The Point Lonsdale Residential Development Project
Water Quality Management Plan
Revision 4 – 26 March 2025



EPBC number	2003/1144	
Project name	The Point Lonsdale Residential Development Project	
Proponent /approval holder and ACN or ABN	Point Lonsdale Land Partners Pty Ltd 16 162 667 736	
The proposed/approved action	Construction of a residential Waterway development comprising of 598 residential lots, 170 independent retirement units and 120 bed aged care facility, built around a single-channel, tidal Waterway located near Point Lonsdale Victoria	
Location of the action	88-90 Point Boulevard, Point Lonsdale, Victoria 3225	
Date of preparation of the WQMP	See Revision Control	Page 2
Person accepting responsibility for this Water Quality Management Plan	See Declaration	Page 3

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Revision Control			
Version	Date	Purpose	Issued to
A	18 Nov 2014	Draft For Review	Point Lonsdale Land Partners Pty Ltd & Reviewers
B	24 Nov 2014	Final Draft	Point Lonsdale Land Partners Pty Ltd & Reviewers
1	3 Dec 2014	Issue to DoE	Point Lonsdale Land Partners Pty Ltd (for DoE) & Reviewers
2	15 March 2015	Issue to DoE	Point Lonsdale Land Partners Pty Ltd and DoE
3	15 May 2015	Issue to DoE (finalized after DoE comments)	Point Lonsdale Land Partners Pty Ltd and DoE
4	10 Jan 2025 20 Jan 2025 22 Jan 2025 24 Jan 2025 14 Feb 2025 21 Feb 2025 24 Mar 2025 26 Mar 2025	1st Draft for Review 2nd Draft for Review 3rd Draft for Review 4th Draft for Review 5th Draft for Review Submit to DCCEEW for Review Submit to DCCEEW for Review Submit to DCCEEW	Point Lonsdale Land Partners Pty Ltd & CoGG Point Lonsdale Land Partners Pty Ltd, DCCEEW & CoGG Point Lonsdale Land Partners Pty Ltd, DCCEEW & CoGG Point Lonsdale Land Partners Pty Ltd, DCCEEW Point Lonsdale Land Partners Pty Ltd, CoGG Point Lonsdale Land Partners Pty Ltd, DCCEEW & CoGG Point Lonsdale Land Partners Pty Ltd, DCCEEW & CoGG Point Lonsdale Land Partners Pty Ltd, DCCEEW & CoGG



Authorized For WithERS Pty Ltd by:

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Signed _____

Full name (please print) DOUG VALLANCE

Organisation (please print) POINT LONSDALE LAND PARTNERS PTY LTD

Date 26 / 3 / 2025

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Table 1 – List of Acronyms

List of Acronyms	
AFCG	Automatic Flow Control Gates
Ag	Silver
AHD	Australian Height Datum
ARI	Annual recurrence Interval
As	Arsenic
BGA	Blue-Green Algae
BoD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
Cd	Cadmium
Chl-a	Chlorophyll-a
Co	Cobalt
CoD	Chemical Oxygen Demand
CoGG	City of Greater Geelong
CoGG Website	A set of related web pages located under a single domain name attributed to CoGG and available to the public.
Cr	Chromium
Cu	Copper
DCCEEW	Department of Climate Change, Energy, Environment and Water, or the Australian Government agency responsible for administering the EPBC Act.
DEECA	Department of Energy, Environment and Climate Action
Development Plan	The Development Plan prepared in response to Schedule 21 of the Development Plan Overlay (DPO 21) for The Point.
DO	Dissolved Oxygen
DPO	Development Plan Overlay
DQO	Data Quality Objective
EES	Environment Effects Statement
EMF	Environment Management Framework. This is part of the CoGG approved Development Plan for The Point. In the Development Plan, the EMF provided the framework for the management, design, construction and operation of the development, noting that final environmental management requirements were to be determined in the Project Environmental Management Plan
EMP	Environment Management Plan
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ERS	Environment Reference Standard
Hg	Mercury
MW	Monitoring Well
NH3	Ammonia
Ni	Nickel
NO2	Nitrite
NO3	Nitrate
NTU	Nephelometric Turbidity Unit

OCP	Organo-chlorine Pesticides
ORP	Oxygen Reduction Potential
PAH	Polycyclic Aromatic Hydrocarbon
Pb	Lead
PEMP	Project Environment Management Plan for The Point, endorsed by the City of Greater Geelong pursuant to its Planning Permit for The Point. In respect of the Waterway, this PEMP requires compliance with: • Subsection 2.0 of Section 13.1 of the Environment Management Framework • The Waterways Master Plan • The Water Quality Management Plan With the Waterway fully constructed and operational since 6 February 2023, the PEMP requirements for the Waterway's operation are those that are relevant.
pH	Potential of hydrogen - a measure of the concentration of hydrogen ions (that is, protons) in a substance; a measure of how acidic/basic water is
PLLP	Point Lonsdale Land Partners, the developer of The Point
PO4	Phosphate,
RAMSAR	The Ramsar Convention, also known as "The Convention on Wetlands", an international environmental treaty signed on 2 February 1971 in Ramsar, Iran, under the auspices of UNESCO
Rev	Revision
TDS	Total Dissolved Solids
Temp	Temperature
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TP	Total Phosphorous
TPH	Total Petroleum Hydrocarbon
TSS	Total Suspended Solids
Vn	Vanadium
VOC	Volatile Organic Carbon
WQMP	Water Quality Management Plan prepared for the purposes of managing water quality and water levels in the Waterway at The Point in compliance with a) the EPBC Act Approval for The Point; b) the Planning Permit for The Point issued by the City of Greater Geelong; and c) relevant Victorian legislation.
WSUD	Water Sensitive Urban Design

1. INTRODUCTION

This Revision 4 of the Water Quality Management Plan (WQMP) sets out the objectives, criteria, and the key tasks for the management of water levels and water quality in the post-construction Waterway at The Point Lonsdale Residential and Waterway Development Project, (The Point).

Table 2 describes how this WQMP addresses the DCCEEW's Environmental Management Plan Guidelines (https://www.dcceew.gov.au/sites/default/files/documents/environmental-management-plan-guidelines.pdf)

Table 2 Addressing DCCEEW EMP Content Guidelines

Guideline Content Requirements	Where Located in this WQMP
Cover page and declaration of accuracy	Cover Page. Declaration of Accuracy on Page 3
Document version control	Page 2
Table of contents	Pages 4 to 6
Executive summary or introduction	Section 1
Conditions of approval reference table	Table 3
Project description	Section 1.3 and Section 1.4
Objectives	For Water Quality Objectives - See Section 2.1 For Operational Water Management Objectives - See Section 3.1 For criteria for WQMP Compliance - See Section 8,
Environmental management roles and responsibilities	See Section 1.1, and the Overview in Appendix B and its Section 9
Reporting	See Table 6 and Section 9
Environmental training	The contractors / consultants listed in Section 9 in the Overview in Appendix B are all suitably experienced and qualified in their areas of specialised services. They have been working on the Waterway for many years and are familiar with their roles in helping deliver the WQMP requirements. They are each responsible for the necessary environmental training of their staff and subcontractors
Emergency contacts and procedures	For Emergency Contacts - See Section 10 Compliance with this WQMP requires the creation and implementation of procedures, and contact details for contracted resources that are documented or referenced in the Waterway Operation and Maintenance Manual
Potential water quality risks	See Section 2.3.
Environmental management measures	For Water Monitoring - See Sections 4, 5 & 6, and Table 5 For Water Quality Management - See Section 7, and Tables 6 and 7
Audit and review	Annual WQMP compliance reports are to be produced by an environmental consultant from their review and assessment of the information and data obtained from the implementation of this WQMP – See Section 9 For WQMP review see Section 1.6
Glossary	Table 1 provides a list of acronyms

To summarise:

- The purpose of the WQMP is to describe how the quality of water, that is taken in from Lakers Cutting, flows through the Waterway and is discharged back into Lakers Cutting, will be managed so that it, when unimpacted by inflows from sources outside The Point:

    a) Complies with the Victorian EPA's Environment Reference Standards that are applicable; and

    b) Protects against water quality risks to the relevant matters of national environmental significance for the purposes of the EPBC Act.

- To this end this WQMP provides:

    a) A statement of water quality objective (See Section 2.1) that:

        i. Is consistent with that stated in the WQMP Revision 3 that was a) approved under EPBC Approval 2003 /1144 and b) part of the CoGG endorsed Project Environmental Management Plan for The Point. This preserves the continuity of the water quality objective;

        ii. Provides a clear basis for trigger levels for water quality;

        iii. Corresponds to the key and overriding compliance requirements for water quality that were contained in the approved EES for this project;

        iv. Is supported by Waterway Management Objectives (see Section 3.1); Surface Water Management Objectives (See Section 3.2); and a description of the operation of the Automatic Flow Control Gates (AFCG) to:

            - Maximise the tidal flows in and out of the Waterway in the interests of water quality management; and
            - Limit the peak water level in the Waterway.

    b) For a tiered protocol for water quality monitoring (see Sections 4.1 and 4.2):

        i. Tier 1 is for the post-construction Waterway in routine "operation and maintenance" mode. Its scope is designed (see below) to provide the data needed for adjudicating compliance with the water quality objective and for making decisions for operation and maintenance purpose;

        ii. Higher tiers would be invoked – on a case-by-case basis - to increase the scope / frequency of monitoring from Tier 1 in response to deterioration in performance of the Waterway or in response to pollution incidents and to help with the operational mitigation or rectification of problems. The changes in scope and frequency would be targeted to the nature and severity of the issue that requires additional monitoring;

        iii. There will be annual reviews of Waterway performance and monitoring data to decide if there is need (or not) for an adjustment in a planned, structured way, of the scope and frequency of the Tier 1 monitoring to be done in the following year;

    c) A description of the monitoring actions (See Sections 5 and 6) and a summary of the monitoring methods (See Appendix D) for:

i. Instrumented Monitoring of water levels, flows and quality;

ii. Water Quality Sampling and Testing.

d) Requirements for water quality management (see Section 7), which include:

i. A description of the triggers for water quality management response actions, with examples of these actions;

ii. A requirement to sustain the proactive approach with the operation and maintenance of the several systems that are involved in Waterway management - an approach that has worked successfully since 2016 (as evidenced by the WQMP Compliance Reports);

e) The compliance criteria for water flows, levels and quality and the processes for measuring and adjudicating compliance (See Section 8);

f) The compliance reporting requirements (See Section 9)

- Experience gained since February 2022[1] has shown that the Automatic Flow Control Gate (AFCG) system, operating with the constructed culverts and fully constructed Waterway:

a) reliably controls tidal water flows, water levels and water quality in the Waterway in line with expectations from the EES, the hydraulic and water quality monitoring and modelling done pursuant to the original EPBC Act approval conditions; and

b) delivers water quality that complies with the water quality objective.

This provides confidence that provided the AFCG system, culverts and Waterway are maintained, their operation will continue to do so.

- Experience has also shown that, in these circumstances, the following are the main impact events posing risks to water quality in the Waterway. These are the main impact events as they are highly likely (because they are expected to occur at least once per year):

a) High algal concentrations and hence Chlorophyll – a concentrations in discharges from Lake Victoria;

b) High algal concentrations and hence Chlorophyll – a concentrations in water in inflows from Lakers Cutting.

- Acknowledging that neither discharges from Lake Victoria nor the tidal range in Lakers Cutting can be controlled by The Point, the management of these two risk categories entails, as part of the operation and maintenance actions conducted for Point Lonsdale Land Partners or CoGG (whichever is in control and management of the Waterway):

a) Making sure the AFCG system is operated and maintained as intended;

b) Conducting the water quality, level and flow monitoring as required by this WQMP;

c) Making sure that the stormwater treatment systems of The Point are working effectively;

[1] As documented in the WQMP compliance reports for 2022, 2023 and 2024

d) Planned proactive harvesting of sea grasses and other aquatic vegetation (e.g., benthic algae) that grow in the Waterway

- Separate to the above two risk categories, there is a risk of a different kind of pollution incident – by which is meant an event that causes a rapid deterioration in water quality in the Waterway. Such an event is considered to be unlikely (meaning this could occur but is considered unlikely or doubtful) or rare (meaning this may occur in exceptional circumstances). This concerns, for example:

  a) Pollutants entering the stormwater systems outside The Point and then discharge into the Waterway, notwithstanding the "rain garden" located in The Point and which is intended to ameliorate the quality of stormwater discharges into the Waterway;

  b) Pollutants entering or present in Lake Victoria and being discharged into the Waterway when Lake Victoria discharges;

  c) Pollutants entering the Waterway from sources in or discharging into Lakers Cutting from sources outside The Point;

  d) Pollutants entering the stormwater systems in The Point and discharging into the Waterway, notwithstanding the water sensitive urban design of these systems;

  e) Pollutants directly entering the Waterway (not via a stormwater system) – for example from a vehicle accident or other act;

- The monitoring for pollution incidents occurs via:

  a) Routine visual observation of water conditions (for example during monthly maintenance of monitoring systems, and at other times);

  b) Notifications from residents of and visitors to The Point;

  c) Observation of changes in the 15-minute interval instrumented monitoring data – if the nature of the pollution affects one or more of Turbidity, pH, Dissolved Oxygen, Oxidation Reduction Potential, Salinity, Temperature, Chlorophyll-a.

- Pollution incidents will be managed by having plans with resources and procedures ready to mitigate the risks within a short time frame. These include:

  a) A capacity to arrange the closure of stormwater discharge culverts within The Point, if this is needed;

  b) A capacity to close (if this is needed) the AFCG (or stop them from opening). This will limit polluted water within the Waterway discharging into Lakers Cutting – and provide time for investigations and actions to limit / prevent further pollution of the Waterway and ameliorate the pollution that exists;

  c) A capacity to scope and conduct tailored investigations (and a root cause assessment) into the nature and source of the pollution – so as to inform decisions on risk management and remediation. Note however that The Point has no control over sources of pollution outside The Point.

- With this mitigation, the consequences for the water of Lakers Cutting from discharges from The Point affected by a pollution incident can be managed to be minor (meaning a minor incident of environmental damage that can be reversed) to moderate (meaning isolated but substantial instances of environmental damage that could be reversed with intensive efforts). The implied risk rating is Low.

1.1 RESPONSIBILITY

The responsibility for maintaining and implementing this WQMP rests with the following entities:

- Pursuant to the varied conditions of the EPBC Act Approval for The Point – with Point Lonsdale Land Partners until this Approval is transferred to the City of Greater Geelong, and thereafter with the City of Greater Geelong for so long as the conditions in that Approval require; and
- Pursuant to the Planning Permit (and as a component in the endorsed Project Environmental Management Plan) for The Point - with Point Lonsdale Land Partners until the responsibility for operation and maintenance of the Waterway at The Point is transferred to the City of Greater Geelong, and thereafter with the City of Greater Geelong.

Supporting the implementation of this WQMP will be resources engaged by these entities to do specific tasks (See Section 7.2 for a list of the categories of tasks).

1.2 THIS REVISION

This Revision 4 of the WQMP replaces the approved Revision 3 which was prepared:

- To comply with the requirements of Condition 3 of the EPBC Act Approval 2003/1144 for The Point; and
- To enable the City of Greater Geelong (CoGG) endorsed Project Environment Management Plan, that was required as a condition of the Planning Permit for The Point, to address the management of water levels and water quality within The Point to deliver outcomes that comply with relevant Victorian legislation.

Figure 1 shows the position of this WQMP within the hierarchy of applicable legislative planning and environmental controls.

This WQMP Revision 4, as WQMP Revision 3 did, addresses and complies with the relevant current requirements of both the EPBC Act Approval and the Planning Permit for The Point. This is to avoid unnecessary duplication or ambiguity that might occur from two separate documents – one specifically for the EPBC Act Approval, and the other for the Planning Permit.

The Planning Permit required the creation and CoGG endorsement of a Development Plan and a Project Environment Management Plan (PEMP) for the design, construction and operation of The Point, with the PEMP to address, among other matters, requirements regarding the Waterway. The WQMP is the component of the PEMP that deals with these Waterway requirements. The Waterway construction was completed and its operation as a fully complete Waterway started on 6 February 2023. Therefore, this Revision 4 of the WQMP omits all that content of Revision 3 of the WQMP that concerned design and construction of the Waterway.

This endorsed Development Plan includes principles and objectives for Waterway management and in referring to the Environmental Effects Statement (EES) for the project, states that:

" *The EES commitments and regulatory conditions providing ongoing management and maintenance of The Point Lonsdale Residential and Waterways Project will be embodied in:*

- *the EMF*
- *the schedule to the DPO*
- *planning permit conditions*
- *where appropriate, Section 173 Agreements*"

Note that EMF means Environment Management Framework, and DPO means Development Plan Overlay. Also note that the EMF:

- Was an intrinsic component of the documents submitted to and considered in the process for the project to secure planning and environmental approvals.
- Is appended to and part of the endorsed Development Plan and requires the PEMP (and so also the WQMP as a component of the PEMP) to be based on environmental risk assessment. The EMF provides a framework for the conduct of the risk assessments needed for this purpose. This was deliberate so as to provide a consistent framework for adapting the content of the PEMP as assessed risks changed.
- Has been revoked in the conditions in the varied conditions of the EPBC Act Approval – and so no longer applies for the purposes of that Approval.

The intent is that this WQMP Revision 4 becomes:

- approved concurrently with the variation of the conditions in of the EPBC Act Approval 2003/114; and
- replaces WQMP Revision 3 for the purposes of in compliance with the PEMP; and
- provides the requirements for the operation and management of the Waterway to comply both with the PEMP and the varied conditions of the EPBC Act Approval.

Note that after the EPBC Act Approval conditions cease to apply to The Point, the WQMP (as revised from time to time by CoGG) will continue to apply to its operation and maintenance of the Waterway.

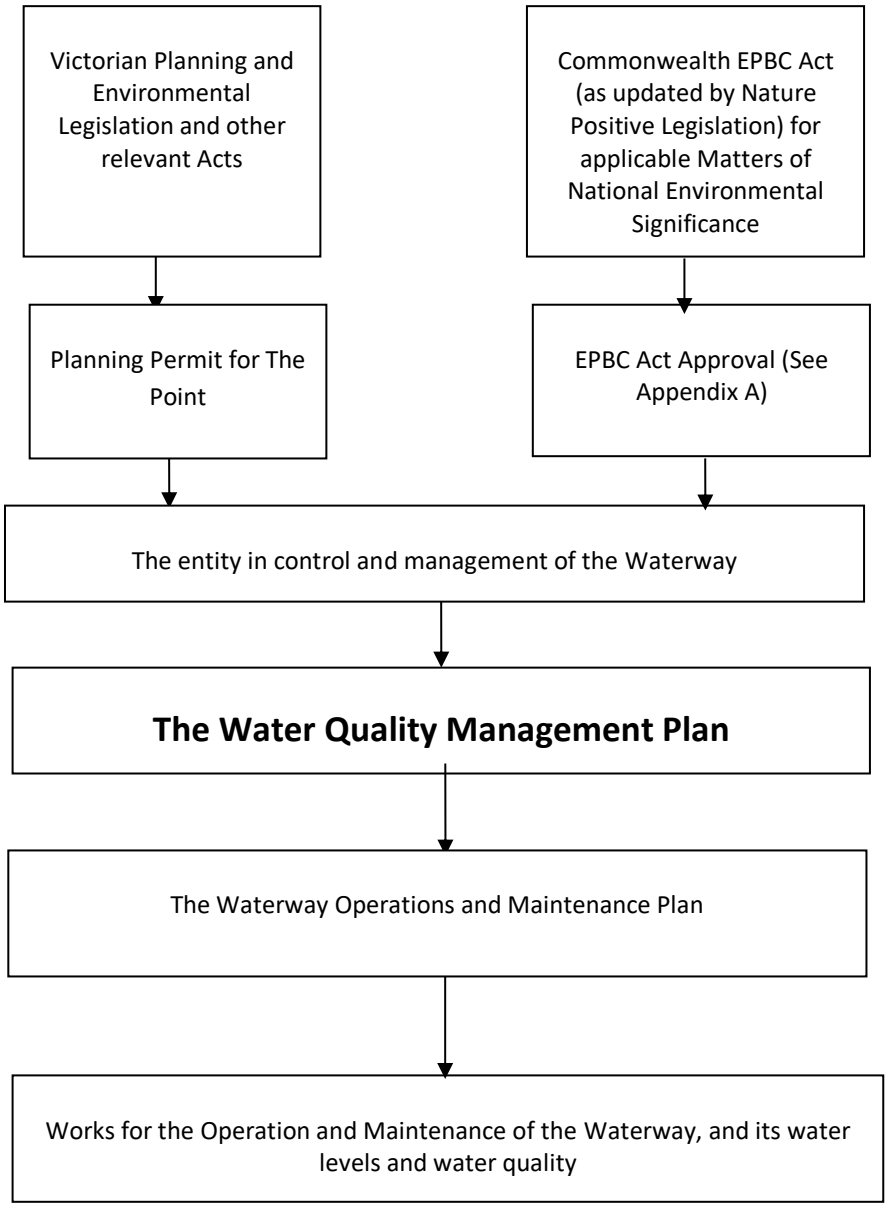
Revision 4 arose from:

- The completion of the construction works that comprised the "action" defined in EPBC Approval 2003/1144 These works were complete by 6 February 2023;
- The handover (scheduled for 6 February 2025, or as soon as agreed between CoGG and PLLP thereafter) of the Waterway assets to CoGG for it to manage and maintain. This handover is by agreement between CoGG and Point Lonsdale Land Partners and follows two years of successful operation and maintenance of the Waterway in compliance with Revision 3 of the WQMP;
- The variation of the conditions in EPBC 2003/1144 (See Appendix A) to apply to the operation and maintenance of the Waterway until the end of 2027, and the reporting of compliance with those conditions.

It is emphasized that in making this Revision 4 of the WQMP, for the purposes of consistency and continuity:

- The general structure of the approved WQMP Revision 3 has been preserved; and
- The framework and requirements in the approved WQMP Revision 3 for management of water levels and water quality in the Waterway have been preserved. In particular the scope of the monitoring, the compliance objectives for water levels and water quality, and how compliance is to be measured and adjudicated remain the same; and
- The content of the approved WQMP Revision 3 that is not relevant for operation and maintenance of water levels and water quality in the constructed Waterway has been removed.

Figure 1: The position of this WQMP within the hierarchy of planning and environmental controls



It is noted that, following the completion of the construction works and informed by the experience, since 6 February 2023, of operating and maintaining the Waterway and complying with the WQMP Revision 3, The Point Waterway Operation and Maintenance Manual has been created. That document is subsidiary to and not part of the WQMP. It is a tool to enable achievement of the objectives of the WQMP. It contains information about the Waterway assets that have been constructed or installed; and sets out the procedures for the Waterway monitoring and management actions described in this WQMP (See Sections 5, 6 and 7). That manual comprises:

- Overview
- Appendix 1 – O&M Manual for Water Management
- Appendix 2 – Key Features Map
- Appendix 3 – Landscape Master Plan
- Appendix 4 – Title Information
- Appendix 5 – As-built Plans
- Appendix 6 – Risk Register

The content of The Point Waterway Operation and Maintenance Manual may, from time to time, become revised. However, such revisions will not impact on the WQMP or trigger a need for its revision or review of the WQMP's approval pursuant to the EPBC Act or the Planning Permit for The Point. The revisions of The Point Waterway Operation and Maintenance Manual may be prompted by, for example:

- A revision to the WQMP (See Section 1.6);
- A need to adjust an operation or maintenance procedure;
- A need to change, renovate, or replace a Waterway asset;
- A change in technology for the collection, logging, telemetry, storage and management of water monitoring data.

A copy of the current (as of the date of this WQMP) Overview is provided in Appendix B

1.3 PROJECT DESCRIPTION

The Point incorporates approximately 600 homes and a 170-unit retirement village surrounded by Waterways, parklands and a conservation reserve, located on a former shell grit mine in Point Lonsdale.

The centrepiece of The Point is the winding, 5.5 kilometre long tidally flushed Waterway, around which the residential community, open space areas, and conservation reserve lie. The Waterway provides amenity for the residents and visitors to The Point and supports intertidal ecosystems along the Waterway's edge and in The Point's conservation reserve. The Waterway is not intended for use by powered water vessels; however, is accessible for passive recreational uses. i.e.; kayaks, paddleboards, etc.

The only outlet from Lake Victoria enters The Point Waterway from Shell Road. This means that The Point's Waterway also is the pathway for flows from Lake Victoria's catchment to discharge into Lakers Cutting. Lakers Cutting also receives stormwater discharges and run off from the land to its north, west and south. Lakers Cutting exchanges water tidally with Swan Bay.

Swan Bay is recognised for its large number of migratory birds that visit during the summer, and also for its marine flora, particularly seagrass. Swan Bay is a RAMSAR-listed wetland and is part of Port Phillip Bay.

1.4 WATERWAY DESCRIPTION

The Waterway is defined by title boundaries which follow the channel alignment and are generally set to follow the 0.2m AHD contour, which represents a typical high tide level with present (2023) tidal conditions in Lakers Cutting.

Under these present tidal conditions, Lakers Cutting high tides can range upwards from about 0.1m AHD; and the 1% AEP high tide with storm surge is presently about 1.45m AHD. Lakers Cutting high tides with storm surge in the range 0.4 to 0.8 m AHD are not uncommon, as are periods of several days with scarcely any tidal fluctuations

Note that the 2010 planning permit, provides for a 'peak water level of 0.9m AHD under the then current climate and sea level; and later, 1.65m AHD with 0.8m sea level rise and the associated climate change'.

Therefore, water in the Waterway can rise above 0.2m AHD. When this occurs, the water outside the 0.2m AHD contour in a horizontal direction is technically within open space and the conservation reserve, or the lower section of lots in the case of the 'old lots' (developed prior to The Point off Silver Ridge Road and Chiswick Court) where there is a concrete plinth on the property boundary set at approx. 0.4m AHD).

Within the Waterway are the hydraulic structures needed for the proper functioning of the Waterway, such as the various culverts and headwalls that facilitate flows through the site and under the Bellarine Highway, Bellarine Railway reserve and Fellows Road. These assets also form part of The Point Waterway

The Waterway:

- Receives one-way flow from Lake Victoria. The Point Waterway does not impact the water level regime in Lake Victoria, with backflow from the Waterway to Lake Victoria prevented by flap valves installed at the Lake Victoria outlet culverts located within The Point (north of Shell Road)
- Exchanges water with Lakers Cutting / Swan Bay. Flow control gates located at the culverts under the Bellarine railway reserve operate automatically (with manual override possible) to allow inflows to the Waterway on a rising Lakers Cutting tide and outflows from the Waterway on a falling Lakers Cutting tide. Under automatic operation the flow control gates allow inflow through the inlet culverts and outflow through the outlet culverts, thereby instilling one-way flow through the Waterway in a clockwise direction.
- Receives stormwater discharges from within The Point and from the Southeast rain garden (located adjacent to Peterho Boulevard) that receives stormwater from the Hollywood estate outside of The Point.
- Receives seepage from groundwater under land to its north; and loses water to groundwater seepage towards Lake Victoria when its water levels are below those in the Waterway. Note however that the quantities of seepage are miniscule compared with the tidal exchange with Lakers Cutting.

Water levels in Lakers Cutting are not affected by The Point development. In contrast, it is the tidal and surge regime within Lakers Cutting that influences the water levels and flows into and out of The Point Waterway.

The intent of the tidal exchange between The Point Waterway and Lakers Cutting is to establish and sustain the physical, biological and chemical processes that will sustain water quality in the Waterway.

Further overview information about the Waterway is provided in Appendix B. Also included in Appendix B is an Overview Map of the Waterway, and a Key Features Map of the Waterway.

There is also more detailed information about the operation of the Waterway and the compliance of the water levels and water quality in the nine annual WQMP compliance reports submitted to DCCEEW and to CoGG. These

nine annual compliance reports address compliance with the requirements[2] of the approved WQMP Rev 3 of 15 May 2015. That WQMP Rev 3 was approved pursuant to the conditions in the original EPBC Act Approval. The nine compliance reports are:

- the first being for the calendar year 2016, (WQMP Compliance Report Rev 1 170301b.pdf);
- the second for the calendar year 2017 (WQMP Compliance Report Rev 1 180329.pdf);
- the third for calendar year 2018 (WQMP Compliance Report Rev 1 190304.pdf);
- the fourth for calendar year 2019 (WQMP Compliance Report Rev 1 200317.pdf),
- the fifth for calendar year 2020 (WQMP Compliance Report Rev 1 210316.pdf)
- the sixth for calendar year 2021 (WQMP Compliance Report for 2021 Rev 1 220325.pdf)
- the seventh for calendar year 2022 (WQMP Compliance Report for 2022 Rev 1 230320.pdf)
- the eighth for calendar year 2023 (WQMP Compliance Report for 2023 Rev 1 240325.pdf)
- the ninth for calendar year2024 (WQMP Compliance Report for 2024 Rev 1 250201.pdf)

The first seven of these relate to the period of construction; the eighth addresses the last weeks of the construction phase and then operation and maintenance; the ninth addresses operation and maintenance.

The information in these compliance reports demonstrates that in the period 2016 to 2024 inclusive, there have been zero instances of non-compliance of water quality with the water quality objectives stated in the WQMP Rev 3. That is, neither the approved action (including construction of the Waterway) in the period 2016 to 2022, nor the operation of the constructed Waterway in 2023 and 2024 has had impacts on relevant matters protected under the EPBC Act. There has in fact been compliance with the approved WQMP Rev 3 in every year 2016 to 2024. This outcome accords with expectations and risk assessments made for the purposes of a) the EES and Planning Approval and b) the varied conditions of the EPBC Act Approval for the project. It also accords with the subsequent work made to gain approval of WQMP Rev 3 pursuant to the EPBC Act Approval.

This track record demonstrates that there can be high confidence that management of the Waterway can deliver outcomes that comply with the objectives for water quality and water levels as stated in this WQMP.

Given that these objectives remain the same as those in the previously approved WQMP Revision 3, their continuing achievement will sustain protection of the quality of water in Lakers Cutting (and relevant matters protected under the EPBC Act) from risks from sources within The Point.

1.5 END DATES FOR MONITORING AND COMPLIANCE REPORTING FOR THE EPBC APPROVAL

Annual WQMP Compliance Reports for the purposes of the varied conditions of the EPBC Act Approval are required for the 2025, 2026, and 2027 calendar years.

The end date for monitoring for the purposes of annual WQMP Compliance Reporting under the varied conditions of the EPBC Act Approval is the end of 2027 unless a later date is agreed between DCCEEW and CoGG.

Requirements for compliance reporting for the purposes of the varied conditions of the EPBC Act Approval will continue to be in effect until:

- Submission of the last WQMP Compliance Report under the EPBC Approval. Unless otherwise agreed between CoGG and DCCEEW, this is the end of March 2028 for submission of the compliance report for 2027 to DCCEEW;

[2] Those requirements for water levels and water quality have been preserved, and expressed in the same terms, in this WQMP Revision 4. See Section 2.1 for the Water Quality objective.

- Publication on the CoGG website of the last WQMP Compliance Report under the EPBC Approval. Unless otherwise agreed between CoGG and DCCEEW, this is the end of April 2028.

To allow for DCCEEW review of the last WQMP Compliance Report under the EPBC Approval, CoGG will continue, until 30 June 2028 (unless otherwise agreed between DCCEEW and CoGG), to implement the Water Quality Management Plan in respect of sustaining compliance with the water quality objective (See Section 2.1), reporting of incidents of non-compliance with that water quality objective, and addressing DCCEEW comments on the last WQMP Compliance Report under the EPBC Approval.

1.6 FUTURE DOCUMENT REVISION AND CONTROL

In the event that revision to this WQMP is required, the process described below will apply.

- The proposed revision will be submitted to DCCEEW for Commonwealth approval if the revision is required before the end date for monitoring for compliance with the varied conditions of EPBC Approval. After the end date for compliance, which is set out in the varied conditions of EPBC Approval, this WQMP may, at CoGG's discretion, be revised to reflect CoGG's requirements at that time for Waterway management and reporting of the outcomes from that management;
- The proposed revision will be given a unique revision number and date of issue;
- The revision, when approved will be issued to those who eligible to receive it.

A register of control copies and to whom they have been issued will be kept for each approved revision of his WQMP.

1.7 ADDRESSING EPBC APPROVAL CONDITIONS

Table 3 describes which Sections of this WQMP address the varied conditions of the EPBC Act Approval Conditions.

Table 3 How This Water Quality Management Plan Addresses the Varied EPBC Approval Conditions

Applicable Conditions Attached to the EPBC Act Approval	*Compliance Approach with WQMP Section Numbers*
3) To protect the water quality potentially impacted by the Action, the approval holder must implement the **Water Quality Management Plan** and continue to implement the **Water Quality Management Plan** until 30 June 2028.	The compliance approach and commitments are set out in this WQMP Revision 4
3A) The approval holder must prepare a **compliance report** for each **Annual Compliance Report Period** (**ACR period**).	The compliance approach and commitments are set out in Section 9.1, noting that: • For the purposes of 3B) c) the definition of an incident is one that amounts to non-compliance with the Water Quality Objective set out in Section 2.1 of this WQMP. • Section 9.2 sets out the approach and commitments for reporting (outside the annual compliance reports) of those incidents that amount to non-compliance with the Water Quality Objective set out in Section 2.1 of this WQMP.
3B) The approval holder must ensure each **compliance report** includes: a) accurate and complete details of compliance and any non-compliance with: i) each condition attached to this approval decision, and ii) all commitments made in the **Water Quality Management Plan**, b) accurate and complete details of how the **plan** was implemented during the **ACR period,** and c) if any **incident** occurred, accurate and complete details of each **incident**	
3C) The approval holder must ensure each **compliance report** is consistent with the *Annual Compliance Report Guidelines*, Commonwealth of Australia 2023.	

