Appendix A**. The development comprises:

- Total of approximately 154 berths in three floating pontoon arms restrained by piles.
- Fixed wave attenuator located parallel with, and along, the southern pontoon arm.
- Minor refurbishment of the existing wharf.
- Provision of power, lighting, water, firefighting equipment, mobile sewage pump out trolley (for small scale pump out) and security access controls to the pontoons and berths.
- Temporary car park comprising 97 spaces plus 3 loading/unloading spaces.
- Temporary 'portable' buildings to house marina administration and toilets:
 - Temporary building 1 will contain Female WC (WC - 2, Hand Wash Basin – 2), Male WC (WC-1, Urinals-2, Hand Wash Basin-2) and Accessible Unisex Facility (WC-1, Hand Wash Basin -1, Shower – 1).

- Temporary building 2 will contain meeting room with kitchen and storage.

The temporary facilities will be replaced by the resort and residential proposal when it is developed.

3 STUDY AREA

The study area covers the development site and the existing water and wastewater infrastructure sites in Cattle Bay.

3.1 DEVELOPMENT SITE

The development site is located on Lots 2 and 4 of DP 1138056, Cattle Bay Road and the adjoining waters of Cattle Bay within Twofold Bay, Eden NSW.

Lot 2 is owned by Eden Resort Hotel Pty Ltd (ERH) and has an area of 1.67 hectares. It contains the majority of the remains of the Heinz cannery. The site comprises a series of level concrete building slabs. They are the remaining foundations of the cannery buildings that previously occupied the site, the majority of which have now been demolished. Two obsolete cannery buildings, 1-3 storeys high, remain in the north eastern corner of the cleared area and are generally outside the subject site. They do not form part of the site that is subject to this proposal.

Lot 4 comprises a strip of foreshore land commencing northwards from the seawall to the rear of the beach.

The subject site plan is shown in **Figure 2**.

3.2 EXISTING WATER AND WASTEWATER INFRASTRUCTURE

3.2.1 Existing Water Infrastructure

The nearest Council's water infrastructure includes DN150 water main in Cattle Bay Road.

3.2.2 Existing Wastewater Infrastructure

There is an existing sewer rising main outside cannery buildings - see picture below.



The nearest Council wastewater infrastructure outside the subject site includes sewer manhole DZ1 in Cattle Bay Road from which a gravity main transports flow to wastewater pumping station PS3 located near the intersection Cattle Bay Road and Chandos Street.

4 PLANNING CONTEXT

The proposed works are located within the Bega Valley Local Government Area (LGA).

The relevant environmental planning instruments is the Bega Valley Local Environmental Plan 2013.

According to these plans, construction of public water and wastewater infrastructure does not require consent.

5 WATER SERVICING STRATEGY

5.1 CONNECTION TO EXISTING WATER INFRASTRUCTURE

Consultation with the Bega Valley Shire Council regarding providing the water services for the proposed development is under way.

This report suggests provision of the water supply from the existing DN150 water main located in Cattle Bay Road.

5.2 PROPOSED WATER SUPPLY CONNECTIONS

The development would have two connections to Bega Valley Shire Council water supply system:

- domestic water supply connection; and
- water connection for servicing of firefighting hydrants.

The domestic water supply would provide potable water for the following:

- 154 marina berths (potable water will be provided from taps integrated into the service pedestals).
- Temporary buildings 1 and 2.
- Fire hose reels.

5.3 AVAILABLE PRESSURE AT THE CONNECTION POINT AND THE REQUIRED PRESSURE.

5.3.1 Available Pressure at the Connection Point

A pressure test has been undertaken on DN150 Council's water main at the corner of Cattle Bay Road and Chandos Street on 6 June 2014. The residual pressure ranged from 200 kPa to 900 kPa.

The results of the test are included in **Appendix B**.

5.3.2 Minimum Service Pressure Required for Domestic and Commercial Applications

The minimum service pressures for the domestic and commercial water supply applications according to Water Supply Code of Australia WSA 03-2002 are as follows:

- Desirable minimum service pressure – 200 kPa (20 metres) for domestic application and 250 kPa (25 metres) for commercial application.
- Minimum service pressure (Note 1) – 6 to 15 metres for domestic and commercial application.

Note 1: Water Agency written approval shall be obtained for service pressures less than the “desirable minimum”.

It is noted that during the peak day demand the service pressure at the Marina would be less than the 20 metres. Hydraulic modelling of the water supply system will be undertaken during the concept design stage.

5.3.3 Minimum Residual Pressure Required for Firefighting

The minimum fire hydrant outlet flow rates and pressures according the AS 2419.1-2005 are as follows:

Fire Hydrant Type	Minimum Required Flow Rate (L/s)	Minimum Required Residual Pressure in NSW (kPa)
Feed fire hydrant, unassisted	10	150
Attack fire hydrant, unassisted	10	250
Internal and external fire hydrants when boosted by a fire brigade pumping appliance	10	700

Notes:

1. 'Unassisted' specifies the system performance characteristics achieved by a water agency's system or other elevated reservoir, before a fire brigade pumping appliance is connected to the system. On-site pumps must not be used to achieve this performance. If pumps are required, then fire hydrants will need to have attack fire hydrant performance and be located in accordance with Clause 3.2.2.2(c) of AS 2419.1-2005.
2. In a system that incorporates a fire brigade booster assembly, external above-ground fire hydrants, accessible by a fire brigade pumping appliance, if located as attack fire hydrants, need only have feed fire hydrant unassisted performance (see Clause 3.2.2.2(d) of AS 2419.1-2005).

Hydraulic modelling of the firefighting water supply system will be undertaken during the concept design stage. If the residual pressure is found to be less than the minimum residual pressure required in

AS 2419.1-2005, then a pressure boosting system will be incorporated into the firefighting water supply design.

5.4 WATER DEMAND

The land based facilities water demand was calculated using Development Servicing Plan (Bega Valley Shire Council, 2013), WSAA standards and NSW Water Directorate Section 64 Determinations of Equivalent Tenements.

An investigation of the marina berths water demand has been undertaken (Marina Water Demand and Wastewater Loadings and Theoretical Flows, Royal HaskoningDHV, April 2015). It is included in **Appendix F** and summarised in **Section 5.4.1**.

The water demands estimated for the Cattle Bay Marina and Temporary Facilities are detailed in **Appendix D** and summarised below:

Water Supply for the Marina Facilities – 100% occupancy rate

Development	Total ET	Design Average Consumption	Average Demand	Peak Day Factor	Peak Day Demand	Peak Hour Factor	Peak Hour Demand
		kL/ET/year	kL/year		kL/day		L/s
Marina	57	205	11,681	2	64.0	5	3.7
Temporary Building 1	2.0	205	410	2	2.2	5	0.1
Temporary Building 2	0.4	205	82	2	0.4	5	0.0
Fire Hose							1.3
TOTAL	59.4		12,173		66.7		5.1

Water Supply for the Marina Facilities – 10% occupancy rate

Development	Total ET	Design Average Consumption	Average Demand
		kL/ET/year	kL/year
Marina	5.7	205	1,168
Temporary Building 1	2.0	205	41
Temporary Building 2	0.4	205	8.2
TOTAL	8.1		1,217

The Marina Water Demand and Wastewater Loadings and Theoretical Flows report included in Appendix F reviewed three Sydney Harbour marinas and the Soldiers Point marina consumption and occupancy rates. Note, occupancy rate is a number of days per year, expressed as percentage, that a vessel is used irrespective whether it leaves a berth. The Sydney Harbour marinas average occupancy rate is

approximately 8%. The Soldiers Point marina average occupancy rate is approximately 9.4%. These levels of occupancy rates are typical for marinas.

The above tables providing details of ETs and theoretical flows based on 100% and 10% occupancy rates have been included for discussion with the Council.

Water Supply for Hydrants

- Fire Hydrants Water Supply – 20 L/s

5.4.1 Marina Water Demand

An investigation of the marina berths water demand has been undertaken (Marina Water Demand and Wastewater Loadings and Theoretical Flows, Royal HaskoningDHV, April 2015). It is included in **Appendix F**.

This study concluded that the Section 64 Determinations of Equivalent Tenements Guidelines for marina significantly exceed the water consumption and wastewater production recorded in the investigated marinas.

It is noted that a number of categories in the Section 64 Determinations of Equivalent Tenements Guidelines was reviewed by the Western Research Institute at the Charles Sturt University in 2007-2008.

Although the Western Research Institute's review did not specifically include marinas, significant variances between the Guidelines and usage trends were found. An example being the standard ETs for caravan parks (Guidelines exceed the usage trend by 40%).

Analysis of the water consumption data collected from a number of marinas has been undertaken. This data has been further verified by theoretical water consumption calculations. A conservative value of 207 L/berth/day was adopted for the average daily demand (for details refer to **Section 3** of the Marina Water Demand and Wastewater Loadings and Theoretical Flows report in **Appendix F**). This equates to 76 kL/berth/year.

The average water consumption of 205 kL/ET/year is in accordance with the Development Servicing Plan (Bega Valley Shire Council, 2013).

Utilising the annual average water consumption (205 kL/ET/year) and average annual demand per berth (76 kL/berth/year), a figure of 0.37 ET/berth can be reverse calculated as a more accurate representation of the true water consumption. For more details refer to **Appendix 2** of the Marina Water Demand and Wastewater Loadings and Theoretical Flows report in **Appendix F**.

This demonstrates marina developments have a lower water usage trend than the Guidelines by approximately 33%.

- Water Directorate Guidelines Marina Water – 0.6 ET per berth.
- Marina Water ET from analyses – 0.37 ET per berth.

The peak hour demand was calculated in accordance with WSAA Water Supply Code of Australia.

5.4.2 Temporary Buildings

The residential equivalent tenements are in accordance with NSW Water Directorate Section 64 Determinations of Equivalent Tenements Guidelines.

The residential average consumption (205 kL/annum) is in accordance with Development Servicing Plan (Bega Valley Shire Council, 2013).

The peak day demand and peak hour demand were calculated in accordance with WSAA Water Supply Code of Australia.

5.4.3 Fire Hose Reels

The fire hose reels will be connected to the domestic water supply, whereas the fire hydrants will be connected to a special hydrant service. The water demand calculations allowed for 2 fire hose reels operating simultaneously providing a minimum flow of 0.63 L/s each in accordance with AS 3962-2001.

5.4.4 Fire Hydrants

The fire hydrants will have its own water supply service, supplied from the existing land based infrastructure. The water demand calculations allowed for 2 fire hydrant outlets to flow simultaneously, minimum required flow rate per outlet 10 L/s in accordance with AS 2419.1-2005.

