Shaping the Future
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Ver.	Date	Drwn	Appr.	Description	Job No.	7135/01/003
2	19/03/2010	JDB				

DATE PLOTTED: 30 March, 2010 - 2:44pm

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WATER LEVEL PROFILE LOCATIONS
PROFILE 'A'
FIGURE 35A

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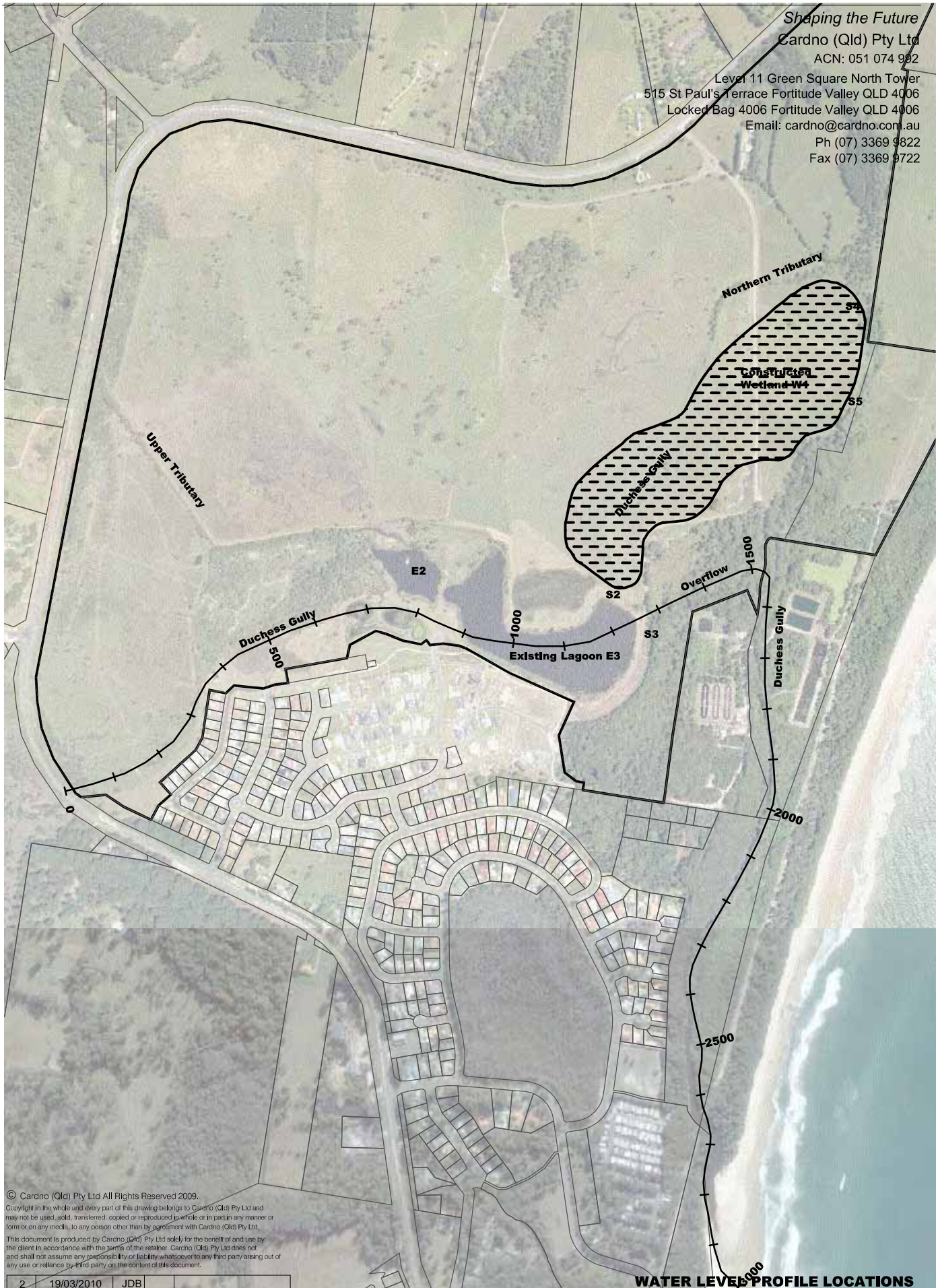

Ver.	Date	Drwn	Appr.	Description	Job No.	7135/003
2	19/03/2010	JDB				

WATER LEVEL PROFILE LOCATIONS
PROFILE 'B'
FIGURE 35B

DATE PLOTTED: 30 March, 2010 - 2:45pm
CAD FILE: L:\7135-01\Acad\Water Engineering & Env DGR Assessments\Figure 35 Profile Locations.dwg
XREF's:
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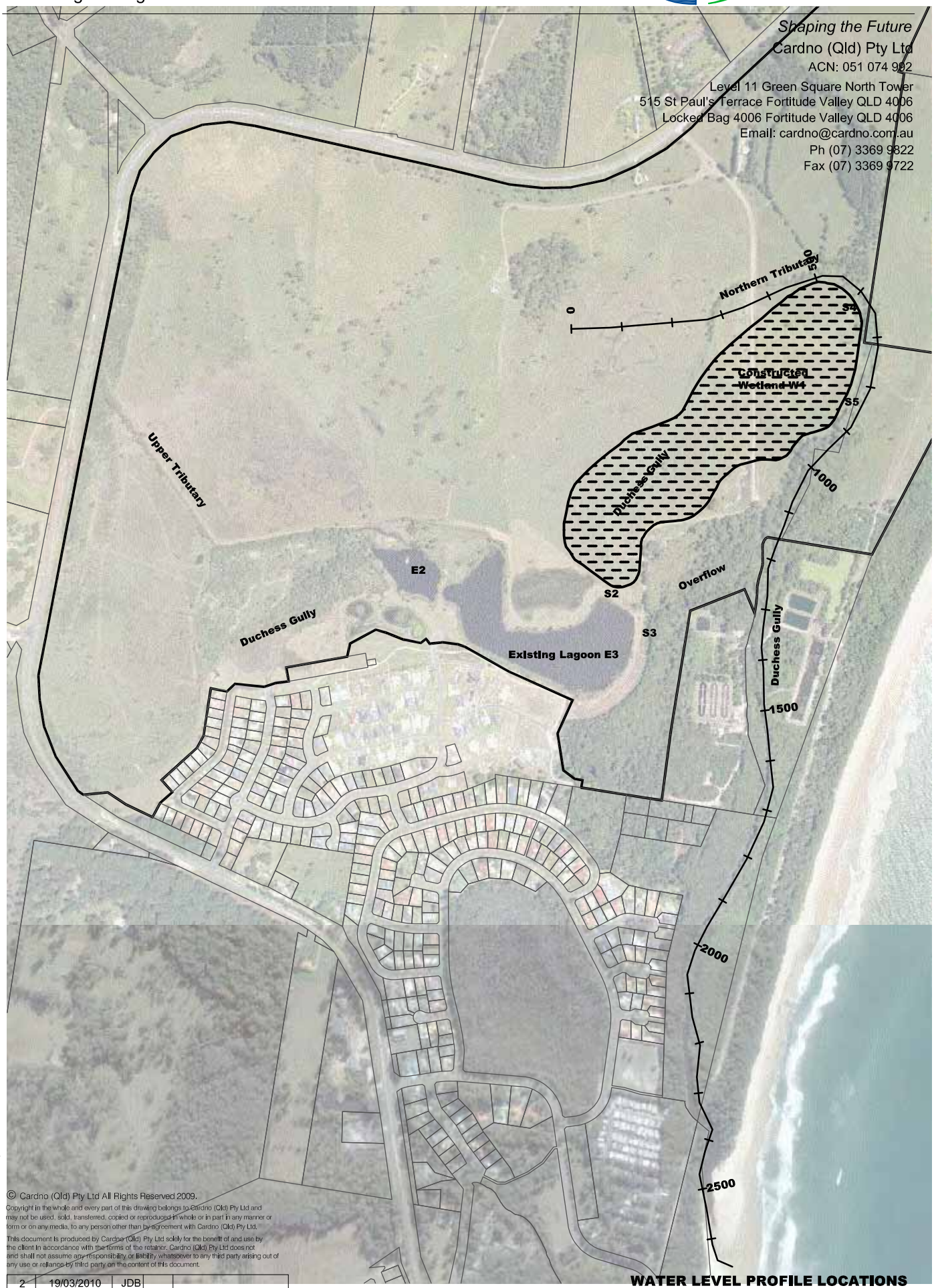