Applicable Conditions Attached to the EPBC Act Approval	*Compliance Approach with WQMP Section Numbers*
3D) The approval holder must, within 4 months following the end of each **ACR period**, in a format that is easily accessible and downloadable, publish each **compliance report** on the **website.**	The compliance approach and commitments are set out in Section 9.1
3E) The approval holder must notify the **department** electronically, within 5 **business days** of each date of publication that the **compliance report** has been published on the **website**. In this notification, the approval holder must provide the **department** with the web address for where the **compliance report** is published on the **website**	
3F) The approval holder must keep each **compliance report** published on the **website** from the first date which that **compliance report** must be published and until at least 31 December 2028.	
5) If the approval holder wishes to carry out any activity other than in accordance with the **Water Quality Management Plan** approved by the **Minister**, the approval holder must submit to the **department** for the **Minister's** written approval a revised version of the **plan**. If the **Minister** approves the revised **plan**, the approval holder must immediately implement the approved revised **plan** in place of the **plan** previously approved.	The compliance approach and commitments are set out in Section 1.6

The varied conditions of EPBC Approval defines the terms highlighted bold in the above. For convenience, the definitions of the following terms are copied here:

- **Annual Compliance Report period** or **ACR period** means each calendar year until 31 December 2027, unless otherwise specified in writing by the **Minister**.
- **Water Quality Management Plan** means *The Point Lonsdale Residential and Waterways Development Project - Water Quality Management Plan Revision 3, Dated 15 May 2015*, or the latest subsequent version approved in writing by the Minister.
- **Website** means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

For the full set of definitions, please refer to the copy of the varied conditions of the EPBC Act Approval in Appendix A.

2 WATER QUALITY OBJECTIVE & RISKS ADDRESSED BY THIS PLAN

2.1 WATER QUALITY OBJECTIVE

The water quality objective is:

- **Sources within The Point[3] are not to cause the annual average concentrations of each compliance parameter at the Outlet culvert *to exceed the annual average* of concentrations of the same parameter at the Inlet culvert, when measured over the same time periods, by an amount that Implies a measurable[4] difference in the level of environmental risk to beneficial uses of that water as defined in the EPA's Environment Reference Standard.**

This approach, rather than defining it in terms of specific concentrations, provides a practical and effective way to

a) Enable the quality of water in the Waterway as affected by contributions of stormwater, groundwater and surface water discharges within the Site to:
   - protect the amenity of the Waterway;
   - protect the health of aquatic ecosystems of the Waterway; and
   - not cause deterioration in the baseline quality of water in Lakers Cutting.

b) Accommodate changes in the baseline quality in Lakers Cutting resulting from factors outside The Point development project, such as:
   - Variations in conditions in Swan Bay;
   - Variations in climate and tidal conditions;
   - Discharges to Lakers Cutting from land outside the development site - i.e., from:
     i. Lake Victoria;
     ii. Point Lonsdale;
     iii. Lake to the north and east of Lakers Cutting.

The above statement of the water quality objective:

- **Is consistent with the water quality objective stated in the WQMP Revision 3 that was a) approved under EPBC Approval 2003 /1144 and b) part of the CoGG endorsed Project Environmental Management Plan for The Point. This preserves the continuity of the water quality objective.**
- **Complies with the Victorian EPA's Environment Reference Standards that are applicable for the quality of water that is taken in from Lakers Cutting, flows through the Waterway and is discharged back into Lakers Cutting, unimpacted by inflows from sources outside The Point.**
- **Protects against water quality risks to the relevant matters of national environmental significance for the purposes of the EPBC Act.**
- **Provides a clear basis for trigger levels for water quality.**
- **Corresponds to the key and overriding compliance requirements for water quality that were contained in the approved EES.**

For the purposes of compliance with the varied EPBC approval 2003/1144, the relevant parameters are:

- Chlorophyll – a
- TSS
- Nutrients

[3] i.e.: ignoring discharges from Lake Victoria or other external sources (outside The Point) of impact on the quality of water in the Waterway.

[4] i.e., a difference that is within the limits of precision and reliability of measurements by commercially available and feasible techniques.

2.2 BASELINE WATER QUALITY IN LAKERS CUTTING AND LAKE VICTORIA

Table 4 shows the Baseline Water Quality Values for pH, TDS, TSS, Turbidity (NTU), NH3, NO3, Total Oxidized Nitrogen, Total Nitrogen, Total Phosphorous, PO4 and Chlorophyll a.

These Baseline Water Quality Values are to assist the operational management of the Waterway to achieve the Water Quality Objective set out in Section 2.1. They provide operational limiting criteria for the results of laboratory tests on water quality samples obtained for the monitoring done for this WQMP

These Baseline Water Quality Values have been derived using data from:

- The 2003/2004 Baseline Water Quality Monitoring Programme conducted by Golder;
- The 2009/2010 Baseline Water Quality Monitoring Programme conducted by GHD;
- The 2013 Water Quality Monitoring conducted by WSP as part of the water quality and hydraulic; monitoring done for the additional modelling required by the EPBC conditions of approval of the project;
- The 2015/2016 Baseline Water Quality Monitoring Programme conducted by HydroTerra;
- The 2020/2021 Baseline Water Quality Monitoring Programme conducted by HydroTerra.

This WQMP also provides an option for additional 13-month baseline water quality monitoring programmes – using the same scope (see outline scope below) and procedures as used for previous programmes. This would be conducted to provide data to track and account for changes in water quality in Lake Victoria and Lakers Cutting and to help update the Baseline Water Quality Values in Table 4. The conduct of such a programme would be triggered if the routine monitoring of water quality in Lakers Cutting or Lake Victoria indicated a measurable and sustained deviation of the baseline water quality from the Baseline Water Quality Values.

Should the need for an additional 13-month baseline water quality monitoring programme arise, and it gets conducted, the results will be documented in a report that would be attached as an Appendix to the next issued annual WQMP compliance report. The report in that Appendix would review all (existing and additional) baseline water quality data and recommend any necessary changes to the Baseline Water Quality Values in Table 4. The next issued WQMP Compliance Report is to contain a copy of Table 4, updated to incorporate the recommended changes.

This updating of Table 4 and its inclusion in the next issued WQMP Compliance Report is the process that has occurred with the previous Baseline Water Quality Monitoring Programmes.

Note that the Baseline Water Quality Values can only be changed in light of the results of an additional baseline water quality monitoring programme.

Outline Scope of Optional Baseline Water Quality Sampling and Testing

If the option for additional baseline water quality monitoring is activated at the discretion of CoGG, the scope and methods will be identical to those employed for the previous baseline water quality monitoring and documented in the reports from that monitoring.

Sampling will be done adjacent to the instrument locations in Lake Victoria, Lakers Cutting and upstream of the outlet culvert.

Sampling within each program will be at:

- Round 1: Weekly intervals in December (4 occasions);
- Round 2: Fortnightly intervals in January (2 occasions);
- Rounds 3 to 12: Monthly intervals from February to end December (11 occasions);

- Seasonal Rounds A to D (end of summer – February; end of autumn – May; end of winter – August; and end of spring - November);
- On at least one occasion - each before, during and after extended wet weather periods. This may require additional sampling occasions.

The analytical scope for the samples collected will include:

- All occasions:
  - Biological – Coliform, *E. coli and Enterococci*
  - Physical – Turbidity (NTU), Total Dissolved Solids, Total Suspended Solids, pH
  - Nutrients – NH3, NO2, NO3, TKN, TP, PO4, BoD, CoD
  - Chlorophyll-a
  - Metals – As, Cd, Cr (III and VI), Co, Cu, Pb, Hg, Ni, Ag, Vn, Zn
  - TPHs
- For the seasonal rounds, additionally:
  - PAHs
  - BTEX
  - OCPs
  - VOC's
  - Total Cyanide
  - Sulphide
  - Phenols and Cresols
  - Chlorinated Hydrocarbons
  - Tributyl Tin

Table 4 Updated and Previous Water Quality Values (Using the Approach Described in the WQMP).

Approach	Item	pH	TDS (mg/L)	TSS (mg/L)	Turbidity (NTU)	Ammonia as N (mg/L)	NO3 - N (mg/L)	Nitrogen (Total Oxidised) (mg/L)	Nitrogen (Total) (mg/L)	Phosphorus (mg/L)	Chlorophyll a (mg/L)	PO4 - P (mg/L)	Dissolved Oxygen (% saturation)		
Derivation of Physical/Chemical Water Quality Objectives (WQO) from Default Water Quality Objectives (DWQO) and Statistics of Baseline Water Quality Data															
													25th Percentile	Minimum	Maximum
Reference Guidelines / Objectives	AWQG 2000 99% (Marine Water)					0.500									
	AWQG 2000 95% (Marine Water)	8.4			10	0.910		0.005	0.120	0.025	0.001			90	110
	SEPP WoV 95% (Marine Reserves)							0.030	0.300	0.025	0.004			80	110
	ERS 2021 (Port Phillip Bay -Exchange subsegment) 75th percentile	8.5		2					0.150	0.050	0.001	0.030			
	ERS 2021 (Central Foothills and Coastal Plains - Lowlands of Barwon, Moorabool, Werribee and Maribyrnong basins and the Curdies and Gellibrand Rivers segment) 75th percentile	8.0			25				1.100	0.060			70		130
Physical/Chemical Default Water Quality Objectives (DWQO) from Reference Guidelines / Objectives															
ERS 2021 Port Phillip Bay 75th perc. else, Max. of ERS 2021 Central Foothills and Coastal Plains 75th perc., AWQG 2000 99%, AWQG 2000 95% and SEPP WoV	DWQO Lakers Cutting	8.5		2	10	0.500		0.030	0.150	0.050	0.001	0.030	70	80	130
ERS 2021 Central Foothills and Coastal Plains 75th perc. else, Max. of AWQG 2000 95% and SEPP WoV	DWQO Lake Victoria	8.0			25	0.910		0.030	1.100	0.060	0.004		70	80	130
2021 Physical/Chemical Water Quality Objectives (WQO) from Statistics of Baseline Data and DWQO															
Max of Lakers Cutting 90% GHD+Golder+HT(15-16)+HT(20-21) and DWQO Lakers Cutting	WQO Lakers Cutting	8.6	49280	46	10	0.500	0.0197	0.030	1.796	0.050	0.005	0.030	87	70	146
Max of Lake Victoria 75% GHD+Golder+HT(15-16)+HT(20-21) and DWQO Lake Victoria	WQO Lake Victoria	8.9	59350	32	25	0.910	0.0130	0.030	3.045	0.065	0.014	0.006	88	60	143
2017 Physical/Chemical Water Quality Objectives (WQO) from Statistics of Baseline Data for HT(15-16)+GHD+Golder and DWQO															
Max of Lakers Cutting 90% GHD+Golder+HT(15-16) and DWQO Lakers Cutting	WQO Lakers Cutting	8.6	51600	53	10	0.500	0.0200	0.030	0.914	0.082	0.005	0.020	79	70	146
Max of Lake Victoria 75% GHD+Golder+HT(15-16) and DWQO Lake Victoria	WQO Lake Victoria	8.6	87950	66	17	0.910	0.0125	0.030	3.634	0.135	0.025	0.044	79	60	127
Physical/Chemical Water Quality Objectives (WQO) Comparison															
WQO Lakers Cutting Difference (2021) - (2017)		0%	-4%	-14%	0%	0%	-1%	0%	96%	-39%	0%	50%	10%	0%	0%
WQO Lake Victoria Difference (2021) - (2017)		4%	-33%	-52%	47%	0%	4%	0%	-16%	-52%	-44%	-86%	11%	0%	12%

Notes: AWQG 2000 = https://www.waterquality.gov.au/anz-guidelines/resources/previous-guidelines/anzecc-armcanz-2000; SEPP WoV = http://www.gazette.vic.gov.au/gazette/Gazettes2018/GG2018S499.pdf (now discontinued and replaced by the ERS); ERS = Environment Reference Standard – see http://www.gazette.vic.gov.au/gazette/Gazettes2021/GG2021S245.pdf; DWQO = Default Water Quality Objective; WQO = Water Quality Objective

2.3 WATER QUALITY RISKS

Experience gained since the completed Waterway commenced operation in February 2022[5] has shown that the Automatic Flow Control Gate (AFCG) system, operating with the constructed culverts and fully constructed Waterway:

- reliably controls tidal water flows, water levels and water quality in the Waterway in line with expectations from the EES, the hydraulic and water quality monitoring and modelling done pursuant to the original EPBC Act approval conditions; and
- delivers water quality that complies with the water quality objective.

This provides confidence that provided the AFCG system, culverts and Waterway are maintained, their operation will continue to do so.

Experience has also shown that, in these circumstances, the following are the main impact events posing risks to water quality in the Waterway. These are the main impact events as they are highly likely (because they are expected to occur at least once per year)[6]:

1 High algal concentrations and hence Chlorophyll – a concentrations in discharges from Lake Victoria:
   a. Lake Victoria receives waters from an upstream catchment and from groundwater (from both the landward and seaward sides). For these waters it acts as a detention pond and evaporation basin.
   b. Lake Victoria's only discharge route is via the Waterway of The Point.
   c. The quality of water in Lake Victoria is poor and deteriorates in the warmer months of the year, with growth in algae and nutrient concentrations (and in recent years including blue-green algae).
   d. When Lake Victoria discharges, it exports its water with its turbidity, algae and nutrients to the Waterway of The Point, and via this Waterway into Lakers Cutting.
   e. The Waterway, with its one-way tidal flows, has different salinity, dissolved oxygen, pH conditions than Lake Victoria, and provides opportunities for attenuation of algal concentrations, and changes in the relative proportions of algal species. Therefore, the algal mix and concentrations, and nutrient concentrations change during passage of the water through the Waterway
   f. Evidence presented in past WQMP compliance reports, submitted to DCCEEW, indicates that
      i. The range of species of algae in the water discharged from Lake Victoria can still be present when that water, having passed through the Waterway, discharges into Lakers Cutting.
      ii. Even when affected by discharges from Lake Victoria, the concentrations of Chlorophyll-a and of nutrients in Waterway water, on its discharge into Lakers Cutting have complied with the WQMP objectives and criteria, except for relatively minor and short-lived, reversible exceedances.
   g. In other words, the consequences to date for both Waterway water quality and Lakers Cutting water quality have to date been minor and reversible. The implied risk is Low to Medium. However, should the quality of Lake Victoria's discharge further deteriorate, it increases the chance that the consequences (and the risk rating) could get worse in future years. Prevention of that would require measures to improve the quality of water in Lake Victoria. This is not a matter within the control of The Point or its Waterway management.
2 High algal concentrations and hence Chlorophyll – a concentrations in water in inflows from Lakers Cutting
   a. In the absence of discharges from Lake Victoria, the range of salinity, nutrient, temperature in the post-construction Waterway resemble those in Lakers Cutting.

[5] As documented in the WQMP compliance reports for 2022, 2023 and 2024
[6] This discussion of risks uses the qualitative risk assessment methodology and likelihood, consequence and risk rating scheme set out in https://www.dcceew.gov.au/sites/default/files/documents/environmental-management-plan-guidelines.pdf

b. At such times, the mix of algal species in the post-construction Waterway resembles those in Lakers Cutting, with algal growth rates affected by rate of tidal inflows from Lakers Cutting
c. Periods of very small tidal range in Lakers Cutting do occur from time to time. These periods can be short – a few days; or they can extend over a week or more. Tides in Lakers Cutting respond to those in Swan Bay, and the flow of water over the sill between Lakers Cutting and Swan Bay.
d. When the periods of low tidal range in Lakers Cutting last more than a few days, and occur with warmer weather, algae growth occurs and can generate algal blooms in the shallower parts of Lakers Cutting. This growth can be accompanied by reductions in dissolved oxygen levels in the water.
e. When there is a low tidal range in Lakers Cutting, the volume rate of tidal exchange between the Waterway and Lakers Cutting is also low. This means that algae growth occurs and can generate algal blooms in the shallower parts of the Waterway as well as in Lakers Cutting. This growth can be accompanied by reductions in dissolved oxygen levels in the water.
f. The monitoring of Chlorophyll-a, salinity, temperature, dissolved oxygen, pH, turbidity in the Waterway, Lakers Cutting and Lake Victoria, provides indicators of the conditions for algal growth. In addition, routine visual observation of water conditions (for example during monthly maintenance of monitoring systems, and at other times) provides information about the presence and distribution of algae in the Waterway.
g. With the monitoring and management of Waterway water quality set out below, and because, to date periods of poorer quality of water in Lakers Cutting have been short lived (a few days to a few weeks), the consequences for water quality in the Waterway have been minor and reversible. The implied risk rating is Low to Medium

Acknowledging that neither discharges from Lake Victoria nor the tidal range in Lakers Cutting can be controlled by The Point, the management of these two risk categories entails, as part of the operation and maintenance actions conducted for Point Lonsdale Land Partners or CoGG (whichever is in control and management of the Waterway):

1 Making sure the AFCG system is operated and maintained as intended
2 Conducting the water quality, level and flow monitoring as required by this WQMP
3 Making sure that the stormwater treatment systems of The Point are working effectively;
4 Planned proactive harvesting of sea grasses and other aquatic vegetation (e.g., benthic algae) that grow in the Waterway, so as to:
    - Limit the accumulation of organic detritus on the floor of the Waterway; and
    - Remove impediments to water flow
    - Prevent benthic algae accumulating to become unsightly
    - Remove excess biomass that has removed nutrients from the water so as to prevent it becoming a future source of nutrients.

Separate to the above two risk categories, there is a risk of a different kind of pollution incident – by which is meant an event that causes a rapid deterioration in water quality in the Waterway. Such an event is considered to be unlikely (meaning this could occur but is considered unlikely or doubtful) or rare (meaning this may occur in exceptional circumstances). This concerns, for example:

1 Pollutants entering the stormwater systems outside The Point and then discharge into the Waterway, notwithstanding the “rain garden” located in The Point and which is intended to ameliorate the quality of stormwater discharges into the Waterway
2 Pollutants entering or present in Lake Victoria and being discharged into the Waterway when Lake Victoria discharges
3 Pollutants entering the Waterway from sources in or discharging into Lakers Cutting from sources outside The Point
4 Pollutants entering the stormwater systems in The Point and discharging into the Waterway, notwithstanding the water sensitive urban design of these systems
5 Pollutants directly entering the Waterway (not via a stormwater system) – for example from a vehicle accident or other act

The monitoring for pollution incidents occurs via:

1 Routine visual observation of water conditions (for example during monthly maintenance of monitoring systems, and at other times)

2 Notifications from residents of and visitors to The Point
3 Observation of changes in the 15-minute interval instrumented monitoring data – if the nature of the pollution affects one or more of Turbidity, pH, Dissolved Oxygen, Oxidation Reduction Potential, Salinity, Temperature, Chlorophyll-a

Pollution incidents will be managed by having plans with resources and procedures ready to mitigate the risks within a short time frame. These include:

1 A capacity to arrange the closure of stormwater discharge culverts within The Point, if this is needed;
2 A capacity to close (if this is needed) the AFCG (or stop them from opening). This can be achieved with manual override of the automatic operation of the flow control gates, or with stop logs. This will limit polluted water within the Waterway discharging into Lakers Cutting – and provide time for investigations and actions to limit / prevent further pollution of the Waterway and ameliorate the pollution that exists;
3 A capacity to scope and conduct tailored investigations (and a root cause assessment) into the nature and source of the pollution – so as to inform decisions on risk management and remediation. Note however that The Point has no control over sources of pollution outside The Point.

With this mitigation, the consequences for the water of Lakers Cutting from discharges from The Point affected by a pollution incident can be managed to be minor (meaning a minor incident of environmental damage that can be reversed) to moderate (meaning isolated but substantial instances of environmental damage that could be reversed with intensive efforts). The implied risk rating is Low.

3 OPERATIONAL WATER MANAGEMENT

3.1 WATERWAY MANAGEMENT OBJECTIVES

The connection of the Waterway with Lake Victoria is to be managed:

- To permit only outflow of water from Lake Victoria, and maintain the current frequency distribution of water levels in Lake Victoria
- To prevent overland flow from Lake Victoria to the Site
- To prevent flood risk to Shell Road from the Waterway System.

The connection of the Waterway with Lakers Cutting, and the Waterway between the Bellarine Railway embankment and the Bellarine Highway is to be managed to maintain the prevention of overland flow between Lakers Cutting and all parts of the Waterway that are south of the Bellarine Railway embankment or south of the Bellarine Highway. Water must not bypass the inlet and outlet culverts under the Bellarine Railway embankment and must not bypass the culverts under the Bellarine Highway.

All parts of the Waterway are to be managed to prevent short-circuiting of water flow by overland flow between sections of the Waterway – even during a 1 in 100 ARI tidal surge and 1 in 100 ARI overflows from Lake Victoria. All water flows must occur within the Waterway.

Management of the Waterway is to:

a) Achieve the water quality objectives set out in Section 2.1; and
b) Therefore, optimize the successive Waterway volume turnover times delivered by tidal exchange with Lakers Cutting. The Waterway volume for this purpose is the volume of water below its 5-day mean water level; and
c) Ensure adequate discharge of stormwater drainage and prevent unwanted inundation of the development.
d) Ensure that the peak Waterway water level does not exceed 0.9 m AHD under current climate and sea level; and later 1.65 m AHD with 0.8m sea level rise and the associated climate change; and
e) For so long as this does not compromise the achievement of the water quality objectives set out in Section 2.1 and in a) above, limit the water level in the Waterway to avoid, to the extent reasonably practicable, inundation of the lower parts of those properties bordering the Waterway and which were established before the development of The Point.

f) Allow for the potential impacts on Waterway water quality from variable degrees of water circulation in the Waterway,
g) Provide options in case of emergency or of malfunction of environmental management measures within Site.
h) Keep the Waterway culverts free of silt, and the reduction in cross -sectional flow areas below annual mean tide level at any point along the Waterway due to silting (from stormwater inflows, inflows from Lake Victoria, and runoff from within the site) to less than 5%[7], over each 10-year period measured from the completion of construction.
i) Remove aquatic vegetation and algae to:
    - Prevent these constraining water flow in localized areas of the Waterway, or through culverts;
    - Prevent or limit the frequency and scope of algal blooms
    - Maintain the amenity of the Waterway
j) Keep culverts and the AFCG free of debris

3.2 SURFACE WATER MANAGEMENT OBJECTIVES

The surface water management objectives are:

- Prevent the generation and discharge of turbid and contaminated water from runoff, or from the site's stormwater discharge points into the Waterway;
- To this end:
    - Maintain stormwater and other drainage systems in the site[8] to comply with
        - Nutrient and Irrigation Management Plan Point Lonsdale Development (April 2010) - Section 4 Environmental Management - for controlling and managing nutrient use within the site post-construction (See Appendix C)
        - Stormwater Drainage Master Plan (30 April 2010) (See Appendix C)
        - Best Practice Environmental Management Guidelines: Urban Stormwater and
        - The Melbourne Water WSUD Engineering Procedures: Stormwater. Inflows from Lake Victoria are excluded from this goal; and
    - Maintain (and repair as needed) the constructed features and landscaping of the Waterway edges and intertidal zones to protect these against erosion from runoff, or from tidal ebbs and flows and from waves / wavelets, or from human recreational activities. Hydraulic Features of Constructed Waterway

[7] It is envisaged this would require a bathymetric survey of the Waterway each 10 years from completion of the Waterway. This requirement is expressed as a percentage of the cross-sectional flow areas estimated at the start of the 10-year period, so as to limit the possibility of restrictions on water flow developing from siltation. These cross-sectional flow areas vary along the Waterway due to the changes in width of the Waterway. They also vary with changes in the mean water level, which influenced by mean sea level. By way of illustration of what siltation might cause 5% loss in flow area, the mean water depth as constructed is about 2.2m – varying between 2 and 2.5 m approximately. A siltation thickness of about 0.1 m would be needed for about a 5% loss in cross-sectional flow area. Such a thickness would be measurable. It is noted however that the water velocities in the Waterway are very low and below thresholds for sediment transport. Therefore, should sediment laden water enter the Waterway, it is likely to settle out close to the point(s) of entry, meaning that while localized silt accumulation is possible, widespread siltation is unlikely.

[8] Stormwater. Inflows from Lake Victoria are excluded from this goal; noting however that it is in the best interests of the water quality in the Waterway and in Lakers Cutting that those responsible for the management of water entering and passing through Lake Victoria to use all reasonably practical measures to exercise their General Environmental Duty under the Environment Protection Act , and improve the presently poor quality of this water so that the quality of water in Lake Victoria better complies, in every month of the year, with the relevant criteria in the EPA's Environment Reference Standard

3.3 MANAGEMENT OF TIDAL FLOWS AND WATER LEVELS

The AFCG operate to:

- Maximise the tidal flows in and out of the Waterway in the interests of water quality management; and
- Limit the peak water level in the Waterway, to:
    - to prevent significant flooding of the gardens of the older properties (built decades before the present development of The Point); and
    - to limit risks of erosion of the banks of the Waterway from tidal ebbs and flows and wind driven waves.

The controls on the AFCG do this using the following cycle of events:

- Closing the outlet gates at about low tide in Lakers Cutting, then
- Opening the inlet gates when the Lakers Cutting water level is higher than the internal Waterway level at the inlet culverts; then
- Closing the inlet gates after high tide and before the Lakers Cutting water level falls below the internal water level at the inlet culverts (or when either the external water level reaches a pre-set value, or the internal Waterway level reaches a different preset value), then
- Opening the outlet gates when the internal water level at the outlet is higher than the Lakers Cutting water level.

In addition, if the internal Waterway level is more than 0.2m above the Lakers Cutting tide level on a falling tide, the AFCG controls will open both the inlet and outlet gates. This is to prevent major and rapid flood discharges from Lake Victoria becoming impounded in the Waterway.

The initial pre-set values for closing the inlet gates are:

- For the external water level = 0.6 m AHD;
- For the internal water level = 0.5 m AHD;

These preset values are adjustable and will need to be adjusted from time to time, in response to sea level rise. The initial values have been set primarily to prevent significant flooding of the gardens of the older properties within The Point (built decades before the present development of The Point). With the current sea levels, these pre-set values do not significantly reduce the tidal flows. As sea level rises, preserving these pre-set values will reduce the proportion of each Lakers Cutting tide that is used to drive the tidal flows in and out of the Waterway. At some point this risks adversely affecting volumetric turnover time and hence water quality in the Waterway, and it will become necessary to increase the pre-set values.

The preset values for the internal water level will not exceed 0.9m AHD under current tidal conditions and not exceed 1.65m AHD when there has been 0.8m of rise in mean sea level from the current mean sea level. The current mean sea level is defined as that pertaining in the 100 years to 2014.

It is also noted that sea level rise will be accompanied by potentially similar rises in a) groundwater levels under the parts of the site closer to Lakers Cutting and b) in the summer water levels in Lake Victoria which are partly fed by seepage from the sea, as well as by groundwater seepage from the direction of The Point, and by intermittent stream flows. This process also threatens increased waterlogging / inundation of lower elevation parts of those older properties.

3.4 LAKE VICTORIA DISCHARGES

For Lake Victoria:

- This can discharge whenever its water levels are both higher than the southern entry sill to the Lake Victoria Channel, and also higher than the tidally influenced water levels in the Waterway;
- Flap valves on the twin culverts at the northern end of the Lake Victorian Channel prevent backflow from the Waterway to Lake Victoria when water way levels are higher than those in the Channel.

Note however that the sandy soils between the Waterway and Lake Victoria mean that seepage flows occur between these water bodies. When water levels in the Waterway are higher than those in Lake Victoria, the seepage direction is towards Lake Victoria.

4 MONITORING ADDRESSED BY THIS PLAN

4.1TIERED MONITORING PROTOCOL

This plan provides for a tiered protocol for water quality monitoring:

1. Tier 1 is for the post-construction Waterway in routine "operation and maintenance" mode. Its scope is designed (see below) to provide the data needed for adjudicating compliance with the water quality objective and for making decisions for operation and maintenance purposes.
2. Higher tiers would be invoked – on a case-by-case basis - to increase the scope / frequency of monitoring from Tier 1 in response to deterioration in performance of the Waterway or in response to pollution incidents and to help with the operational mitigation or rectification of problems. The changes in scope and frequency would be targeted to the nature and severity of the issue that requires additional monitoring.

The Tier 1 monitoring will monitor:

1. The water quality, level, and flow rates at the inlet and outlet culverts:
   - Using continuous instrumented measurement (e.g., each 15 mins) to provide both leading indicators and also compliance records for selected key parameters;
   - Using quarterly sampling and laboratory testing of water to help maintain instrument calibration and to enable testing of other compliance parameters.

   This water quality data provides the compliance monitoring data – that is the data needed to adjudicate compliance with the Water Quality Objectives. These water level data are for adjudicating compliance with the limits on water levels arising from the Planning Permit.

   These data from all the monitoring sites are also used for operational monitoring and management

2. The water quality, level, and flow from Lake Victoria
   - Using continuous instrumented measurement (e.g., each 15 mins) to provide both leading indicators and also records for selected key parameters so as to be able to demonstrate whether or not this is the cause of any exceedance of compliance criteria at the outlet culvert from the site Waterway.

   This data is not part of the compliance monitoring data set but is used, operationally, to assess whether or not Lake Victoria is a source of non-compliance at the outlet culvert, or a source of impairment of water quality in the site Waterway. This also provides leading indicators of deterioration in the quality of Lake Victoria's water that might become of concern for water quality in the site Waterway.

3. The water quality and level in Lakers Cutting east of Fellows Road:

- Using continuous instrumented measurement (e.g., each 15 mins) to provide records for selected key parameters so as to be able to detect any change that may or may not be caused by the post-construction condition.

This data is not part of the compliance monitoring data set but is used, operationally, to discern and assess differences in trends in water quality between Lakers Cutting and the site Waterway. This also provides leading indicators of deterioration in the quality of Lakers Cutting's water that might become of concern for water quality in the site Waterway.

4. The water quality and level at the location in the Waterway furthest from the inlet and outlet culverts:
   - Using continuous instrumented measurement (e.g., each 15 mins) to provide records for selected key parameters so as to be able to detect any change that may or may not be caused by the post-construction condition.

   This data is not part of the compliance monitoring data set. It provides operational monitoring data where, nominally, the volumetric rate of water flow in the site Waterway is the slowest, and therefore where the local volumetric water turnover time is the longest within the site Waterway. The monitoring data from this location will inform management of the hydraulic performance of the Waterway to achieve the desired water quality at the outlet culvert.

5. Weather at the site – using an instrumented weather station.

   This data is not part of the compliance monitoring data set. This is required so as to provide leading indicators and records of extreme weather periods that may impact Waterway water levels and water quality, such as via storm surges, periods of low tidal range in Lakers Cutting, high temperature / evaporation, high rainfall etc.

4.2 REVIEWS OF SCOPE AND FREQUENCY OF MONITORING

There will be annual reviews of Waterway performance and monitoring data to decide if there is need (or not) for an adjustment in a planned, structured way, of the scope and frequency of the Tier 1 monitoring to be done in the following year.

In conducting the reviews, the following factors will be considered, using suitably experienced professional judgement:

- Have adverse trends in data occurred or has exceedance of compliance criteria occurred such that increases in scope and frequency of the Tier 1 monitoring are necessary to:
  a. Better adjudicate compliance with the WQMP Water Quality Management Objective; or
  b. Refine operational management of the Waterway?

- Has the post-construction Waterway water quality demonstrated consistent and sustained compliance - over a period of 3 years - with the compliance requirements, such that the scope and frequency of can be reduced without compromising:
  a. Adjudication of compliance with the WQMP Water Quality Management Objective; or
  b. Operational management of the Waterway?

At all times, the scope and frequency of monitoring is to be sufficient to support:

- timely decision-making and actions to manage the quality of water in the post-construction Waterway to comply with the water quality management objective in this Water Quality Management Plan; and
- demonstration of compliance with the water quality management objective in this Water Quality Management Plan.

The outcome of that review, and the nature and scope of any needed adjustment, is to be documented in the WQMP compliance report for the year preceding the year of any adjustment needed.

Should that annual review result in a planned adjustment to the scope and frequency of the Tier 1 monitoring that is needed to adjudicate compliance with the WQMP Water Quality Objective, this would trigger a revision of this WQMP, with that revision needing to be approved by each relevant agency before revision of the Operational and Maintenance Plan and implementation of the adjustment.

Should that annual review result in a planned adjustment to the scope and frequency of other Tier 1 monitoring data (i.e., needed for operational not compliance purposes), this will not trigger a revision of this WQMP but would trigger revision of the Operational and Maintenance Plan before implementation of the adjustment.

4.3 SUMMARY OF MONITORING METHODS

Appendix D contains a summary of the monitoring methods for:

- Instrumented Monitoring of water levels, flows and quality.
- Water Quality Sampling and Testing.