6 WASTEWATER SERVICING STRATEGY

6.1 CONNECTION TO EXISTING WASTEWATER INFRASTRUCTURE

Consultation with the Bega Valley Shire Council regarding providing the wastewater services for the proposed development is under way.

This report suggests transporting the wastewater from the development to the existing manhole DZ1. A gravity main transports flow from DZ1 to the wastewater pumping station PS3. Both, the manhole DZ1 and PS3 are located in proximity of the site.

The following facilities would produce wastewater to be discharged into the Council wastewater system:

- Marina pump out (manual).
- Temporary buildings 1 and 2.

6.2 WASTEWATER LOADINGS

The land based facilities wastewater loadings were calculated using Development Servicing Plan (Bega Valley Shire Council, 2013) and NSW Water Directorate Section 64 Determinations of Equivalent Tenements.

An investigation of the marina wastewater loadings has been undertaken (Marina Water Demand and Wastewater Loadings and Theoretical Flows, Royal HaskoningDHV, April 2015). It is included in **Appendix F** and summarised in **Section 6.2.2**.

The estimated wastewater loadings are detailed in the attached calculations in **Appendix D** and summarised below:

Development	Total ET	Design Average Dry Weather Flow	Average Dry Weather Flow	Peak Dry Weather Flow	Stormwater Allowance	Peak Wet Weather Flow
		L/ET/day	L/s	L/s	L/s	L/s
Marina	4	508	0.02	0.1	0.2	0.3
Temporary Building 1	3.1	508	0.02	0.1	0.2	0.3
Temporary Building 2	0.6	508	0.004	0.01	0.04	0.1
TOTAL	7.7					0.6

6.2.1 • Temporary Buildings

The residential equivalent tenements were calculated in accordance with the NSW Water Directorate Section 64 Determinations of Equivalent Tenements Guidelines.

The residential average dry weather flow was calculated in accordance with Development Servicing Plan (Bega Valley Shire Council, 2013) - 508 L/ET/day.

6.2.2 Marina Pump Out

An investigation of the marina berths water demand has been undertaken (Marina Water Demand and Wastewater Loadings and Theoretical Flows, Royal HaskoningDHV, April 2015). It is included in **Appendix F**.

This study concluded that the Section 64 Determinations of Equivalent Tenements Guidelines for marina significantly exceed the wastewater production recorded in the investigated marinas.

The wastewater production calculated in accordance with the Guidelines (0.9 ET/ berth) excessively exceeds the pump out volumes recorded in the investigated marinas. Further, the mobile pump-out flow rate of 0.3 L/s is exceeded by 10.2 L/s.

Adopting the average dry weather flow of 508 kL/ET/day (Bega Valley Shire Council Development Servicing Plan) and pump-out flow rate of 0.3 L/s results in 4 ETs.

6.2.3 Bilge Water

All marina berth tenants will be inducted in the use of, and supplied with, a bilge water absorbing pad as part of rules and regulations of the marina. The bilge absorbing pad will absorb any oil from the bilges. The bilge water will then be disposed of via certified collection.

6.3 MARINA PUMP OUT

Sewage is proposed to be removed from the holding tanks of vessels at the marina and disposed of to the on-land sewerage system by means of a mobile sewage pump out trolley (supplied by Superior Jetties, or similar). The proposed mobile unit is shown in **Appendix E**.

The operation would take place as follows:

- The trolley is wheeled to the required point adjacent to the vessel on the floating marina and the flexible discharge hose is attached to the holding tank on the vessel.
- The unit is attached to the power available on the marina at the service pedestal. The unit is also fitted with a battery in the event power is not available on the marina for any reason.
- The pump discharges the sewage from the holding tank on the vessel into the tank within the mobile unit. The tank within the unit has a capacity of 90 litres which would accommodate the majority of vessels permanently berthed at the marina. Should the holding tank on the vessel exceed the size of the tank on the mobile unit, the mobile unit can be used a number of times.
- The mobile unit is wheeled to an on-land connection point to the local sewerage system.

The use of a mobile sewage pump out system has the benefit of taking the pump out system to the vessel rather than relying on the vessel owner to bring the vessel to a dedicated pump out facility. It enables the marina operator to be more proactive in satisfying its commitments under an Environment Protection Licence (EPL) and Operational Environmental Management Plan (OEMP).

During development of this report Royal HaskoningDHV provided responses to a number of questions that the Bega Valley Shire Council rose about the mobile pump out operation. This consultation is detailed in **Appendix E**.

7 CONCLUSION

There is a long history to the development of marina facilities in Twofold Bay. The economic and social benefits of a Marina to Eden and the Bega Valley Shire are self-evident and have long been recognised.

The proposed development would create only small scale water demand and wastewater loadings.

It is proposed to provide the water supply from the existing DN150 water main located in Cattle Bay Road.

It is proposed to transport the wastewater from the development to the existing manhole DZ1. A gravity main transports flow from DZ1 to the wastewater pumping station PS3. Both, the manhole DZ1 and PS3 are located in proximity of the site.

Figures

Figures



FIGURE 1 –LOCATION OF SUBJECT SITE WITHIN EDEN

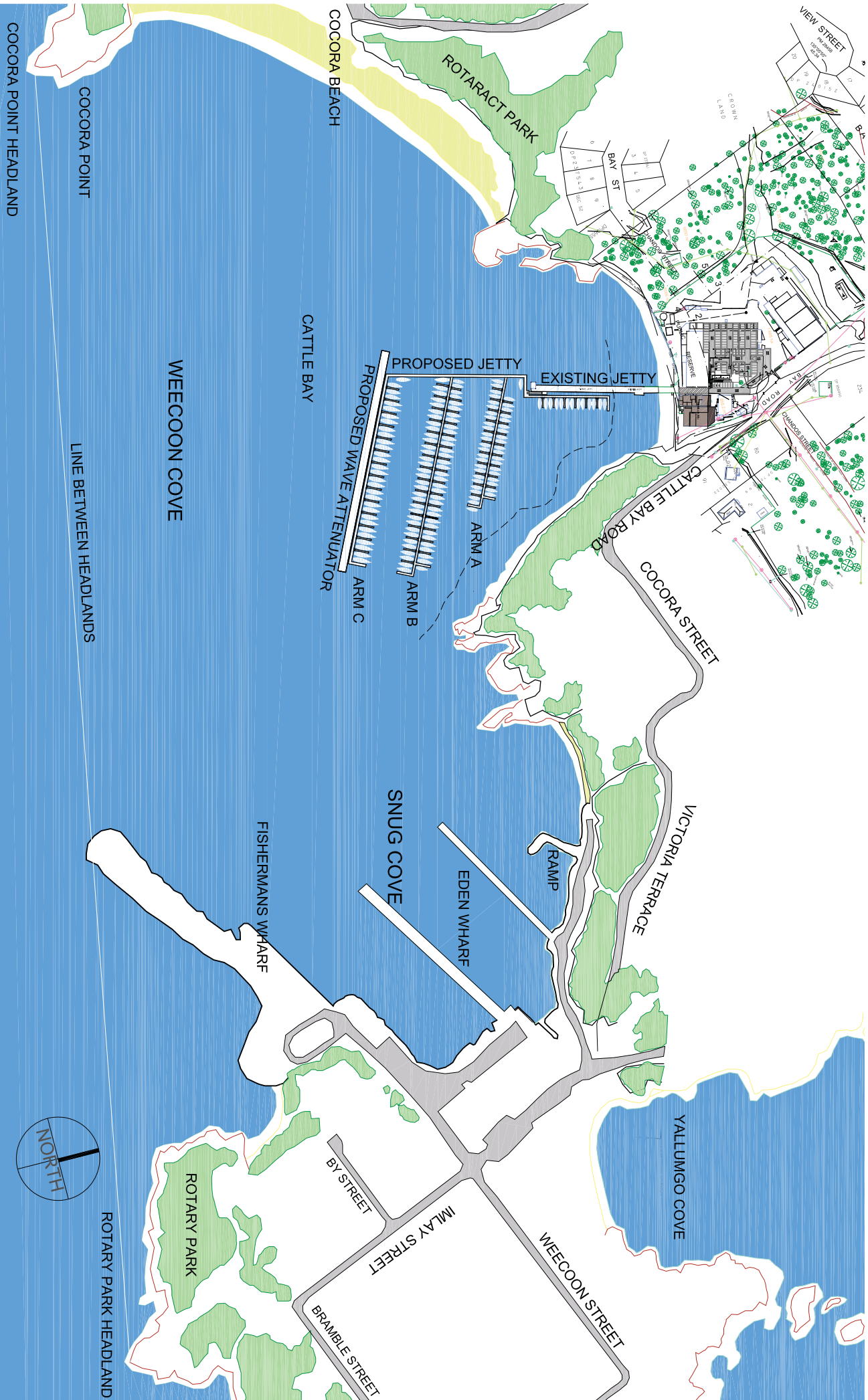
(Source: Proposed Marina and Temporary Land Facilities Environmental Impact Assessment, Inspire Urban Design and Planning Pty Ltd and Haskoning Australia Pty Ltd, 21 May 2013)