Ver.	Date	Drwn	Appr.	Description	Job No.	7135/03
2	19/03/2010	JDB				

DATE PLOTTED: 30 March, 2010 - 2:45pm

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WATER LEVEL PROFILE LOCATIONS
PROFILE 'C'
FIGURE 35C

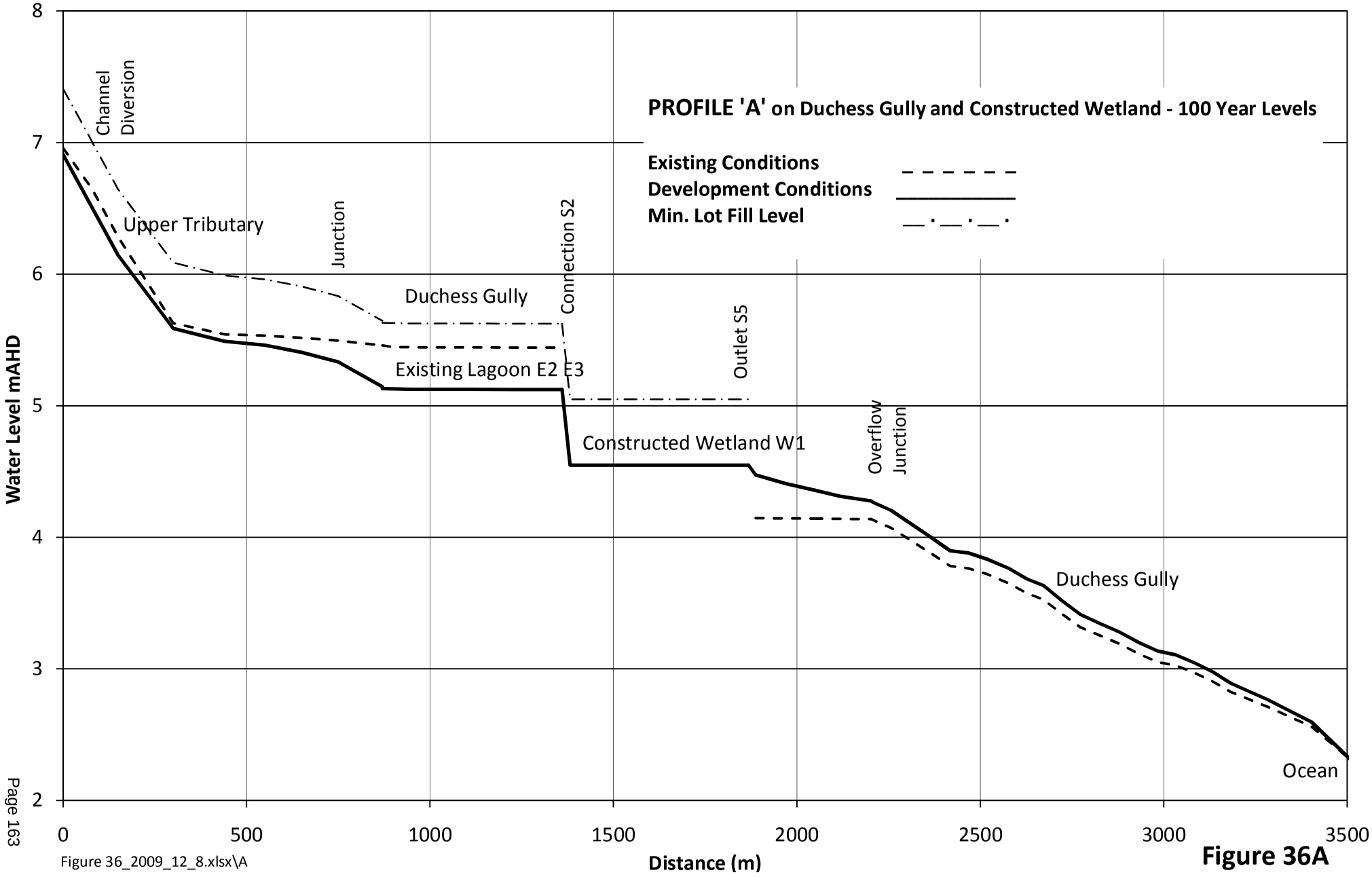


Figure 36_2009_12_8.xlsx\A

Figure 36A

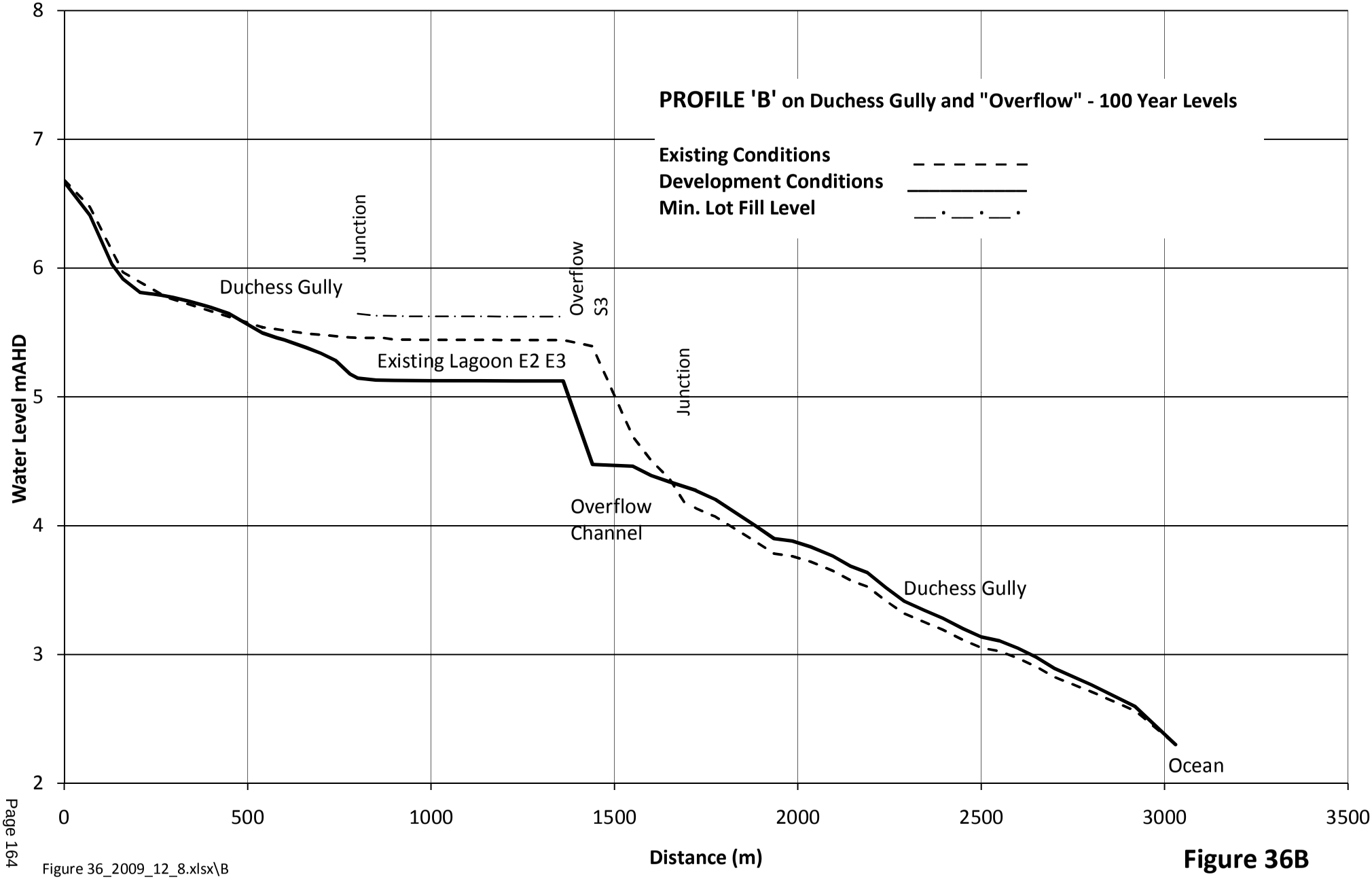


Figure 36B

Figure 36_2009_12_8.xlsx\B

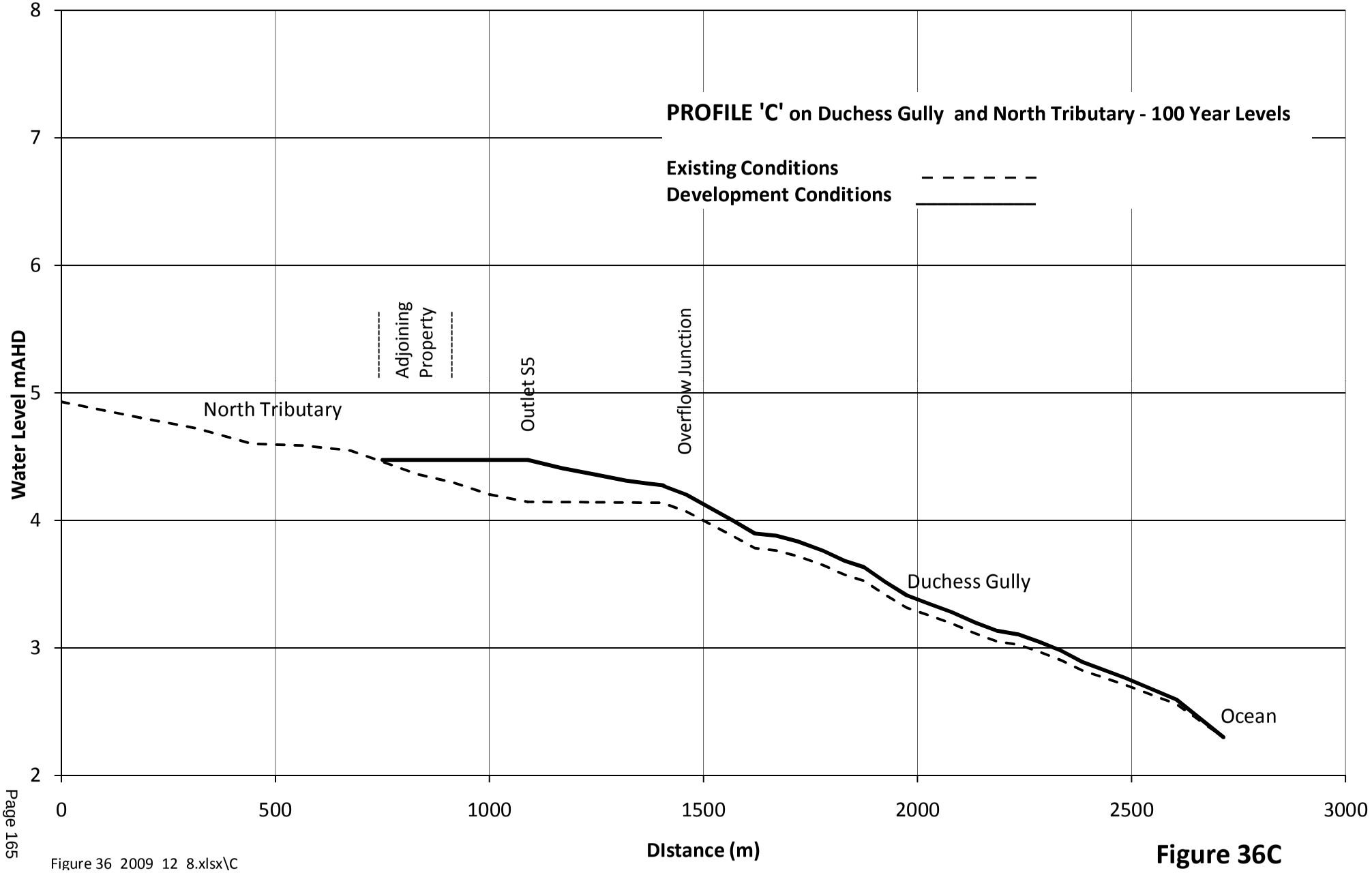
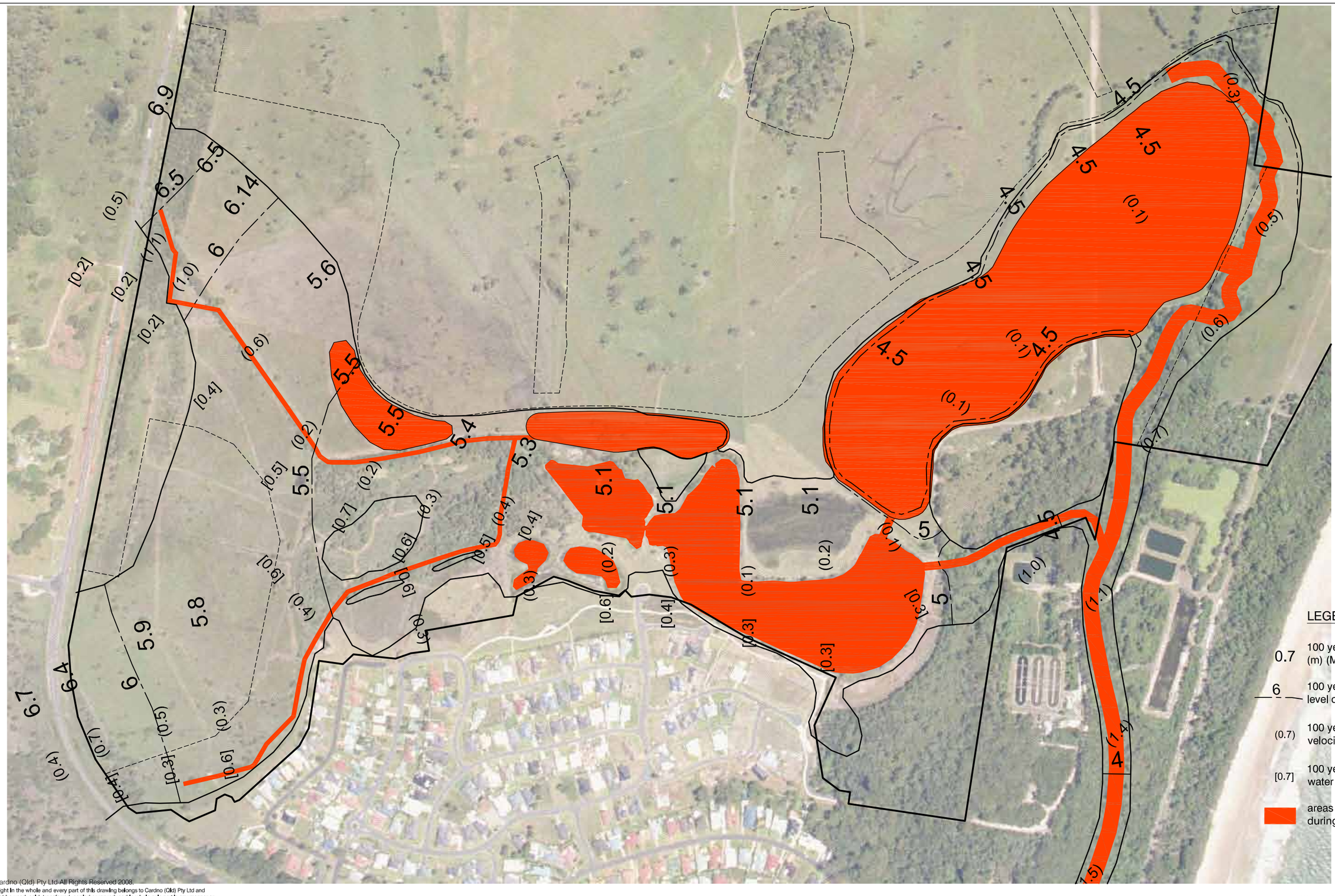