5 MONITORING ACTIONS

Figure 2 shows the locations for monitoring. Table 5 lists what will be monitored at these locations:

5.1. INSTRUMENTED WATER QUALITY, WATER FLOW AND WATER LEVEL MONITORING

The methods for instrumented and telemetered monitoring of water levels, flows or quality will be the same as those reported in the WQMP Compliance reports submitted to date.

The instrumented monitoring at Sites 2, 3, 6B, 7B, 9 measures, at 15-minute intervals:

- Water Level;
- Chlorophyll-a, Turbidity (NTU), ORP, DO, pH, Temp corrected conductivity and Salinity, Temp

The instrumented monitoring at Sites 4, 6A, and 7A measures water levels and flows at 15-minute intervals.

5.2. WATER SAMPLING AND TESTING

At quarterly intervals, water samples will be collected from Sites 2, 3, 6B, 7B and 9 and laboratory tested for the same parameters that are being measured by the Instruments. These samples will also be tested for some additional parameters, so as to assist with interpretation of the instrument data. The total suite of parameters will be:

- Chl-a, TSS, DO, ORP, pH, TDS, Conductivity, TN, NO3, NO2, NH3, TKN, TP, PO4, BoD, CoD.

The methods and analytical detection limits for the laboratory testing are the same as those used for the water quality monitoring to date, and as reported in the WQMP Compliance reports submitted to date.

5.3. WEATHER MONITORING

The weather station monitors:

- Air Temperature;

- Rainfall;
- Wind speed and gust speed;
- Wind direction;
- Solar Radiation;
- Relative Humidity;
- Atmospheric Pressure;
- Vapour Pressure.

The primary purpose of the weather station is to provide atmospheric pressure data for use in correcting pressure-sensed water depths to water levels in m AHD. The other data is of secondary importance but helps from time to time.

6. OTHER MONITORING ACTIONS

The operation and maintenance of the Waterway will be helped by the other monitoring actions listed below. These are not needed for providing data to adjudicate compliance with the WQMP water quality compliance objective.

6.1. OBSERVATIONAL MONITORING

Observational monitoring will include periodic:

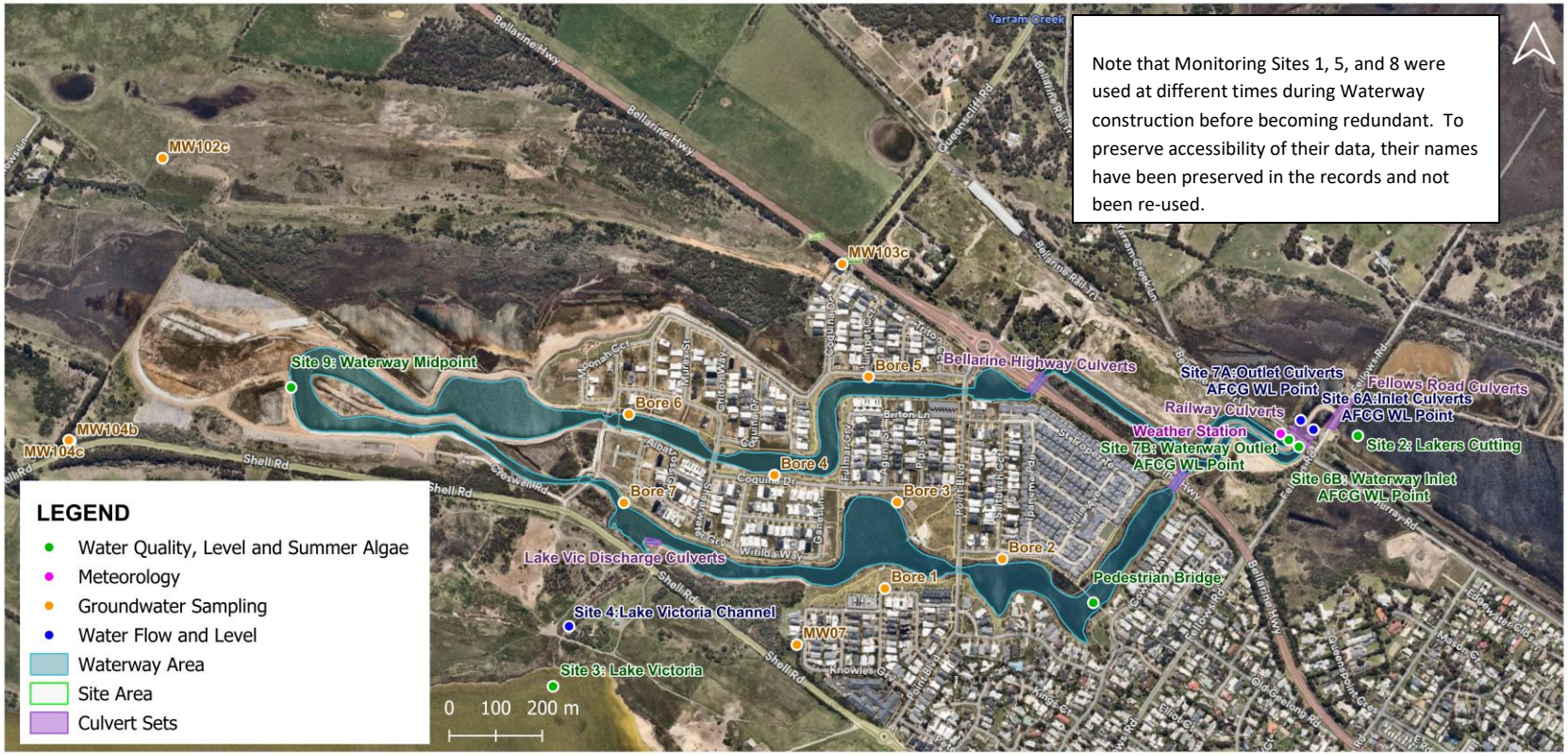
- Observational checks on stormwater treatment systems. These will trigger preventive maintenance of their treatment capacity;
- Observational checks of the condition of Waterway edges for signs of erosion;
- Observational checks of impediments to flow:
  - Condition of culverts and the AFCG;
  - Growth of sea grass.
- Observational checks of water quality:
  - Presence/ extent / type of algae;
  - Litter.

6.2. ALGAE SAMPLING AND TESTING

Experience has shown that given the increased potential for higher algal concentrations in the warmer months of the year, and given the summer holiday increases in the population of The Point Lonsdale area it is helpful, both for operational decision making about the timing of algae removal from the Waterway; and to have information available for stakeholder communications, to collect and speciate algae and test algal concentrations from Sites 2,3, 6B, 7B, 9 and – on a case by case basis – other locations, in between about September - October and about March – April.

The methods and analytical detection limits for this work will be the same as those reported in the WQMP Compliance reports submitted to date.

Figure 2 Map of Monitoring Locations



HydroTerra
Environmental Monitoring Specialists

SITE NAME: THE POINT
SITE ID: PTL001
SITE ADDRESS: 88-90 POINT BLVD, POINT LONSDALE VIC 3225
MAP: SITE OVERVIEW

IMAGE SOURCE: NEARMAP
IMAGE DATE: 12/10/2024

REFER TO THE POINT WATERWAY OVERVIEW OMM FOR MORE INFORMATION

Table 5 Monitoring Locations

What is Monitored	Tier 1 Monitoring (Base Level)		Additional Monitoring triggered by results from Tier 1
	WQMP Compliance Monitoring Locations	Other Locations (To inform water management)	
Instrumented Water Level and quality (15-minute interval monitoring with monthly clean and calibration checks	• Site 6 B (Inlet Culverts at Railway Embankment) • Site 7 B (Outlet Culverts at Railway Embankment)	• Site 2 (Lakers Cutting – near the western end on the east side of Fellows Road) • Site 3 (Lake Victoria - upstream of its outlet to the Lake Victoria Channel leading to the site Waterway) • Site 9 (at the west end of the site Waterway –furthest from the outlet to Lakers Cutting	As required to investigate a deterioration in water quality or to adjust Waterway operations and maintenance or to manage a remedial action.
Quarterly water sampling and laboratory testing	• Site 6 B (South end of the Inlet Culverts at Railway Embankment) • Site 7 B (South end of the Outlet Culverts at Railway Embankment)	• Site 2 (Lakers Cutting – near the western end on the east side of Fellows Road) • Site 3 (Lake Victoria - upstream of its outlet to the Lake Victoria Channel leading to the site Waterway) • Site 9 (at the west end of the site Waterway –furthest from the outlet to Lakers Cutting	
Instrumented Water Flow and Level (15-minute interval monitoring with monthly clean and calibration checks	Not Applicable	• Site 6A (in each of the Inlet Culverts at Railway Embankment) • Site 7 A (in each of the Outlet Culverts at Railway Embankment) • Site 4 (in the channel between Lake Victoria and the site Waterway)	
Weather Station	Not Applicable	• Adjacent to the south end of the outlet culverts	
AFCG Operations	Not Applicable	• Checks of AFCG opening and closing - made via a) the Integrated Dashboard graphs from signals sent from the PLC for the AFCG, and b) via the security cameras	
Algae	Not Applicable	• For summer sampling and testing: Sites 2, 3, 6B, 7B, 9 and at the Pedestrian Bridge	

What is Monitored	Tier 1 Monitoring (Base Level)		Additional Monitoring triggered by results from Tier 1
	WQMP Compliance Monitoring Locations	Other Locations (To inform water management)	
		• Visual checks as and where needed for routine algae and seagrass removal episodes	
Culverts	Not Applicable	• Fellows Road, Railway and Bellarine Highway Culverts for annual drone surveys to check for sediment and marine growth;	
Groundwater	Not Applicable	• Not Applicable	• On as needed basis to check groundwater quality at one or more of Bores 1, 2, 3, 4, 5, 7, MW 102c, 103c, 104b, 104c.

7. WATER QUALITY MANAGEMENT

7.1 RESPONDING TO WATER QUALITY TRIGGERS

Table 6 lists the triggers for water quality management response actions and provides examples of these actions. The triggers would arise from the water quality conditions identified by observational checks and the Tier 1 monitoring. Table 6 also indicates when reporting to DCCEEW or DEECA or EPA is needed.

The nature, scope and timing of the management action, or actions to rectify incidents will depend on the nature of the incident and the root - causes that emerge from investigations. Therefore, Table 6 provides illustrative examples of the kinds of management or rectification actions that might be adopted. Where an incident triggers a WQMP non-compliance report, there will be a root-cause assessment, and rectification. Note that where there is exceedance of a water quality objective from causes that lie outside the site, this will not represent a WQMP non-compliance.

The tools with which to manage and adjust water quality may be limited by considerations of practicality. In principle, the candidates include:

- Adjusting the algorithms and pre-set parameters used by the programmable logic controller (PLC) for the AFCG's to adjust the triggers for gate opening or closing; or to vary the number of AFCG in operation; or to change the % open or closed the AFCG operate to. Currently the system drives the three inlet AFCG in unison and likewise for the three outlet AFCG. Also, currently the AFCG are operated to be either fully open or fully closed. Experience this far indicates the present setting or the algorithms in the PLC are satisfactory for the control of the flow and water level regime within the site Waterway. Should the need for changes arise, the nature of the adjustments will depend on the circumstances, for example:
    - A need to reduce Waterway levels to stay below the operational compliance criterion, while looking to optimise tidal lows through the Waterway; or
    - A need to increase water flows through the Waterway to improve water quality at the outlet, while preserving compliance with the permitted limit for peak water levels (See Table 8); or
    - A short-term need to increase the volume of water within the Waterway, for example to dilute water quality parameters, while preserving compliance with the criterion for peak water levels; or
    - Other needs that may arise.

- Earthworks to adjust the volume of the Waterway below mean water level;
- Earthworks to adjust the bathymetry by localized changes to improve flow regimes locally;
- Closing culverts to isolate the site Waterway.

    It is noted however that the Waterway provides the pathway by which the land catchment upstream of the site drains to Lakers Cutting. Closing the culverts is regarded as a last resort measure and will only be actioned should it not cause adverse consequences, such as;
    - *Flooding or deterioration of upstream water quality;*
    - *Impede remediation or rectification of the sever pollution incident and its causes; or*
    - *Contravention of other legislation administered by other agencies such as the Corangamite Catchment Management Authority.*

- Isolating deficient or impaired WSUD stormwater management systems from the Waterway;
- Rectifying defects in or improving WSUD stormwater management systems; and
- Removal (to the extent reasonably practicable and feasible) of material in the Waterway that is adversely impacting water quality. Such material could comprise, for example:

- Litter
- Algae
- Sea grasses
- Sediment
- Other pollutants

7.2 PROACTIVE OPERATION AND MAINTENANCE OF WATERWAY SYSTEMS

The approach to Water Quality Management - and one that has worked successfully since 2016 (as evidenced by the WQMP Compliance Reports) – is to be proactive with the operation and maintenance of the several systems that are involved. These systems are:

- The AFCG systems;
- The water level and water quality monitoring systems, and weather station;
- The culverts;
- Data Management systems;
- Water Level Control Features.

This proactive operation and maintenance covers the following categories of tasks:

- Oversight and review of water quality, level and flow, monitoring and management; environmental risk assessment; WQMP and PEMP documents;
- WQMP compliance reports;
- AFCG hardware maintenance:
  - AFCG drive systems;
  - The gates;
- Maintaining the software and systems for control of the AFCG;
- Provision, installation, operation and maintenance of instrumentation and data telemetry and data management for the Water Quality, Level and Flow monitoring;
- Operation and maintenance of the Integrated Dashboard, SharePoint of records, and the Operation and Maintenance Manual for the Waterway monitoring and management;
- Vacuum Tanker /Drain Cleaning Service;
- Seagrass / Algae Management Removal;
- Power supply;
- Telecommunications supply.

The systems installed at The Point operate in sea water and salty air environments. These environments are hostile and cause degradation. The systems can experience upset conditions. Being proactive means:

a) Being assiduous with maintenance to prevent upset conditions as much as practicable; and
b) Responding to upset conditions so that these are corrected as soon as practicable.

Informed by operational experience to date, Table 7 lists illustrative examples of possible upset conditions and:

- how they will be identified to trigger response action;
- the nominal urgency of the response,
- comments on the potential significance of the upset condition.

It is expected that accumulating experience with the operation and maintenance of the Waterway will improve knowledge of upset conditions and the procedures for how to deal with them.

Meeting the requirements in Tables 6 and proactively responding to the kinds of upset conditions listed in Table 7 will keep the Waterway systems operating as intended and delivering water quality and water level outcomes that comply with the objectives and criteria in this WQMP.

Table 6 Examples of Water Quality Management Triggers and Response Actions

Triggers = Water Quality Condition Prompting Response Action	Examples of Possible Causes (Actual cause to be established by review of all available data)	Potential Risk [9] of Non-Compliance with this WQMP's Water Quality Objective	Overview of Water Quality Management Response Action	Reporting (see Section 8 for Reporting Timeframes)
Severe water quality problem in the Waterway as indicated by an actual or potential major exceedance of the water quality objective or Lakers Cutting baseline water quality value at the outlet of the Waterway – See Table 9, This identified by routine observational checks and /or data from monitoring of the Waterway compared with the	Severe pollution Incident within the site (e.g., caused by failure of a WSUD stormwater management system; a fire; a road accident; a chemical spill)	Low (See discussion in Section 2.3)	Take immediate measures to prevent further pollution and to contain the existing pollution – provided this can be done safely and without adverse consequences (e.g., flooding or deterioration of upstream water quality) within the site or in Lake Victoria[10]. Consider use of targeted additional monitoring to assist root cause assessment or demonstrate rectification is effective Root cause assessment of the incident Rectification of the incident and its causes Review operation and maintenance actions and procedures to see if these need adjusting to prevent a recurrence	Advise EPA, DEECA, DCCEEW as this is a potential WQMP water quality objective non-compliance incident that may impact water quality in Lakers Cutting Report to EPA, DEECA, DCCEEW on rectification and resolution of the incident Confirm with EPA, DEECA, DCCEEW the incident is closed out In the Annual WQMP Compliance Report, the incident and its resolution

[9] See the qualitative risk assessment methodology and likelihood, consequence and risk rating scheme set out in https://www.dcceew.gov.au/sites/default/files/documents/environmental-management-plan-guidelines.pdf. The Risk Rating Matrix from this document is copied in Figure 3

[10] This is especially important when considering closing the outlet culverts to temporarily prevent further discharge to Lakers Cutting. If such closure is considered advisable, then consider the need for permissions from Corangamite Catchment Management Authority

Triggers = Water Quality Condition Prompting Response Action	Examples of Possible Causes (Actual cause to be established by review of all available data)	Potential Risk [9] of Non-Compliance with this WQMP's Water Quality Objective	Overview of Water Quality Management Response Action	Reporting (see Section 8 for Reporting Timeframes)
Baseline water quality values and /or the WQMP Water Quality Objectives				
	Pollution Incident outside the site affecting water in Lakers Cutting or the Waterway	Low (See discussion in Section 2.3)	Take measures to limit the impacts of the pollution within the site or from within the Waterway on Lakers Cutting – provided this can be done safely and without adverse consequences (e.g.: flooding or deterioration of upstream water quality) within the site or in Lake Victoria[11].	Advise EPA, DEECA, DCCEEW noting this is not a WQMP water quality objective non-compliance matter In the Annual WQMP Compliance Report, record the incident
Quarterly checks of: a) annual average of outlet concentrations for an instrumented parameter; and b) the results of the quarterly water quality sampling and testing reveals that there has been either a) an exceedance of the water quality objective or b) and either a major exceedance of the	Instrument output drift, meaning that exceedance is an artefact of the instrument operation not a real exceedance	Nil – this does not affect water quality	Change frequency of instrument maintenance; or recalibrate instrument; or replace instrument	Internal reporting to record resolution of the issue This is not a WQMP water quality objective non-compliance matter
	Lake Victoria outflows	Low to Medium (See discussion in Section 2.3)	None Consider use of targeted additional monitoring to assist assessment of nature and significance of risk to Waterway water quality and to help risk communication	Advise EPA, DEECA, DCCEEW noting this is not a WQMP water quality objective non-compliance matter In the Annual WQMP Compliance Report, record the incident(s)
	Excessively Low tidal inflows (below those assumed in the design of the Waterway)	Low to Medium (See discussion in Section 2.3)	None, other than operate the AFCG to optimize the tidal exchange	

[11] As per Footnote 8

Triggers = Water Quality Condition Prompting Response Action	Examples of Possible Causes (Actual cause to be established by review of all available data)	Potential Risk [9] of Non-Compliance with this WQMP's Water Quality Objective	Overview of Water Quality Management Response Action	Reporting (see Section 8 for Reporting Timeframes)
Lakers Cutting baseline water quality value sustained for more than 3 months, or a minor exceedance sustained for more than 6 months[12] (The terms minor and major are defined in Table 9)				
	Pollution Incident (other than Lake Victoria Outflows) outside the site affecting water in Lakers Cutting or Lake Victoria	Low (See discussion in Section 2.3)	Take measures to limit the impacts of the pollution within the site or on Lakers Cutting – provided this can be done safely and without adverse consequences (e.g.: flooding or deterioration of upstream water quality) within the site or in Lake Victoria[13]. Consider use of targeted additional monitoring to assist assessment of nature and significance of risk to Waterway water quality and to help risk communication	
	Pollution Incident within the site (e.g., caused by failure of a WSUD stormwater management system; a fire; a road accident; a chemical spill)	Low (See discussion in Section 2.3)	Take measures to limit the impacts of the pollution within the site or on Lakers Cutting – provided this can be done safely and without adverse consequences (e.g.: flooding or deterioration of upstream water quality) within the site or in Lake Victoria[14]. Consider use of targeted additional monitoring to assist assessment of nature and significance of risk to Waterway	Advise EPA, DEECA, DCCEEW as this is either a potential WQMP water quality objective non-compliance incident or if the water quality objective has been exceeded, an actual WQMP non-compliance incident Report to EPA, DEECA, DCCEEW on rectification and resolution of the incident

[12] Checks against the Baseline Water Quality Values are made using data from the quarterly water quality sampling and testing
[13] As per Footnote 8
[14] As per Footnote 8

Triggers = Water Quality Condition Prompting Response Action	Examples of Possible Causes (Actual cause to be established by review of all available data)	Potential Risk [9] of Non-Compliance with this WQMP's Water Quality Objective	Overview of Water Quality Management Response Action	Reporting (see Section 8 for Reporting Timeframes)
			water quality and to help risk communication and management	Confirm with EPA, DEECA, DCCEEW the incident is closed out In the Annual WQMP Compliance Report, the incident and its resolution
Quarterly checks of annual statistics of volumetric turnover times reveal an adverse trend that can be ameliorated by Waterway management action	Sediment, other blockage or malfunction in one or more of the culverts	Low	Root cause assessment of the incident Consider use of targeted additional monitoring to assist assessment of nature and significance of risk to Waterway water quality and to help risk communication and management Rectification of the incident and its causes (the nature and scope of the rectification will be determined on a case-by-case basis, informed by the root cause assessment). For example: • Clearance of sediment or blockage in a culvert; • Adjusting the preset water level control parameters to allow inflows from a bigger % of the Lakers Cutting tidal range • In extended periods of low tidal ranges in Lakers Cutting, consider allowing two-way flow via both inlet and outlet AFCG	Internal reporting to record cause, rectification and resolution of the issue. This is not a WQMP water quality objective non-compliance matter.
	Higher mean Lakers Cutting tide level coupled with increased frequency of high tides in Lakers Cutting above the preset water level control parameters	Nil – this does not affect water quality.		
	Tidal ranges in Lakers Cutting lower than anticipated from the tidal records at West Channel Pile	Low to Medium (See discussion in Section 2.3)		

Triggers = Water Quality Condition Prompting Response Action	Examples of Possible Causes (Actual cause to be established by review of all available data)	Potential Risk [9] of Non-Compliance with this WQMP's Water Quality Objective	Overview of Water Quality Management Response Action	Reporting (see Section 8 for Reporting Timeframes)
			Review operation and maintenance actions and procedures to see if these need adjusting to prevent a recurrence	
Monthly observations indicate an enduring pattern of floating litter or of turbidity or of algal or seagrass growth in a part of the Waterway	Excessively Low tidal inflows (below those assumed in the design of the Waterway)	Low	Root cause assessment of the incident Rectification of the incident and its causes (the nature and scope of the rectification will be determined on a case-by-case basis, informed by the root cause assessment). For example: • Consider improving litter capture and maintenance of stormwater WSUD systems • Consider additional or more frequent measures to trim / harvest the sea grass or remove the aquatic weeds Review operation and maintenance actions and procedures to see if these need adjusting to prevent a recurrence	
	Impaired performance of litter capture by WSUD systems	Low		
	Poor local water circulation / movement due to restrictions from sea grass or aquatic weeds	Low		
Water levels exceed applicable peak water level criteria	Sediment, other blockage or malfunction in outlet culverts	Low	Root cause assessment of the incident Rectification of the incident and its causes (the nature and scope of the rectification will be determined on a case-by-case basis, informed by the root cause assessment). For example:	Internal reporting to record cause, rectification and resolution of the issue. This is a hydraulic issue not an environmental issue This is not a WQMP water quality objective non-compliance matter

Triggers = Water Quality Condition Prompting Response Action	Examples of Possible Causes (Actual cause to be established by review of all available data)	Potential Risk [9] of Non-Compliance with this WQMP's Water Quality Objective	Overview of Water Quality Management Response Action	Reporting (see Section 8 for Reporting Timeframes)
	Malfunction of operation of AFCG	Low	• Clearance of sediment or blockage in a culvert; • Adjusting the preset water level control parameters to allow inflows from a bigger % of the Lakers Cutting tidal range • AFCG system maintenance Review operation and maintenance actions and procedures to see if these need adjusting to prevent a recurrence	
Monitoring indicates either an algal bloom in Lake Victoria, or Chlorophyll –a levels in Lake Victoria exceed 50 ug/L and are rising	Growth of noxious or toxic algae following recent hypertrophic, hypersaline conditions in Lake Victoria	Low to Medium (See discussion in Section 2.3)	Review potential risk to the environmental values of the post-construction Waterway or Lakers Cutting from a discharge and consider if additional risk prevention, or mitigation measures for the Waterway are warranted and practicable	Internal reporting to record actions Consider need to advise CCMA, DEECA, EPA (especially if there is a BGA risk), noting this is not a WQMP water quality objective non-compliance matter

Figure 3 Copy of Tables 1, 2 & 3 from DCCEEW's EMP Guidelines[15]

Table 1 Likelihood

Qualitative measure of likelihood	How likely is it that this event/issue will occur after control strategies have been put in place
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

Table 2 Consequences

Qualitative measure of consequences	What will be the consequence/result if this issue does occur rating
Minor	Minor incident of environmental damage that can be reversed
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts
High	Substantial instances of environmental damage that could be reversed with intensive efforts
Major	Major loss of environmental amenity and real danger of continuing
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage

Table 3 Risk Rating

	Consequence				
	Minor	**Moderate**	**High**	**Major**	**Critical**
Highly Likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

[15] See https://www.dcceew.gov.au/sites/default/files/documents/environmental-management-plan-guidelines.pdf

Table 7 Waterway Management Systems - Examples of Upset Conditions

Waterway System Upset Condition Event	Upset Condition Identification Method	Urgency of Response	Comment (Note that the nature and timing of each response will be determined on a case-by-case basis, keeping focused on the primacy of the need to sustain demonstrable compliance with the WQMP water quality objective and with the WQMP objectives for peak water levels. Dealing with upset conditions is key means to this end, but not a regulatory compliance requirement of itself.)
AFCG Systems			
Gates cycling.	Routine check of graphs of AFCG water level and gate open / close history.	High	This means risk of undue wear and tear for AFCG moving parts leading to increased maintenance costs. It also means less than optimal tidal exchange and water quality in the Waterway - and so risk of exceedance of WQO in the WQMP.
Inlet gate not closing for falling tide.		High	This means reverse flow out of the Waterway when external tides lower than the Waterway level. It also means less than optimal tidal exchange and water quality in the Waterway - and so risk of exceedance of WQO in the WQMP.
Outlet gate not closing for rising tide.		High	This means reverse flow into the Waterway when external tides higher than the Waterway level. It also means less than optimal tidal exchange and water quality in the Waterway - and so risk of exceedance of WQO in the WQMP.
Lakers Cutting storm surge trigger did not close AFCG.		Very High	This means risk of exceeding the target peak water level in the Waterway. If initial investigation shows water levels in Waterway could > 0.5m AHD in the next 2 days, then immediately set AFCG to manual and close all AFCG less than optimal tidal exchange and so water quality in the Waterway.
Excess Lake Victoria discharge did not open AFCG and Waterway level >0.5m AHD.		Very High	If water levels in Waterway > 0.5m AHD, then immediately set AFCG to manual and operate manually to keep water levels < 0.5 m AHD.
Excess Lake Victoria discharge did not open AFCG and Waterway level <0.5m AHD.		Medium	If water levels in Waterway risk > 0.5m AHD in the next 6 days, then immediately set AFCG to manual and operate manually to keep water levels < 0.5 m AHD.
PLC data transmission to Integrated Dashboard interrupted, no malfunction of AFCG operation.		High	This means loss of visibility of the AFCG water level and AFCG open / closed status information. The information from the cameras and from the water level and flow data for Sites 6 and 7 will allow ongoing checks that the AFCG are operating OK. However, the duration of the loss of visibility needs to be minimised.
Power failure and one or more AFCG not closed.	Power failure alarm, check of AFCG status.	Very High	If initial investigation shows, that before power gets restored, water levels in Waterway could exceed the target peak water level (initially 0.5m AHD), then immediately set AFCG to manual and close all AFCG.
Power failure and all AFCG closed.		Medium	If initial investigation shows, that before power gets restored, water levels in Waterway could exceed the target peak water level (initially 0.5m AHD), then immediately set AFCG to manual and keep AFCG closed.
Intermittent or self-correcting Electro- or Mechanical malfunction of an AFCG (e.g., Over-torquing, over-temperature, or other upset condition.	Routine check of fault logs, plus 6 monthly maintenance check.	Low	This issue might be caused by a) progressive wear and tear of moving parts b) cycling or more than desirable frequency of gate operation.
Sustained Electro- or Mechanical malfunction of an AFCG (e.g., Over-torquing, over-temperature, or other upset condition).		High	Gates are to be operated manually or kept closed pending the resolution of the problem. The stop logs can be used as a back-up.
AFCG Water level sensor signal aberration causing AFCG malfunction.	Alarm from PLC.	High	The PLC is programmed to reject water level aberrant data and so in principle the AFCG should continue to operate OK. However, if this is not the case, the AFCG are to be operated manually or kept closed pending the resolution of the problem. The stop logs can be used as a back-up. If the problem lies with a water level sensor or with communications between the sensors and the PLC the problem solution may take several weeks.

Waterway System Upset Condition Event	Upset Condition Identification Method	Urgency of Response	Comment (Note that the nature and timing of each response will be determined on a case-by-case basis, keeping focused on the primacy of the need to sustain demonstrable compliance with the WQMP water quality objective and with the WQMP objectives for peak water levels. Dealing with upset conditions is key means to this end, but not a regulatory compliance requirement of itself.)
			There are 4 sets of three AFCG water level sensors. 1 set at each of the upstream and downstream ends of the inlet and outlet culverts. The three sensors in each set are to provide a) a necessary degree of redundancy and b) a necessary degree of reliability and precision in water level measurements used to trigger AFCG operation. It is possible for one or more sensors in any set to malfunction without necessarily causing the AFCG to malfunction. However, it is highly desirable for all three sensors in each set to function properly.
AFCG Water level sensor aberration not causing AFCG malfunction.	Alarm from PLC.	Medium	The PLC is programmed to reject water level aberrant data and so in principle the AFCG should continue to operate OK. However, the problem is to be addressed. There are 4 sets of three AFCG water level sensors. 1 set at each of the upstream and downstream ends of the inlet and outlet culverts. The three sensors in each set are to provide a) a necessary degree of redundancy and b) a necessary degree of reliability and precision in water level measurements used to trigger AFCG operation. It is possible for one or more sensors in any set to malfunction without necessarily causing the AFCG to malfunction. However, it is highly desirable for all three sensors in each set to function properly.
Cameras / Lights malfunction.	No vision from cameras	Medium	The cameras and lights provide a) a useful back up check on the AFCG operation and b) are useful for site security checks for unauthorised entry to the AFCG area.
Security issue not affecting AFCG operation.	Logged from the Cameras or from a site visit.	Medium	Visible evidence of damage to fences or gates or to equipment.
Security issue affecting AFCG operation.	Logged by one or more of the upset conditions above.	Very High	For example, if there has been damage to AFCG equipment or cables.
Culverts			
Culverts (Fellows Road, Railway, Bellarine Highway, Shell Road to Waterway) - contain sea grass or sediment build up that constrains flow.	Annual drone check of culverts reveals sea grass and / or sediment that reduces flow; or quarterly review of trends in statistics of Waterway volumetric turnover times shows increasing trend in turnover time not linked to trends in tides.	Low	Annual checks (e.g., using a submersible drone) are beneficial. Such observations to date indicate that: • Sea grass and vegetation tend not to collect in the culverts – or to collect in small amounts as debris and not to grow. • Sediment accumulation in the culverts has been minimal and not of concern. • Seagrass growth can prosper at the Lakers Cutting ends of the Fellow Road culverts. This is not within the property of The Point and clearance - if required, from time to time, to remove an unwanted restriction on flow into and out of The Point - will be a matter to be resolved with permission from Parks Victoria and with the support of CCMA.

Waterway System Upset Condition Event	Upset Condition Identification Method	Urgency of Response	Comment (Note that the nature and timing of each response will be determined on a case-by-case basis, keeping focused on the primacy of the need to sustain demonstrable compliance with the WQMP water quality objective and with the WQMP objectives for peak water levels. Dealing with upset conditions is key means to this end, but not a regulatory compliance requirement of itself.)
Shell Road culverts flap valves not closing properly.	Routine check of Site 4 water flows shows abnormal rates of backflow to Lake Victoria from Waterway.	Medium	The cause might be deterioration of the flap valve seals, or an object (e.g. piece of wood, metal, or brick / concrete; or even sediment build up) preventing flap valve closure. Backflow can only occur when Waterway levels are higher than those in Lake Victoria, and with the flap valves closed the flow sensor in the Victoria channel typically records low rates of backflow - thought to be from seepage from the water way under Shell Road into the channel. Abnormal rates of backflow would be about an order of magnitude higher.
Water Flow, Level, Quality Sensors; Weather Station			
Flow sensor (Site 6A, 7A) malfunction.	Routine checks of sensor data, plus monthly clean and calibration checks.	Low	Sensor replacement requires divers and procuring the replacement sensor. The interim measure is to estimate flow through the set of 3 culverts using the data from the remaining active sensors.
Water level sensor (Site 2, 6B, 7B) malfunction		High	These are key sensors for Routine checks on Waterway operation. If one of these malfunctions - the spare sensor needs to be deployed, while the problem with the malfunctioning sensor is resolved.
Water Level sensor (Site 3, 4, 9) malfunction; Water Flow Sensor (Site 4) malfunction		Low	If this malfunctions, the spare can be deployed, while the problem with the malfunctioning sensor is resolved.
Water Quality - DO, Turbidity, Chl-a (Site 2, 6B, 7B) malfunction		High	These are key sensors for Routine checks on Waterway operation. If one of these malfunctions - the spare sensor needs to be deployed, while the problem with the malfunctioning sensor is resolved.
Water Quality - DO, Turbidity, Chl-a (Site 3, 9) malfunction; Water Quality - pH, EC/Salinity, Redox, Temp (Site 2, 3, 6B, 7B, 9) malfunction.		Low	If one of these malfunctions, the spare can be deployed, while the problem with the malfunctioning sensor is resolved.
Weather Station - Malfunction of barometer.		Medium	The barometer is needed for water level calculations for Sites 2, 3, 6B, 7B, 9. The back up is to use the nearest BoM data.
Weather Station - Malfunction of other sensors.		Low	
Data Management Systems			
Transmission gaps, drift or random spikes in water level and quality (Sites 2, 6B, 7B, 3, 4, 9) and flow (Sites 6B, 7B, 4) data not resolved and impact the moving averages or other data statistics that are compared with compliance criteria.	Routine checks of graphs.	High	The stored raw data is to be corrected and placed in "corrected data" files having had the more straightforward types of transmission gaps, drift or random spikes resolved using algorithms. The algorithms may not resolve all these issues, and some may only be spotted manually. No less frequently than annually and preferably quarterly, the "corrected data" files are to be screened to remove "bad data" and to check the corrections and produce "QC'd data" files, with assessments of data quality with respect to DQO's.