FIGURE 2 – SUBJECT SITE PLAN

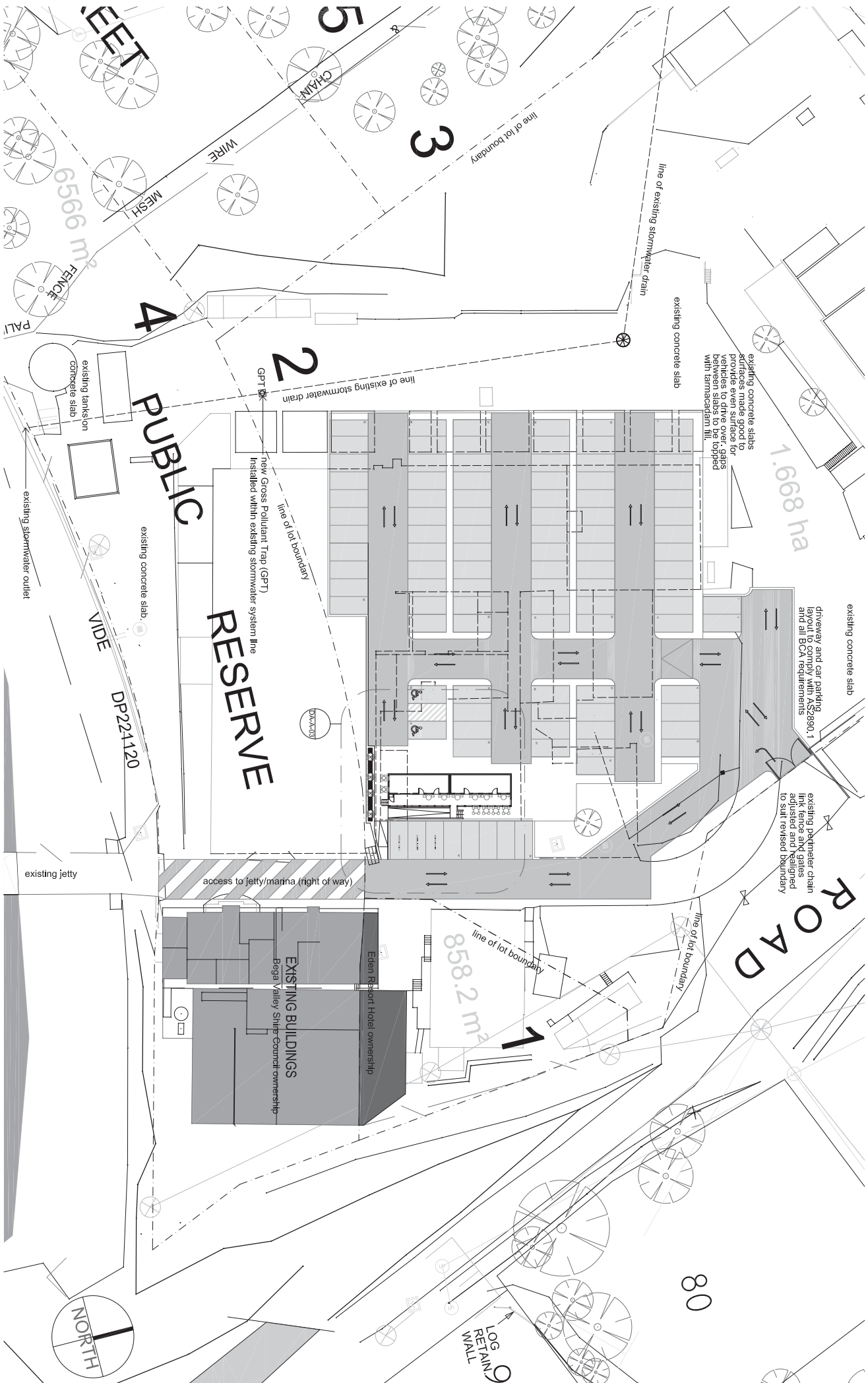
(Source: Proposed Marina and Temporary Land Facilities Environmental Impact Assessment, Inspire Urban Design and Planning Pty Ltd and Haskoning Australia Pty Ltd, 21 May 2013)

Appendix A – Drawings



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PROJECT :	CLIENT :	TOWN PLANNING CONSULTANT :	ARCHITECT :	DRAWING TITLE :
STAGE ONE - PROPOSED MARINA DEVELOPMENT, CATTLE BAY, EDEN, NSW	EDEN RESORT HOTEL PTY LTD	INSPIRE URBAN DESIGN + PLANNING Tel. 0417 486 768 www.inspireplanning.com PO Box 7277 South Sydney Business Hub NSW 2015	BLACK architecture and project management PO Box 439, Alexandria, NSW 1435 NSW Registration No. 6036, ABN: 36 686 957 832 Tel (02) 8971 6565 Mob 0414 765 104 Email: kevinhynblack@blackapm.com	CONTEXT PLAN INDICATING PROPOSED SITE LAYOUT & MARINA LAYOUT
DWG NO: DA-A-01			SCALE: 1:3500@A3	
PROJECT NO.			ISSUE	
DRAWN BY			KLB	
CHECKED BY			KLB	
ISSUE DATE			8-05-13	
ISSUED FOR			DIMENT APPLICATION	
			A	



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PROJECT :

STAGE ONE - PROPOSED
MARINA DEVELOPMENT,
CATTLE BAY, EDEN, NSW

CLIENT :

EDEN RESORT
HOTEL PTY LTD

TOWN PLANNING CONSULTANT :

INSPIRE URBAN DESIGN + PLANNING
Tel. 0411 486 768 | www.inspireplanning.com
PO Box 7277 South Sydney Business Hub NSW 2015

ARCHITECT :

BLACK
architecture and project management
PO Box 439, Alexandria, NSW 1535
NSW Registration No. 6026, ABN: 26 068 597 832
Tel (02) 8971 6566 Mob 0414 765 104
Email: kevin@blackp.com

DRAWING TITLE :

PROPOSED
SITE DEVELOPMENT AND
STORMWATER PLAN

DWG NO. :

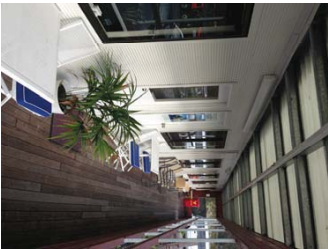
DA-A-02

SCALE	1:500 @ A3	ISSUE
PROJECT NO.		
DRAWN BY	NLB	
CHECKED BY	NLB	
ISSUE DATE	6-05-13	
ISSUED FOR	DWENT APPLICATION	

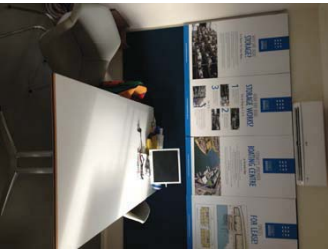
A



proposed temporary accommodation viewed from entrance steps



view along deck



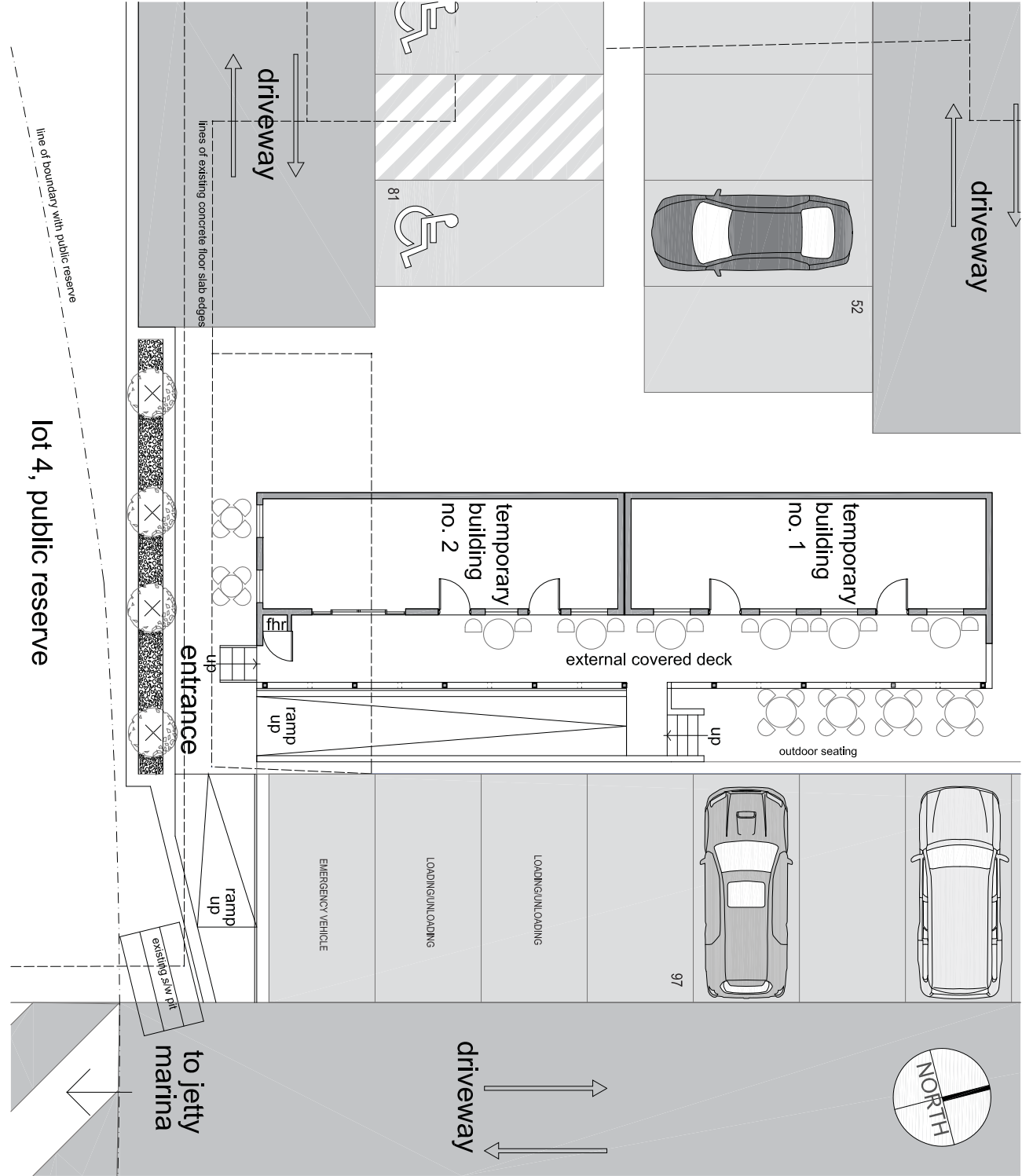
typical office accom



typical tea room

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PROJECT :	CLIENT :	TOWN PLANNING CONSULTANT :	ARCHITECT :	DRAWING TITLE :	DWG NO. :
STAGE ONE - PROPOSED MARINA DEVELOPMENT, CATTLE BAY, EDEN, NSW	EDEN RESORT HOTEL PTY LTD	INSPIRE URBAN DESIGN + PLANNING Tel. 0411 486 788 1 www.inspireplanning.com PO Box 7277 South Sydney Business Hub NSW 2015	BLACK architecture and project management PO Box 439, Alexandria, NSW 1535 NSW Registration No. 6026, ABN: 26 066 597 832 Tel (02) 8971 6666 Mob 0414 765 104 Email: kevin@black@blackapm.com	TEMPORARY BUILDINGS FLOOR PLAN AND TYPICAL IMAGES	DA-A-03
					SCALE 1:100@A3
					PROJECT NO. KLB
					DRAWN BY KLB
					CHECKED BY KLB
					ISSUE DATE 6-05-2013
					ISSUED FOR DWENT APPLICATION
					ISSUE A



Appendix B – Correspondence with Council



Bega Valley Shire Council

17 June 2014

Haskoning Australia Pty Ltd
Suite 5, Level 5
100 Walker Street
North Sydney NSW 2060

M. Van Tilburg 20/06/14

Dear Sir/Madam,

Water Flow and Pressure test at Cattle Bay Road, Eden: Lot 2 DP 1138056

Further to your application for water flow and pressure test received 6th June 2014, I enclose the following information:-

Pressure and flow at nearest accessible hydrant on Council's 150mmØ water main locate at the corner of Cattle Bay Road and Chandos Street, Eden.