Figure 36C

Figure 36 2009 12 8.xlsx\C



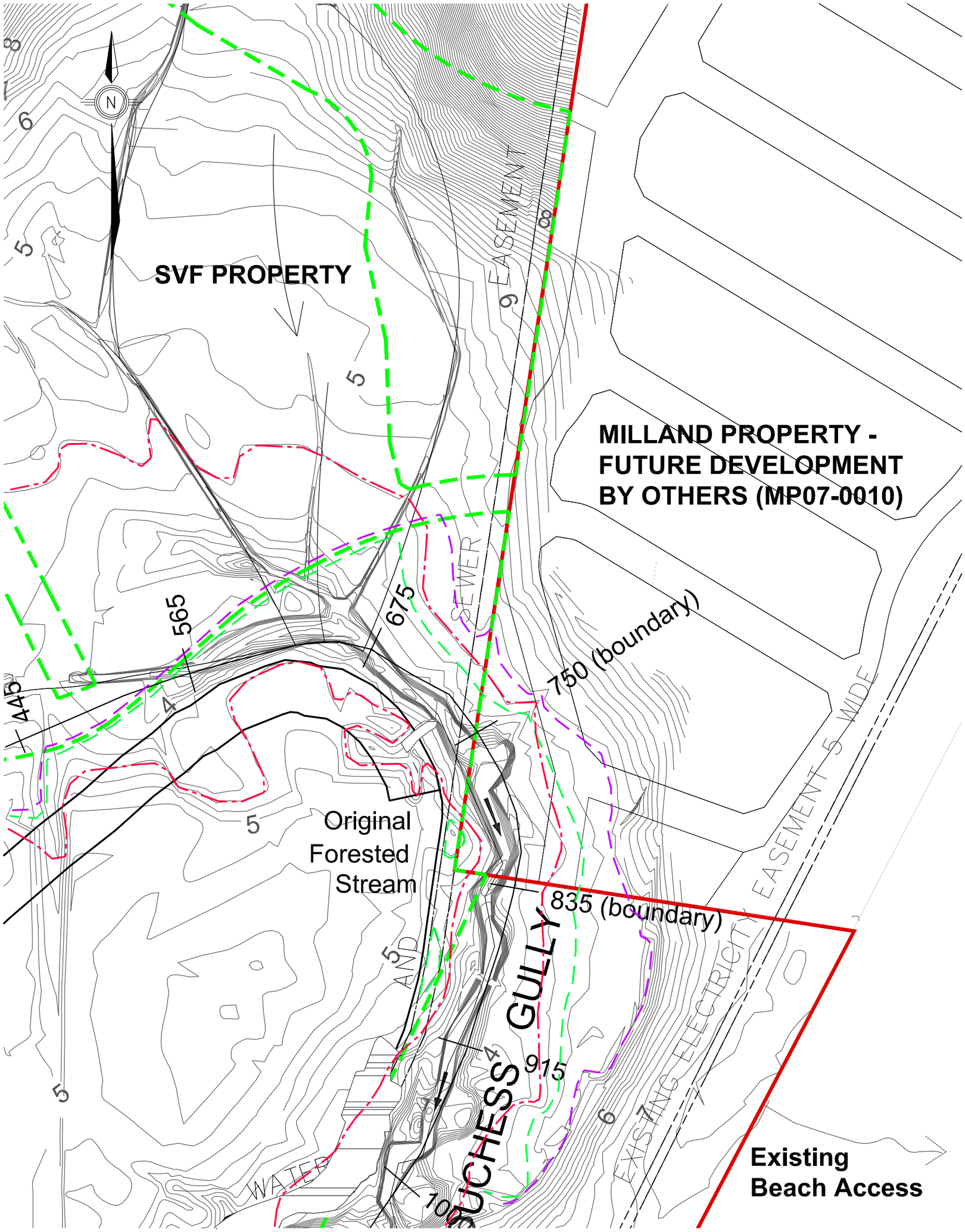
Scale 1:5000 (A3)