Waterway System Upset Condition Event	Upset Condition Identification Method	Urgency of Response	Comment (Note that the nature and timing of each response will be determined on a case-by-case basis, keeping focused on the primacy of the need to sustain demonstrable compliance with the WQMP water quality objective and with the WQMP objectives for peak water levels. Dealing with upset conditions is key means to this end, but not a regulatory compliance requirement of itself.)
Records in SharePoint folders are incomplete or not reasonably up to date (e.g., Field sheets, operation and maintenance reports, compliance reports etc).		Low	
Abnormal discrepancy between water levels measured by AFCG sensors and by sensors at Site 2, 6B, 7B.	Monthly checks of graphs, using data from the monthly clean and calibration checks.	Low	The cause of the abnormality is to be identified and resolved. The abnormality is to be removed from the "corrected data".
Monthly reporting of data quality vs DQO's reveals an abnormality	Monthly data quality reporting.	Low	The cause of the abnormality is to be identified and resolved. The abnormality is to be removed from the "corrected data".
Water Level Control Features			
The AFCG Controls: Sea Level rise affects volumetric turnover times enough to raise concern about meeting water quality compliance objectives.	At least annual review of the statistics of volumetric turnover times.	Very Low	The AFCG Water Level Controls include: • The initial (2023) cap for the peak water level in the Waterway is selected to be 0.5 m AHD. Achieving this is controlled by pre-set trigger values for the Lakers Cutting Storm Surge level (mAHD) for closing the AFCG. This cap is predicated on a) the Lakers Cutting tidal regime of 2023 and its mean tide level which provides adequate volumetric turnover times for managing water quality in the Waterway; and b) the aim to prevent flooding of the lower parts of the pre-Point properties on the south side of the Waterway • The limits for the peak water level permitted by the Planning Permit are 0.9 m AHD (with the Lakers Cutting tidal regime of 2007 and its mean tide level) rising to 1.65m AHD when there is 0.8m of sea level rise from 2007. As the mean sea level in Lakers Cutting rises from climate change, trying to preserve the cap for the peak water level of 0.5 m AHD will reduce the volumetric turnover times from tidal exchange and risk impairing water quality in the Waterway. Therefore, from time to time, it will be necessary to raise this cap for the peak water level in increments so as to preserve adequate volumetric turnover times from tidal exchange. The consequence will be an increase the frequency and depth of flooding of the lower parts of the pre-Point properties on the south side of the Waterway; and also, the frequency of tidal and wave encroachment on the banks of the Waterway. It is also noted that with sea level rise, there will be an accompanying rise in groundwater levels that may impact the lower parts of these pre-Point properties.
Prevention of Short-Circuiting: The peak water level in the Waterway risks flow short-circuiting between the northern and southern legs of the Waterway.	Track peak water level for the Waterway.	Very Low	The separations between these legs of the Waterway have constructed elevations intended to prevent short-circuiting of water levels up to 0.9 m AHD. With a peak tidal water level of 0.75 m AHD or more, it is possible waves could impact and damage the dividing berms or walls, prompting a need to adjust and raise them The peak water level permitted by the Planning Permit 0.9 m AHD (with the Lakers Cutting tidal regime of 2007 and its mean tide level) rising to 1.65m AHD when there is 0.8m of sea level rise from 2007.

Waterway System Upset Condition Event	Upset Condition Identification Method	Urgency of Response	Comment (Note that the nature and timing of each response will be determined on a case-by-case basis, keeping focused on the primacy of the need to sustain demonstrable compliance with the WQMP water quality objective and with the WQMP objectives for peak water levels. Dealing with upset conditions is key means to this end, but not a regulatory compliance requirement of itself.)
Prevention of Overland Flow from Lakers Cutting: 1:100 ARI water levels in Lakers Cutting risk entering site by overland flow or stormwater drains; or mean that the frequency of short-circuiting water flows between the inlet and outlet between Fellows Road and the Railway risks becoming too high.	It is suggested that each 10 years, starting in 2030, the modelled 1:100 ARI water level for Lakers Cutting is reviewed.	Very Low	At the time of permitting The Point, the 1:100 ARI water levels in Lakers Cutting were estimated at 1.45 m AHD, rising to 2.35 m AHD with 0.8 m of sea level rise. The Point has been constructed to prevent water with levels in Lakers Cutting up to 1.45 m AHD from bypassing the culverts under the railway and to have a low risk of bypassing the culverts under the Bellarine Highway.in significant quantities. Also, the elevation of the dividing wall between the inlet and outlet channels north of the railway is 0.9 m AHD. Sea level rise will slowly increase the risk of bypasses and trigger a need for work to prevent overtopping of: • the railway embankment, and • the Waterway bank on the west side of Fellow Road, between the railway and the Bellarine Highway, and • the Bellarine Highway near the Waterway culverts
Prevention of Overland Flow from Lake Victoria: 1:100 ARI water levels in Lake Victoria risk bypassing the Lake Victoria channel and its culverts Waterway to enter the site by overland flow over Shell Road	It is suggested that each 10 years, starting in 2030, the modelled 1:100 ARI water level for Lake Victoria is reviewed.	Very Low	The elevation of the low point in Shell Road near the Lake Victoria Channel is approximately 0.8 m AHD. The 1:100 ARI for Lake Victoria was modelled to be 0.5 m AHD with The Point and with 2007 mean sea level, rising to 0.8 m AHD with 0.8 m sea level rise. However, the future 1:100 ARI level of Lake Victoria is also subject to changes in patterns of catchment inflows and changes in groundwater levels and groundwater seepage rates. These factors may mean future 1:100 ARI level of Lake Victoria could rise above that of the low point in Shell Road. Uncontrolled overland flows into The Point could impair water quality in the Waterway and harm the ground on which the water flowed.
Prevention of Overland Flow to Lake Victoria: Peak Water levels in the Waterway become higher than Shell Road and risk overland backflow to Lake Victoria.	Track the modification of the target peak water level for the Waterway to preserve adequate volumetric turnover times.	Low	The elevation of the low point in Shell Road near the Lake Victoria Channel is approximately 0.8 m AHD, compared with a current target peak water level in the Waterway of 0.5 m AHD, and permitted peak water levels of 0.9 m AHD (w mean Lakers Cutting water level as of 2007) and 1.65 m AHD with a 0.8 m rise in that mean water level from level rise.

8. COMPLIANCE MEASUREMENT

This Section describes the required outcomes for water flows, levels and quality and how compliance with these outcomes will be measured and adjudicated.

8.1. WATER FLOWS AND WATER LEVELS

Table 8 lists the required outcomes and their measurement for water flows and levels.

Table 8 Outcomes and Their Measurement – Water Flows and Water Levels

Outcomes for water flows and water levels	Measurement
1. The total Waterway volume turnover time from inflows from Lakers Cutting is to be sufficient to sustain compliance of Waterway water quality with the WQMP water quality objective.	For each calendar year: • Instrumented measurement each 15 minutes of: ○ Inflows from Lakers Cutting ○ Water Level in the Waterway • Use of the last measured bathymetry of the Waterway for the construction of a digital elevation model of the Waterway bathymetry • Computation of the 5-day moving average mean water level of the Waterway and the 5-day moving average total Waterway volumes below this mean water level • Computing the successive numbers of days inflow required to reach the 5-day moving average total Waterway volumes below this mean water level. These are the successive total Waterway volume turnover times • Reporting statistics of the turnover times
2. The maximum Waterway water level does not exceed the following values under conditions of 1 in 100-year storm surge and 1 in 100-year outflows from Lake Victoria: a. 0.9 m AHD with current mean sea level - defined as that pertaining in the 100 years to 2014; or b. 1.65m AHD when the mean sea level has risen by 0.8m from current conditions - defined as that pertaining in the 100 years to 2014.	The hydraulic modeling of the Waterway has demonstrated compliance. This modelling was reported to DCCEEW as a pre-requisite to secure DCCEEW approval of the WQMP Revision 3. The operation of the AFCG has pre-set water level triggers that trigger AFCG operations to limit water levels below these values. These pre-set water level triggers can be adjusted. In other words, measured water levels are used to trigger closure of the AFCG to prevent inflows from Lakers Cutting during a storm surge; or to trigger opening of the AFCG to allow enhanced rates of outflow if the water levels in the waterway are being raised unduly by outflows from Lake Victoria
3. No significant silting up of hydraulic structures connecting the Waterway to Lakers Cutting.	Annual checks of siltation of these hydraulic structures Records of these measurements demonstrate de-silting of any of these hydraulic structures within 3 months of any measurement showing more than 5% loss of cross-sectional area
4. Any reduction of Waterway water volume capacity (defined by the relationship between water volume and water level for the constructed Waterway) is not to exceed 5%.	A bathymetric survey of the constructed parts of the Waterway to be conducted each 10 years from the start of Waterway operations to produce digital elevation models of the Waterway at the start and end of each 10-year period.

Outcomes for water flows and water levels	Measurement
	The use of these models to compute the change in by the relationship between water volume and water level and so assess, for each water level, the Waterway volume as a % of the as constructed volume

8.2. QUALITY OF OUTFLOWS TO LAKERS CUTTING

Table 9 lists the outcomes and their measurement for water quality.

Table 9 Outcomes and Their Measurement – Outflow Water Quality

Outcomes for water quality of outflows to Lakers Cutting (ignoring effects from Lake Victoria's water):	Measurement
For parameters being monitored continuously, monthly checks of annual average of outlet concentrations for an instrumented parameter reveals whether or not it exceeds annual average of the inlet concentrations. This measured instrument parameters are Chlorophyll-a, Turbidity (NTU), ORP, DO, pH, Temp corrected conductivity and Salinity, Temp. For the purposes of compliance with the varied conditions of the EPBC Act approval 2003/1144, the relevant parameters are: • Chlorophyll – a • TSS (Turbidity in NTU)	Instrumented measurement of chlorophyll-a in the outflow at 15-minute intervals As a minimum quarterly calibration of the instrumented measurement of Chl-a, Nutrients, TSS (turbidity), pH, Temp corrected conductivity and Salinity concentrations by taking water samples and subjecting these both to laboratory instrument measurement and laboratory analysis. For clarity: • Annual averages are to be computed from data which has been corrected for instrument drift and other sources of error; • To accommodate the effect of measurement uncertainty in each of the computed annual averages from corrected data: ○ An exceedance of the annual average of the inlet concentrations by less than 20% means that the averages are for all practical purposes indiscernible; and ○ A minor exceedance is an annual average of outlet concentrations that is between 20% and 40% above the annual average of the inlet concentrations; and ○ A major exceedance is an annual average of outlet concentrations that is more than 40% above the annual average of the inlet concentrations. • A major exceedance sustained for more than 3 months represents a potentially measurable difference in the level of environmental risk to beneficial uses of water as defined in the EPA's Environment Reference Standard • A minor exceedance sustained for more than 6 months also represents a potentially measurable difference in the level of environmental risk to beneficial uses of water as defined in the EPA's Environment Reference Standard

Outcomes for water quality of outflows to Lakers Cutting (ignoring effects from Lake Victoria's water):	Measurement
The quarterly laboratory-measured water quality parameters are Chl-a, TSS, DO, pH, TDS, Conductivity, TN, NO3, NO2, NH3, TKN, TP, PO4, BoD, CoD For the purposes of compliance with the varied conditions of the EPBC Act approval 2003/1144, the relevant parameters are: • Chlorophyll – a • TSS • Nutrients Quarterly review of these laboratory tested parameters in water discharged by the site into Lakers Cutting reveals whether or not their concentrations exceed the Baseline Water Quality Values derived from the cumulative ranges measured by the Baseline Water Quality programmes from 2003 /2004 onwards.	Sampling and laboratory testing of outflow water at Location 6 using the methods set out in Waterway OMM. Trend analysis of the results and comparison of the results with the Baseline Water Quality Objectives derived from the cumulative ranges measured by the Baseline Water Quality programmes from 2003 /04 onwards The sampling interval to be quarterly unless one or more of the following have occurred: • There is a non-compliance with the WQMP water quality objective or there is a confirmed adverse trend towards non-compliance in the instrumented monitoring data for water quality at Site 6 or Site 7. • There has been an environmental incident that has caused the discharge of Table 9 listed chemicals (or other chemicals of potential concern) into the Waterway, or Lake Victoria. In that event, the sampling and testing scope and frequency will be reviewed (See Table 6). For clarity: • The measured data are to be of acceptable precision and repeatability by reference to EPA Guidelines; • To accommodate the effect of measurement uncertainty in each of the computed annual averages from laboratory measured data: ○ An exceedance of a Baseline Water Quality Value by less than the average Relative Percent Difference (RPD) of data from field duplicates means that the measured concentration is, for all practical purposes, indiscernible from the Baseline Water Quality Value; and ○ A minor exceedance is a measured concentration that is between 1 and 2 RPD's above the Baseline Water Quality Value; and ○ A major exceedance is a measured concentration that is more than 2 RPD's above the Baseline Water Quality Value. • A major exceedance sustained for more than 3 months represents a potentially measurable difference in the level of environmental risk to beneficial uses of water as defined in the EPA's Environment Reference Standard • A minor exceedance sustained for more than 6 months also represents a potentially measurable difference in the level of environmental risk to beneficial uses of water as defined in the EPA's Environment Reference Standard

9. WATERWAY MANAGEMENT COMPLIANCE REPORTS TO RESPONSIBLE AUTHORITIES

9.1. ANNUAL COMPLIANCE REPORT

The WQMP has been framed with the intent that its implementation will produce information with which to report on compliance with the WQMP requirements to:

- the Commonwealth – via annual compliance reports for each calendar year until the end of 2027, unless a later date is agreed between DCCEEW and CoGG.
- the City of Greater Geelong, and as needed to agencies such as EPA and DEECA – via the same annual compliance reports for each calendar year

Therefore, there will be an annual WQMP Compliance Report on the implementation of the WQMP. This report will be produced by a suitably qualified and experienced independent environmental consultant engaged by CoGG who will review the available records from operation, maintenance and monitoring of the Waterway. The report will, for the calendar year to 31 December:

- For the purposes of the Varied EPBC Approval, be consistent with the *Annual Compliance Report Guidelines*, Commonwealth of Australia 2023;
- Summarise the incidents in the reporting year that triggered non-compliance reports (see below) plus the subsequent investigations, rectification and close-out reporting;
- Contain tables, graphs and explanatory text that summarise the degree of compliance with the requirements of the WQMP concerning:
    - The WQMP Water Quality Objective;
    - The Baseline Water Quality Values;
    - Waterway water Levels.
- Contain or provide links to all monitoring data collected in the reporting year;
- Contain an assessment of the quality of this monitoring data collected, and of any limitations the data quality implies for the assessment of compliance with the provisions of the WQMP;
- Contain a description of what was done to check the work in the reporting year to implement the WQMP.

For the purposes of reporting compliance with the conditions of EPBC Approval the annual compliance reports for 2025, 2026 and 2027 will:

- be submitted to DCCEEW before the end of March for the preceding calendar year; and
- be published on a CoGG website in a format that is easily accessible and downloadable by the end of April for the preceding calendar year. Each WQMP Compliance Report for 2025, 2026 and 2027, will be kept on the CoGG website until at least 31 December 2028. CoGG will notify DCCEEW electronically, within 5 business days of each date of publication that the WQMP Compliance Report for the preceding calendar year has been published on the **CoGG** website. In this notification, CoGG will provide the DCCEEW with the web address for where the WQMP Compliance Report is published on the CoGG website**.**

The report for 2027 will be the last WQMP Compliance Report submitted to DCCEEW unless CoGG and DCCEEW agree otherwise.

The annual WQMP Compliance Report will also be submitted to CoGG and may, at CoGG's discretion, be copied for information to external agencies such as DEECA and / or EPA. Annual compliance reports for calendar years after 2027 will be submitted to CoGG.

9.2. INCIDENT TRIGGERED NON-COMPLIANCE REPORTS

Incidents of non-compliance with the water quality objective set out in Section 2.1 of this WQMP will be notified within 72 hours of occurrence:

- to DCCEEW, if the incident occurs within the period of operation of the varied conditions of the EPBC Act Approval (i.e., in the period to end June 2028, unless otherwise agreed between CoGG and DCCEEW); and
- internally within CoGG

These event reports will be followed by any necessary root-cause report analysis and rectification plan (See Table 6) within 2 weeks, or such other time as is agreed. The rectification plans will contain proposed timelines for actions and for reporting on outcomes so that the event can be closed out by agreement with DCCEEW.

A register will be kept of water quality incidents that trigger non-compliance reports or management actions. This register will record:

- The date of the incident;
- The dates of communications and reports;
- The dates of actions to investigate and rectify the causes of the incident;
- The date that the incident is closed out.

This register will be appended to the annual compliance report.

10. RESOURCING AND RESPONSIBILITIES

10.1. FOR IMPLEMENTING THE WQMP

As indicated in Section 1.2, overall responsibility for implementing the WQMP (and the Waterway OMM), and for ensuring sufficient resources are applied to this task, rests with Point Lonsdale Land Partners Pty Ltd until this responsibility is passed to CoGG.

Section 9 in the Overview in Appendix B lists the resources used by Point Lonsdale Land Partners to implement the various categories of tasks required.

10.2. EMERGENCY CONTACTS

The key emergency contacts responsible for managing environmental emergencies, should these occur are:

On behalf of Point Lonsdale Land Partners (until EPBC Approval transferred to CoGG):

Doug Vallance
Development Director
Moremac
m 0417 585 000
t 03 9851 3304
e dougvallance@moremac.com.au

On behalf of CoGG (After Waterway transfer to COGG, and after EPBC Approval transferred to CoGG)

Jeanette Spittle
Co-ordinator Environment and Biodiversity
City of Greater Geelong
WADAWURRUNG COUNTRY
PO BOX 104 GEELONG VIC 3220 AUSTRALIA
P: 03 5272 5272 | M: 0428 402 543
E: jspittle@geelongcity.vic.gov.au

APPENDIX A – VARIED EPBC APPROVAL CONDITIONS

To be inserted when available

APPENDIX B – OVERVIEW OF THE POINT WATERWAY, OVERVIEW MAP, KEY FEATURES MAP

Waterway Overview

The Point
POINT LONSDALE

Point Lonsdale, 3225, Victoria

REVISION 1

15TH OCT 2024

PREPARED BY

Moremac.

Revision History

Revision No.	Date	Prepared By	Reviewed By	Approved for Issue By
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Issue Register

Distribution List	Date Issued	Number of Copies
City of Greater Geelong	21/10/2024	1 (Digital)

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1. Introduction

The intent of The Point Waterway Overview (WO) is to provide those responsible for managing The Point Waterway with an overview of the Waterway's function and its operations and the maintenance in accordance with the parameters defined in the Project Environmental Management Plan (PEMP) and Water Quality Management Plan (WQMP).

Provision of the WO is noted in the Council endorsed Waterway Master Plan (noted as a Waterway Operation & Maintenance Manual in the Waterway Master Plan). The Waterway Master Plan was required under Condition 12 of the development Planning Permit (673/2007).

The City of Greater Geelong confirmed on the 29th of March 2023 that the waterway and the associated assets were completed and fully functioning and that the 2-year operational management period for the waterway commenced on the 6th of February 2023. Council confirmed handover of the waterway, and the associated assets is scheduled for the 6th of February 2025 subject to Council's satisfaction the waterway is operating in accordance with all the relevant endorsed / approved plans.

1.1 Development Description

The Point incorporates approximately 600 homes and a 170-unit retirement village surrounded by waterways, parklands and a conservation reserve, located on a former shell grit mine in Point Lonsdale.

The centre piece of The Point is the winding, 5.5 kilometre long tidally flushed waterway, around which the residential community, open space areas, and conservation reserve lie. The waterway provides amenity for the residents and visitors to The Point and supports intertidal ecosystems along the waterway's edge and in The Point's conservation reserve. The waterway is not intended for use by powered water vessels however is accessible for passive recreational uses. i.e; kayaks, paddleboards, etc.

The only outlet from Lake Victoria enters The Point waterway from Shell Road. This means that The Point's waterway also is the pathway for flows from Lake Victoria's catchment to discharge into Lakers Cutting. Lakers Cutting also receives stormwater discharges and run off from the land to its north, west and south. Lakers Cutting exchanges water tidally with Swan Bay.

Swan Bay is recognised for its large number of migratory birds that visit during the summer, and also for its marine flora, particularly seagrass. Swan Bay is a RAMSAR-listed wetland and is part of Port Phillip Bay.

1.2 Waterway Description and Associated Assets

The waterway is defined by title boundaries which follow the channel alignment and are generally set to follow the 0.2m AHD contour, which represents a typical high tide level with present (2023) tidal conditions in Lakers Cutting. Under these present tidal conditions, Lakers Cutting high tides can range upwards from about 0.1m AHD; and the 1% AEP high tide with storm surge is presently about 1.45m AHD. Lakers Cutting high tides with storm surge in the range 0.4 to 0.8 m AHD are not uncommon, as are periods of several days with scarcely any tidal fluctuations

Note that the 2015 Water Quality Management Plan, endorsed pursuant to the 2010 planning permit, provides for a 'peak water level of 0.9m AHD under the then current climate and sea level; and later, 1.65m AHD with 0.8m sea level rise and the associated climate change'.

Therefore, water in the waterway can rise above 0.2m AHD. When this occurs, the water outside the 0.2m AHD contour in a horizontal direction is technically within open space and the conservation reserve, or the lower section of lots in the case of the 'old lots' (developed prior to The Point off Silver Ridge Road and Chiswick Court) where there is a concrete plinth on the property boundary set at approx. 0.4m AHD). Refer Appendix 4 Waterway Titles.

Within the Waterway are the hydraulic structures needed for the proper functioning of the waterway, such as the various culverts and headwalls that facilitate flows through the site and under the Bellarine Highway, Bellarine Railway reserve and Fellows Road. These assets also form part of The Point Waterway.

The Waterway:

- Receives one-way flow from Lake Victoria. The Point Waterway does not impact the water level regime in Lake Victoria, with backflow from the Waterway to Lake Victoria prevented by flap valves installed at the Lake Victoria outlet culverts located within The Point (north of Shell Road) – refer Appendix 5.6.
- Exchanges water with Lakers Cutting / Swan Bay. Flow control gates located at the culverts under the Bellarine railway reserve operate automatically (with manual override possible) to allow inflows to the Waterway on a rising Lakers Cutting tide and outflows from the Waterway on a falling Lakers Cutting tide. Under automatic operation the flow control gates allow inflow through the inlet culverts and outflow through the outlet culverts, thereby instilling one-way flow through the Waterway in a clockwise direction.
- Receives stormwater discharges from within The Point and from the Southeast rain garden (located adjacent to Peterho Boulevard) that receives stormwater from the Hollywood estate outside of The Point.
- Receives seepage from groundwater under land to its north; and loses water to groundwater seepage towards Lake Victoria when its water levels are below those in the Waterway. Note however that the quantities of seepage are miniscule compared with the tidal exchange with Lakers Cutting.

Water levels in Lakers Cutting are not affected by The Point development.

In contrast, it is the tidal and surge regime within Lakers Cutting that influences the water levels and flows into and out of The Point Waterway.

The intent of the tidal exchange between The Point Waterway and Lakers Cutting was to establish and sustain the physical, biological and chemical processes that will sustain water quality in the Waterway, and this has been achieved

1.3 Environmental Obligations

The endorsed Water Quality Management Plan (WQMP Rev 3 150515) documents how water quality is to be managed to comply with the Planning Permit and the currently applicable EPBC Act Approval for the project.

The key commitment in this WQMP is that:

- Over the same time periods, there is to be no significant difference[1] in the quality of water at the inlet from Lakers Cutting and at the outlet back to Lakers Cutting resulting from the post-construction waterway and site development[2]; and
- The post-construction waterway and site development are not to cause the annual average of concentrations of each compliance parameter at the outlet culvert to exceed the annual average of concentrations of the same parameter measured at the inlet culvert over the same time period.

This endorsed commitment provides a practical approach that accommodates changes in the baseline quality in Lakers Cutting resulting from factors outside The Point development project, such as:

- Variations in conditions in Lakers Cutting / Swan Bay,
- Variations in climate and tidal condition,
- Discharges to Lakers Cutting from land outside the development site: i.e. from:
    - Lake Victoria

[1] The difference is sufficiently small as to:

- Imply an indiscernible difference in the level of environmental risk to the beneficial uses of that water as defined in the State Environment Protection Policy (Waters of Victoria); and /or
- Be within the limits of precision of measurements by commercially available and feasible techniques.

Note that with the advent of The Environment Protection Act 2017, the Environment Reference Standard (http://www.gazette.vic.gov.au/gazette/Gazettes2021/GG2021S245.pdf) replaced the State Environment Protection Policy (Waters of Victoria, and the concept of beneficial uses was replaced by the concept of environmental values

[2] i.e.: ignoring discharges from Lake Victoria through the site.

- Point Lonsdale
- Lakes & rural catchments to the northwest and northeast of Lakers Cutting

For the purposes of compliance with the EPBC approval condition 2h., the relevant parameters are:

- Chlorophyll – a
- TSS
- Nutrients

2. Key Asset Description

2.1 Waterway

The Waterway at the Point is approximately 5.5km in length between the inlet and outlet locations at Fellows Road, Lakers Cutting.

The Waterway channel width averages between 10-20m wide with some wider sections which include shallow and deep water to meander the waterway. The main channel depth ranges from 1.5m to 3.5m. A full as-built set of the waterway plans is included in Appendix 5.

With the flow control gates in automatic operation, water flows through the channel system in a clockwise direction. It takes typically about 10 to about 30 days for water to complete a full circuit of the Waterway through the channel system between the inlet and outlet culverts at Lakers Cutting. This rate of turn-over results in a flow speed of approx. 7.6 m per hour to approx 23 m per hour, which is essentially unnoticeable to a passing observer.

2.2 Railway Culverts (Inlet and Outlet)

The Waterway passes under the Bellarine Railway adjacent to Fellows Road via inlet and outlet culverts. The Railway Inlet and Outlet culverts each consist of 1 x 1650 dia. concrete pipe, sided by 2 x 1500mm dia. concrete pipes.

The length of each culvert set is approx. 44m, as they extend to the full width of the railway reserve.

The Automatic Flow Control Gates (AFCG) which control one-way flow through the Waterway channel system, are fixed to the southern end of the Railway culverts. Refer Section 2.5 for more detail. The AFCG are protected by 1.8m high gated security fencing.

Refer Appendix 5 for As-built Plans.

2.3 Bellarine Highway Culvert (Inlet and Outlet)

The Waterway channel passes under the Bellarine Highway in two locations:

1. Inlet Culverts (South - East) – This is located northwest of Cowry Way adjacent to the shared pathway crossing of the highway. The culverts consist of 5 x 1200mm dia. concrete pipes. The length of the culvert set is approx. 42m.
2. Outlet Culverts (North - West) – This is located southeast of the Bellarine Hwy and Point Boulevard roundabout. The culverts consist of 5 x 1200mm dia. concrete pipes. The length of the culvert set is approx. 39m.

Refer Appendix 5 for As-built Plans.

2.4 Fellows Road Culverts (Inlet and Outlet)

The inlet and outlet culverts pass under Fellows Road just north of the Bellarine Railway reserve, to connect the Waterway from the west to Lakers Cutting to the east.

There are two sets of culverts (Inlet and Outlet), both consisting of 8 x 1200mm wide x 600mm deep concrete box culverts. The length of the culverts sets is approx. 12.5m.

Refer Appendix 5 for As-built Plans.

The grade from Lakers Cutting into the Fellows Road culverts is from a low, relatively flat level of RL -0.4m AHD in Lakers Cutting, down to the base level of the Fellows Road culverts of RL -0.8m AHD, with the Waterway channels (inlet and outlet) on the western side of Fellows Rd then sloping down to the Railway culvert base level of RL -1.85m AHD.

2.5 Automatic Flow Control Gates & Associated Assets and Infrastructure

The Automatic Flow Control Gates (AFCG) consist of six separate mechanisms, which operate automatically to control water flow in and out of The Point Waterway. The gates are located at the southern end of the Bellarine Railway Culverts, just off Fellows Rd. Refer Appendix 3 - The Point Key Features Map.



Photo 1: Automatic Flow Control Gates – A set of three inlet gates.

The purposes of the AFCG are to balance the achievement of following three requirements:

- To deliver sufficient one-way flow through The Point Waterway system in order to prevent water stagnation and associated water quality issues in the Waterway. The amount of one-way flow that is possible is a function of the tidal range in Lakers Cutting, and this tidal range fluctuates depending on weather conditions, the phases of the moon, the seasons, and the tides in Swan Bay and Port Phillip Bay; and
- To adjust and limit the peak water levels within the waterway. Note that:
    - The 2015 Water Quality Management Plan, endorsed pursuant to the 2010 planning permit, provides for a 'peak water level of 0.9m AHD under the then current[3] climate and 1% AEP tide levels in Lakers Cutting (presently about 1.45 m AHD); and later, 1.65m AHD with 0.8m sea level rise and associated 1% AEP tide levels in Lakers Cutting (estimated to be about 2.35 m AHD):
    - Currently the limit on peak water levels is set at 0.5m AHD. This can be adjusted
    - Limiting the peak water levels below 0.9m AHD under current climate and sea level, or below 1.65m AHD with 0.8m sea level rise and the associated climate change, imposes a limit on the amount of one-way flow that is possible through the waterway. This means that as sea level rises it will become unavoidable to adjust upwards the present limit of 0.5 m AHD, in order to preserve the ability to manage water quality in the waterway.

[3] when the Planning Permit was issued in 2010

- To allow discharges from Lake Victoria to pass through the waterway into lakers Cutting, as part of the one-way flow of water

The one-way flow is achieved by using natural tidal movements in Lakers Cutting, in combination with penstock valves that open and close automatically, to manage water in and out of the Waterway. The penstock valve system is called the 'Automatic Flow Control Gates' or AFCG.

The Point Waterway fills on the rising tide and lowers on a falling tide. The water passes through the 5.5km length in a clockwise direction. The AFCG operation allows for changes in climate and weather conditions, catchment discharges, storm surcharges and can be adjusted to accommodate rises in sea level.

The gates operate on small head differentials, generated from daily tidal variations, and these are measured on the upstream and downstream ends of the inlet and outlet structures. In automatic operation, the gates are triggered to be either fully open or fully closed and are controlled only as a group of three. That is, all three gates on the inlet will be fully open or all three gates will be fully closed; and similarly for the three gates at the outlet.

The AFCG are controlled automatically by a computer located in a Control Building on the corner of Fellows Rd and the Bellarine Railway.

Manual operation of the AFCG is also possible. Provision of stop logs for both the north and south ends of the inlet and outlet culverts are provided for maintenances purposes, which can be manually installed when required.

The AFCG have been designed so that their operation does not require regular onsite attendance. Attendance should only be required when there is either planned maintenance, a fault is identified or for training purposes.

Refer Appendix 1 for The Point Waterway Operation and Maintenance for the AFCG.

2.6 Lake Victoria Inlet Culverts (Shell Road Backflow Valves)

The Lake Victoria Inlet Culverts (Shell Road Backflow Valves) are located on the south side of The Point Waterway & north of Shell Road, approx 630m northwest of the Shell Road / Point Boulevard Roundabout. Access to the inlet culverts/ backflow valves is via a gate on Shell Road.

The length of the Lake Victoria Inlet Culverts (Backflow Valves) within The Point is approx. 65m. A junction pit (2.7m x 1m) splits the length at a change in direction approximately at the midway mark.

The outlets of the culverts at the Waterway edge, are fitted with stainless steel flap valves, which prevent any flows going back toward Lake Victoria from The Point Waterway. The culvert inlets are fitted with a stainless-steel grate preventing objects any greater than 80mm wide from entering the culverts.

The City of Greater Geelong have an easement over the Lake Victoria outlet channel (refer Section 3.2) between Lake Victoria and Shell Road to enable access for maintenance. The outlet channel south of Shell Road and the culverts under Shell Road were constructed by Council some years ago before The Point Waterway was constructed.

It is also important that the backflow valves are monitored to ensure that they are correctly functioning. No water should be permitted to flow into Lake Victoria from The Point Waterway, with the valves designed to enable outflows from Lake Victoria into The Point Waterway.