Flow in litres per second	Residual pressure in Kpa @ 8:30 am on 11 th June 2014
30 (maximum permissible flow)	200
25	500
20	600
15	750
10	850
5	880
0	900

The above pressure information was obtained by field pressure testing. The recorded pressure data may fluctuate from time to time depending on the system demand, time of day, reservoir levels etc. This data should be used as a guide only and not be used as available water for any development requirements!

It should be noted that a qualified hydraulic consultant should be engaged to assess internal fire fighting requirements.

If you need further information about this matter, please contact myself on (02) 6499 2159.

**ADDRESS ALL
CORRESPONDENCE TO:**

PO Box 492
Bega NSW 2550

DX 4904
ABN 26 987 935 332

Council Chambers
Zingel Place, Bega

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(02) 6499 2222
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M. Van Tilburg
Michael Van Tilburg
Civil Assets Specialists
Water and Sewerage Services

Appendix C – Example Marina Water Usage and Sewage Pumpout

EXAMPLE MARINAS WATER CONSUMPTION

	Middle Harbour		50 Berth Marina in		Pittwater Marina in		Soldiers Point Marina	
Month	Water Usage L	Notes	Water Usage L	Notes	Water Usage L	Notes	Water Usage L	Notes
January	65,000		49,000		57,000		98,000	
February	42,000		31,000		37,000		78,000	
March	33,000		25,000		29,000		96,000	
April	24,000		19,000		22,000		87,000	
May	18,000		15,000		17,000		46,000	
June	11,000		12,000		9,000		53,000	
July	6,000		4,000		5,000		37,000	
August	5,000		4,000		4,000		56,000	
September	18,000		20,000		19,000		34,000	
October	21,000		22,000		21,000		74,000	
November	38,000		30,000		29,000		39,000	
December	58,000		51,000		49,000		133,000	
Total Water Usage	339,000		282,000		298,000		831,000	
Number of Berths	70		50		70		111	
WATER USAGE BREAKDOWN								
Average Water Usage								
L/berth/ annum	4,843		5,640		4,257		7,486	
Annual Average Occupancy	8.0% ⁽¹⁾		8.0% ⁽¹⁾		8.0% ⁽¹⁾		9.4% ⁽²⁾	
L/berth/day	13		15		12		21	
L/berth/day	166		193		146		218	
Peak months - Dec & Jan								
December								
L/month	58,000		51,000		49,000		133,000	
% of Occupied Berths	21.0% ⁽⁶⁾		21.0% ⁽³⁾		21.0% ⁽⁶⁾		18.0% ⁽⁴⁾	
L/berth/day	127		157		108		215	
January								
L/month	65,000		49,000		57,000		98,000	
% of Occupied Berths	21.0% ⁽⁶⁾		17.7% ⁽³⁾		21.0% ⁽⁶⁾		13.0% ⁽⁵⁾	
L/berth/day	143		179		125		219	
Average Water Demand over 6 months								
% of Occupied Berths	13.6% ⁽⁶⁾		13.6% ⁽³⁾		13.6% ⁽⁶⁾		13.6% ⁽⁶⁾	
L/berth/day	120		144		105		170	

Notes:

1. According to the Boating Association of NSW data (http://www.bia.org.au/pp_index/pp/pp_b.htm) the average occupancy rate
2. The occupancy rate at Soldiers Point Marina (Port Stephens area), based on the marina records, is 34 days. Expressed as a
3. The 50 Berth Marina data based on the Rose Bay and Point Piper Marinas survey (Traffic and Parking Impact Review of Proposed
4. The approximate berth occupancy rate in Soldiers Point marina was estimated based on the recorded data. In December the
5. The approximate berth occupancy rate in Soldiers Point marina was estimated based on the recorded data. In January the
6. For the Middle Harbour Marina and Pittwater Marina in Sydney adopted same occupancy rates as recorded for the Rose Bay

EXAMPLE MARINAS WASTEWATER PRODUCTION

	Middle Harbour Marina in Sydney			50 Berth Marina in Sydney Harbour			Pittwater Marina in Sydney Harbour		
Month	Sewage Pump hours run	Sewage Pumped	Pumped Flow	Sewage Pump hours run	Sewage Pumped	Pumped Flow	Sewage Pump hours run	Sewage Pumped	Pumped Flow
	Hrs	L	L/s	Hrs	L	L/s	Hrs	L	L/s
January	4	288	0.02	2	144	0.02	4	288	0.02
February	3	216	0.02	3	216	0.02	2.5	180	0.02
March	2.5	180	0.02	2	144	0.02	2	144	0.02
April	2	144	0.02	1	72	0.02	2	144	0.02
May	1.75	126	0.02	0.5	36	0.02	1	72	0.02
June	1	72	0.02	0.5	36	0.02	0.75	54	0.02
July	1	72	0.02	0.5	36	0.02	0.5	36	0.02
August	2	144	0.02	1	72	0.02	0.5	36	0.02
September	2	144	0.02	3	216	0.02	3	216	0.02
October	3	216	0.02	3.5	252	0.02	3.5	252	0.02
November	4	288	0.02	4	288	0.02	4	288	0.02
December	5	360	0.02	5	360	0.02	5	360	0.02
Total Wastewater Production per Year		2,250			1,872			2,070	
Number of Berths		70			50			70	
WASTEWATER									
Average Wastewater									
L/berth/ annum		32			37			30	
Berth Occupancy Rate		8.0%			8.0%			8.0%	
L/berth/day		1.1			1.3			1.0	
100% Occupancy Rate		100%			100%			100%	
L/berth/ annum		5,022			5,850			4,621	
L/berth/day		13.8			16.0			12.7	

Appendix D – Cattle Bay Marina Water Demand and Wastewater Loadings

CATTLE BAY MARINA AND TEMPORARY LAND FACILITIES PROJECT

PROPOSED DEVELOPMENT

Offshore Marina	154 Berths
Temporary Building 1	Female WC containing WC - 2, Hand Wash Basin - 2; Male WC containing WC-1, Urinals-2, Hand Wash Basin-2; Accessible Unisex Facility containing WC-1, Hand Wash Basin -1, Shower - 1
Temporary Building 2	Kitchen sink

WATER DEMAND CALCULATIONS

Water Supply for the Marina Facilities

Development	Standard Unit				Design Average Consumption (kL/ET/annum)	Average Day		Peak Day Demand			Peak Hour Demand		
		Number	ET/ Item	Total ET		(kL/year)	(kL/day)	Peak Day Factor	Total Demand (kL/day)	(L/s)	Peak Hour Factor	Total Demand (kL/hr)	(L/s)
Marina	Berth	154	0.37	57.0	205	11,681	32.0	2	64.0	0.7	5.00	13.3	3.7
Temporary Building 1	WC	4	0.4	1.6	205	328	0.9	2	1.8	0.0	5.00	0.4	0.1
Temporary Building 1	Shower	1	0.4	0.4	205	82	0.2	2	0.4	0.0	5.00	0.1	0.0
Temporary Building 2	Kitchen Sink	1	0.4	0.4	205	82	0.2	2	0.4	0.0	5.00	0.1	0.0
Fire Hose Reels	operating simul.	2	0.63 L/s each		205								1.3
TOTAL				59		12,173	33.4		66.7	0.8		13.9	5.1

Notes:

- For more details on the marina equivalent tenements (ETs) refer to the Cattle Bay Marina Water Demand and Wastewater Loadings and Theoretical Flows (Royal HaskoningDHV, April 2015).
 - The temporary buildings equivalent tenements have been calculated in accordance with NSW Water Directorate Section 64 Determinations of Equivalent Tenements Guidelines (i.e. 0.4 ET/Public WC, 0.4 ET/ Public Shower, assumed the same for kitchen sink).
 - The fire hose reels will be connected to the domestic water supply, whereas the fire hydrants (see below) will be connected to a special hydrant service.
 - Allowed for 2 fire hose reels operating simultaneously providing a minimum flow of 0.63 L/s each, refer AS 3962-2001.
 - The domestic average consumption (205 kL/ET/year) is in accordance with Development Servicing Plan (Bega Valley Shire Council, 2013).
 - The peak day demand and peak hour demand were calculated in accordance with WSAA Water Supply Code of Australia.
- Peak day demand (also known as 'maximum day demand') = Average day demand x Peak Day Factor (PDF = 2 for populations below 2 000).
- Peak hour demand (also known as 'maximum hour demand') = Average hour demand (on peak day) x Peak Hour Factor (PHF = 5 for populations below 2 000).

Water Supply for Hydrants

Allowed for 2 fire hydrant outlets to flow simultaneously, minimum required flow rate per outlet 10 L/s, refer AS 2419.1-2005.

The fire hydrants will have its own water supply service, supplied from the existing land based infrastructure.

Hydrants	Fire Fighting Flow	20.0
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WASTEWATER LOADINGS

Wastewater from the Temporary Buildings

Development	Standard Unit	Wastewater Loading			Average Dry Weather Flow L/s	r	Peak Dry Weather Flow L/s	Stormwater Allowance L/s/ ET	Peak Wet Weather Flow L/s
		Number	ET/ Item	Total ET					
Temporary Building 1	WC	4	0.63	2.5	0.015	4.00	0.06	0.15	0.2
Temporary Building 1	Shower	1	0.63	0.6	0.004	4.00	0.01	0.04	0.1
Temporary Building 2	Kitchen Sink	1	0.63	0.6	0.004	4.00	0.01	0.04	0.1
TOTAL				4					0.3

Notes:

1. The gravity main would transport wastewater to the existing manhole DZ1. Gravity mains transports flow from DZ1 to Wastewater Pumping Station PS3. Both, manhole DZ1 and pumping station PS3 are located in proximity of the development site.
2. The residential equivalent tenements were calculated in accordance with the NSW Water Directorate Section 64 Determinations of Equivalent Tenements Guidelines.
3. The residential average dry weather flow was calculated in accordance with Development Servicing Plan (Bega Valley Shire Council, 2013) - 508 L/ET/Day.

Pump Out

Sewage is proposed to be removed from the holding tanks of vessels at the marina and disposed of to the on-land sewerage system by means of a mobile sewage pump out trolley ('Muck Truck', as supplied by Superior Jetties, or similar).

Development	Standard Unit	Wastewater Loading			Design Average Dry Weather Flow (L/ET/day)	Calculated Average Dry Weather Flow (L/s)	r	Peak Dry Weather Flow L/s	Stormwater Allowance L/s/ ET	Peak Wet Weather Flow L/s
		Number	ET/ Item	Total ET						
Marine Berths	berth	154	0.03	4.0	508	0.02	4.0	0.1	0.2	0.3

Bilge Water Pump Out

All marina berth tenants will be inducted in the use of, and supplied with, a bilge water absorbing pads as part of rules and regulations of the marina. The bilge absorbing pad will absorb any oil from the bilges. The bilge water will then be disposed of via certified collection.