FIGURE 37
FLOOD HAZARD CONDITIONS - 100 YEAR ARI STORM EVENT

Ver 2 Date: 19 March 2010

St. Vincents Foundation Pty Ltd

PRINT DATE: 30 March, 2010 - 3:23pm
CAD FILE: L:\7135-01\Acad\Water Engineering & Env DGR Assessments\Figure 37 - Flood Hazard Conditions Plan.dwg
XREF's: Contours for weirs 21-2-08



LEGEND

- Site Boundary
- Existing inundation limit
- Development inundation limit
- Development inundation limit with +20% climate change increase in rainfall intensity

FIGURE 38
INUNDATION LEVELS ON ADJOINING MILLAND LAND

Ver 2 Date: 19 March 2010

St. Vincents Foundation Pty Ltd

CAD FILE: L:\7135-01\Acad\Water Engineering & Env DGR Assessments\Figure 38 - Inundation Levels on Milland Property.dwg
XREF's: Contours for weirs 21-2-08; wetland outline

PRINT DATE: 30 March, 2010 - 3:24pm

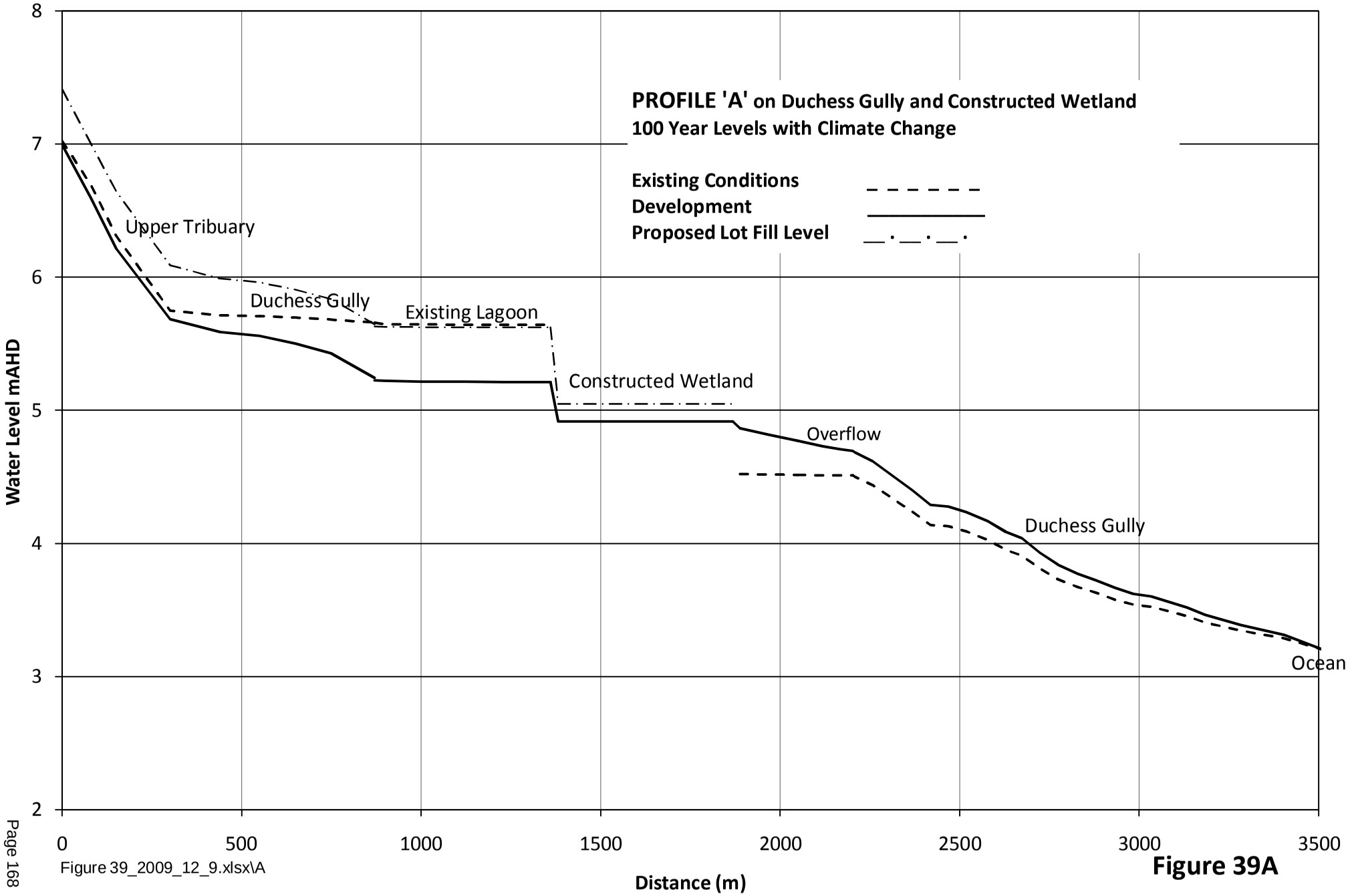


Figure 39_2009_12_9.xlsx\A

Figure 39A

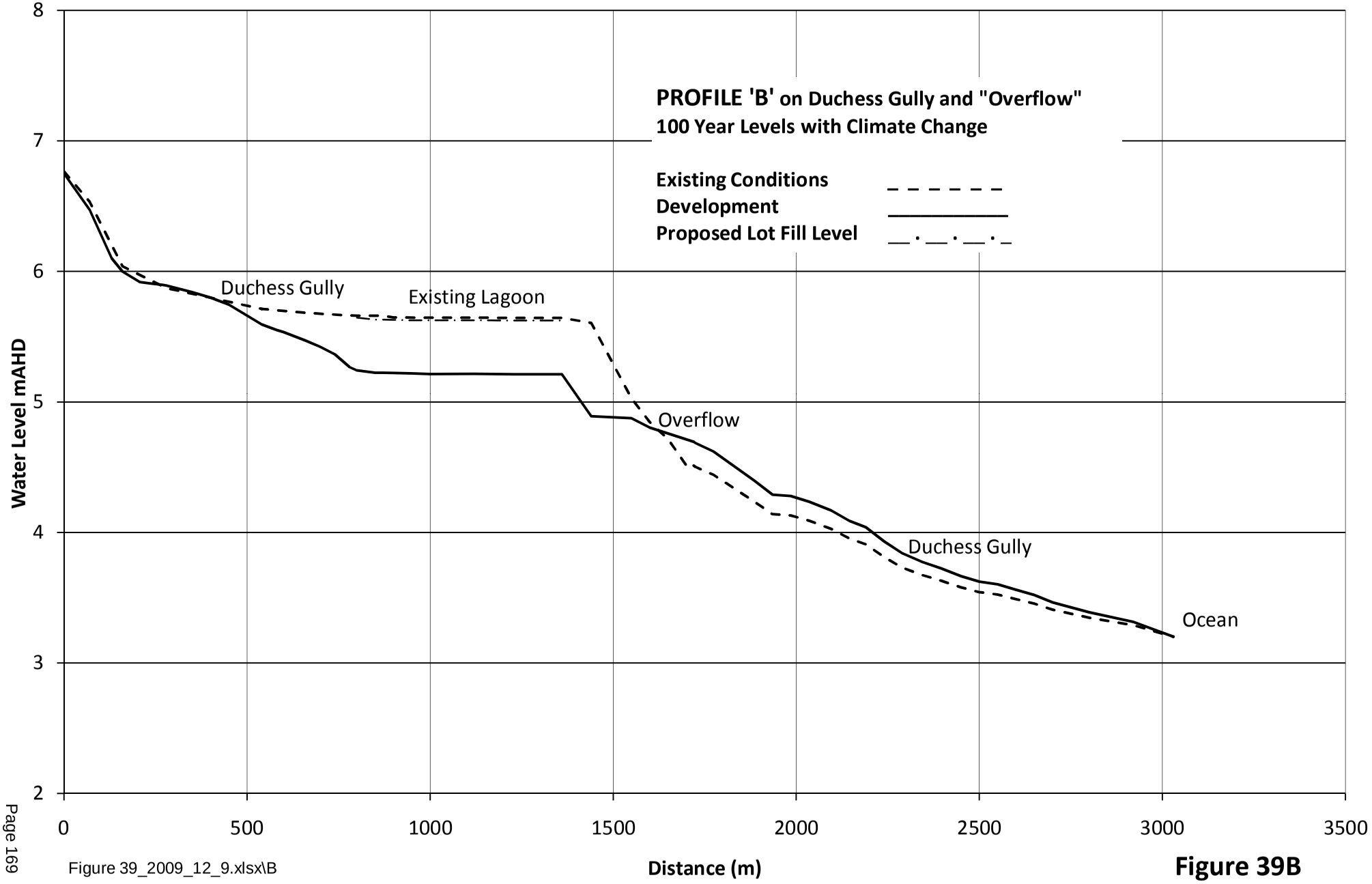


Figure 39_2009_12_9.xlsx\B

Figure 39B

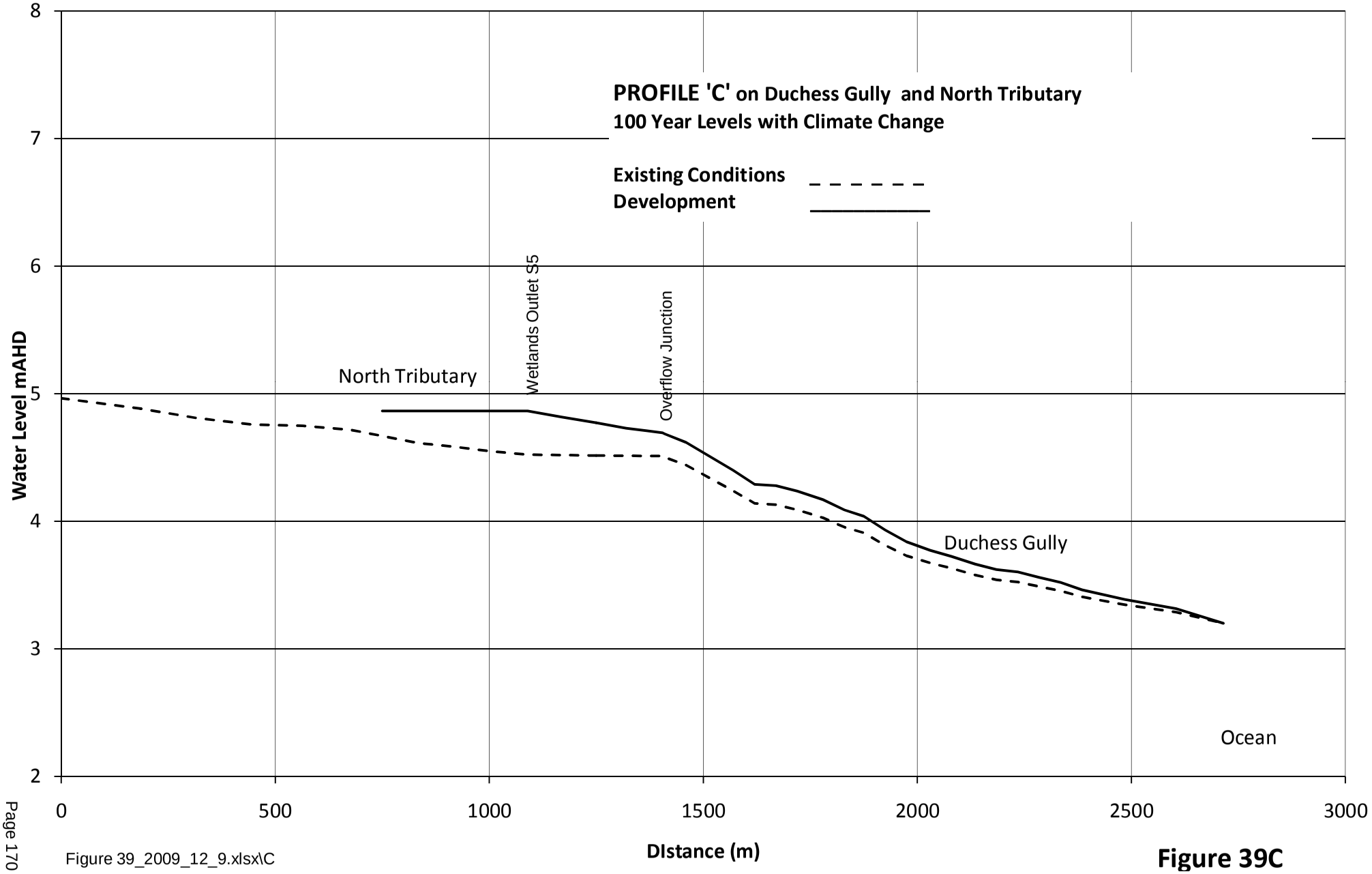


Figure 39_2009_12_9.xlsx\C

Figure 39C

5. OPEN SPACE CORRIDOR OPERATIONAL MANAGEMENT

5.1 DGR Item References

The following DGR items are addressed in this section:

RAINBOW BEACH CONCEPT PLAN (CP)

Item	Topic
CP2.2	Consider the functioning of the wetland including the responsibility for ongoing management, any potential risk to public safety and potential environmental impacts such as groundwater, water quality and hydrology.