It is important to note that these inlet culverts are the only outlet for Lake Victoria.

2.7 Ancillary Culverts

2.7.1 Western Saltmarsh Culverts

These pipe culverts are located at the western boundary fence of The Point conservation reserve.

They consist of 3 sets of 900mm wide x 300mm high concrete box culverts approximately 12m in length. The culverts allow for overland flows (following extended periods of rain) to pass from private property to the west of The Point under the conservation reserve maintenance track and into the created saltmarsh area, which in turn drains into the western end of The Point Waterway.

Beaching at the entry and exit points to the culverts prevents washout. The base of the culverts has been set at RL0.6m AHD to obtain grade to the Waterway to the east and manage any flooding levels within the private land.

2.7.2 Northern Saltmarsh Balancing Culverts

These pipe culverts are located approximately 500m west of Stage 22A under the conservation reserve maintenance access track northern bund.

These balancing culverts consist of 3 x 300mm Polyethylene *Stormpro* Pipes approximately 12m in length.

The saltmarsh areas to the north of the maintenance access track and Stages 21 to 22A, are naturally fed by the water table and local overland flows. This results in water filling the saltmarsh area during wetter months and drying out in hotter months of the year.

The invert level of the culverts has been set at RL 0.4m AHD to allow for the natural 'filling and drying out' process to continue, but also to limit the higher level of the water.

2.7.3 Pipe Culvert - West of Stage 23

This pipe culvert is located approx 80m west of Stage 23 under the centre bund maintenance access track.

The pipe culvert consists of a single 225mm diameter polyethylene *Stormpro* pipe which acts to avoid excessive water pooling immediately west of Stage 23 within native vegetation and thereby creating the natural draining that occurred prior to development works.

Refer Appendix 5 for As-built Plans.

3. Neighbouring Assets

Surrounding The Point there are several features whose water quality can influence the health of the water in The Point Waterway.

It is expected Council would operate and maintain these features on a scheduled basis and in accordance with good practice standards, in order that there is little risk of adverse impacts on the health of water in The Point Waterway.

As these are outside of the development area the maintenance regime of these features is not within the scope of this document.

The next subsections outline these features and identifies some issues that are pertinent to the quality of their water quality.

3.1 Lake Victoria

Lake Victoria receives water from runoff and stormwater discharges from the surrounding land (urban & rural catchments), from groundwater seepage from under the surrounding land, from stream flows from its catchment, and from direct rainfall.

The water level and water quality in Lake Victoria fluctuate seasonally. In summer Lake Victoria's losses of water, from evaporation, cause its water levels to fall and its water quality to deteriorate.

The only outlet for Lake Victoria is via the Lake Victoria channel (which heads north to Shell Road), then via The Point Waterway (via the Lake Victoria Inlet Culverts – refer Section 2.6), so that flows can reach Lakers Cutting / Swan Bay / Point Philip Bay.

There is an earthen sill at the southern mouth of the Lake Victoria channel, which builds up from time to time and should form part of the general maintenance of Lake Victoria to manage flows and water levels.

Lake Victoria receives and accumulates sediment, organic detritus, nutrients and pollutants. When the water level falls below the earthen sill, these will increase in concentrations.

Because the lake is shallow, it is:

- Prone to fluctuations in water temperature from diurnal air temperatures and changes in weather conditions,
- Prone to Eutrophication,
- Likely has sediments that are organic rich and include monosulphidic black ooze and which support seasonal algal blooms,
- Is prone to growth of cyanobacteria, as well as other algae (under certain conditions).

This means the waters of Lake Victoria, seasonally may:

- Represent a risk to the quality of water in the Waterway and potentially also to that in Lakers Cutting,
- Pose risks to the amenity of Lake Victoria,
- Pose potential risks to the health of people and wildlife using Lake Victoria.

Better management of the water quality in Lake Victoria could include things like:

- Improving the quality of inflows to Lake Victoria - can all stream inflows go via a constructed wetland to remove nutrients, sediment etc?
- Having Lake Victoria discharge through a wetland to protect the environment downstream of the lake.
- Removing biomass and organic rich sediments from Lake Victoria periodically.

3.2 Lake Victoria Channel

Flows from Lake Victoria enter The Point Waterway via a channel that extends (within private land south of Shell Road) from the north-eastern corner of the lake to Shell Road.

The Lake Victoria Channel was constructed by others with a flat invert level of about –0.25m AHD, with a sill at 0.0m AHD at the Lake Victoria end and with two sets of drop culverts (also constructed by others) – one at Shell Road and one under a dirt track near Lake Victoria.

The drop culverts can capture and detain sediment. This means that from time to time they need to be checked and have excess sediment removed

The City of Greater Geelong have an easement over the Lake Victoria outlet channel between Lake Victoria and Shell Road to enable access for maintenance.

Water levels in Lake Victoria can range from as low as about –0.4 m AHD in Summer to as high as +0.5 m AHD after Winter.

When the channel was constructed the discharges from Lake Victoria went into a set of interconnected ponds south of the Bellarine Highway (prior to The Point development proceeding), which were poorly connected to Lakers Cutting. In Summer, after Lake Victoria's water level fell below the sill and outflows stopped, the residual water in the channel would drain into these ponds.

Now, with The Point Waterway constructed, water levels in the waterway do not fall below about 0.1m AHD, which is above the invert level of the channel. This means that when Lake Victoria's water level is below the sill (at the entrance to the Lake Victoria channel) outflow to The Point Waterway can no longer occur. There can also be seepage under Shell Road from The Point towards Lake Victoria. Some of this seepage emerges in the channel, where it is trapped.

The consequence is that this trapped water in the channel can evaporate and become eutrophic with potential for algal blooms and odours.

The solution to this would be to:

- Grade the channel invert down from 0.0 at the sill to –0.25m AHD at the drop culvert under the dirt track.
- Grade the channel invert down from –0.25 m AHD at the drop culvert under the dirt track to –0.5 m AHD at the edge of Lake Victoria.

With these changes, when Lake Victoria's water level falls below the sill, water would empty from the channel back into Lake Victoria, allowing the channel to drain and dry out, and not trap water arriving from seepage under Shell Road.

3.3 Lakers Cutting and Connection to Swan Bay

Lakers Cutting is a man-made feature extending from Fellows Road east to Swan Bay.

At the Swan Bay end is a broad shallow sill. Tides in Swan Bay can fall to levels that constrain the tidal exchange between Lakers Cutting and Swan Bay, especially when concurrently there is abundant aquatic vegetation on the sill.

Between this sill and Fellows Road there are areas of deeper water separated by shallower water – a consequence of the patterns of dredging that made Lakers Cutting.

The quality of water in Lakers Cutting is the primary determinant of water quality in The Point Waterway.

The keys to sustaining good water quality in Lakers Cutting include:

- Reducing the frequency and durations of periods when lower than average tidal ranges in Swan Bay, coupled with the elevation of the sill between Lakers Cutting and Swan Bay and the density of seagrass growth on this sill, inhibit tidal exchange between Swan Bay and Lakers Cutting.
  When such periods occur in Spring and warmer months, growth in seagrass and algae can deplete dissolved oxygen levels and raise chlorophyll-a levels in Lakers Cutting, to undesirable levels for healthy ecosystems. One way to achieve this goal would be to cut a channel through the sill. Another way is to implement periodic seagrass harvesting.

- Improving the quality (less sediment, less nutrients, less algae and organic matter) of stormwater discharges and streamflow discharges into Lakers Cutting from:
    - Lake Victoria
    - Farmland to the northwest and northeast of Lakers Cutting
    - Residential and urban land to the south & southeast of Lakers Cutting (ie: Point Lonsdale and Queenscliff).

3.4 Southeast Rain Garden (Peterho Blvd)

The urban catchment located southeast of The Point drains into the Waterway via a rain garden located adjacent to Peterho Boulevard, approx. 50m southwest of Lakes Entrance roundabout.

This catchment provides a source of incoming flows to the Waterway and as such, the rain garden and associated infrastructure, requires regular and appropriate maintenance to prevent poor water quality outcomes that could impact negatively on The Point Waterway.

4. Water Sensitive Urban Design

The Point streetscapes include a water sensitive urban design (WSUD) drainage system that helps to deliver quality waterway and overall environmental outcomes for the community.

The below items that make up the WSUD system require maintenance as per standard Council practice. Failure to properly maintain may negatively impact water quality in the Waterway.

4.1 Streetscape Grassed Swales and Vegetated Rain Gardens

All lots within The Point development drain to the Waterway. The Point is made up of road reserves up to 18m wide, generally with two-way crossfall pavements 5.5m wide plus a 1.5 m wide footpath on at least one side.

The design intent was to create a rural coastal streetscape throughout the development with no kerb and channel.

The pavement centrelines are flat and shed uniformly into flanking bioretention swales 300mm wide at its base, that flank the pavement on both sides.

The swale drains act as linear bioretention system without the need for under-drainage capacity to be provided in the form of slotted AG pipes and transition/drainage layers. The swales are formed using a bioretention filter media with a hydraulic conductivity of 180-200 mm/hr.

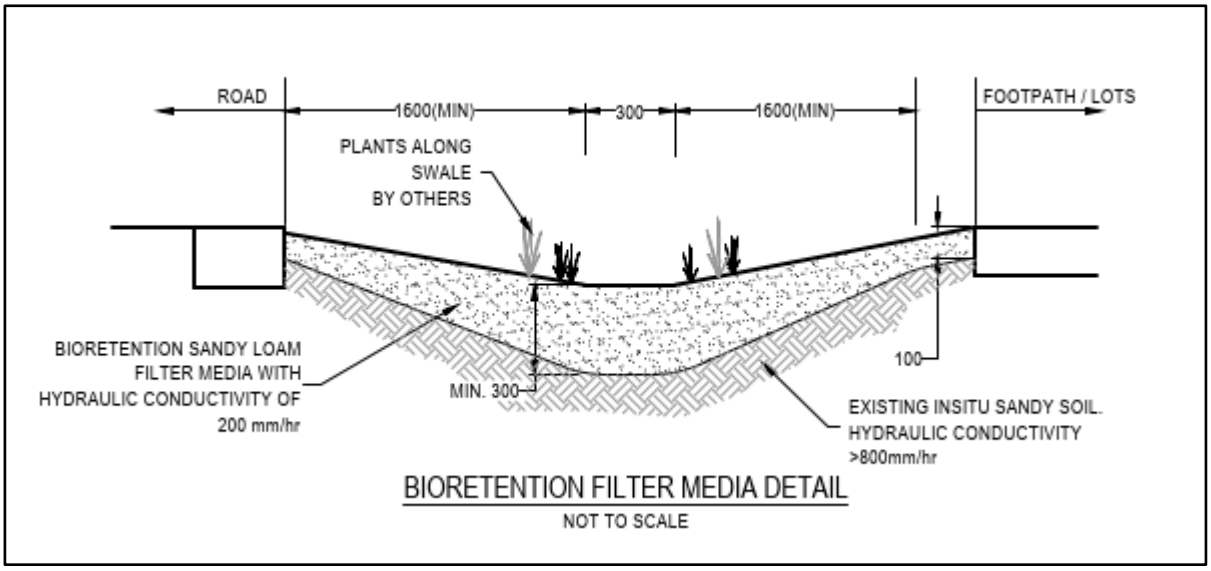


Image 1: Grassed Swale Arrangement

Regularly spaced rain gardens located in the nature strips direct flows towards the swales and provide a sustainable stormwater management solution with the primary goal of improving water quality. This is achieved via the following:

1. Filtering and trapping pollutants, such as sediments, nutrients, and heavy metals, preventing them from reaching water bodies.
2. Plant absorption reduces the concentration of pollutants through their root systems.
3. The soils in the rain gardens supports microbial activity, breaking down and metabolizing pollutants.
4. Reducing erosion by slowing down stormwater runoff and sediment transport into water bodies.
5. Promoting water infiltration that recharges groundwater.

The rain gardens should be monitored and inspected regularly for signs of erosion and sedimentation. Such inspections should include visual checks of the inlet and outlet structures to ensure water is flowing properly through the garden.

Maintenance activities of the garden are typical for any other garden. i.e; weeding, mulching, pruning, watering, pest control and rubbish removal.

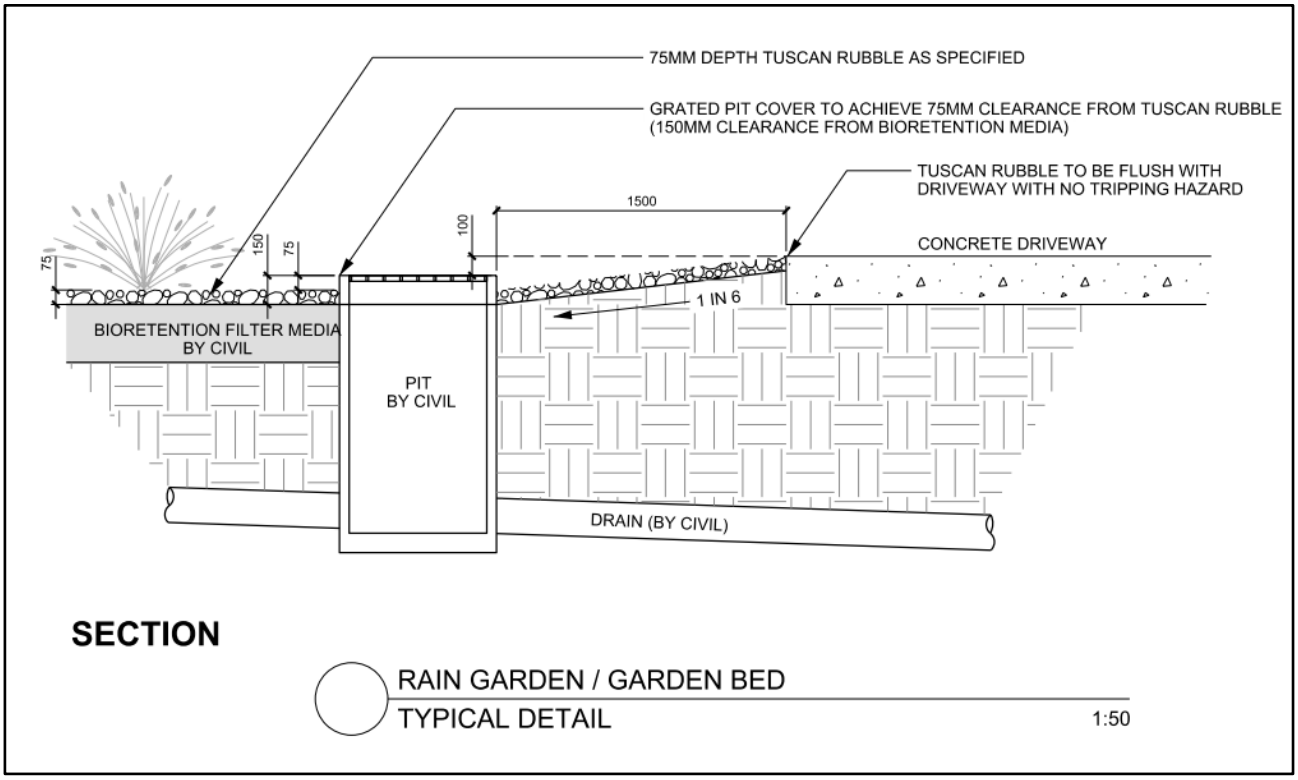


Image 2: Typical Rain Garden Bed Arrangement

4.2 Drainage Pit and Pipes

A 300mm (nominal) diameter pipe system below the swales deals with high intensity rainfall events. Water ingress to the pipe network is via 600 x 600mm grated pits, that also provide backup drainage capacity in the trapped swale depressions between driveways and road/footpath intersections.

The reserve frontage swales receive drainage runoff from only half of the road reserve and have no overflow connection to the pipe system. If surcharged, these swales will shed water uniformly towards the tidal waterway.

Pits need to be monitored and cleaned to avoid blockage as per standard practice.

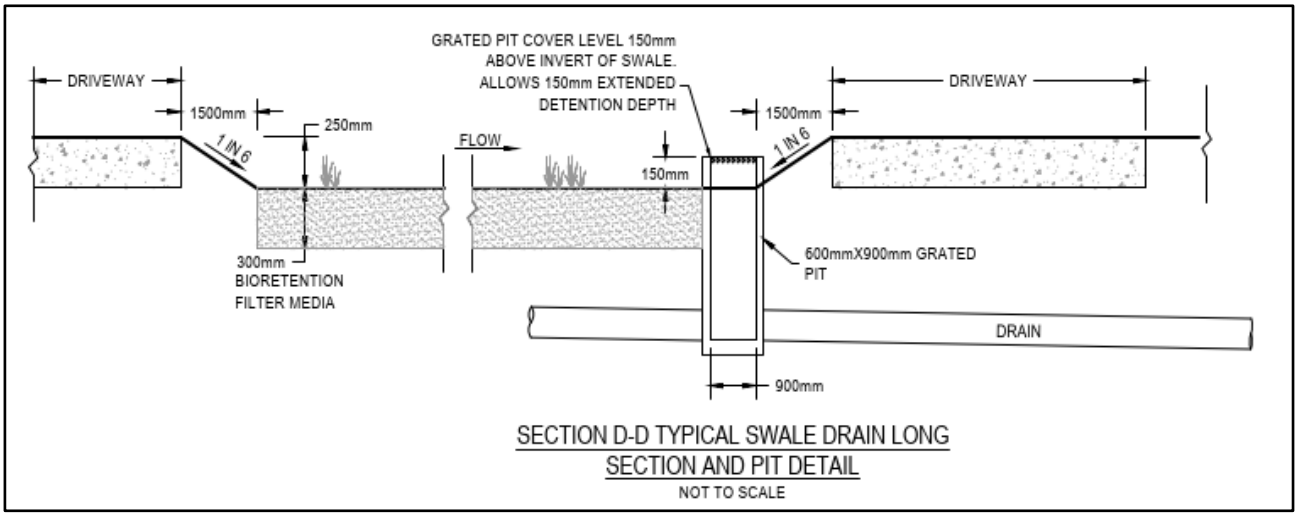


Image 3: Typical Swale Drain Arrangement

4.3 Waterway Open Space Reserve

The landscaped Waterway Open Space Reserves will be managed and maintained by Council Open Space Maintenance (Parks and Recreation). The various Waterway Open Space Reserves are on individual titles and separate to The Point Waterway titles.

The handover of the landscaping to Council of the respective waterway open spaces reserves is ongoing in line with standard landscaped open space reserve handover processes.

5. Waterway Operation and Maintenance

Detail toward the Operation and Maintenance of the Waterway is included in the balance of The Point Waterway Operation and Maintenance Manual (OMM) of which this Overview forms a part. The OMM is subservient to and serves the purposes of the Water Quality Management Plan (WQMP).

The balance of the OMM addresses:

- Purpose
- System Components
- AFCG System
- Water Quality Monitoring (WQM) System
- Integrated Dashboard
- Operation and Maintenance of Systems
- Roles and Responsibilities
- Schedules
- Records
- Ownership of Information and Data
- Health, Safety Environment and Quality
- Procedure for Review and Revision

6. Risks - Upset Condition Response and Management

Risks are identified and addressed under Appendix 6.

7. Responding to Sea Level Rise

7.1 Flexibility in Design and Construction

The Point Waterway has been designed and constructed to provide the delivered outcomes and flexibility in design to enable the ability by Council, in the future, to respond to sea level rise in a practical and achievable manner.

This flexible approach was a key to the overall approval and future management processes for The Point Waterway.

The Point Waterway has been designed and constructed to:

- Provide minimum floor levels for all residential and commercial buildings of 2.35m AHD and minimum lot levels of 2.0m AHD, to accommodate the Victorian Coastal Strategy projected sea level rise of 0.8 metres by the year 2100.

- Enable the 1% AEP water level within the Waterway to not exceed 0.9m AHD, with the mean sea level (when the Planning Permit was issued in 2010) and 1.65m AHD with a 0.8m rise in this mean sea level.
    - The Waterway has been constructed to ensure that inflows and outflows to the Waterway occur via the inlet and outlet culverts under the Bellarine Railway embankment, the Bellarine Highway and Shell Road - not via overland flow that bypasses these culverts;
    - As the mean sea level rises, the risk rises that the 1% AEP water level in Lakers Cutting rises and with it there is increased risk of flooding of Fellows Road south of the railway, the railway embankment and/or the Bellarine Highway. In the absence of work by government agencies to respond to that risk by raising Fellows Road and/or the railway embankment and/or the Bellarine Highway, the layout of The Point provides flexibility for it to:
        - Raise the nib wall on the railway embankment that prevents overland flow bypassing the inlet and outlet culverts; and/or
        - Raise an embankment on the southern side of the inlet waterway from that nib wall on the railway embankment to the Bellarine Highway, and along the Bellarine Highway property boundary – to prevent overland flow reaching the Waterway; and/or
        - Extend the embankment along the property boundary on the southern side of the Bellarine Highway or take other measures to prevent overland flow reaching the Waterway either directly from a flooded Bellarine Highway or via the stormwater drains or entrance road to The Point.
    - As mean sea level rises so will 1% AEP water level in The Point Waterway will rise, and when that rises above approx 0.8 m AHD there is a risk that Shell Road may get overtopped, leading to overland flow from The Point into Lake Victoria, if its water levels are lower at the time. The layout of The Point provides flexibility for it to accommodate a wall or berm along its boundary with Shell Road to prevent this overland flow reaching Lake Victoria.
    - As mean sea level rises so will 1% AEP water level in Lake Victoria will rise, and when that rises above about 0.8 m AHD there is a risk that Shell Road may get overtopped, leading to overland flow from Lake Victoria into The Point Waterway, if its water levels are lower at the time. In the absence of work by government agencies to respond to that risk by raising Shell Road, the layout of The Point provides flexibility for it to accommodate a wall or berm along its boundary with Shell Road to prevent this overland flow reaching the Point's waterway.
- Enable, the peak water level in the Waterway to be controlled to be below a pre-determined operational level lower than the 1 % AEP water level of Lakers Cutting. Currently this is 0.5m AHD.
  As mean sea level rises, it is envisaged that this pre-determined operational level will need to be raised from time to time in order to sustain the volumetric turnover time within ranges that enable the water quality objective of the WQMP to be complied with.
- Ensure that the within the Waterway south of the railway embankment, flows do not short-circuit between the sections of the waterway by flowing over the central dividing bunds.
  As mean sea level rises, it is envisaged from time-to-time there will be a need to raise the central dividing bunds so as to preserve adequate freeboard between the 1% AEP water level in the water way and the crest of the bunds.
- Ensure that between the Bellarine Railway embankment and Fellows Road, flows do not short-circuit between the inlet and outlet channels of the Waterway in this location, unless Fellows Road is overtopped by tides in Lakers Cutting.
  As mean sea level rises, it is envisaged from time-to-time government agencies will raise Fellows Road to limit the frequency of this overtopping. Such raising of Fellows Road will provide the opportunity to raise the dividing bund between the inlet and outlet legs of the Waterway that lies between Fellows Road and the railway embankment.

7.2 Triggers for Considering Responding to Sea Level Rise

7.2.1 Trigger for Adjusting the Operational Peak Waterway Level

- The high tide level in the Waterway is typically about 0.05m below those in Lakers Cutting, and low tides are about 0.01m above those in Lakers Cutting. Typical tides in Lakers Cutting (in the absence of storm surges) have a range of 0.0 to 0.4m above a low tide of 0.1 to 0.15m AHD.
- For mean sea levels as at 2010, a high tide in Lakers Cutting (with a 1% ARI storm surge) can reach 1.45m approximately. And it is estimated that with 0.8m sea level rise this high tide with storm surge could reach 2.35m AHD in Lakers Cutting.
- Under the endorsed Water Quality Management Plan, the peak water level in The Point Waterway is to be controlled to not to exceed 0.9m AHD for mean sea levels as of 2010, and 1.65m for mean sea levels 0.8m higher than those in 2010.
- The AFCG enables the peak water level in The Point Waterway to be controlled operationally to be less than a selected, adjustable value, to limit the height of storm surges entering the Waterway.

Currently (2024) this selected value is 0.5m AHD. This is achieved by triggering the inlet flow control gates to close when the Lakers Cutting tide is 0.6m AHD, or when the water way level reaches 0.5m AHD.

As mean sea level rises with climate change, it is envisaged that from time to time this selected value will need to be adjusted upwards, whether to accommodate a higher Lakers Cutting surge level or to sustain the volumetric turnover times for water in the waterway that are needed for acceptable water quality.

It is suggested that the trigger for such adjustment include:

- from annual reviews of data, an increasing trend in the moving average volumetric turnover times coupled with declining trends in water quality that are considered to be related to this increasing trend (i.e. not to the quality of water in Lakers Cutting or Lake Victoria).

7.2.2 Trigger for Checking Risk of Overland Flow - Shell Road Culverts

In the absence of works to raise Shell Road (as necessary) to preserve adequate freeboard above a 1% AEP level in Lakers Cutting or to limit the frequency of these being overtopped, then The Point may require consideration of the need to design, and construct works to prevent overland flows bypassing the Shell Road Culverts.

It is suggested that the first trigger to review this potential need should be when either the operational peak water level in The Point Waterway exceeds 0.7m AHD or peak annual Lake Victoria water levels exceeds 0.7m AHD. This level is 0.1m below the current finished level low point in Shell Road of 0.8m AHD. It is further suggested that the review process should include consultation with:

- The Corangamite Catchment Management Authority to identify any updates to the 1% AEP level for Victoria.
- VicRoads and relevant other government agencies to ascertain if a need to raise Fellows Road, or the Bellarine Railway embankment or the Bellarine Highway has been identified and if so when such work may occur.

It is also suggested that the outcomes from the review should also include a definition of the next trigger for review.

7.2.3 Trigger for Checking Risk of Overland Flow Bypassing Bellarine Railway and Bellarine Highway Culverts

In the absence of works to raise Fellows Road, or the Bellarine Railway embankment or the Bellarine Highway (as necessary) to preserve adequate freeboard above a 1% AEP level in Lakers Cutting or to limit the frequency of these being overtopped, then manager of The Point Waterway may require consideration of the need to design and construct works to prevent overland flows bypassing the Bellarine Railway and Bellarine Highway Culverts.

It is suggested that the first trigger to review this potential need should be when a Lakers Cutting tide flood exceeds 0.8m AHD, and that the review process should include consultation with:

- The Corangamite Catchment Management Authority to identify any updates to the 1% AEP level for Lakers Cutting.
- VicRoads and relevant other government agencies to ascertain if a need to raise Fellows Road, or the Bellarine Railway embankment or the Bellarine Highway has been identified and if so when such work may occur.
- It is also suggested that the outcomes from the review should also include a definition of the next trigger for review.

7.2.4 Triggers for Checks / Adjustment of Separation Bunds

The Waterway channels are located adjacent to each other:

- Between the Fellows Road culverts and the inlet and outlet culverts under the Bellarine Railway embankment;
- Between the inlet and outlet culverts under the Bellarine Railway embankment and the inlet channel culverts under the Bellarine Highway; and
- At the western end of The Point waterway.

In these segments of The Point Waterway 'short-circuiting' of water is prevented by the elevations of the separation bunds constructed between the two channels.

These elevations are:

- Separation Bund between Fellows Road and Bellarine Railway Embankment culverts: 0.8 m AHD (matching the adjacent level of the Fellows Road pavement),
- Separation Bund between the inlet and outlet culverts under the Bellarine Railway embankment and the inlet channel culverts under the Bellarine Highway: 1.0m AHD,
- Separation Bund between channels at the western end of The Point Waterway: 1.0m AHD.

No specific or regular active maintenance activities are expected to be necessary, however regular monitoring by way of observation should occur regardless. However:

- From time to time, as mean sea level rises and causes the peak water level in the Waterway south of the inlet and outlet culverts under the Bellarine Railway embankment to rise to within 0.2m of the separation bund crest levels, it will become necessary to review the adequacy of the amount of freeboard between the levels of the crests of these bunds, and the peak water level in the waterway; and
- Storm surges or waves higher than approx. 0.8m AHD in Lakers Cutting have the potential to inundate and flood over Fellows Road and the separation bund between Fellows Road and Bellarine Railway embankment culverts. When this occurs, it will be necessary to check the integrity of this bund, make any necessary repairs, and review the adequacy of the amount of freeboard between the levels of the crests of this bund and storm surge levels in Lakers Cutting.

8. Operations and Maintenance Manual Management Review

The Operations & Maintenance Manual (and its risk assessment) should be reviewed no less frequently than every 5 years and adapted to account for:

a) The lived experience;

b) Review of future risks and challenges and opportunities, not necessarily only from sea level rise.

9. Key Contacts (Stakeholders, Suppliers, Support Personal)

Stakeholders		Contact Name	Address	Phone No. / Email
Victrack		Assad Niazmand	Level 8, 1010 La Trobe St, Docklands, VIC 3008	+61 3 9619 8631 services@victrack.com.au
Bellarine Rail Operator		Rupert Capper	PO Box 166 Queenscliff ,VIC 3225	0407 300 210 or 5258 2069 Rupert.Capper@vline.com.au
Corangamite Catchment Management Authority		Penny Reed Dr. Geoff Taylor	PO Box 159 (64 Dennis St) Colac, VIC 3250.	1800 002 262 Penny.Reed@ccma.vic.gov.au geoff.taylor@ccma.vic.gov.au
Suppliers	**Business Name**	**Contact Name**	**Address**	**Email / Phone No.**
AFCG Spares	Acrodyne	Diane Grande	7/11 Havelock Road, Bayswater, VIC 3153	03 8727 7800 dgrande@acrodyne.com.au
ACFG operations monitoring and trouble shooting; Provision, installation, operation and maintenance of Instrumentation and data telemetry and data management for the Water Quality, Level and Flow	Hydroterra	Ture Carlson|	Unit 42/328 Reserve Road, Cheltenham, VIC 3192	0421 509 312 tcarlson@hydroterra.com.au
AFCG Penstock Suppliers	AWE	Mark La Forest	18 Hansells Parade Riverview, QLD 4303	0438 138 903 marklaforest@aweng.com.au
AFCG I.T / Software Control systems	Whitetechnics	Stephen Boyd	Unit 4 / 36 New Street, Ringwood, VIC 3134	0419 314 075 sboyd@whitetechnics.com.au
Control Hardware	Gordon McKay	Alistair Miller	2/10 Crown Street South Geelong, VIC 3220	0425 788 604 Alistair@gmckay.com.au
Support Services	**Service**	**Contact Name**	**Address**	**Phone No. / Email**
GHD	Algae / Water Quality Monitoring	Amanda Maxwell	Level 2, 45 Brougham Street, Geelong , VIC	0493 401 537 / 03 5273 1850 Amanda.maxwell@ghd.com

Hydroterra	The Water Quality, Level and Flow monitoring; and the AFCG operations monitoring including the management of the resulting data Managing the records from implementing the Point Waterway Operation and Management Manual	Ture Carlson|	Unit 42/328 Reserve Road, Cheltenham, VIC 3192	0421 509 312 tcarlson@hydroterra.com.au
Whitetechnics	Maintaining the software and systems for control of the AFCG	Stephen Boyd	Unit 4 / 36 New Street, Ringwood, VIC 3134	0419 314 075 sboyd@whitetechnics.com.au
Acrodyne	Servicing and maintenance of the AFCG drive systems	Diane Grande	7/11 Havelock Road, Bayswater, VIC 3153 Australia	03 8727 7800 dgrande@acrodyne.com.au
WithERS Environmental Risk Strategies Pty Ltd	Oversight and review of water quality, level and flow, monitoring and management; environmental risk assessment; WQMP and PEMP documents and WQMP compliance reports	Nick Withers		0400 473 572 / 03 9431 3823 nick.at.withers@gmail.com
Vacuum Tanker /Drain Cleaning Service	Council Preferred			
Support Services	**Service**	**Contact Name**	**Address**	**Phone No. / Email**
Seagrass / Algae Management Removal & Coordinator	Garden Design & Rejuvenation	Billy Clifton	1-3 Cockle Crescent, Point Lonsdale, VIC	0438 581 251 billyc22@bigpond.com
Seagrass / Algae Harvest Contractor	Australian Aquatic Solutions	Tim Pepperell	17 Eleanor St, Ashburton, VIC 3147	1300 411 494 Tim@australianaquaticsolutions.com.au

Appendices

1 The Point Waterway Operation & Management Manual

2 Waterway Master Plan

3 The Point – Key Feature Map

4 Waterway Titles

5 As-built Plans

5.1 Waterway (Plan View and X-Sections)

5.2 Bellarine Railway Inlet & Outlet Culverts

5.3 Bellarine Highway Outlet Culvert (West)

5.4 Bellarine Highway Inlet Culvert (East)

5.5 Fellows Road Inlet & Outlet Culverts

5.6 Shell Road Backflow Valves / Culverts

5.7 Ancillary Culverts

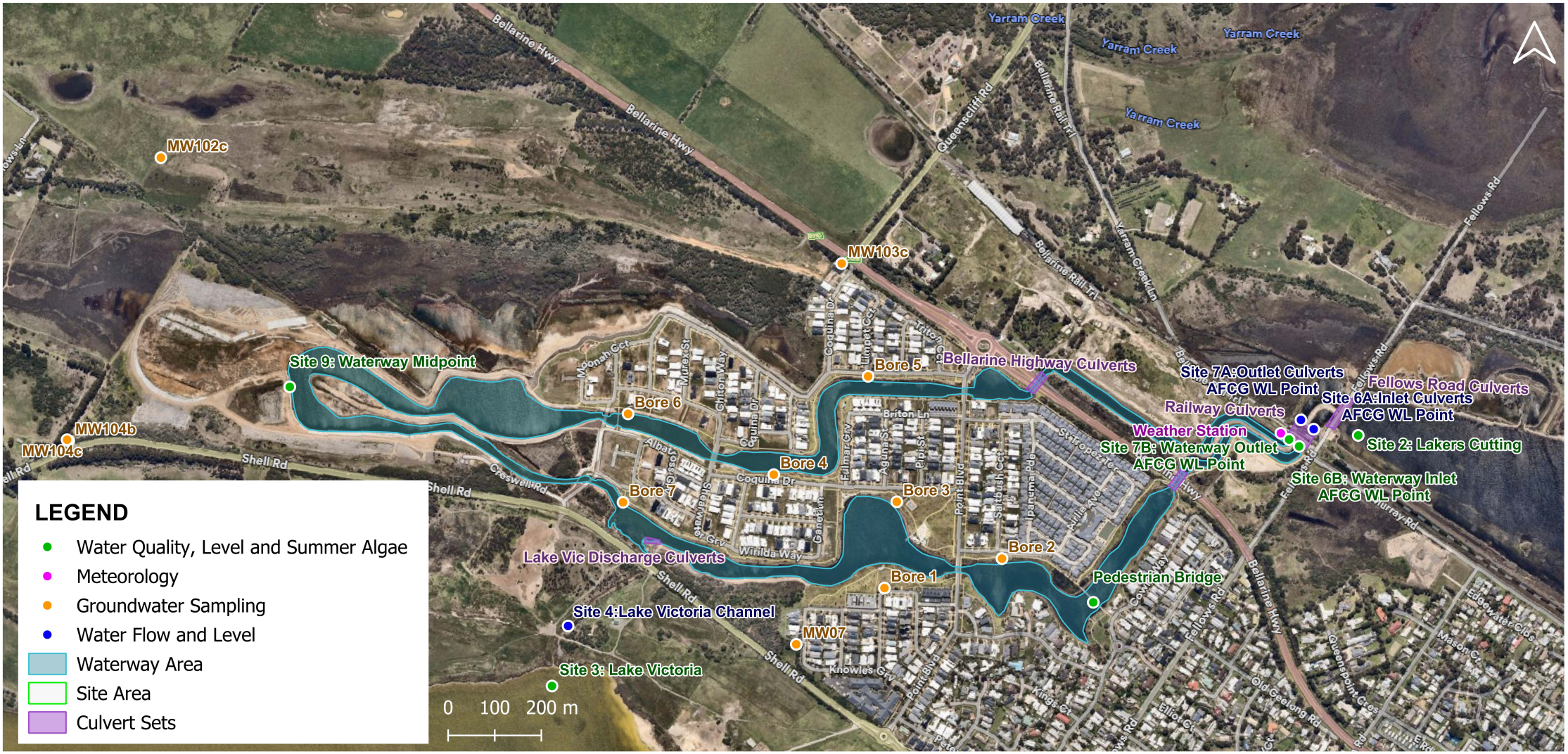
5.8 Automatic Flow Control Gates (Ref Appendix 1)

6 The Point Automatic Flow Control Gate Operations and Maintenance Manual

7 Risks – Upset Condition Response and Management

MOREMAC

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Email: info@moremac.com.au



HydroTerra
Environmental Monitoring Specialists

SITE NAME: THE POINT
SITE ID: PTL001
SITE ADDRESS: 88-90 POINT BLVD, POINT LONSDALE VIC 3225
MAP: SITE OVERVIEW

IMAGE SOURCE: NEARMAP
IMAGE DATE: 12/10/2024

REFER TO THE POINT WATERWAY OVERVIEW OMM FOR MORE INFORMATION

The Point Development - Feature Map

6 Feb 24



APPENDIX C – COPIES OF NUTRIENT AND IRRIGATION MANAGEMENT PLAN (2010) AND STORMWATER DRAINAGE MASTER PLAN (2010)

Nutrient and Irrigation Management Plan
Point Lonsdale Development

Prepared for

Stockland Pty Ltd

Page 56 of 120

Signature

17:3:11
Date

Decemeber, 2010

NOTE: THIS DOCUMENT CONTAINS 32 PAGES. (INCL. THIS PAGE)

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ILLUSTRATIVE MASTERPLAN

POINT LONSDALE RESIDENTIAL AND WATERWAYS DEVELOPMENT

NB: This plan expresses general intent and design principles with regard to land use within the site for the purposes of assessment by the relevant authorities. The proposal is subject to change as a consequence of this review and will be refined as part of the planning process.