Total Wastewater Flow to manhole DZ1 and pumping station PS3	L/s	0.6
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Appendix E – Mobile Sewage Pump Out Trolley



90 L storage tank

Rechargeable battery power supply

In / out diaphragm pump

Operation component housing

Item	Council Question	RH Response
1.	Establish the volume (capacity) of the mobile sewage pump out trolley	90 L waste storage, refer to the attached photo.
2.	How it travels along the wharves (electronic / or on rails)	Mobile sewage pumpout trolley is pushed along the wharves on wheels, refer to the attached photo.
3.	Does it pick up from a number of boats before discharging or only one at a time	Only one at a time.
4.	How is the prevention of spills accommodated: a. with the mobile sewage pump out trolley b. at the receiving area (where the boats are) c. at the discharge location	a. spill kit b. procedure and training for use of mobile sewage pumpout trolley, spill kit c. at the discharge point will be purpose built bunded area.
5.	No provision for any 'cam-lock' type facility is permitted within Council reticulation system – more details on this proposal is required and a different arrangement maybe required	Currently, the mobile sewage pumpout trolley is proposed to be discharged via a cam lock fitting. An alternate connection system will be investigated to meet Council reticulation requirements. Please advise of available alternatives.
6.	Is there a 'bund' area at discharge location	Yes, there will be a bunded area at the discharge point.
7.	Is there sampling point for the quality of discharge to Council sewer	Provision will be made for a sampling point for the quality of discharge to Council sewer - at the discharge point.
8.	Is there a need for washdown / cleaning the mobile sewage pump out trolley	Minimal, if required would be done at the bunded area by a trained operator.
9.	What are the odour issues and how are they addressed with a. the mobile sewage pump out trolley b. at discharge location	a. The mobile sewage pump out trolley is a fully enclosed system. b. It is a sealed connection point, minimal odour issues are expected.
10.	Is the discharge location within public area	Location to be confirmed.

Appendix F – Marina Water Demand and Wastewater Loadings and Theoretical Flows

Marina Water Demand and Wastewater Loadings and Theoretical Flows

1 BACKGROUND

Eden Resort Hotel Pty Ltd has commissioned Royal HaskoningDHV to prepare the Water and Wastewater Servicing Study for the Cattle Bay Marina Development.

The site is located approximately 1 kilometre west of the Eden town centre on the NSW south coast, in the Bega Valley local government area. The development involves a new marina and temporary land facilities.

The draft Water and Wastewater Servicing Study was issued in July 2014. Consequently, the Bega Valley Shire Council requested to adopt the Section 64 Determinations of Equivalent Tenements Guidelines for determining the development Equivalent Tenements.

Royal HaskoningDHV noted that while adopting the above guidelines the marina design water demands significantly exceeded the water consumption recorded in other marinas in NSW. Further, the above guidelines do not consider that the berths are proposed to be serviced via a mobile pump out facility. As a result, the wastewater flows calculated based on the Section 64 Determinations of Equivalent Tenements Guidelines excessively exceed the pump out duty of the proposed mobile pump out facility.

Therefore, further investigation of the marina water demands, wastewater loadings and theoretical flows has been undertaken and is detailed in this report.

The investigation is detailed in the following sections:

- Marina Water and Wastewater Equivalent Tenements, refer **Section 2**.
- Example Marinas Water Demand, refer **Section 3**.
- Water Demand and Theoretical Flows Calculations, refer **Section 4**.
- Example Marinas Wastewater Flows, refer **Section 5**.
- Wastewater Loadings and Theoretical Flows Calculations, refer **Section 6**.
- Conclusion, refer **Section 7**.

2 MARINA WATER AND WASTEWATER EQUIVALENT TENEMENTS

2.1 GENERAL

This study reviewed the Section 64 Determinations of Equivalent Tenements Guidelines and a number of policies for determination of the equivalent tenements adopted by various Councils and Water Agencies.

2.2 SECTION 64 DETERMINATIONS OF EQUIVALENT TENEMENTS GUIDELINES

The Water Directorate published the Section 64 Determinations of Equivalent Tenements Guidelines (Guidelines) (Water Directorate, May 2009). The document was originally developed by Hunter Water Australia under the direction and peer review of the Water Directorate's Policy subcommittee. The Water Directorate Technical Guidelines are intended to be used to assist Councils in proportioning developer charges across different land use categories.

Since the Guidelines were first published in 2005, the Water Directorate has encouraged feedback on the content, structure and usefulness of the document. The focus of the document was to assist Councils with calculating the appropriate Equivalent Tenement (ET) load for water and sewerage systems for various types of development. It is clear that a number of Councils have adopted many aspects of the Guidelines.

According to these guidelines the Marina water and wastewater equivalent tenements (ETs) are as follows:

- Water – 0.6 ET/ berth
- Wastewater – 0.9 ET/ berth

It is noted that a number of categories in the Guidelines was reviewed by the Western Research Institute at the Charles Sturt University in 2007-2008.

Data collected by the Water Directorate from eighteen Councils across NSW and analysed by the Western Research Institute provides an indication of the variability that may exist across different categories and different geographical areas.

Although the Western Research Institute's review did not specifically include marinas, significant variances between the Guidelines and usage trends were found. An example being the standard ETs for caravan parks, the comparison results were as follows:

- Water Directorate Guidelines Water – 0.5 ET per site.
- "Best Fit" Water ET from analyses 2007 and 2008 – 0.3 ET per site.

This is an example of a lower usage trend than the Guidelines (Guidelines exceed the usage trend by 40%).

Further, the Guidelines state that as with any series of guidelines, it is important for each end-user to apply appropriate local knowledge and characteristics to any adopted formulae.

It is noted, that the Cattle Bay Marina will not include some high water usage facilities typical of other marinas, e.g. a repair and maintenance area.

2.3 WATER AGENCIES GUIDELINES FOR DETERMINATION OF EQUIVALENT TENEMENTS

The following guidelines for determination of the Marina ETs were identified to be used by the Water Agencies:

Water Authority	Description	Water Design	Sewer Design
Hunter Water Corporation	Marina	0.61 ET/ berth	10 ET/ built up ha
Sydney Water Corporation	Marina	Individually assessed	Individually assessed
SEQWater – Gold Coast City Council Area	Marina (Transient Moorage)	0.4 ET/ berth	0.4 ET/ berth
	Marina (Live aboard)	0.8 ET/ berth	0.8 ET/ berth
	Marina (Commercial)	0.2 ET/ berth	0.2 ET/ berth
SEQWater – Redland Council Area	Marine Services	0.1 ET per 100 m ² floor area	0.07 ET per 100 m ² floor area
SEQWater – Queensland Urban Utilities	Marina	Individually assessed	Individually assessed
TasWater	Marina	0.008 ET/ m ² (Gross Building Floor Area)	0.008 ET/ m ² (Gross Building Floor Area)

It is noted that Hunter Water Corporation adopts a similar value for determination of the marina water ETs as stated in the Section 64 Determinations of Equivalent Tenements Guidelines.

However, for the marina serviced via a pump out facility Hunter Water Corporation accepts the wastewater ETs to be based on the pump out flow (e.g. Trinity Point Marina Project).

Sydney Water does not have a policy for determining the marina ETs but assess marina developments on a case by case basis. They apply the WSAA code to determine demands and loads based on the nature of the proposed development. For non-conventional demands Sydney Water relates to conventional water use fixtures to estimate demands and wastewater loads. Sydney Water also suggested to approach existing marinas for information on their water usage.

The SEQWater policies are more detailed as they distinguish between the type of the marina and the actual floor area of the development.

3 EXAMPLE MARINAS WATER CONSUMPTIONS

This study reviewed the following marinas water consumption:

- Middle Harbour Marina in Sydney, 70 berths
- 50 berth Marina in Sydney
- Pittwater Marina in Sydney, 70 berths

- Soldiers Point Marina in Port Stephens, 111 berths

The above marina's water consumption data is included in **Appendix 1**.

Based on this data the annual water consumption ranged between 4.3 kL/berth/annum to 7.5 kL/berth/annum.

Based on the Boating Industry Association of NSW data the average occupancy rate in Sydney Harbour is 8%. Note, occupancy rate is the number of days per year, expressed as a percentage, that a vessel is used irrespective whether it leaves berth. The 8% occupancy rate is based on a frequency of use 12 times per year for 2.5 days, i.e. 30 days per year.

The occupancy rate at Soldiers Point Marina (Port Stephens area), based on the marina records, is 34 days. Expressed as a percentage it is equal to 9.4%.

Based on these occupancy rates and marinas recorded water consumptions, an approximate water consumption per day per berth has been estimated. These values are presented in **Figure 3-1** and range from 146 to 218 L/berth/day. Note, these water consumption values are only for the days the vessels are occupied.

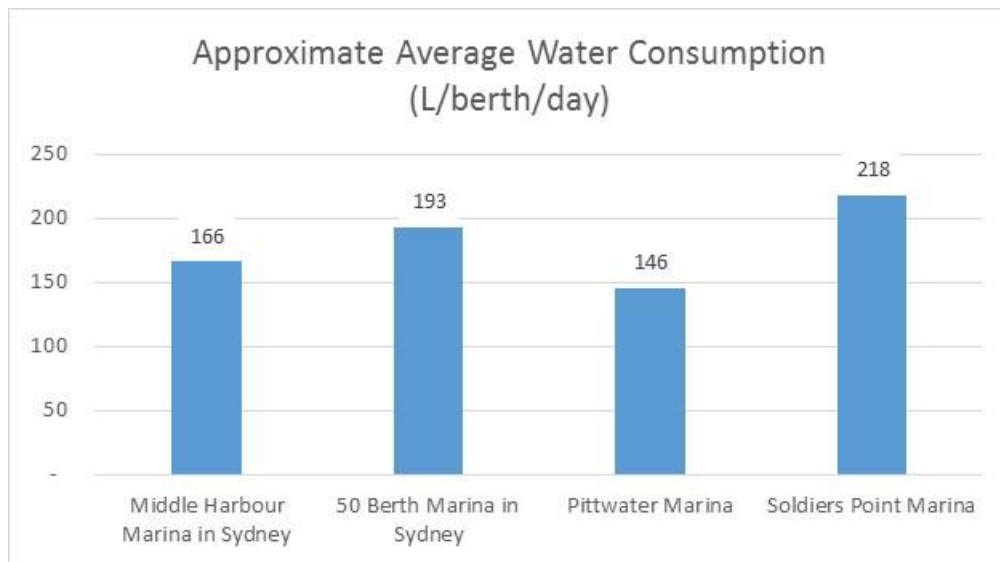


Figure 3-1: Approximate Average Daily Water Consumption per Berth

To verify the above values, an approximate daily consumption for a recreational vessel was calculated as follows:

- Toilet – 5 flushes/day/person x 2.2 L/flush (conventional marine toilet systems can use 3-4 litres per flush, vacuum toilet systems use 0.4-0.5 litres per flush. Average 2.2 L/flush has been adopted).
- Shower – 5 minutes/day/person x 1L/minute.
- Brushing Teeth – 1 L/brush/person x 2 times per day.
- Kitchen – 5 L/person/day.
- Total of 56 L/person/day.