PROJECT APPLICATION – OPEN SPACE CORRIDOR & CONSTRUCTED WETLAND (PA)

Item	Topic
PA2.1	Provide a detailed description of each of the proposed uses across the site and describe the relationship between open space, drainage and habitat functions.
PA2.2	Describe the proposed ownership and long-term management regime for each component of the site including playing fields, constructed wetland and general open space.
PA8.2	Provide an assessment of the potential impacts of the constructed wetland on public safety and liability and provide, where relevant, appropriate management measures.

5.2 Objective

The objective of this section is to provide a rational comprehensive basis for:

- Discharging the owner's responsibilities for the Open Space Corridor;
- Achieving the objectives for the Open Space Corridor outlined in the development proposals;
- Managing risks associated with activities and operations within the Open Space Corridor;
- Providing for sustainable funding of operational activities in perpetuity.

5.3 Existing Operational Arrangements

The site, including the Open Space Corridor, is held at present under private freehold title.

5.4 Proposed Development Operational Arrangements

5.4.1 Land Uses

The land uses under the proposed development are set out fully in Section 1.4.3.

5.4.2 Land Ownership

Ownership of the Open Space Corridor, including district sporting fields, the existing lagoons and other water bodies, the constructed wetland, the stormwater treatment wetlands, drainage swales, the pocket woodland, eastern creek and other open space areas as listed in Table 4 will pass to Port Macquarie Hastings Council by way of dedication after the successful completion of establishment.

All other areas will be held under private freehold title after development.

5.4.3 Operational Control of Open Space Corridor Use

Operational control of the Open Space Corridor is proposed to pass to Port Macquarie Hastings Council after the successful completion of the establishment period.

5.5 Issues Affecting Operational Management Strategy

The following issues have been considered in deriving the operational management strategies and procedures:

- Environmental values and sustainability
- Ecosystem viability and Characteristics
- Public Access and Recreational Uses
- Inundation Hazard Management
- Major Event Management
- Public Safety and Liability
- Maintenance Funding

5.6 Public Access and Safety Review

The proposed development includes the construction of a new wetland. This new wetland in combination with the existing lagoon will preserve and further promote the existing wildlife habitat within the site and will also provide stormwater treatment for the proposed development. The new wetland will have a maximum depth of 3.2 metres, an approximate area of 12.7 hectares and an approximate volume of 165 ML. The proposed wetland will be connected to both the existing lagoon and the "middle" reaches of Duchess Gully.

As the proposed wetland is primarily part of the stormwater treatment train for the development, as well as providing potential habitat for aquatic flora and fauna, the principle issue for public safety is that of accidental drowning.

A risk management assessment was conducted for the proposed wetland based on the Guidelines for Water Safety in Urban Water Developments published by the Royal Life Saving Society of Australia in January 2004.

The level of consequence (harm) if an accident happens within the waterbodies and the likelihood of that consequence to happen are:

- Consequence: Drowning = catastrophic or Category 1
- Likelihood : unlikely or Category D

Likelihood						
A	B	C	D	E		
1	2	4	7	11	1	Consequence
3	5	8	12	16	2	
6	9	13	17	20	3	
10	14	18	21	23	4	
15	19	22	24	25	5	

The risk management matrix gives this combination a score of 7, which falls into the yellow (or medium risk) zone.

Further, the Facility Visitation Rate (FVR) for the waterbodies was calculated as follows.

As the proposed development can be defined as cleared land with activity based infrastructure, it rates 3 (development). The estimated population usage was conservatively assumed to be 2 (5 to 50 people at a time), as no formal access to either the existing lagoon or proposed constructed waterbodies will be provided unless there are appropriate barriers and/or safety benching installed. The usage refers to residents walking around the open space areas adjoining the lagoon.

Although the lake forms part of the residential estate and walkways will exist near the waterbodies, vegetative and physical barriers will be placed to prevent access to the existing lagoon and proposed constructed wetland.

Signage will also be installed in appropriate locations around the existing lagoon and proposed constructed wetland to explain their purpose and deter people from entering into the water. Although no formal gathering spots exist near the waterbodies and no watersports or swimming will be encouraged within them, the frequency for the waterbodies was conservatively assumed to be 4 (as the possibility exists that some residents might walk around the open space areas adjoining the lagoon on a daily basis).

The Facility Visitation Rate (FVR) for the waterbodies is then (3x2) + 4 = 10, value which falls into the medium risk category.

As both indicators fall into the medium risk category, attention and preventive measures have been considered for the waterbodies. These preventive strategies include:

Specific design measures, such as flattened batters (safety benches) below the water level have been incorporated into the system. The safety benches will have a maximum grade of 1:8 (V : H) for the first 3.0 metres before transitioning through a 1:5 (V : H) grade over 0.5 metre. The safety benches will be densely planted such that casual entry will be difficult. A secondary safety bench will be constructed at 0.9 metres.

These will ensure that persons accidentally entering the water, particularly children, are unlikely to progress into deeper water, and can easily get back to the shore. The design of the lake incorporates a safety ledge 0.5 m deep and 3.0 m wide around the periphery of the water body to accommodate this requirement.

Other safety measures to be placed around the waterbodies will include the following:

- *Vegetative barriers* – the revegetation program has been specifically designed to create vegetative barriers to the existing lagoon and proposed constructed wetland. Around the existing lagoon, the vegetative barrier will commence from the terrestrial fringe into the submerged zone of the lagoon. The extent of the barrier has been specifically designed to prevent public access to the water from at least 2 to 3 metres back from the Normal Top Water Level (NTWL) mark to reduce the likelihood of unexpected entry into the waterbody.

- *Physical Barriers* – no formal access to either the existing lagoon or proposed constructed waterbody will be provided unless there are appropriate barriers and/or safety benching installed. This will apply to areas where viewing platforms or shared cycle/pathways may be situated along the edge of the existing lagoon or proposed constructed water body.

- *Signage* – non-obtrusive and highly resistant to vandalism signage will be installed in appropriate locations around the existing lagoon and proposed constructed waterbodies. Signage will incorporate the following elements:
    - The purpose of the wetland (i.e. stormwater treatment and wildlife habitat);
    - Significant environmental features (e.g. waterbird nesting habitat);
    - Appropriate safety warnings; and
    - Prohibition of domestic animals such as dogs within the wetland.

Under the proposed development, the existing lagoon and the constructed wetland will also be provided with water level and flow control structures in the form of simple fixed weirs and overflow embankments.

The weirs will discharge storm runoff for all storms up to and including the 5 Year ARI events with these flows confined to scour-protected channels separated from all pedestrian walkways so as to maintain public safety during these events. Where necessary, pedestrian walkways will span these channels via bridges.

The overflow embankments will discharge storm runoff in excess of the 5 Year ARI events. Although the embankments are designed to carry these flows with no erosion damage, flow conditions on the embankments during these major runoff events will represent high hazard conditions for pedestrians because of the water velocities created. Some pedestrian walkways are located on these embankments. Appropriate signage should be installed at these locations to warn pedestrians and prevent access to these sections of the walkways during major runoff events when embankments are overtopped.