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1. Introduction

Stockland Development Pty Ltd proposes to develop 81 hectares of residentially zoned land located along the Bellarine highway on Point Lonsdale (north western edge). The proposed development consists of up to 768 dwellings, including a retirement village and aged care lots. It will also include areas of public open space within conservation reserves, parklands and waterways and a small community hub.

Of the land owned by Stockland, land south of the railway line has been extensively modified by previous land uses comprising shell grit and sand mining and some backfill of mined areas. The development area also includes Lonsdale Lakes Estate which was never completed and currently consists of a series of partially connected lakes. These lakes are currently unmanaged and experience hyper saline conditions and algal blooms.

The development project presents an opportunity to improve land and water quality management on the site, providing approximately 61 ha of land for revegetation and ongoing management. The development will also allow for a reversal of degrading processes such as grazing weed invasion, rubbish dumping and illegal four wheel driving and motorbike riding which if left unabated will continue to degrade the ecological values existing on the site.

The scope of work for this Management Plan includes:

1. rehabilitation and revegetation strategies employing native vegetation of local provenance and monitoring and performance criteria thereto,
2. new landscape plantings,
3. managing fertiliser and irrigation inputs,
4. water sensitive urban design features within the development and areas of open space,
5. measures to enhance onsite nutrient retention, and
6. progress and compliance reporting.

This report is generally in accordance with:

- The Point Lonsdale Residential and Waterways Illustrative Masterplan (MDG, 2010)
- The Point Lonsdale Residential & Waterways Project Environment Effects State and Technical Reports Vols 1 – 4 (Stockland, 2007)
- The Minister's Assessment under the Environmental Effects Act 1978 of the Stockland Residential & Waterways Development Point Lonsdale (Jan 2009).

2. Site Overview

This section provides an overview of Point Lonsdale, including location, topography, geology, hydrology, drainage, flora and fauna.

2.1 Location

Point Lonsdale is located approximately 30km east of Geelong and 105km from Melbourne. Queenscliffe is located approximately 5km east of the site and central Point Lonsdale is approximately 1.5km to the south east.

The site is located at the entrance to the existing Point Lonsdale town and is bound to the north by the Bellarine Railway.

The site occurs within the City of Greater Geelong and the Borough of Queenscliffe.

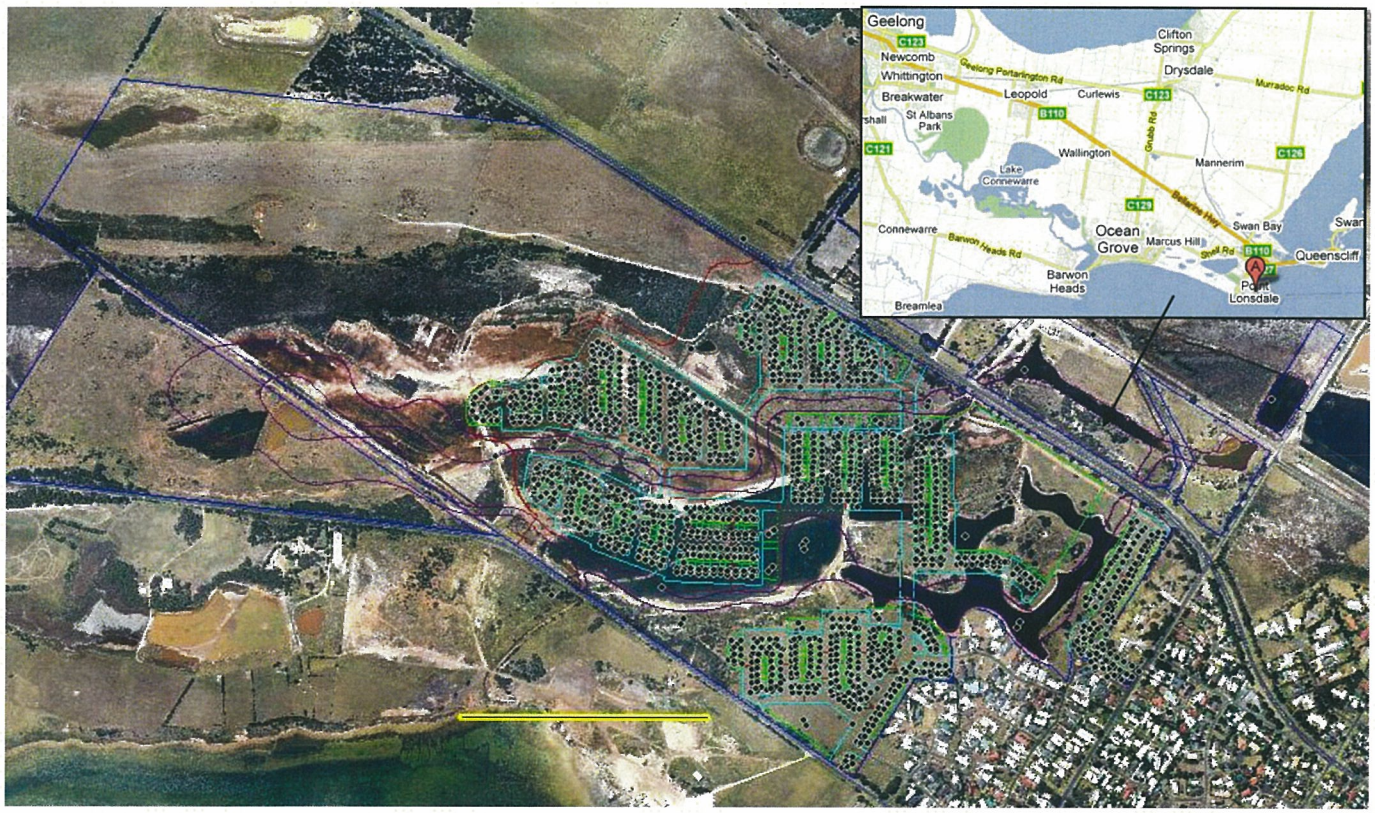


Figure 1: Point Lonsdale Development Location.

2.2 Topography

The site is situated on the northern edge of a low lying coastal plain between the ocean beach and Swan Bay and is bound by higher ground to the north and developed coast to the east. The tops of dunes running through the site range from around 4 to 8m AHD, with the areas between these dunes ranging between 0.5 to 1m AHD.

2.3 Geology

The Geological Survey of Victoria's 'Sorrento' geological map sheet (1997) indicates that the project site is located on Quaternary age deposits described as Aeolian deposits (older dune and sheet sands, siliceous aeolinite) and Swamp deposits (stream alluvium sand silt).

The swamp deposits are located in east west zones across the southern portion of the site. The Aeolian deposits occur as dune structures which separate the swamp deposits. The northwest portion of the site is underlain by outcrops of middle to upper Tertiary age Brighton Group formation; these deposits comprise fluvial gravels, sands and silts with conglomerates, siltstones and ironstones at depth in the sequence (Stockland 2007).

Soils in low lying areas comprising swamp deposits (stream alluvium and silt) display properties consistent with Acid Sulfate Soils.

2.4 Groundwater

Two aquifers exist under the site, the Quaternary Sand Aquifer and the Brighton Group Aquifer. Groundwater flow is mostly horizontal through the aquifers, with vertical flow restricted by soil and rock layers. Groundwater flow is to the south and south east, being dominated by Lake Victoria which acts as a sink during dry weather.

The recharge of both these aquifers is largely through rainfall infiltration, with minor recharge from flow from the Brighton Group Aquifer to the Quaternary Sand Aquifer.

Depth to groundwater at the site ranges between -0.3m AHD to 0.4m AHD under the Moonah vegetation and between 0.5m AHD to 1.0m AHD under the low lying wetland in the northwest of the site. Groundwater fluctuates by approximately 1m between dry and wet periods (Stockland 2007).

Water Quality results from groundwater monitoring across the site are summarised below:

- TDS concentrations in the monitoring wells range from 580mg/L to 58000mg/L.
- Groundwater in the QSA ranges from 6400mg/L to 6800mg/L and is classified as saline.
- Groundwater in the BGA reflects a marginally saline condition, ranging from 7900mg/L to 8500mg/L.
- Salinity in groundwater near the lakes was much higher, ranging from 15000mg/L to 58000mg/L.

- Copper, Nickel, Zinc concentrations in the groundwater exceed the SEPP Guidelines at a number of the monitoring locations.
- Elevated nitrate occurs in monitoring bore MW102b, however levels are still below the applicable guidelines.
- TKN levels and to a lesser extent nitrate levels were above the SEPP criteria in various monitoring bores.

2.5 Surface Water

Portions of the site have previously been used for shell grit mining, with areas excavated to depths of around 2m below the existing ground level. Some of these have been subsequently filled in; however depressions have formed across the site due to these activities. These contain pooled water forming lakes and lagoons, particularly in the central and western parts of the site. Channels have been excavated on the site to link these lakes to the sea via Lakers Cutting and to link Lake Victoria to the onsite lakes (Stockland 2007).

Water bodies that will potentially be impacted by the development are the on-site lakes, Lakers Cutting and Lake Victoria.

On site lakes
As discussed above, the current on-site lake system is highly disturbed and would require a relatively low level of aquatic ecosystem protection. Importantly, however, water quality within the lake system will need to be maintained to enhance public and aesthetic amenity, while also seeking to protect the environmental values of downstream receiving water bodies (including Port Phillip Bay).

Lakers Cutting
Lakers Cutting is a tidal water body between the on-site lakes and Swan Bay and has been classified as a slightly to moderately disturbed aquatic ecosystem. Water quality currently exceeds EPA Guidelines.

Lake Victoria
Groundwater seeping from the site has the potential to impact on water quality in Lake Victoria

Baseline surface water quality data is summarised below:

- Water salinity in onsite lakes ranges between seawater (35000 mg/L) and hypersaline (96000 mg/L) due to sea water occasionally entering from Swan Bay via Laker Cutting.
- Salinities in the surrounding water bodies range from49000 mg/L to 89000 mg/L in Victoria Lake and 35000 mg/L to 46000 mg/L in Lakers Cutting.
- Copper, nickel and zinc concentrations in Victoria Lake and copper in Lakers Cutting exceed the SEPP Guidelines for these water bodies.

- In Victoria Lake, ammonia, total nitrogen and total phosphorus occasionally exceeded the ANZWQG 2000 and SEPP Guideline values.
- In Lakers Cutting, guideline concentrations of nitrogen, oxidised nitrogen and total phosphate were exceeded.

2.5.1 Flooding

Flood modelling for the site has previously been undertaken by SKM, Water Technology Pty Ltd (2003) and Golder Associates (2007). Based on the work undertaken by Golder Associates, the current design flood level for the site is 0.9m AHD.

3. Irrigation Management

3.1 Irrigation Water Source Options

The Point Lonsdale area is supplied with water from the Queenscliffe Water Basin which is situated approximately 1km north of the proposed development. Potential water resource and servicing options include:

- Groundwater abstraction.
- Greywater/wastewater treatment and reuse.
- Rainwater tanks.
- Mains water.

3.2 Irrigation Design Philosophy

Several water conservation strategies are proposed for the development at Point Lonsdale and are listed below:

- Reduced areas of lawn and turf.
- Soil improvement.
- Waterwise plant selection.
- Mulching.
- Water efficient irrigation systems.
- Maintaining soil structure.

3.3 Water Conservation Strategies

3.3.1 Reduced areas of lawn and garden

The average lot size on the development is approximately 485m^2, with 7 super lots of 1920 m^2 each containing 7 terrace houses. The footprint of dwellings on these lots will be large with smaller lawn and garden areas. Therefore irrigation and nutrient use on these properties will also be reduced.

Householders will be encouraged to design gardens with low water demanding plants such as native species and drought tolerant grass, thereby reducing the resultant nutrient and water inputs associated with the proposed development

An analysis of the relationships between lot size (i.e. residential density), stormwater generation and irrigation demand has been previously undertaken that shows lot sizing can go a long way towards achieving a sustainable onsite water and nutrient balance (Bott and Evangelisti, 2007; Figure 2).

This work shows that the net effect of increasing lot density (or decreasing lot sizes) across an urban landscape is that:

- stormwater generation is increased;
- irrigation demand is reduced; and
- direct recharge via pervious areas remains relatively unchanged.

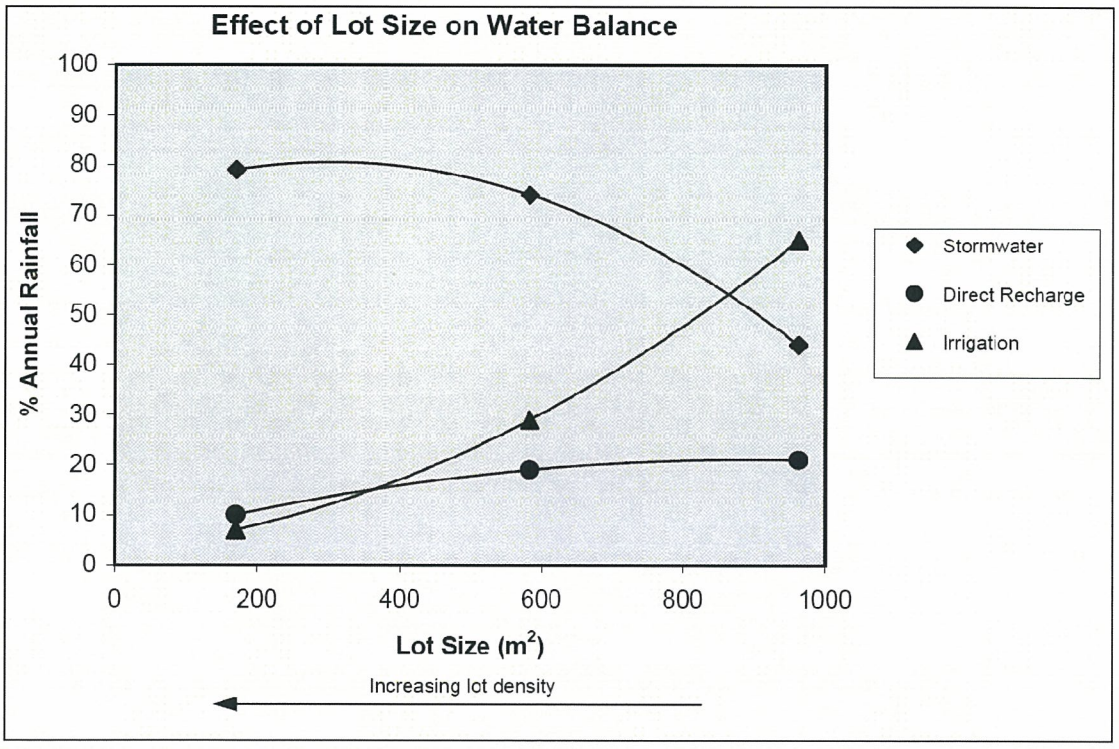


Figure 2: As lot density increases (i.e. the area of individual lots is reduced) irrigation demand declines and the volume of stormwater increases (Bott and Evangelisti, 2007)

The current understanding is that once lot sizes exceed approximately 900m^2 there is a net deficit in terms of water balance (that is, annual irrigation demand exceeds stormwater generation).

At high lot densities (that is, smaller lot sizes), stormwater generation greatly exceeds irrigation demand because of the diminishing size of irrigable areas (that is, garden

areas are reduced because the building footprint occupies a greater proportion of the lot area).

From this work the optimum average lot size to achieve an onsite water balance will generally be in the range of 300-600m^2. The proposed development falls within this range with average lot sizes of approximately 485m^2.

Higher density development are generally more suited near receiving waters of environmental significance as the post development nutrient input rates (without implementation of WSUD measures) are minimised.

3.3.2 Soil Improvement

Topsoil removed during the development process will be used to top-dress areas designated for turf and/or garden establishment prior to planting. However, it is noted that due to the prior uses of much of the site, such topsoil may be scarce in areas. Other methods of soil improvement may involve importing clean fill/soil, however this will be dependent on costs. This will substantially improve soil moisture retention particularly on the sandier soils and encourage deeper root penetration.

Soil improvement may be incorporated to a depth of 200 to 300mm in landscaped areas, in particular garden beds, which will reduce irrigation use by some 20-30% in areas of sandy and/or highly permeable soils with low soil moisture retention properties.

Soil improvement will entail the addition of organic (humic) material and/or loam within the topsoil. In addition to improving soil moisture retention, the Phosphorus Retention Index (PRI) of the topsoil will also be increased. This aspect of soil improvement is discussed further in Section 4.

3.3.3 Waterwise Plant Selection and Nursery Establishment

Home owners will be advised via the Design Essentials document prepared for the project on the principals of waterwise landscapes and suitable plants recommended for their gardens.

A native nursery will be commissioned to collect seed of locally indigenous species. This is to maximise seed quantity available for propagation, recognising that the extent of native plantings will be considerably higher than those associated with traditional urban development which rely heavily on turf establishment for areas of public open space.

Once the seed bank has been established, it will be upgraded each season with the emergence of new seeds, seedlings or species for the life of the development and staging process.

The above approach will ensure a comprehensive collection of locally indigenous seed and advanced plant material is available at the time of development to assist with the rehabilitation of wetland and foreshore areas (and their buffers) and, more generally, for landscaping of public open space and lot-level garden plantings throughout the development.

Plant lists are provided in the Design Essentials document and the Landscape Masterplan which identifies species suitable for the various landscaping sub-elements within the development and is based on previous flora surveys of the site. Detailed landscape plans will be prepared for streetscapes and public open space for each stage of the development and will provide details regarding species selection and planting densities.

3.3.4 Mulching

The use of mulch is a widely accepted component within the Water Wise garden theme which reduces moisture evaporation and limits weed growth.

Most landscape treatments will include a 50mm thick organic, composted fine mulch. If mulch is to be imported to the site it will be Australian Standard Certified and comprise recycled crushed, composted green waste and be free of disease.

Where appropriate to do so, onsite vegetation that cannot be retained during development of Point Lonsdale will be chipped and/or mulched for reuse within landscaped areas.

3.3.5 Water Efficient Irrigation Systems

Best Practice Irrigation Technologies

Efficient methods of irrigation not only lower water, power and maintenance costs, but also minimise fertiliser leaching. It is proposed to utilise innovative irrigation technologies based on the latest 'Best Practice Guidelines for Urban Irrigation' according to the Irrigation Association of Australia. This will aid delivery of a well-controlled and effective irrigation regime throughout the development for those areas that require irrigation. Following are some of the technologies that will be applied to this development:

- soil moisture sensors calibrated to seasonal water requirements of local vegetation ;

- in-line drip irrigation strategies for low maintenance areas and subterranean irrigation (where appropriate) to provided direct delivery to plant roots; and
- landscape hydro-zoning to minimise water demand and wastage.

Hydro-zoning principles will be applied to landscaping treatments for public open spaces. This means plants will be grouped and zoned according to their specific watering needs (that is, higher-water-demanding plants will not be planted within a group of lower-water-demand plants), thereby improving irrigation efficiencies and water savings.

3.4 Water Consumption Targets

An irrigation schedule has been developed (Table 1) based upon the Landscape Masterplan (Appendix A, extract). This is based upon an irrigation season spanning November to March each year and concludes that some 63 kL will be required to meet all irrigation requirements (households plus public open space) across the development. This comprises a total estimated area of irrigation of 9.4 hectares.

The initial irrigation requirements can be expected to be greater than 63 kL due to plant establishment demands and native vegetation restoration works in the initial years of development. Once plant establishment has occurred, the above irrigation requirements will largely be constrained to areas of irrigated turf and residential gardens.

Table 1: Irrigation schedule

% of April incl in season	0%		Month	Jan	Feb	Mar	Apr	May	Sep	Oct	Nov	Dec	Season
% of Sept incl in season	0%		MDE	7.5	7.2	5.3	3.7	2.3	3.2	4.6	5.7	6.7	4.3
Irrigation season (wks)	30.3		#days	31	28	30	0	0	0	0	30	31	**150**
			MME	232.5	201.6	159	0	0	0	0	171	207.7	**971.8**
Irrigation Type	**m^2**	**SC**	**ET%**	**KILOLITRES (kL)**									
POS irrigated Turf	4,278	1.2	**50%**	597	517	408	0	0	0	0	439	533	**2,494**
POS Garden Native	560,000	0	**30%**	0	0	0	0	0	0	0	0	0	**0**
childcare turf	210	1.2	**60%**	35	30	24	0	0	0	0	26	31	**147**
child care Natives	140	0	**30%**	0	0	0	0	0	0	0	0	0	**0**
aged care turf	1,200	1.2	**60%**	201	174	137	0	0	0	0	148	179	**840**
aged care natives	800	0	**30%**	0	0	0	0	0	0	0	0	0	**0**
Verges	15,000	1.2	**50%**	2,093	1,814	1,431	0	0	0	0	1,539	1,869	**8,746**
Turf - residential	72,644	1.2	**60%**	12,161	10,544	8,316	0	0	0	0	8,944	10,863	**50,829**
native-residential	72,644	0	**30%**	0	0	0	0	0	0	0	0	0	**0**
Turf - super lots	386	1.2	**60%**	65	56	44	0	0	0	0	48	58	**270**
native - super lots	386	0	**30%**	0	0	0	0	0	0	0	0	0	**0**
Total Equivalent area (m^2)	**727,688**	**TOTALS -------->**		15,151	13,137	10,361	0	0	0	0	11,143	13,534	63,326

MDE=mean daily evaporation, MME=mean monthly evaporation, SC=scheduling coefficient, ET%=evapotranspiration. *Evaporation data from Laverton Station
Total irrigable area = 9.4 hectares

3.4.1 Alternative Lot Level Supply

Buildings provided with rainwater tanks will be plumbed to capture 100% of the roof area run off. This water can be used for toilet flushing and other suitable indoor uses as well as garden irrigation. If tanks are used, it has been suggested that they be sized at 3KL/100m^2.

As sized, the rainwater tanks would reduce potable water supply demand by about 1.06ML/yr, this is approximately 65% of the estimated mean annual demand per lot. No recycled water supply is to be connected to the development.

4. Nutrient Management

The overarching outcomes of this Nutrient and Irrigation Management Strategy are to provide guidance for the staged development of Point Lonsdale:

- To protect water quality within the lakes and surrounding area;
- To enhance riparian values and functions and corridor linkages through linking on site lakes; and
- To enhance walkability and visual and recreational amenity.

The following section outlines strategies to:

- reduce nutrient inputs to the site in the first instance;
- promote onsite retention of nutrients (in particular, phosphorus) through the judicious use of soil amendment; and
- attenuate offsite nutrient losses through a Drainage and Stormwater Management Plan (Neil Craigie, 2010) which embodies appropriate Water Sensitive Urban Design (WSUD) techniques.

4.1 Land Use Change and Nutrient Budget

The following design elements have been incorporated within the development to minimise both irrigation and fertiliser use:

- increased lot densities within the development in order to significantly reduce the areas that require irrigation and nutrient applications;
- retention and protection of native vegetation where practicable; and
- establishing riparian habitat around on-site lakes.

Nutrient load reduction targets for the development are shown in Table 2 (Stockland 2007). These reductions signify the difference between the use of WSUD considerations (as proposed) versus a conventional (non-WSUD) drainage system.

Table 2: Nutrient reduction targets for Point Lonsdale

	Total Suspended Solids (mg/L)	Total Nitrogen (mg/L)	Total Phosphorous (mg/L)
Annual load reduction target using WSUD	80%	45%	45%

An indicative nutrient budget for the site has been prepared (Table 3) and is premised upon the Landscape Masterplan (MDG, 2010; extract presented in Appendix A). Using this budget, the average phosphorus application across the entire site is predicted to be 2.28kg/ha with an average nitrogen application rate 6.85kg/ha.

It is important to note that the water balance and nutrient budget contained in this report apply to the whole estate pre- and post-urban development. These budgets have been used as the basis for management of water quality impacts on receiving environments and provide surety that in applying best management landscaping practices to future stages of the estate, attainment of the stated water quality objectives will not be prejudiced.

Table 3: Nutrient Budget

Land use	Area (ha)	% Total area	Post-development		
			Areal Inputs (t/yr)		
			Area fertilised (ha)	P (13 kg P/ha/yr)	N (30 kg N/ha/yr)
Public Open Space	124.0	88%			
Irrigated turf (Active POS)	20.0	14%	20	0.3	0.6
Wetlands, lake system, foreshore reserves, native vegetation etc	18.0	13%	0	0	0
Native Mass Plantings^	86.0	61%	0	0	0
super lots	0.1	0%			
Irrigated Gardens	0.03	0%	0.03	0.0004	0.001
Native Gardens^	0.03	0%	0.03	0.0003^	0.001^
residential	14.5	10%			
Irrigated Gardens	7.3	5%	7.3	0.09	0.218
Native Gardens^	7.3	5%	7.3	0.07^	0.334^
childcare	0.03	0%			
Irrigated Gardens	0.02	0%	0.02	0.0003	0.001
Native Gardens^	0.01	0%	0.01	0.0001^	0.000^
aged care	0.2	0%			
Irrigated Gardens	0.1	0%	0.1	0.0015	0.004
Native Gardens^	0.1	0%	0.1	0.0008^	0.004^
Verge	1.5	1%			
Irrigated	1.5	1%	1.5	0.02	0.045
Total	**140.3**	**100%**	**36**	**0.4**	**1.2**

Notes: * Slow release osmocote used for establishment only ^ Recommended use for establishment is 20g/m2 at 5%P & 23%N

4.2 Integrating Water Sensitive Urban Design (WSUD) Elements

The Environmental Effects Statement (Stockland, 2007) identified the need for an increased focus on total water cycle management and Water Sensitive Urban Design (WSUD) to improve the management of stormwater, particularly nutrients, and increase the efficiency of the use of water. Total water cycle management supported by WSUD is generally recognised as the most effective way to manage water resources in an urban development context.

The application of WSUD techniques, tailored to the geomorphology and nutrient transport mechanisms specific to a site, afford an additional opportunity to attenuate nutrient export and reduce the risk of adverse water quality impacts arising from urban development and secure and protect existing remnant vegetation, wetland and riparian habitats.

Effective management of nutrient export from any site typically necessitates that a 'Treatment Train' approach be adopted. This refers to the process of sequencing non-structural and structural design elements to maximise their effectiveness for the purpose of achieving water quality and flow design objectives.

Figure 3 summarises the sequencing of specific structural elements within the 'Treatment Train' as identified within the Drainage and Stormwater Management Plan (Neil Craigie, 2010) prepared for the site.

The following strategies have been identified to minimise offsite nutrient losses:

- the use of phosphorus-free nitrogenous fertilisers and slow-release phosphate fertilisers (see Section 5.1);
- reducing nutrient and irrigation demand by minimising the area (hectares) of active recreation, turf and residential gardens within the development;
- the use of fertiliser trial 'test-strips' to determine optimal plant biomass/nutrient response curves for turf areas;
- plant sap testing to ensure fertiliser applications are tailored to meet plant growth requirements, thereby minimising excessive nutrient application and reducing the availability of surplus nutrient for offsite nutrient loss; and
- soil amendment of biofiltration swales to enhance their phosphorus retention capacity.

Limited soil nutrient testing will be undertaken in order to calibrate the relationships between fertiliser application rate, soil storage and the plant growth/biomass response curve to determine maintenance treatments for turf areas.