Based on the above data, an approximate daily water consumption per recreational vessel with various number of people onboard was estimated and is presented in **Figure 3-2**.

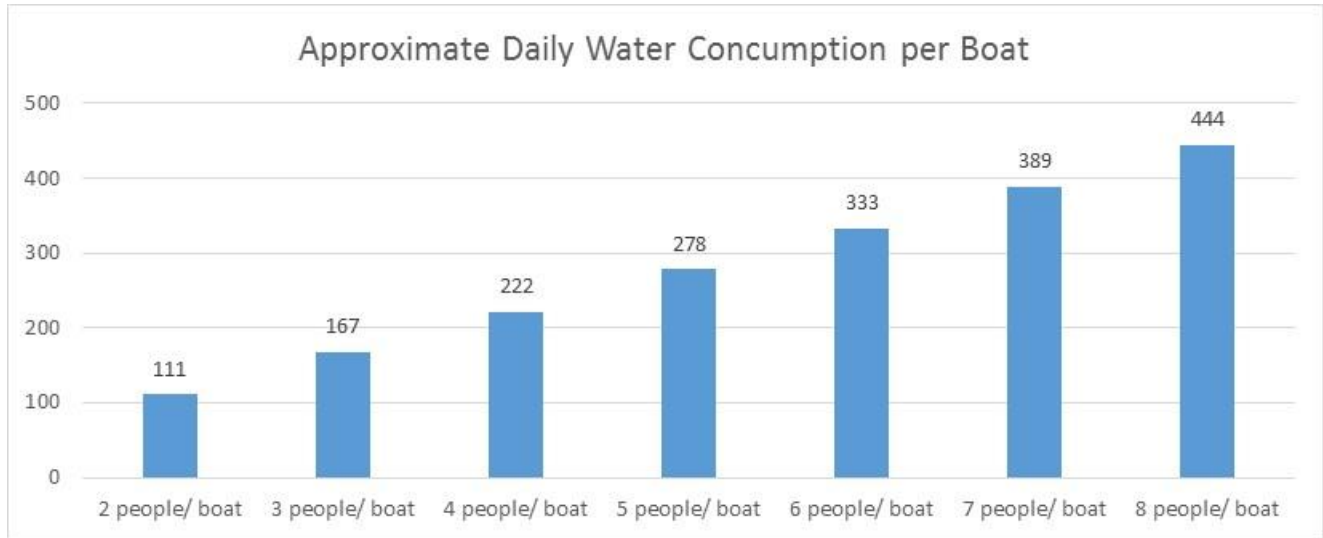


Figure 3-2: Approximate Average Daily Water Consumption per vessel for Various Number of People Onboard

The Cattle Bay Marina is proposed to include a mix of berth sizes from 12m to 18m to cater for a range of watercraft from small local recreational craft to larger recreational vessels. The preliminary proposal includes the following:

- 63 berths 12 m long;
- 65 berths 15 m long; and
- 23 berths 18 m long.

It is noted that the exact mix of berth sizes will be finalised in the preparation of final documentation for the project.

Estimating the average number of people onboard per vessel as 2.5 people for 12 m long berths, 4 people for 15 metres long berths and 6 people (conservative value) for 18 metres long berths, the approximate average water consumption will be 207 L/day/berth. This value is only for the days the vessels are occupied.

This conservative value (207 L/day/berth) was adopted in the Cattle Bay Marina water demand calculations detailed in **Section 4**.

4 WATER DEMAND AND THEORETICAL FLOWS CALCULATIONS

4.1 MARINA WATER DEMAND CALCULATION IN ACCORDANCE WITH THE SECTION 64

DETERMINATIONS OF EQUIVALENT TENEMENTS GUIDELINES

The domestic average water consumption in accordance with Development Servicing Plan (Bega Valley Shire Council, 2013) is 205 kL/ET/year.

The equivalent tenements (ET) for the marina in accordance with the Section 64 Determinations of Equivalent Tenements Guidelines are 0.6 ET/berth.

The water demand and theoretical flows calculated in accordance with the above guidelines are presented in **Appendix 2**.

The theoretical annual water demand per berth when adopting the above (0.6 ET/berth and 205 kL/ET/year) is 123 kL/berth/year. The annual water demands recorded in the example marinas ranged from 4.3 to 7.5 kL/berth/year. These annual water demands are presented in **Figure 4-1**.

It is noted that the Sydney marinas have an average occupancy rate of 8% and Port Stephens marina had an approximate average occupancy 9.4% (for details refer **Section 3**). The theoretical water annual demand is calculated for 100% occupancy rate. Therefore, the recorded values increased to 100% occupancy rate have been included in the graph for comparison. These values are still significantly lower than the theoretical water annual demand of 123 kL/year/berth calculated based in the 0.6 ET/berth and 205 kL/ET/year.

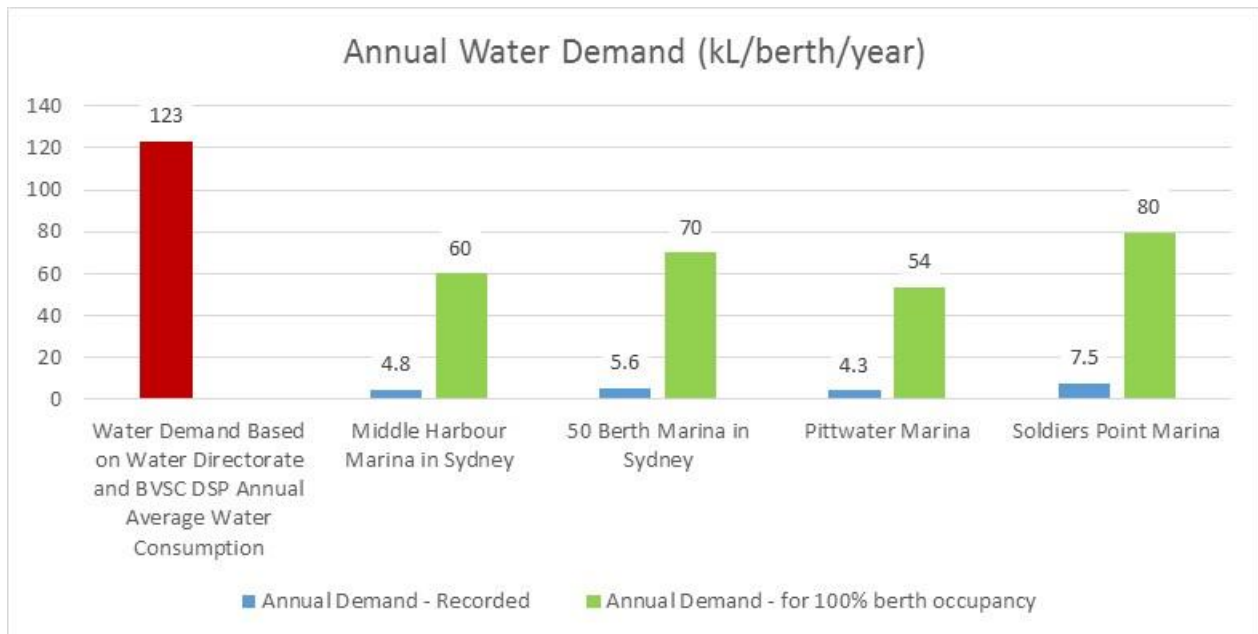


Figure 4-1: Annual Water Demand per Berth

When adopting 0.6 ET/ berth and 205 kL/ET/year the theoretical average daily water consumption is 337 L/day/berth and on peak day 674 L/berth/day.

The average day water demands recorded in the example marinas are significantly lower ranging from 146 to 218 L/day/berth. Refer **Figure 4-2**.

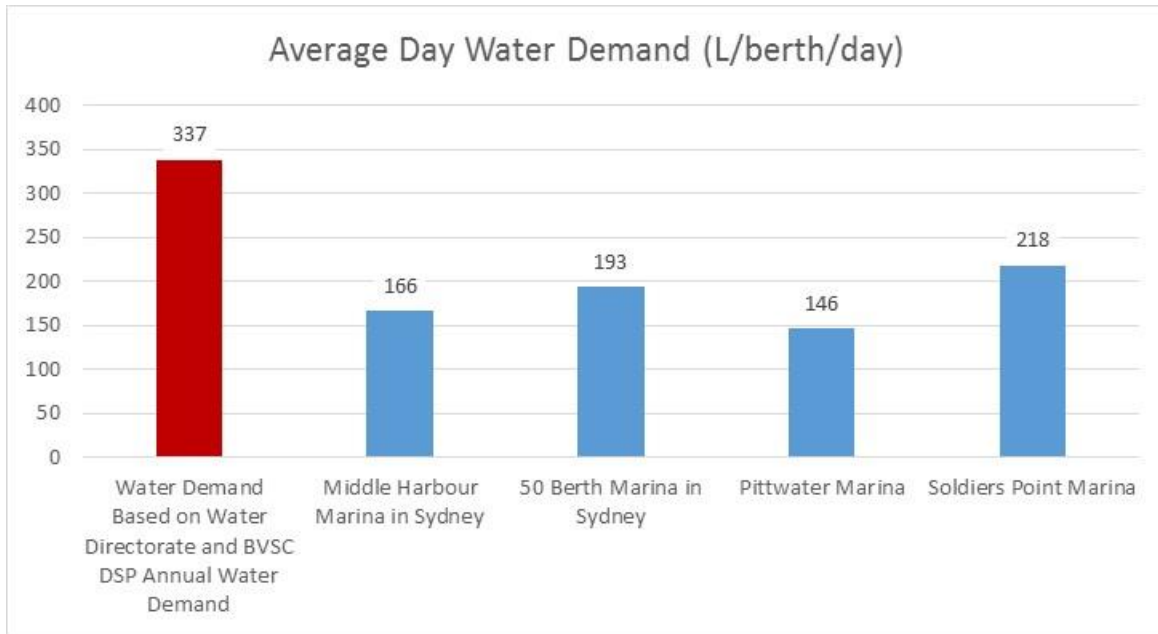


Figure 4-2: Average Water Demand per Berth per Day

4.2 AMENDED MARINA WATER DEMAND CALCULATION BASED ON RECORDED DATA

The adopted average water consumption of 205 kL/ET/year is in accordance with the Development Servicing Plan (Bega Valley Shire Council, 2013).

A conservative value of 207 L/berth/day was adopted for the average daily demand (for details refer to **Section 3**). This equates to 76 kL/berth/year.

Utilising the annual average water consumption (205 kL/ET/year) and average annual demand per berth (76 kL/berth/year), a figure of 0.37 ET/berth can be reverse calculated as a more accurate representation of the true water consumption. For more details refer to **Appendix 2**.

This marina water demand has been calculated for berths only and does not include the temporary on land facilities. It is noted that Cattle Bay marina will not include some high water usage facilities typical of other marinas, e.g. a repair and maintenance area. Note, the above conversion ratio for ET per berth is 33% lower than the value in Guidelines. (Similar trend was found by the Western Research Institute's review for caravan parks, refer **Section 2.2**).

Further, this conversion ratio is adopted e.g. by SEQWater as is detailed in **Section 2.3**.

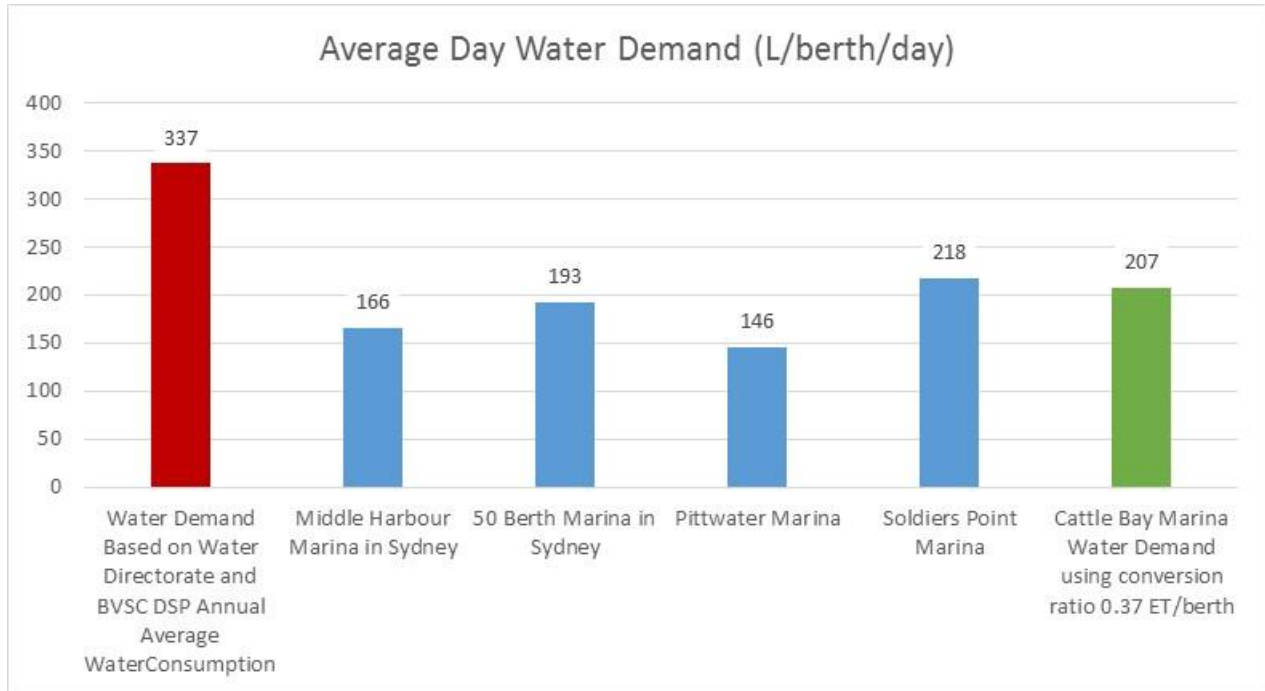


Figure 4-3: Average Daily Water Demand

5 EXAMPLE MARINAS WASTEWATER FLOWS

This study reviewed the following marinas wastewater production:

- Middle Harbour Marina in Sydney, 70 berths
- 50 berth Marina in Sydney
- Pittwater Marina in Sydney, 70 berths

The marinas wastewater production data are included in **Appendix 3**.

Based on this data the annual wastewater production ranged between 30 L/berth/annum to 37 L/berth/annum.

6 WASTEWATER LOADINGS AND THEORETICAL FLOWS CALCULATIONS

6.1 MARINA WASTEWATER CALCULATION IN ACCORDANCE WITH THE SECTION 64 DETERMINATIONS OF EQUIVALENT TENEMENTS GUIDELINES

The domestic average dry weather flow in accordance with Development Servicing Plan (Bega Valley Shire Council, 2013) is 508 kL/ET/day.

The equivalent tenements (ET) for the marina in accordance with the Section 64 Determinations of Equivalent Tenements Guidelines are 0.9 ET/berth.

The wastewater loadings and theoretical flows calculated in accordance with the above guidelines are presented in **Appendix 4**.

When adopting the above values (508 kL/ET/day and 0.9 ET/berth) the theoretical average dry weather flow is 457 L/day/berth and 167 kL/year/berth.

The below graphs demonstrate that these values excessively exceed the pump out volumes recorded in the example marinas included in **Appendix 3**.

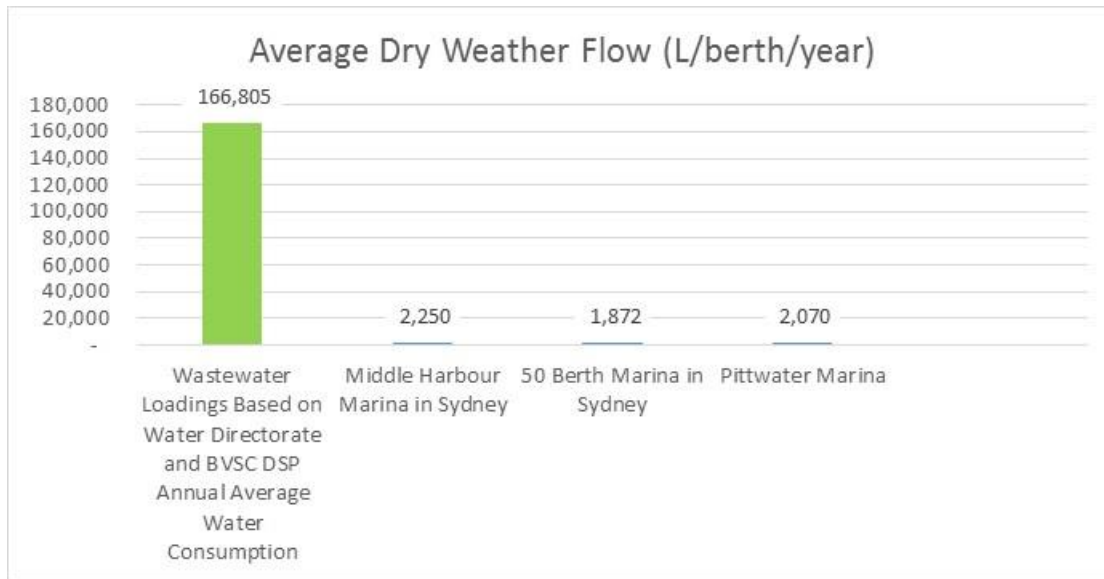


Figure 6-1: Average Dry Weather Flow per Berth per Year

Further, it is noted that the average dry weather flow of 457 L/day/berth also exceeds the average day water consumptions of 146 to 218 L/day/berth recorded in example marinas (refer **Section 3**).

6.2 AMENDED MARINA WASTEWATER CALCULATIONS BASED ON RECORDED DATA

The adopted average dry weather flow of 508 kL/ET/day is in accordance with the Development Servicing Plan (Bega Valley Shire Council, 2013).

A flow rate of 0.3 L/s was adopted for the mobile pump-out facility.

The wastewater loadings and theoretical flows calculated in accordance with the above are presented in **Appendix 4**.

Adopting the average dry weather flow of 508 kL/ET/day (Bega Valley Shire Council Development Servicing Plan) and mobile pump-out flow rate of 0.3 L/s results in 4 ETs.

This approach was adopted e.g. by Hunter Water Corporation as is detailed in **Section 2.3**.

7 CONCLUSION

This study concluded that the Section 64 Determinations of Equivalent Tenements Guidelines for marina significantly exceed the water consumption and wastewater production recorded in the investigated marinas.

It is noted that a number of categories in the Section 64 Determinations of Equivalent Tenements Guidelines was reviewed by the Western Research Institute at the Charles Sturt University in 2007-2008.

Although the Western Research Institute's review did not specifically include marinas, significant variances between the Guidelines and usage trends were found. An example being the standard ETs for caravan parks (Guidelines exceed the usage trend by 40%).

Analysis of the water consumption data collected from a number of marinas has been undertaken. This data has been further verified by theoretical water consumption calculations. A conservative value of 207 L/berth/day was adopted for the average daily demand (for details refer to Section 3). This equates to 76 kL/berth/year.

The average water consumption of 205 kL/ET/year is in accordance with the Development Servicing Plan (Bega Valley Shire Council, 2013).

Utilising the annual average water consumption (205 kL/ET/year) and average annual demand per berth (76 kL/berth/year), a figure of 0.37 ET/berth can be reverse calculated as a more accurate representation of the true water consumption. For more details refer to **Appendix 2**.

This demonstrates marina developments have a lower water usage trend than the Guidelines by approximately 33%.

- Water Directorate Guidelines Marina Water – 0.6 ET per berth.
- Marina Water ET from analyses – 0.37 ET per berth.

The wastewater production calculated in accordance with the Guidelines (0.9 ET/ berth) excessively exceeds the pump out volumes recorded in the investigated marinas. Further, the mobile pump-out facility flow rate of 0.3 L/s is exceeded by 10.2 L/s.

Adopting the average dry weather flow of 508 kL/ET/day (Bega Valley Shire Council Development Servicing Plan) and pump-out facility flow rate of 0.3 L/s results in 4 ETs.

Therefore, Royal HaskoningDHV propose to adopt the following values:

- Marina Water Demand – 0.37 ET/berth; and
- Marina Wastewater Production (mobile pump-out) – 4 ET.