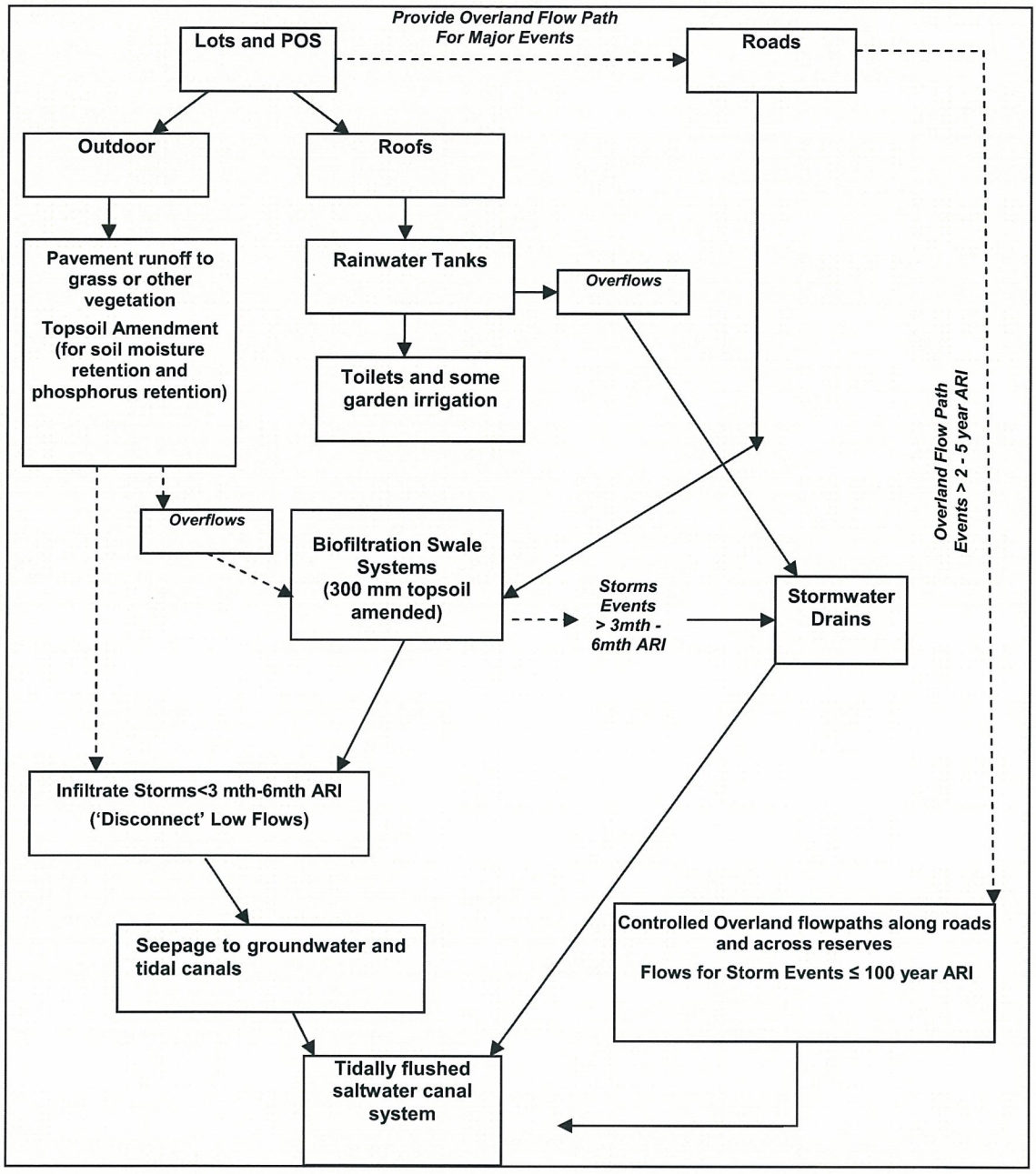


Figure 3: Proposed stormwater management system for Point Lonsdale development (after Craigie, 2010).

It is important to note that design considerations for specific WSUD elements will be provided within the Project Environmental Management Plan (PEMP) which will also provide the mechanism to monitor, manage and report to Council on issues relating to nutrient and irrigation management.

Final designs will be subject to detailed modelling and drainage design prepared for each future stage of development and lodged with the appropriate subdivision application.

4.2.1 Improving Onsite PRI

The Phosphorus Retention Index (PRI) is a commonly used laboratory-based measure of the potential for a soil to adsorb and bind phosphorus (rendering it immobile and unable to run-off to waterways). The low PRI and high permeability of the native soils at Point Lonsdale raises the potential for increased phosphorus leaching associated with the proposed development:

For a significant portion of the site, the depth to groundwater is insufficient for onsite infiltration and it has been proposed to transport fill from within the site to meet this drainage need.

The use of soil amendment is a commonly used practice to reduce contaminants at source and to promote onsite infiltration. This involved blending imported soils with the native soils to yield a topsoil with a moderate to high PRI (PRI >15). It is important, however, to ensure that soil permeability can be maintained at >1m/day in order to allow onsite infiltration to occur. The blending ratio of soil amendment/native soils is dependent upon the PRI of both materials, however, generally it is expected that to yield a topsoil of PRI>15 will require about 5-10% amending material by volume to a depth of 200-300mm.

A similar strategy is proposed for enhancing the PRI of biofiltration swales, whilst retaining suitable permeability for subsoil drainage functionality.

4.2.2 Biofiltration Swales

Vegetated swales are commonly used to infiltrate and convey stormwater in lieu of pipes and to provide for removal of coarse and medium sediment and are often combined with buffer strips.

It is proposed to replace traditional grassed 'swales' within the development with 'naturalised' biofiltration swales, integrated with underground pipes and pits so that water quality treatment performance is achieved whilst normal minor drainage system hydraulic performance standards are ensured. These modified swale systems will effectively remove gross pollutants, sediments, metals and nutrients from the surface runoff and provide the following design elements and functionality:

- Like traditional swales, the biofiltration swales will be vegetated but with indigenous perennial grasses, sedges and shrub species tolerant of seasonal and extended drying periods. The high infiltration capacity of in-situ sands very effectively drains waters entering the swales so that it is necessary to add/amend surface soils to about 300 mm depth to mitigate infiltration drainage rates and add more organic content to support sustainable plant growth. It is the combination of plant growth and controlled infiltration rates that promotes biofiltration and nutrient uptake and eliminates the need for irrigation and

fertiliser use in drainage lines. In conjunction with the porous underlying sands, these features also effectively mitigate any potential nuisance issues associated with standing water (such as mosquitoes);

- Provides flood storage such that the biofiltration swales will retain events <1:3 months which will suffice for effective water quality treatment of >95% of all flows. Larger events will overtop grille pits selectively located along the swales and enter the associated secondary piped stormwater conveyance system and thence be conveyed to the tidal canals. This integrated system provides equivalent minor drainage system performance to that in any conventional residential development.

  Overland flows in excess of the minor drainage system capacity will be conveyed along the road reserves and out to the tidal canal without posing any threat to residential lot areas or creating any safety hazard to traffic or pedestrians. Again this major drainage system operates exactly the same as in any conventional residential subdivision.
- Like the swales, the balance of the pervious areas of the development will also incorporate a layer of amended soil to increase the soil Phosphorus Retention Index of the in-situ sands to maximise infiltration and treatment of water before runoff reaches the swale drainage systems.

  Roofwater from all housing will be directed to raintanks with water reused for toilet flushing and other appropriate internal and external uses so that demand for external potable water supply is also effectively minimised.

  Overflows from raintanks will be directly connected to the underground pipes and hence the tidal canal. This minimises the water volumes entering the treatment swales so that treatment efficiency is maximised for the pollutants of most concern which are those generated with runoff from road pavements and surrounds.
- Biofiltration swales will be designed to be 'softened' to present a natural and aesthetically pleasing form that incorporates native vegetation to blend with the local landscape.

  The alignment of biofiltration swales will be tailored to each site to minimise the disturbance to existing mature trees where practicable.

  Biofiltration swales will be used in combination with perimeter roads to effectively separate residential properties from the tidal canal system and open space areas. The use of boundary roads not only facilitates stormwater management but also emergency vehicle access in case of fire (as well as other design objectives).

These conceptual designs have been validated as part of the overall stormwater drainage strategy for the development. However, for application they remain subject to detailed design which will be provided in a Drainage and Structure Management Plan for each stage of development.

Routine operation and maintenance tasks for the drainage system will include the following items:

- Periodic clearing and removal of windblown and waterborne gross pollutants to maintain the visual appeal and functional operation of the water quality treatment system;
- Bi-annual health evaluation of the vegetation in and around the swales, with trimming of same, weed treatment, and removal/replacement of any dead or diseased plants; and
- periodic checks to pick up and identify any issues of potential inadequate infiltration capacity (as would be indicated by a patch of standing water), with corrective measures to be implemented as appropriate to maintain treatment efficiency and protection against mosquitoes.

It is important to note that the Project Environmental Management Plan (PEMP) will provide the mechanism to monitor, manage and report to Council on issues relating to management of the biofiltration swales.

4.2.3 Lake System

It is proposed to link the existing lakes on the site to create a Tidal Lake System as depicted in Figure 4 below.

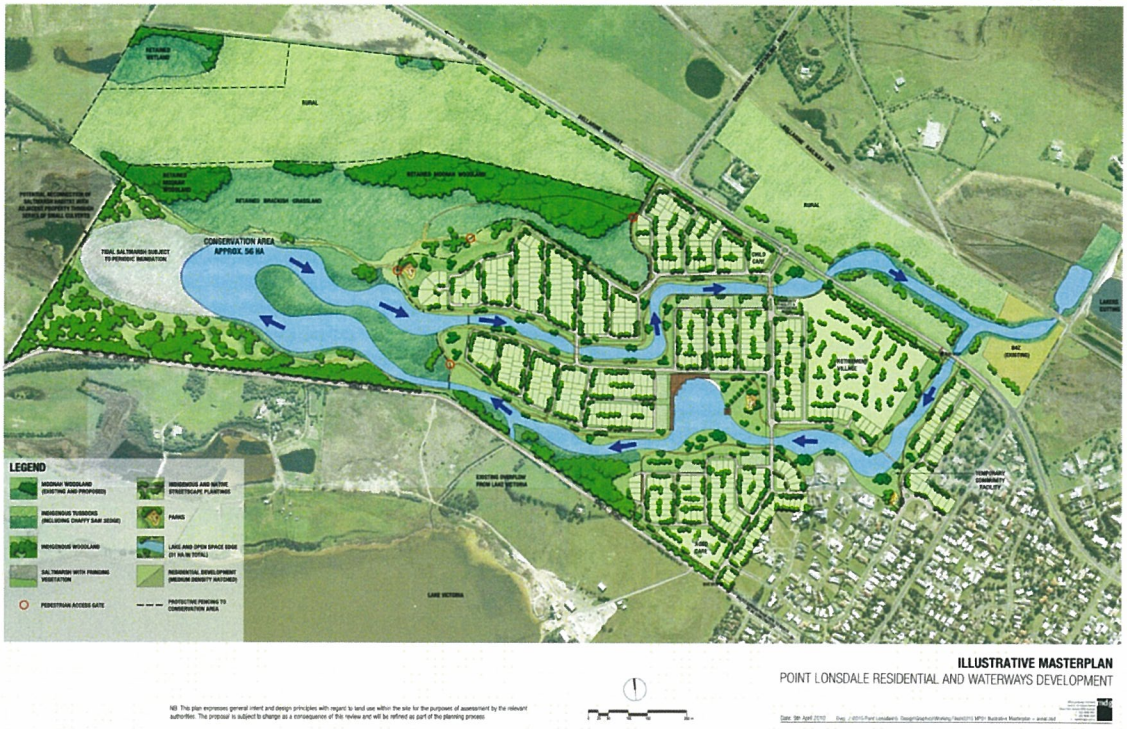


Figure 4: Vegetation densities within the constructed 'tidal lake system' will need to provide floodway passage for high flows within a meandering channel.

A typical cross-section for a Tidal lake system consists of grassed swales with 1:8 side slopes. However, it is believed that an alternative swale design and cross-section will be acceptable if the design objectives for the Master Plan and general design objectives in accordance with Australian Rainfall and Runoff (2001) can be achieved.

Fringing/floodplain habitats offer feeding, reproduction, and refuge habitat for invertebrates, fish, waterfowl, amphibians, birds, and mammals. In addition, they also have a significant influence on in-stream habitat. Depending on the type, extent, and density of fringing vegetation, 'tidal lake systems' can be designed to provide the following critical functions, even if they never come in contact with floodwater:

- improve water quality. Riparian vegetation retains sediment and pollutants from overland flow and during flood events, and increases the uptake, storage and release of nutrients into and out of the aquatic environment.
- enhance ecological connectivity and linkages.
- retain water during storm events and release it slowly over time, providing longer-term base flow contributions
- stabilize stream banks and control erosion and sedimentation
- provide a source of woody organic material to the stream, which can act as sediment storage areas, provide cover and refuge habitat for fish and other aquatic organisms, and create or improve the quality of pools, riffles, backwater, and off-channel habitat
- provide near-bank cover and stabilisation of fill batters.

When fringing areas are accessible to floodwater, they have the additional benefits of reducing the depth of in-stream flow during high-flow events, thereby lowering the sediment carrying capacity of the stream (and, in turn, bed and bank erosion).

Construction of the 'tidal lake system' will require the acquisition and procurement of large amounts of plant material. Local stocks of native plants will be best suited to site conditions. Some of the required plant materials may be salvaged from adjacent healthy donor sites near the project area or propagated from local plant material. In either case, source material will be carefully researched to ensure it was legally and responsibly collected (that is, material has not been obtained from protected wetlands), and that material is disease-free and suited to local site conditions.

Successful planting requires sufficient planning, site evaluation, monitoring, and maintenance to ensure that long-term goals are met. Plant materials must be carefully selected with regard to site conditions and constraints (Figure 5).

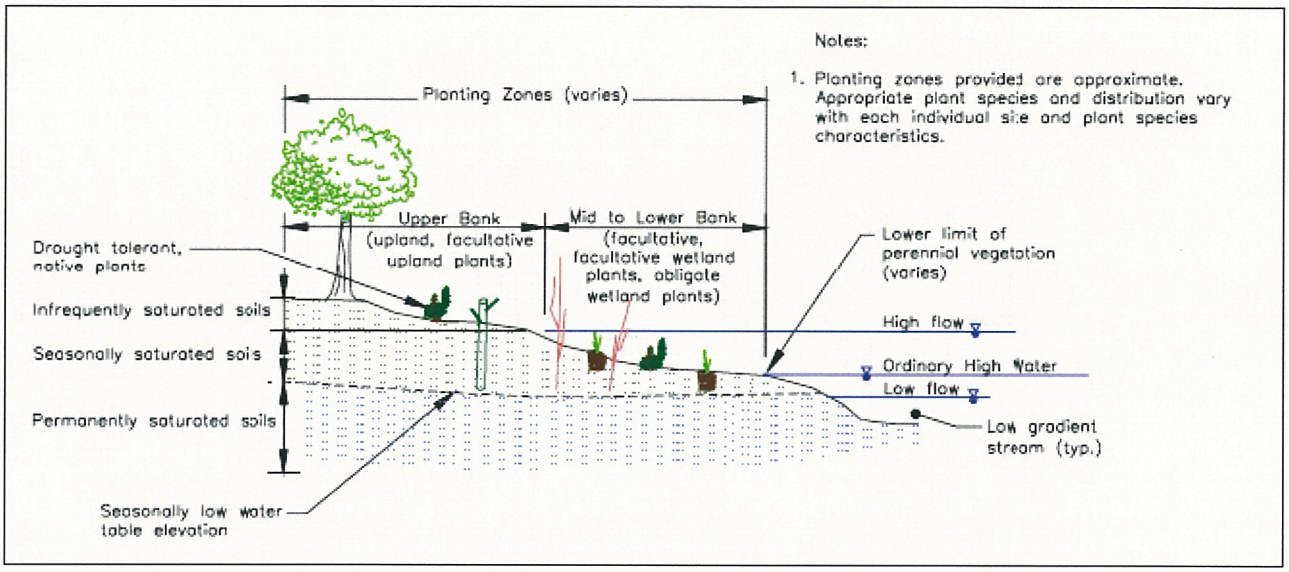


Figure 5: Hydrology-based planting regimes for 'tidal lake systems'

The list of steps below is the recommended sequence for planning creation of fringing habitats:

- conduct a site review including nearby hydrological, ecological and morphological (stream) analogues and desired future condition;
- identify site constraints;
- identify needed weed and land management requirements;
- develop ecological and hydrological design and interface with subsoil drainage system;
- select plant species;
- select plant-material types (e.g., woody, herbaceous, bare-root, seed, potted);
- determine planting density and layout;
- schedule timing of plantings (to minimise erosion and achieve planting success);
- consider site-preparation requirements;
- determine planting techniques; and
- define monitoring, reporting and maintenance procedures

4.3 Monitoring

Monitoring will be undertaken quarterly, with annual reporting to City of Greater Geelong for a period of no less than 2 years post development for each stage of development (to coincide with the landscaping maintenance period).

A preliminary water quality management plan has been prepared for the Point Lonsdale development, the objectives of this plan will be to ensure:

- Surface and groundwater quality within the development meets water quality objectives; and
- That the performance of the drainage system regarding biofiltration and offsite nutrient discharge is acceptable.
- The project achieves and sustains demonstrable compliance with the State Environmental Protection Policy (Waters of Victoria) and State Environmental Protection Policy (Groundwaters of Victoria).

The objectives for water quality will be achieved by monitoring at key points along the stormwater treatment train within the development to demonstrate their correct functioning. The stormwater treatment train includes structural and non-structural Best Management Practices implemented in parallel or sequence to achieve best practice stormwater management.

The monitoring program will focus on monitoring discharge and nutrient loads from the development post-urbanisation (Table 4).

A final water quality management plan will be developed and submitted to the Commonwealth Department of Environment Water Heritage and the Arts (DEWHA) for approval once the 2nd round of baseline water quality monitoring program has been completed, in late 2010.

Table 4: Surface Water Monitoring Schedule

Monitoring	Flow	Water Level	Frequency	Duration	Analytes
Biofiltration swale (outlet)	✓	✓	Continuous flow/ water level Opportunistic water quality	2 years	TDS, pH, TP, FRP, NH_3-N, NO_3-N, TN
Tidal lake system	✓	✓	Continuous flow/water level. Automated flow proportional water sample	2 years	TDS, pH, TP, FRP, NH_3-N, NO_3-N, TN

Opportunistic sampling of discharge from the biofiltration swales will be undertaken to gauge effectiveness of the nutrient attenuation and subsoil drainage system.

5. Landscape Master Plan

A Landscaping MasterPlan (MDG 2010) for the development has been prepared detailing plantings schemes with the aim of improving the visual amenity and maximising natural ecological and hydrological functions within the site.

The need to integrate irrigation demand, nutrient and fertiliser usage, weed and fire management, public access, walkability, visual amenity and drainage design to meet ecological and hydrological objectives is recognised.

5.1 Fertiliser Formulations

The following is indicative of the preferred fertiliser formulations to be used within various Public Open Space areas within the Point Lonsdale development.

5.1.1 Planted Areas

Fertiliser requirements during the planting and establishment phase of planted native areas will be limited to the use of slow release fertilisers with low phosphate content as per the following specifications:

DESCRIPTION:	Fertiliser Plant Pills
STORAGE:	Store in a dry area away from dust and extreme temperatures.
CHEMICAL COMPOSITION	
Total Nitrogen (N)	8.3%
Total Phosphorus (P)	5.0%
Total Potassium (K)	10.0%
Sulphur (S)	4.6%

Maintenance of vegetation post-establishment will be based on seasonal uptake and will be monitored on a 6 monthly basis for the duration of the establishment period (24 months). Slow release fertiliser applications will be made only on an 'as-required' basis in a single annual application – it is not envisaged that fertiliser application will be necessary following the initial slow-release application at the time of planting.

5.1.2 Turfed Areas

Fertiliser requirements during the establishment and growing phases of turfed areas will be limited to the use of granulated fertilisers with a zero phosphate content and containing an NPK profile equivalent to the following specifications:

PRODUCT: BAILEYS TRISTAR GRANULATED	
DESCRIPTION:	Light brown granulated fertiliser
CHEMICAL COMPOSITION	SPECIFICATION
Total Nitrogen (N)	8.2%
Total Phosphorus (P)	0%
Total Potassium (K)	16.5%
Iron (Fe)	1.0%
Magnesium (Mg)	1.6%

5.1.3 Roles and Responsibilities

Table 5 defines the responsibility for ensuring the items relating to fertiliser application and nutrient runoff are actioned.

Table 5: Fertiliser application and nutrient control responsibilities

Item	Timing	Responsibility
Fertiliser application rates	Pre and post development	Contractor construction superintendent, Developer
Storm water management, landscaping and vegetation management, are designed and constructed in such a way as to minimise the potential for nutrient build-up and eutrophication	Pre development and during-construction	Contractor construction superintendent
Water quality monitoring program	Pre and post development	Developer, Council
Education of residents in correct fertiliser application rate and native vegetation options	Post development	Developer, Council

6. References

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Appendix A

Landscape Masterplan



ILLUSTRATIVE MASTERPLAN

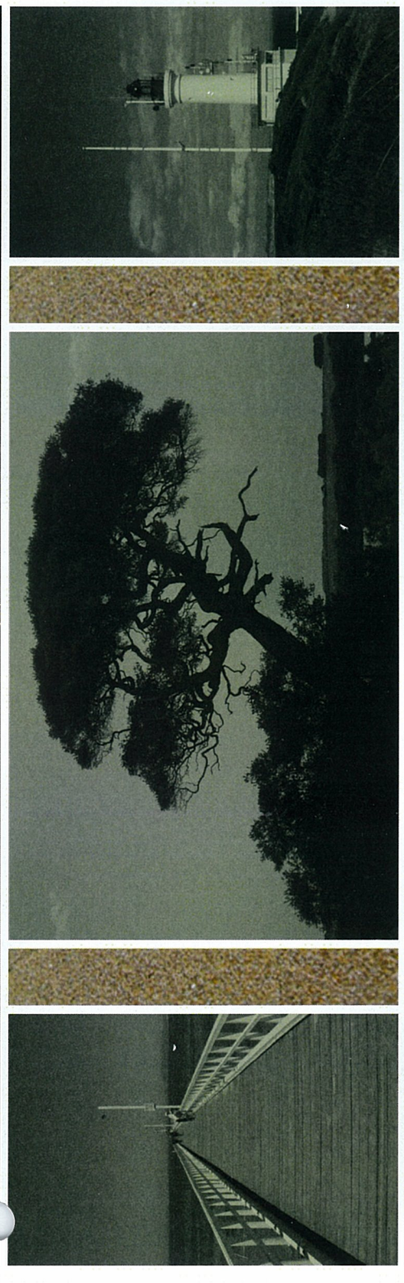
POINT LONSDALE RESIDENTIAL AND WATERWAYS DEVELOPMENT

NB: This plan expresses general intent and design principles with regard to land use within the site for the purposes of assessment by the relevant authorities. The proposal is subject to change as a consequence of this review and will be refined as part of the planning process.

Date: October 2010 Dwg: J:\0715 Point Lonsdale\...

APPENDIX M STORMWATER DRAINAGE MASTERPLAN





THE POINT

AT POINT LONSDALE

Stockland

Point Lonsdale

Neil M Craigie Pty Ltd
ACN 074 582 282 ABN 29 074 582 282

Waterway Management Consultants

STOCKLAND

POINT LONSDALE RESIDENTIAL AND WATERWAYS PROJECT

STORMWATER DRAINAGE MASTERPLAN

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Signature
17.3.11
Date

FOR: WATSONS PTY LTD

20 November 2010 (Version 7)

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1. Introduction

This Stormwater Drainage Masterplan (SWDMP) has been prepared as part of the planning submission for a development plan approval from the City of Greater Geelong. It relates to land owned by Stockland which is known as the Point Lonsdale Residential and Waterways Project. It will be a residential community aligned around a tidal waterway system.

This masterplan/report is generally in accordance with:

- The Point Lonsdale Residential and Waterways Illustrative Masterplan in Clause 4.0;
- The Point Lonsdale Residential & Waterways project Environment Effects State and Technical Reports Vols. 1 – 4 (Nov 2007);
- The Minister's Assessment under the Environmental Effects Act 1978 of the Stockland Residential & Waterways Development Point Lonsdale (Jan 2009).

The SWDMP covers drainage requirements including water quality issues, external catchments, downstream properties, internal pipeline alignments and 100 year overland flow paths and construction phase activities.

This report is not concerned with consideration of (a) major upstream catchments draining into and determining final flood levels around the tidal waterway, or (b) design and operation of the tidal control system.

Further detail in relation to detail drainage design will provided as part of the discharge of Condition 11 of Planning Permit 673/2007.

2. The Site

The Point Lonsdale Residential and Waterways Project site is located between Bellarine Highway and Shell Road on the north western edge of Point Lonsdale. The land drains generally north easterly towards Swan Bay.

Figure 1 shows the subdivision concept and staging plan and the alignment and area of the reserve containing the proposed open tidal waterway system through the estate. A total of 42.26 ha of new residential land is proposed in Stages 1-14C inclusive (roads 16.12 ha, lots 26.10 ha), plus 8.0 ha for a retirement village and aged care facility. The large reserves for the tidal waterway and other uses are additional to these development areas.

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An existing subdivision in the southwest corner of the land (Peterho Boulevard, Lakes Entrance, Silver Ridge Road) was established as part of the original Lonsdale Lakes development in the late 1980's. As part of the Planning Permit, drainage from that existing development is to be considered as part of the overall new residential development with water quality treatment works to be retrofitted.

3. External Catchments

From the viewpoint of the drainage systems required to serve the proposed residential subdivision in the Point Lonsdale Residential and Waterways Project there are no external catchments. All new lots will drain to the new tidal waterway system, in similar fashion to other "canal" estates such as Patterson Lakes.

Drainage from the original Lonsdale Lakes subdivision (15.4 ha) forms part of the catchment to the tidal waterway and is piped to an existing 1050 mm diameter outfall adjacent to the roundabout at the intersection of Peterho Boulevard and Lakes Entrance Drive. The permit requires some retrofitting of water quality to this existing development. This is discussed in Section 6.

4. Major Flood Levels

As part of the Point Lonsdale Residential and Waterways Project EES process, flooding regimes applicable to the subject land were agreed with the responsible authorities (City of Greater Geelong-CoGG, and Corangamite Catchment Management Authority-CCMA).

Under existing climate conditions the 100 year ARI level is agreed to be 0.90 m AHD with mean high tide level of 0.20 m AHD. In regard to future climate change impacts and sea level rise scenarios, an allowance of 0.80 m in mean sea level is to be catered for up to the year 2100. Hence at 2100 the estimated mean high tide level will be 1.00 m AHD. The agreed 100 year ARI flood level at 2100 is 1.65 m AHD.

These flood level constraints have resulted in a set of standard minimum development levels across all parts of the new residential areas as follows:

- Minimum road levels of 1.50 m AHD;
- Minimum lot levels on street frontages of 2.00 m AHD;
- Minimum floor levels of 2.35 m AHD.

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5. Main drainage systems

5.1 Streetscape Form and Design

To minimize earthworks volumes and to take best advantage of the sandy deep soils across the site a standard design approach has been adopted to street cross-sectional and longitudinal levels.

The typical street in the Point Lonsdale Residential and Waterways Project is up to 18 m wide with two-way crossfall pavement 5.5 m wide plus a 1.5 m wide footpath on one side. Landscape architecture intent is to create a rural streetscape throughout the development with no kerb and channel. Swale drains should flank the pavement on both sides with indigenous vegetation species or other species as approved by CoGG to be used.

Geotechnical advice is that hydraulic conductivity of the insitu sandy soils is not less than 800 mm/hr. This allows the swale drains to be designed as linear bioretention systems without the need for under-drainage capacity to be provided in the form of slotted AG pipes and transition/drainage layers.

Figure 2 (sheets 1 and 2) shows how the landscape design intent has been interpreted with the swale drains to create the proposed drainage solution, using a 16 m width road reserve. With the 18 m wide streets additional space is available and can be used to vary batter slopes and/or alignment of the swales.

In essence the design approach for the main cut/fill areas for the Stage 7A-13B areas is based on minimising earthworks quantities by setting the roads dead flat along the centreline with two-way crossfalls into flanking swales providing the drainage mechanism.

Details are as follows:

- Pavement edge and centreline levels to be set at 1.80 and 1.90 m AHD respectively throughout these parts of the development (hence pavement crossfall to average 3.6%);

- Pavements to shed uniformly into flanking bioretention swales having 300 mm base width and invert at 1.55 m AHD throughout;

- Bioretention filter media to have hydraulic conductivity of 180-200 mm/hr, to be not less than 300 mm in depth, and with insitu subsoils providing all under-drainage infiltration capacity (800 mm/hr);

- All swales to be planted and landscaped with indigenous grasses and sedges, or other species as approved by CoGG. Selected indigenous shrubs and trees to be used as required for landscape effect;

Where grade exists (or is to be created by earthworks) to provide positive one-way fall towards the tidal waterways, such as in Stages 2A-5 (south) and Stages 6A-14C inclusive (north), then the concept is adjusted accordingly by tilting to provide the required fall towards the tidal waterways.

Whilst the bioretention/infiltration swale systems will effectively deal with day-to-day drainage conditions, they cannot be expected to cope with high intensity rainfall events. To ensure that the drainage standard provided to the new development complies with normal 5 year Average Recurrence Interval (ARI) drainage standards, a 300 mm (nominal) diameter pipe system is also to be provided in the streetscape with pits located so as to provide backup drainage capacity in the trapped swale depressions between all driveways and road/footpath intersections. The 600*600 mm pits are set with grille covers at levels of 1.70 m AHD to maintain 150 mm extended detention depth for the bioretention systems whilst retaining 100 mm overflow depth prior to flooding of pavement edge/driveway areas.

Figure 3 illustrates by way of typical example using Stage 13A and 13B, the intended layout of primary 5 year ARI capacity piped drainage systems and swales, having regard to driveway, road pavement and footpath constraints.

The swales on the tidal waterway reserve lot frontages are considered separately from the balance swales. The reserve frontage swales receive drainage runoff from just 50% of the road reserve and have no overflow connection to the pipe system. If surcharged these swales will shed water uniformly towards the tidal waterway along crest level of 1.70 m AHD.

5.2 Rainwater Tanks

All buildings are to be provided with rainwater tanks plumbed to capture 100% of roof area. The water is to be used for toilet flushing and other suitable internal uses, plus external uses including garden irrigation. No recycled water supply is to be connected to the estate.

The tanks are to be sized at 3 KL/100 m^2 roof area with 100% of the roof area being captured.

The rainwater tank overflows from all lots are to be connected directly to the pits on the 300 mm drainage pipes.

No other surface drainage from lot areas is to be connected to the pipes-all such drainage must pass to the swale systems.

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5.3 5 Year ARI Drainage Capacity

The 300 mm diameter pipe size is selected as the default minimum having regard to Council standards, catchment sizes, and practical maintenance considerations now and well into the future. At 1 in 200 slope the on-grade capacity of each is 70 l/s which exceeds the 5 year ARI peak runoff rate for 1 ha of residential catchment (67 l/s). Each 600*600 mm grille pit has inlet capacity of at least 65 l/s at 100 mm overflow depth, assuming 50% blockage.

Using Stage 13 A as an example again the catchment captured by the pipe drainage system is 1.11 ha for which 5 year ARI peak flow is about 75 l/s and 100 year ARI peak flow is about 185 l/s. Two pipes are provided serving about 50% of the catchment each so 300 mm diameter is well in excess of requirements. There are up to 15 pits required which equates to inlet capacity of almost 1 m^3/s assuming 50% blockage.

Hence the 300 mm diameter pipe system with grille pits will ensure 5 year ARI capacity standard is provided at swale pondage levels just below pavement edge levels, as is required.

5.4 High Flow Capacity

For short duration high intensity rainfall events, peak rates of runoff will occur from the small residential catchments without significant response by way of water level rise in the large tidal waterway system.

Under such circumstances the street network is designed to shed the water out to the tidal waterway reserves, with flood level in the street governed by the rate of discharge across the confining control perimeter road crest level (1.90 m AHD).

Assuming free overflow conditions across the reserve the hydraulic capacity of the Stage 13 A internal road can determined for ponded level 300 mm below floor levels (2.05 m AHD=0.15 m effective head) using the weir equation with coefficient 1.5 and effective minimum width of 16 m. Peak outflow rate = 1.49 m^3/s at each end. The peak 100 year ARI discharge from the catchment is about one order of magnitude lower so minimum freeboard of 300 mm will always be maintained against flood levels arising from local catchment runoff.

Lots fronting the perimeter roads (the crests of which are set uniformly at 1.90 m AHD) are fully protected against flooding.

The concept drainage arrangement for Stage 13A and 13B on Figure 3 shows the overland flow pathways.

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Figure 4 indicates the overall overland flow and pipe network to be created in the estate.

Where one-way longitudinal fall is provided towards the tidal waterways, the streets will still function as conventional floodways. Peak discharges are far less than critical thresholds for safety as expressed in references such as Melbourne Water's Floodway Safety Criteria-Model Guidelines (Appendix A of the Land Development Manual).

5.5 Water Quality Treatment

The concept drainage arrangement for Stage 13A and 13B on Figure 3 is the prototype for each stage across the new development.

Where earthworks design is able to provide positive grade towards the tidal waterway outfalls then the concept layout is adjusted to include that grade. All boulevard roads fronting the tidal waterway reserve will be formed as per the standard concept on Figure 3.

Water quality treatment results obtained for Stage 13A will apply on average, across the whole of the new development with the proposed swale system installed in all 16-18 m roads.

A MUSIC model (Version 3) has been used to assess the treatment effectiveness of the Stage 13A assets against best practice requirements. The Geelong North 6 minute rainfall sequence for 1980-1989 inclusive has been used for modelling purposes in accord with CoGG policy.

The subarea data for Stage 13A is summarized in Table 2.

The model results are summarized in Table 3. Two scenarios were considered: (a) zero infiltration losses from the base of the bioretention filters and (b) with infiltration losses of 800 mm/hr from the base of the filters.

As the MUSIC model does not simulate the fate of pollutants lost to infiltration, the pollutant removal rates shown in the final rows of Table 3 are not realistic. However the 90% reduction in overall surface runoff volume reaching the tidal waterway reasonably simulates the actual outcome. With such high subsoil infiltration capacity, virtually all surface runoff (freshwater) will enter the tidal waterway as groundwater inflow (mixed with saline groundwater) if the swale system is adopted as shown on Figure 3.

It is suggested that a conservative approach to simulation of stormwater quality impacts within the tidal waterway system would be to adopt the pollutant removal results for zero infiltration loss. These still show that treatment performance will significantly exceed best practice objectives.