Appendix 1 – Example Marinas Water Consumption

APPENDIX 1

EXAMPLE MARINAS

	Middle Harbour Marina in Sydney		50 Berth Marina in Sydney Harbour		Pittwater Marina in Sydney Harbour		Soldiers Point Marina	
Month	Water Usage L	Notes	Water Usage L	Notes	Water Usage L	Notes	Water Usage L	Notes
January	65,000		49,000		57,000		98,000	
February	42,000		31,000		37,000		78,000	
March	33,000		25,000		29,000		96,000	
April	24,000		19,000		22,000		87,000	
May	18,000		15,000		17,000		46,000	
June	11,000		12,000		9,000		53,000	
July	6,000		4,000		5,000		37,000	
August	5,000		4,000		4,000		56,000	
September	18,000		20,000		19,000		34,000	
October	21,000		22,000		21,000		74,000	
November	38,000		30,000		29,000		39,000	
December	58,000		51,000		49,000		133,000	
Total Water Usage	339,000		282,000		298,000		831,000	
Number of Berths	70		50		70		111	
WATER USAGE BREAKDOWN								
Average Water Usage								
L/berth/ annum	4,843		5,640		4,257		7,486	
Annual Average Occupancy	8.0% ⁽¹⁾		8.0% ⁽¹⁾		8.0% ⁽¹⁾		9.4% ⁽²⁾	
L/berth/day	166		193		146		218	
Peak months - Dec & Jan								
December								
L/month	58,000		51,000		49,000		133,000	
% of Occupied Berths	21.0% ⁽⁶⁾		21.0% ⁽³⁾		21.0% ⁽⁶⁾		18.0% ⁽⁴⁾	
L/berth/day	127		157		108		215	
January								
L/month	65,000		49,000		57,000		98,000	
% of Occupied Berths	21.0% ⁽⁶⁾		17.7% ⁽³⁾		21.0% ⁽⁶⁾		13.0% ⁽⁵⁾	
L/berth/day	143		179		125		219	
Average Water Demand over 6 months								
% of Occupied Berths	13.6% ⁽⁶⁾		13.6% ⁽³⁾		13.6% ⁽⁶⁾		13.6% ⁽⁶⁾	
L/berth/day	120		144		105		170	

Notes:

1. According to the Boating Association of NSW data (http://www.bia.org.au/pp_index/pp/pp_b.htm) the average occupancy rate in Sydney Harbour is 8%. Note, occupancy rate is the number of days per year, expressed as a percentage, that a vessel is used irrespective whether it leaves berth. The 8% occupancy rate is based on a frequency of use 12 times per year for 2.5 days, i.e. 30 days per year.
2. The occupancy rate at Soldiers Point Marina (Port Stephens area), based on the marina records, is 34 days. Expressed as a percentage it is equal to 9.4%.
3. The 50 Berth Marina data based on the Rose Bay and Point Piper Marinas survey (Traffic and Parking Impact Review of Proposed Extension to Smith's Boatshed, Parriwi Road, The Spit, NSW, CHRISTOPHER HALLAM & ASSOCIATES PTY LTD, January 2011)
4. The approximate berth occupancy rate in Soldiers Point marina was estimated based on the recorded data. In December the average number of days that vessel was occupied in berth is 5.5 days. Expressed as a percentage it is equal to 18%.
5. The approximate berth occupancy rate in Soldiers Point marina was estimated based on the recorded data. In January the average number of days that vessel was occupied in berth is 4 days. Expressed as a percentage it is equal to 13%.

APPENDIX 1

6. For the Middle Harbour Marina and Pittwater Marina in Sydney adopted same occupancy rates as recorded for the Rose Bay and Point Piper Marinas (Traffic and Parking Impact Review of Proposed Extension to Smith's Boatshed, Parriwi Road, The Spit, NSW, CHRISTOPHER HALLAM & ASSOCIATES PTY LTD, January 2011).

Appendix 2 – Cattle Bay Marina Water Demand Calculations

Notes on the Revised ET per Berth Conversion Ratio

1. The Average Water Annual Consumption is calculated as follows:
 - a. Average Water Annual Consumption (kL/year) = Average Water Annual Consumption (kL/ET/year x Number of ETs
 - b. The Average Water Annual Consumption (kL/ET/year) is given by the Water Authority or Council.
 - c. According to the Bega Valley Shire Council (BVSC) Development Servicing Plan for Water Supply Services the Domestic Average Annual Consumption is 205 kL/ET/year. This value has been adopted while calculating the marina theoretical water consumption.

Notes:

- *The Water Directorate nominates Average Residential Annual Consumption as 230 kL/ET/year.*
 - *An Equivalent Tenement (ET) is a standard measure used to assess the impact of a particular business or land type on the water (and sewerage) system, relative to a residential dwelling.*
 - *A standard residential property is considered to have an ET value of one.*
 - *ET assessments for non-residential properties are achieved by multiplying the number of units by the ET factor, taking into account the size, purpose and other variables related to the property.*
2. According to the Water Directorate the Water Directorate the marina ETs are calculated as 0.6 ET/berth. Using this value and the above Average Annual Consumption of 205 kL/ET/year, the Average Annual Consumption is 123 kL/berth/year.
 3. An assessment to verify the marina average annual water consumption has been undertaken.
- Note:
- *The Cattle Bay marina will not include some facilities typical of other marinas, e.g. a repair and maintenance area.*
 - *The water demand for the temporary on land facilities has been calculated separately and has not been included in this investigation.*
4. Analysis of the water consumption data collected from a number of marinas has been undertaken. This data has been further verified by theoretical water consumption calculations. A conservative value of 207 L/berth/day was adopted for the average daily demand (for details refer to Section 3). This equates to 76 kL/berth/year.
 5. Utilising the annual average water consumption (205 kL/ET/year) and average annual demand per berth (76 kL/berth/year), a figure of 0.37 ET/berth can be reverse calculated as a more accurate representation of the true water consumption.

Notes:

- *It should be also noted that the theoretical water demands do not take into account the berth occupancy rate based on frequency of use per year. As a result, the theoretical water demands provide conservative values based on 100% berths occupied each day. The water supply system must be able to supply for the whole development.*

APPENDIX 2

MARINA WATER DEMAND CALCULATIONS

Option 1 - Adopting Marina Equivalent Tenements as per Water Directorate

Development	Standard Unit				Design Average Consumption (kL/ET/annum)	Average Day		Peak Day Demand			Peak Hour Demand		
		Number	ET/ Item	Total ET		(kL/year)	(kL/day)	Peak Day Factor	Total Demand (kL/day)	(L/s)	Peak Hour Factor	Total Demand (kL/day)	(L/s)
Marina - calculations for 1 berth	Berth	1	0.6	0.60	205	123	0.337	2	0.674	0.01	5.00	3.370	0.04
Marina - calculations for total no of berths	Berth	154	0.6	92.4	205	18,942	51.9	2	103.8	1.2	5.00	519.0	6.0

Option 2 - Adopting Peak Day Demands based on the Marina Survey Data and Theoretical Calculations (refer Section 3 of the report)

Development	Standard Unit				Design Average Consumption (kL/ET/annum)	Average Day		Peak Day Demand			Peak Hour Demand		
		Number	ET/ Item	Total ET		(kL/year)	(kL/day)	Peak Day Factor	Total Demand (kL/day)	(L/s)	Peak Hour Factor	Total Demand (kL/day)	(L/s)
Marina	Berth	1	0.37	0.37	205	76	0.207	2	0.41	0.00	5.00	2.07	0.02
Marina	Berth	154	0.37	56.8	205	11,635	31.9	2	63.8	0.7	5.00	318.8	3.7

Appendix 3 – Example Marinas Wastewater Production

APPENDIX 3

EXAMPLE MARINAS

	Middle Harbour Marina in Sydney			50 Berth Marina in Sydney Harbour			Pittwater Marina in Sydney Harbour		
Month	Sewage Pump hours run Hrs	Sewage Pumped L	Pumped Flow L/s	Sewage Pump hours run Hrs	Sewage Pumped L	Pumped Flow L/s	Sewage Pump hours run Hrs	Sewage Pumped L	Pumped Flow L/s
January	4	288	0.02	2	144	0.02	4	288	0.02
February	3	216	0.02	3	216	0.02	2.5	180	0.02
March	2.5	180	0.02	2	144	0.02	2	144	0.02
April	2	144	0.02	1	72	0.02	2	144	0.02
May	1.75	126	0.02	0.5	36	0.02	1	72	0.02
June	1	72	0.02	0.5	36	0.02	0.75	54	0.02
July	1	72	0.02	0.5	36	0.02	0.5	36	0.02
August	2	144	0.02	1	72	0.02	0.5	36	0.02
September	2	144	0.02	3	216	0.02	3	216	0.02
October	3	216	0.02	3.5	252	0.02	3.5	252	0.02
November	4	288	0.02	4	288	0.02	4	288	0.02
December	5	360	0.02	5	360	0.02	5	360	0.02
Total Wastewater Production per Year		2,250			1,872			2,070	
Number of Berths		70			50			70	
WASTEWATER									
Average Wastewater									
L/berth/ annum		32			37			30	
Berth Occupancy Rate		8.0%			8.0%			8.0%	
L/berth/day		1.1			1.3			1.0	
100% Occupancy Rate		100%			100%			100%	
L/berth/ annum		5,022			5,850			4,621	
L/berth/day		13.8			16.0			12.7	

Appendix 4 – Cattle Bay Marina Wastewater Calculations

APPENDIX 4

MARINA WASTEWATER CALCULATIONS

Option 1 - Adopting Marina Equivalent Tenements as per Water Directorate

Development	Standard Unit	Number	ET/ Item	Total ET	Design Average Dry Weather Flow (L/ET/day)	Calculated Average Dry Weather Flow (L/day)	r	Peak Dry Weather Flow L/s	Stormwater Allowance L/s/ ET	Peak Wet Weather Flow L/s
Marina - calculations for 1 berth	Berth	1	0.9	0.9	508	457	4.0	0.02	0.05	0.1
Marina - calculations for total no of berths	Berth	154	0.9	138.6	508	70,409	3.09	2.52	8.04	10.6

Option 2 - Adopting Annual Wastewater Production and ETs based on the Marina Recorded Data

Development	Standard Unit	Number	ET/ Item	Total ET	Design Average Dry Weather Flow (L/ET/day)	Calculated Average Dry Weather Flow (L/day)
Marina	Berth	1	0.03	0.03	508	16.0
Marina	Berth	154	0.03	4.98	508	2,531.5

Option 3 - Adopting Annual Wastewater Production and ETs based on the Pump Out Flow Rate

Development	Standard Unit	Number	ET/ Item	Total ET	Design Average Dry Weather Flow (L/ET/s)	Calculated Average Dry Weather Flow (L/s)	r	Peak Dry Weather Flow L/s	Stormwater Allowance L/s/ ET	Peak Wet Weather Flow L/s
Marine Berths	berth	154	0.03	4.0	0.006	0.0	4.0	0.09	0.23	0.32