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The results also show that, as sized, the rainwater tanks would reduce potable water supply demand by about 1.06 ML/yr for the 16 lots. That equates to about 66 KL/lot/yr which is about 65% of the estimated mean annual demand/lot.

TABLE 2		**Stage 13A Characteristics**	
No. of lots	16	Roof areas (@200 m2/lot)	3,200 m2
Total lot area	7,459 m2	Tank volume (3 KL/100 m2)	96 KL
Total road area	4,630 m2	Internal water demand (50 KL/lot/yr)	2.19 KL/day
Total Stage area	12,089 m2	External water demand (4 ML/ha/yr)	845 KL/yr
Average lot size	466 m2	Extended detention depth	0.15 m
Pervious areas of lots (50% of balance)	2,130 m2	Bioretention filter depth	0.3 m
Perimeter swale catchment	1,020 m2	Hydraulic conductivity	200 mm/hr
Balance road catchment	3,610 m2	Perimeter swale length/area	170 m/50 m2
Balance lot catchment	4,259 m2	Balance swale length/area	300 m/90 m2

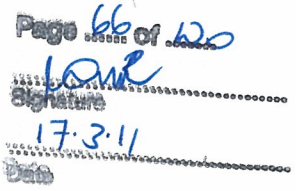
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TABLE 3 MUSIC Model Results (Geelong North 1/01/1980 to 31/12/1989, 6 min)					
Scenario	**Parameter**	**Inflow loads**	**Residual loads**	**%Removal of inflow loads**	**Best practice targets**
No infiltration losses	**Rainwater tanks**				
	Flow (ML/yr)	1.41	0.35	76	-
	TSS (kg/yr)	36.8	5.7	85	
	TP (kg/yr)	0.20	0.05	77	
	TN (kg/yr)				
	Road/lot bioretention swales				
	Flow (ML/yr)	2.14	2.14	0	
	TSS (kg/yr)	374	35.7	91	
	TP (kg/yr)	0.89	0.26	70	
	TN (kg/yr)	4.92	2.72	45	
	Perimeter bioretention swales				
	Flow (ML/yr)	0.29	0.29	0	-
	TSS (kg/yr)	51.7	5.4	90	
	TP (kg/yr)	0.16	0.05	68	
	TN (kg/yr)	0.71	0.39	45	
	Total Integrated System				
	Flow (ML/yr)	3.85	2.77	28	-
	TSS (kg/yr)	462	46.8	90	80
	TP (kg/yr)	1.24	0.36	71	45
	TN (kg/yr)	8.90	3.79	57	45
With infiltration losses (800 mm/hr from base of filter)	**Rainwater tanks**				
	Flow (ML/yr)	1.41	0.35	76	-
	TSS (kg/yr)	36.8	5.7	85	
	TP (kg/yr)	0.20	0.05	77	
	TN (kg/yr)				
	Road/lot bioretention swales				
	Flow (ML/yr)	2.14	0.03	98	-
	TSS (kg/yr)	374	1.7	99	
	TP (kg/yr)	0.89	0.06	99	
	TN (kg/yr)	4.92	0.06	99	
	Perimeter bioretention swales				
	Flow (ML/yr)	0.29	0.0	100	-
	TSS (kg/yr)	51.7	0.0	100	
	TP (kg/yr)	0.16	0.0	100	
	TN (kg/yr)	0.71	0.0	100	
	Total Integrated System				
	Flow (ML/yr)	3.85	0.37	90	-
	TSS (kg/yr)	462	7.4	98	80
	TP (kg/yr)	1.24	0.05	96	45
	TN (kg/yr)	8.90	0.74	92	45



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6. The Existing Residential Development

6.1 Existing Conditions and Constraints

Drainage from the original Lonsdale Lakes subdivision (15.4 ha) forms part of the catchment to the tidal waterway and is piped to an existing outfall adjacent to the roundabout at the intersection of Peterho Boulevard and Lakes Entrance Drive.

The terminal pipeline system is 1050 mm diameter at invert of -1.2 m AHD. Hence the pipeline outlet and lower reach is permanently drowned by the existing and proposed tidal water levels, and the pipe is partially submerged upstream until invert level rises above 0.0 m AHD. This does not occur until Peterho Boulevard meets Lakeland Court. The pipeline was constructed in the late 1980's and is shown on design plans as being rubber-ring jointed.

The permit requires some retrofitting of water quality treatment capacity to this existing development. However the permit is silent on standards to be achieved and this is fortunate because existing built infrastructure cannot always be retrofitted to fully comply with best practice.

It is considered that the appropriate performance outcome should be for stormwater runoff from the entire Point Lonsdale Residential and Waterways Project development (existing and new) as a whole to comply with best practice water quality treatment standards. This allows a lesser standard of treatment to be retrofitted to the existing area if necessary, subject to over-treatment elsewhere in the new estate making up any shortfall in load removal.

Internal conditions (sand/silt depths and water quality) in the submerged segments of the Peterho Boulevard pipeline are not known, however it would reasonable to expect that the water within the pipe may fluctuate from fresh to brackish to saline in accordance with rainfall patterns and (saline) groundwater seepage into the pipe via leaks. In a 20-25 year old pipeline leaks are considered inevitable regardless of attention paid to initial construction.

Such water quality characteristics, if confirmed by investigation, would inhibit application of freshwater wetland systems and limit treatment options. In any event end-of-line treatment cannot avoid the use of pump systems.

6.2 Primary Options

A practical consideration is that the existing pipe system and residential development was constructed in the late 1980's prior to any consideration for water quality treatment. Consequently there is little space within the estate proper for insertion of assets such as bioretention systems, other than in the streetscapes. The street reserves are generous compared with current day standards and space is available to retrofit

bioretention inserts behind or in front of the kerbs on the upslope side of each side entry pit.

On outright treatment performance grounds this retrofit solution would be favoured against the alternative of installing a pump station at the downstream end of the pipeline and lifting the water into some other consolidated treatment system. Pollutants are removed from drainage waters prior to entry to the submerged pipes leading to better longer term maintenance outcomes. Surface interception systems such as the bioretention inserts also effectively avoid salinity problems now and into the future as all runoff from the road reserves and lots can be expected to be freshwater.

However it is also understandable for the developer to prefer the end-of-line approach for ease of implementation and cost, because a pump station and major end-of-line control structure works are required to be built anyway. At this time the preferred option by Stockland is the end-of-line approach.

6.3 Concept Arrangement

It is not possible to test or confirm the integrity of the pipeline against saline leakage inflow at this time because it is currently open-ended and submerged in saline water. The expectation is that when the permanent end-of-line control structure works and associated pumpout system are installed to keep the pipes open, that saline groundwater will gradually fill the pipe during dry weather periods and then be flushed out in rain periods. This process will then re-occur with the water cycling from saline to fresh in accord with weather patterns.

The appropriate design response to this likely condition would be to build-in provision for two pumps; a small duty pump to deal with seepage conditions (discharging saline water to the canals via sand filter), and a larger one to dewater the system after rain with the freshwater discharging to a bioretention basin.

During actual runoff events the system will submerge and operate by gravity with the internal head in the pipe system rising as needed to get the water out at the other end over a control weir. Pumping would restore empty pipe conditions a few days after rainfall ceases.

Low flows over the control weir would go to the bioretention basin with floodflows bypassed straight to the canal. Under current design conditions with high tide at 0.20 m the control weir low flow crest (or orifice pipe offtake) would be set at about 0.75 m AHD with the bioretention surface set marginally lower at 0.70 m. This allows a filter media of 500 mm depth to be installed above the saline tidal influence so that dependant vegetation can survive.

The flood overflow weir would be set at 0.85 m AHD and be sized to prevent flooding in the pipes upstream for 5 yr ARI conditions. Based on the HGL grade

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shown on the plans, and low points in the street network at about 1.5 m, the outlet flood level across the weir should not exceed about 1.1 m. The 1050 mm pipe has a capacity of about 1 m^3/s at the indicated HGL grade so the weir length would need to be at least 5 m at 0.85 m.

A detail concept has yet to be prepared for the treatment system and pump station.

However the MUSIC model has been used to confirm sizing and effectiveness of the proposed end-of-line retrofit treatment system.

By trial and error it was found that if the objective was to comply with best practice for the existing development then the bioretention basin would have:

- filter surface area of 450 m^2, at level of 0.70 m AHD;
- site area of about 600 m^2;
- filter depth of 0.5 m;
- mean particle size of 0.45 mm and hydraulic conductivity of 180 mm/hr.

No under-drainage system is required due to the high hydraulic conductivity of the insitu sands.

Space is available to construct works of this size adjacent to the existing waterway near the present end of Peterho Boulevard. It is suggested that the bioretention basin could be easily integrated around the shoreline at setback of about 6 m.

7. Construction Stage Activities

The construction phases of the tidal waterway and the residential development and subsequent building works must also be properly managed to ensure environmental values are protected along the way. To do this, Site Environmental Management Plans (EMP's) will need to be prepared to address construction-related impacts. These plans would be submitted for approval prior to commencement of works on each stage or group of stages as the case may be.

Key items to be factored into the EMP's are as follows:

- All site works are to be carried out in accord with contemporary best site management practice.
- Implement erosion prevention and control measures generally in accordance with the provision of "Construction Techniques for Sediment Pollution Control" (EPA Publication No. 275, 1991), with "Environmental Guidelines for Major

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Construction Sites" (EPA Publication No. 480, December 1995), and with "Doing it right on subdivisions. Temporary environmental protection measures for subdivision construction sites" (EPA Publication No. 960).

- Areas of disturbance should be kept to a minimum on each stage and stage works areas clearly fenced to prevent machine access or materials storage elsewhere.

- Construct and establish the tidal waterway excavations (or segments thereof) effectively offline to the receiving environment of Lakers Cutting and Swan Bay to act as sedimentation pondages, as part of initial construction. Establishment of appropriate ephemeral and terrestrial vegetation communities in the various swales should follow at the earliest suitable planting time.

- Divert runoff from undisturbed areas away from active works areas.

- Locate soil stockpiles at least 20 metres from any drainage line or pit.

- Remove soil and clay from tyres before trucks leave site.

- Remove foreign soil and plant matter from trucks before entering site.

- All significant vegetation to be retained should be fenced out prior to commencement of any site works within appropriate setbacks.

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Neil M Craigie

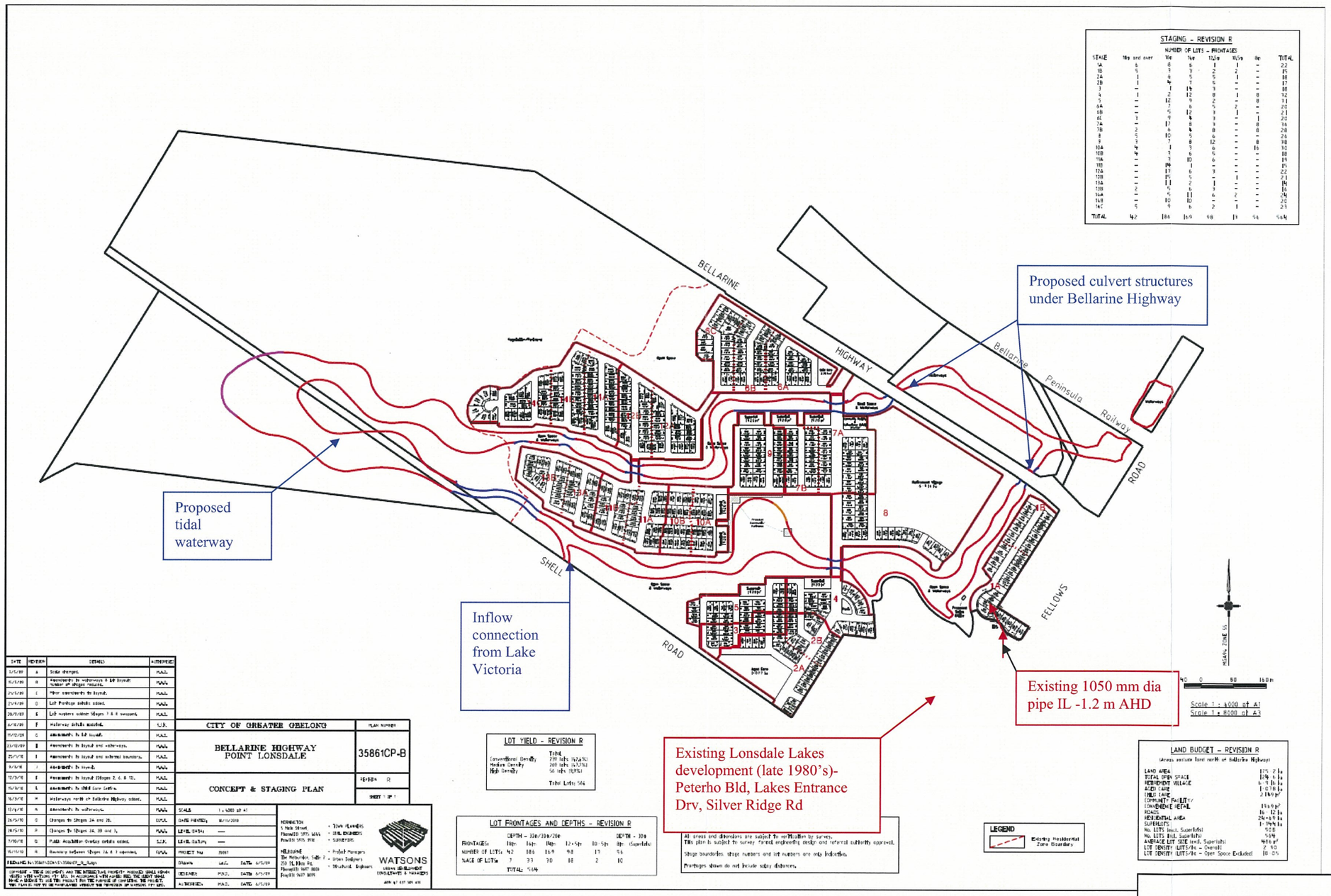
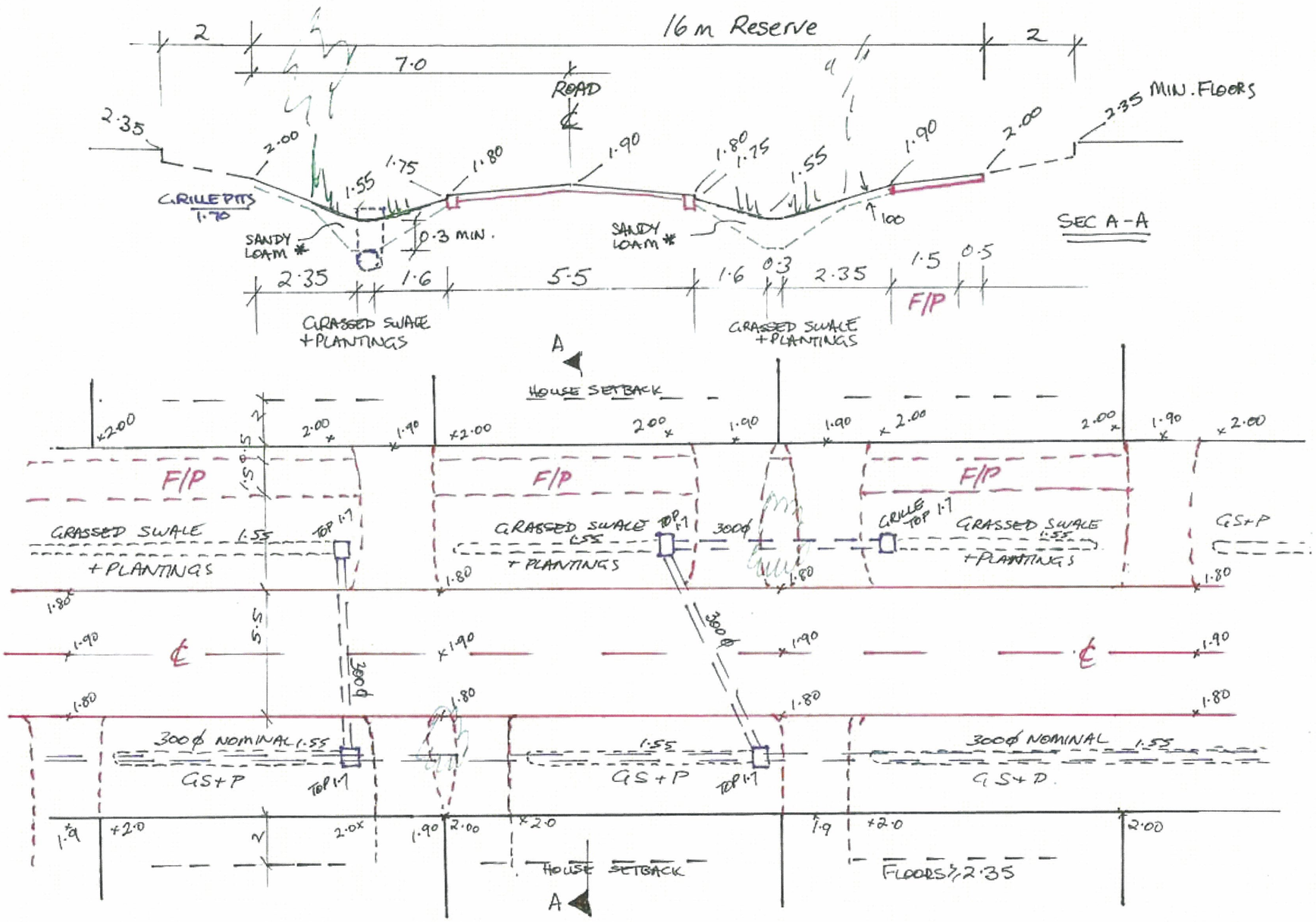


Figure 1
Concept and Staging Plan for Point Lonsdale Residential and Waterways Project

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* Bioretention filter media to be Sandy Loam with hydraulic conductivity of 200 mm/hr. No under-drainage system required.

Figure 2 (Sheet 1 of 2)

Proposed street drainage system concept for 16 m wide streets (similar arrangement for 18 m wide streets but with reduced/varied batter slopes)

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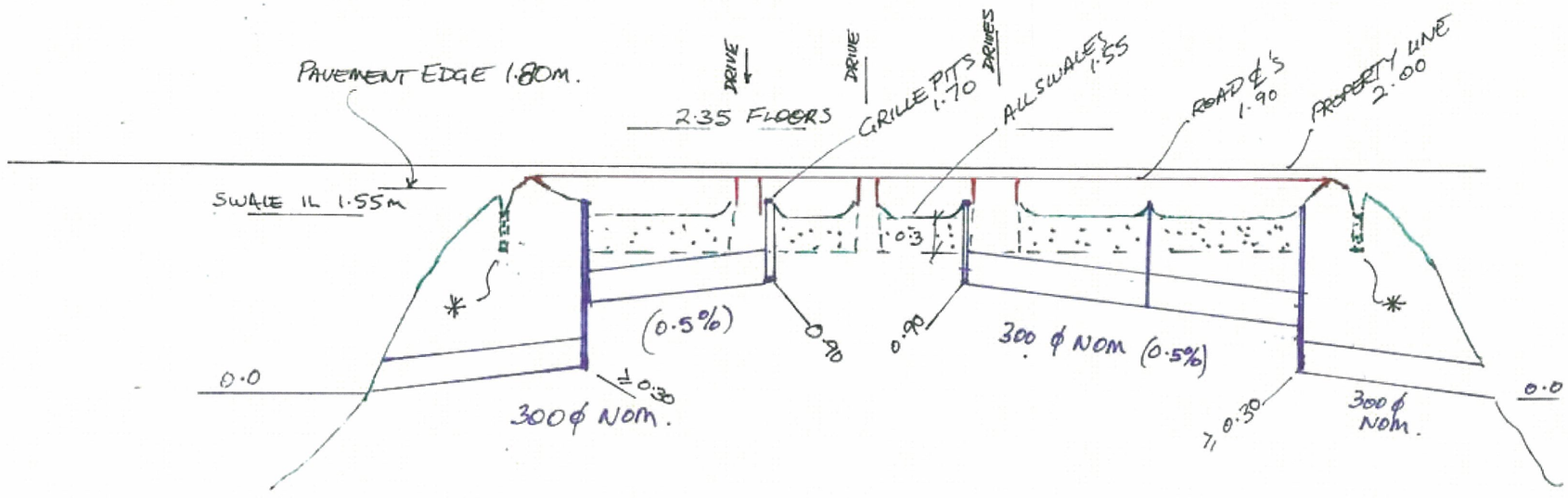
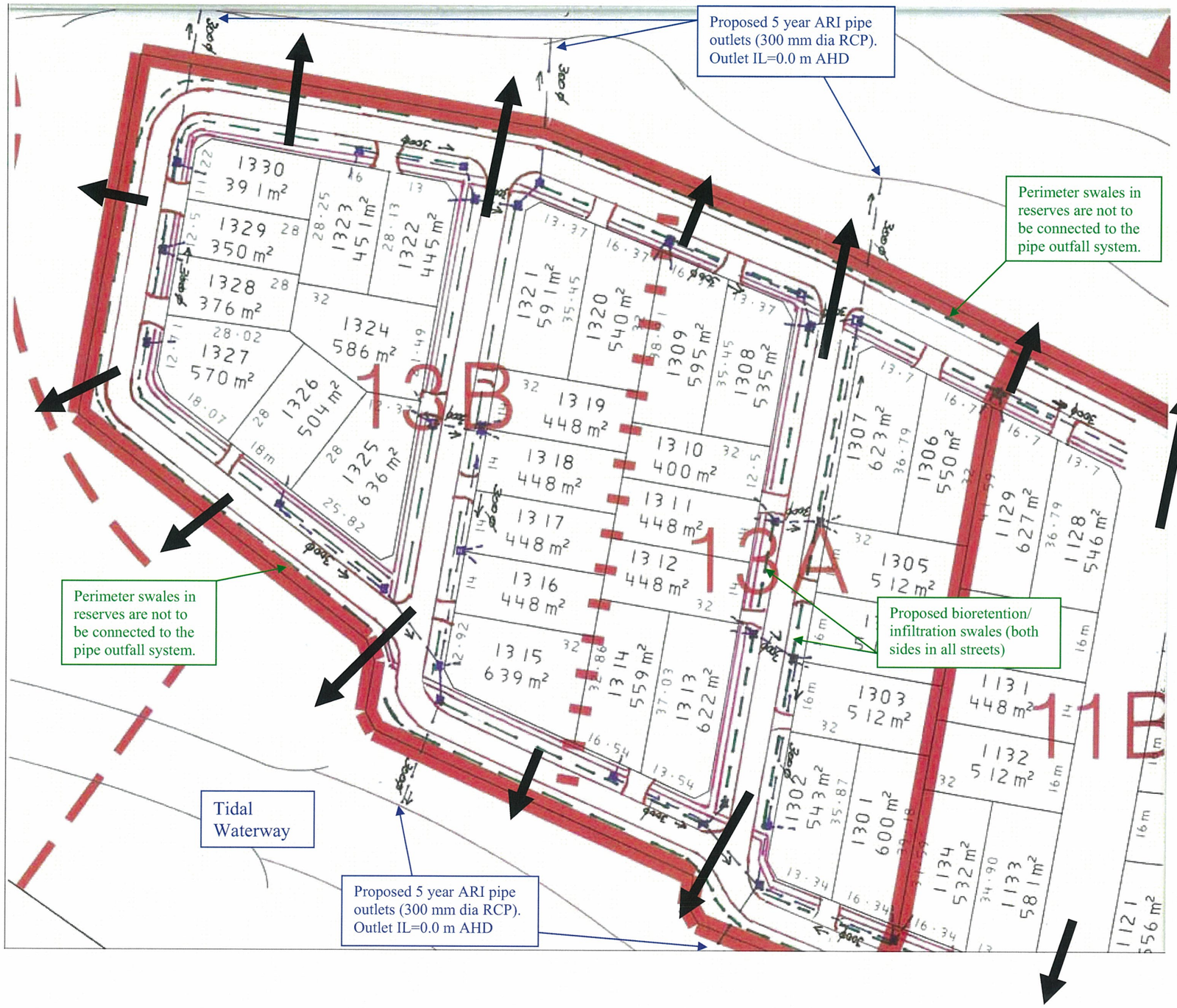


Figure 2 (Sheet 2 of 2)

Longitudinal section of proposed street drainage system concept
(for streets with two-way outfall to the tidal canals)

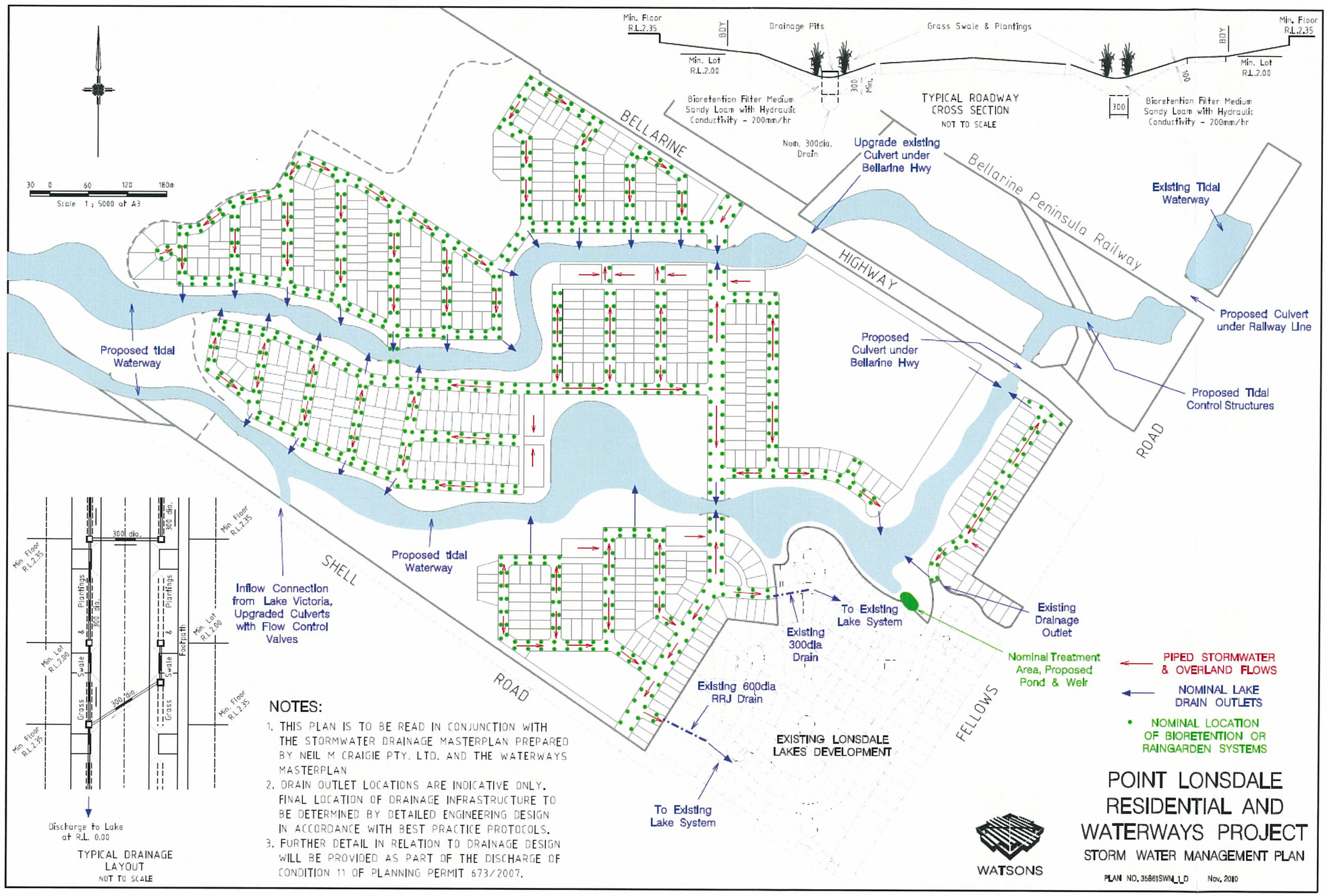
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Figure 3

Enlarged extract of Stage 13A and 13B showing proposed drainage system concept



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Figure 4

Proposed stormwater drainage system concept

APPENDIX D LIST OF OPERATION AND MAINTENANCE PROCEDURES AND METHODS

The operation and maintenance of the Waterway to achieve the objectives of this Water Quality Management Plan is underpinned by a set of procedures, and methods that are documented / referenced in the Waterway operation and maintenance manual.

This manual requires that procedures and methods sustain compliance with applicable guidelines and standards, the requirements of applicable legislation, and the in-house procedures and standards of the relevant supplier.

The supplier for the relevant component holds the applicable and current procedures / methods for their work / services.

AFCG Components, Procedures and Methods

The AFCG encompasses the gates, culverts, level sensors, cameras, PLC, power supply, and accessories. The components of the Actuated Flow Control Gates (AFCG) System are documented below.

AFCG Components

Gate Actuator System	The Gate Actuator System includes six electromechanical actuated flow control gates that are opened and closed to control flow through the Waterway. There are three located in the inlet culverts and three located in the outlet culverts and these open and close based on the tide.
PLC System	The Programmable Logic Controller (PLC) System controls a system's functions. It is a computer control system that automates processes and continuously monitors the state of inputs and outputs. It includes data loggers and data transmission to White Technics and HydroTerra.
Water Level Sensors	The Water Level Sensors are a series of twelve EchoPod® DL24 water level transmitters in stilling tubes. These provide water level readings that control the movement of the gates. The sensors are located at sites 6A, 6B, 7A, and 7B.
AFCG Cameras	The AFCG Cameras are a pair of cameras mounted at the AFCG site to monitor Site 6B and 7B control gates. The cameras are powered by mains power with a solar panel backup. Live footage is accessed via an app.
Culverts	The Culverts are a series of structures that channel water under roads and railways. The culverts are divided by location: at the AFCG (6); Fellows Road (16); and Bellarine Highway. Water flow is controlled by the gates located at the six AFCG culverts. Two additional culverts are in the Lake Victoria channel at Shell Road, which contain one-way valves to prevent backflow into the lake.
Stoplog System	The Stoplog System is a series of stoplogs located at the gates that are used to restrict the flow of water. These are lowered to prevent water flowing in or out of the Waterway.

Control Hut	The Control Hut (also known as the PLC Shed) is a building which houses the PLC, essential spares, and the kayak and accessories. The control hut is powered by the grid and contains lighting and an air-conditioning unit.
Power Supply	All the above systems require a power supply. Power is supplied by the grid and/or solar panels.

AFCG System SOPs

Component with Procedure / Method	Supplier Responsible for the Procedure / Method Referenced in the Operation and Maintenance Manual
Cameras	**HydroTerra**
White Technics control of AFCG	**White Technics**
AFCG Gates	**AWE**
AFCG electro-mechanical systems	**Acrodyne** **Gordon Mackay**
Water Level Sensors	**HydroTerra**
Culvert cleaning of seagrass and growth	**HydroTerra**
NBN systems	**White Technics**
Stoplog systems	**AWE**
Control hut & AFCG power supplies	**HydroTerra**

Water Monitoring System

Water Monitoring Components

Water Quality Meters	The Water Quality Meters are a series of Eureka Manta Water Quality Multiprobes that continuously monitor in-situ parameters in the Waterway, Lakers Cutting, and Lake Victoria. The parameters are Chlorophyll-a, Turbidity (NTU), ORP, DO, pH, Temp corrected conductivity and Salinity, Temp. There are five water quality meters deployed at The Point at Site 2, Site 6B, Site 7B, Site 4, and Site 9. Each of these are paired with a telemetry system comprising of a data logger and solar panel.
Flow Meters	The Flow Meters are a series of flow meters installed in the AFCG Culverts and the Lake Victoria Channel. There is one flow meter installed in each of the six AFCG Culverts and one flow meter measuring water flow in the Lake Victoria Channel.
Weather Station	The Weather Station is an instrumented weather station that measures meteorological conditions at the Site. It monitors temperature, humidity, solar radiation, precipitation, wind speed and wind direction. The Weather Station has a telemetry system consisting of a data logger and solar panel.
Surface Water Sampling	Surface Water Sampling and testing is undertaken quarterly across the Waterway, Lakers Cutting, and Lake Victoria. Field measurements are taken in addition to laboratory testing of surface water samples for chemical parameters, chlorophyll, turbidity, and more.
Groundwater Sampling	Groundwater Sampling and testing is undertaken biannually at monitoring wells located at the Site. Field measurements of water quality are taken in addition to laboratory testing of groundwater samples.
Algae Sampling	Algae Sampling and testing is undertaken regularly in the Waterway and Lakers Cutting. Field measurements of water quality are taken in addition to laboratory testing of algae samples.
Laboratory Testing	Testing by laboratories that are NATA accredited for the required analyses.

Water Monitoring Procedures and Methods

Component with Procedure / Method	Supplier Responsible for the Procedure / Method Referenced in the Operation and Maintenance Manual
Instrumented Water flow	HydroTerra
Instrumented Water quality	HydroTerra
Water sampling for laboratory testing	HydroTerra
Algae sampling for laboratory Testing	HydroTerra
Groundwater sampling for laboratory testing	HydroTerra
Weather station	HydroTerra
Water Level corrections for barometric pressure and instrument drift	HydroTerra
Laboratory Testing	The subcontracted NATA registered laboratories

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