5.7 Operational Management Procedures

Regular Operational and Environmental Monitoring procedures and principles for the Open Space Corridor are discussed in the Open Space Management Strategy document which is Appendix D to this document.

Management Action Trigger Events may include:

- Inundation
- Erosion damage
- Water quality control
- Algal blooms
- Vegetation and weed control
- Fauna and Fish Populations
- Insect control
- Bushfires

All of these events and their possible effect on the Open Space Corridor are subject to the final detailed design of the proposed landscaping for the Project Application for the Open Space Drainage and Habitat Corridor. At the time of writing this report the final landscaping design had not been finalised and detailed costings of the Operational and Environmental Monitoring procedure and principles have not been completed.

5.8 Funding

Port Macquarie Hastings Council have recently completed Voluntary Planning Agreements with respect to open space and environmental lands and their management and dedication to Council in the new urban release area number 13.

It is anticipated that the landowner and Port Macquarie Hastings Council will follow a similar process of negotiation in new urban release Area 14. This process will commence with Council at that point in time at which the Environmental Land Management costings are available.

5.9 DGR Item Responses

RAINBOW BEACH CONCEPT PLAN (CP)

Item	Topic
CP2.2	Consider the functioning of the wetland including the responsibility for ongoing management, any potential risk to public safety and potential environmental impacts such as groundwater, water quality and hydrology.

Response:

Responsibility for ongoing management

The Open Space Management Strategy provides the framework within which the Open Space Corridor is to be managed by the Land Owner as part of the Rainbow Beach Development. Details are provided concerning strategies that have been developed and which are to be implemented by the Land Owner to ensure the construction and occupation of the urban development component of the Rainbow Beach development does not adversely impact upon the values of the Open Space Corridor including the constructed wetland.

Risk to public safety

The Open Space Management Strategy addresses issues associated with public access and safety within the Open Space Corridor, in respect of providing (Section 2.13.4 and 5.6):

- appropriate mechanisms to restrict unauthorised and inappropriate forms of access into the Open Space Corridor by contractors involved in the construction phase of the Rainbow Beach development;
- appropriate infrastructure to facilitate controlled public access to and within the Open Space Corridor for passive recreational pursuits compatible with the area's environmental values; and
- appropriate infrastructure to facilitate Council access to and within the Open Space Corridor for environmental management purposes.

A risk minimisation approach based on the principles of not inviting people to danger and ensuring risk is minimised through reasonable provision of safety measures is to be implemented on the site.

The safety measures to be implemented on the site in relation to the wetland areas include the following:

- Vegetative barriers – the revegetation program has been specifically designed to create impenetrable vegetative barriers to the existing lagoon and proposed constructed wetland. Around the existing lagoon, the vegetative barrier will commence from the terrestrial fringe into the submerged zone of the lagoon. The extent of the barrier has been specifically designed to prevent public access to the water by reducing the likelihood of unintentional entry into the waterbody.
- Physical barriers – no formal access points to either the existing lagoon or proposed constructed waterbody will be provided unless there are appropriate barriers and/or safety benching installed. This will apply to areas where viewing platforms or shared cycle/pathways are situated along the edge of the existing lagoon or proposed constructed water body.
- Signage – signage that complies with Australian standards (AS1742) and is non-obtrusive and highly resistant to vandalism will be installed in appropriate locations around the existing lagoon and proposed constructed waterbody. This signage will incorporate the following elements:
  - the purpose of the wetland (i.e. wildlife habitat and stormwater treatment);
  - significant environmental and ecological features (e.g. waterbird nesting habitat);
  - appropriate public safety warnings; and

- prohibition of domestic animals such as dogs within the wetland areas.

The overflow embankments will discharge storm runoff in excess of the 5 Year ARI events. Although the embankments are designed to carry these flows with minimal erosion damage, flow conditions on the embankments during these major runoff events will represent high hazard conditions for pedestrians because of the water velocities created. As Some pedestrian walkways are located on these embankments, appropriate signage will be installed at these locations to warn pedestrians and prevent access to these sections of the walkways during major runoff events.

Potential environmental impacts such as groundwater, water quality and hydrology

Potential environmental impacts of the wetland on hydrology, water quality and groundwater are shown to be inconsequential (section 2.6.5) or beneficial (Section 2.10.6)

PROJECT APPLICATION – OPEN SPACE CORRIDOR & CONSTRUCTED WETLAND (PA)

Item	Topic
PA2.1	Provide a detailed description of each of the proposed uses across the site and describe the relationship between open space, drainage and habitat functions.
Response: The land uses under the proposed development are set out fully in Section 1.4.3. Land uses include residential areas located on higher ground on the northern part of the site along Ocean Drive, associated community facilities and a constructed wetlands area located on the eastern part of the site on Duchess Gully the watercourse of which forms an open space corridor.	
PA2.2	Describe the proposed ownership and long-term management regime for each component of the site including playing fields, constructed wetland and general open space.
Response: Ownership of the Open Space Corridor, including district sporting fields, the existing lagoons and other water bodies, the constructed wetland, the stormwater treatment wetlands, drainage swales, the pocket woodland, eastern creek and other open space areas as listed in Table 4 are proposed to pass to Port Macquarie Hastings Council by way of dedication after the successful completion of any development construction maintenance period.	
PA8.2	Provide an assessment of the potential impacts of the constructed wetland on public safety and liability and provide, where relevant, appropriate management measures.
Response: The safety and liability issues for the proposed development are set out and dealt with fully in Section 5.6 (Public Access and Safety Review).	

6. CONSTRUCTION MANAGEMENT

6.1 DGR Item References

The following DGR items are addressed in this section:

PROJECT APPLICATION – OPEN SPACE CORRIDOR & CONSTRUCTED WETLAND (PA)

Item	Topic
PA9.1	Provide an assessment of the potential impacts during construction of the proposal. The assessment should include, but not be limited to, consideration of: • Truck movements required and traffic routes proposed for use; • Impacts on traffic and pedestrians; • Impacts on the amenity of adjoining properties including noise, dust and sediment, and erosion controls; • Where relevant, mitigation measures to manage identified impacts.

6.2 Truck Movements and Traffic Routes Proposed for Use

6.2.1 Assessment of Impacts

Assuming that earthmoving trucks or vehicles will remain onsite throughout the duration of the works, vehicle movements associated with construction for the Project Application will be movements associated with initial arrival of earthmoving machinery and delivery of construction and landscaping materials. Other anticipated traffic movement requirements are associated with vehicle movements for and arrival and departure of workers to the site during construction times. Given that all fill will be sourced from the site, no truck movements are necessary to import fill to the site. If required, a quantitative estimate of truck movements on and off site can be established at detail design or construction certificate approval phase of the project.

6.2.2 Proposed Mitigation Measures

With regard to proposed traffic routes, a single entry point to the site will be designated with access to Ocean Drive on the northern boundary of the site. The purpose of this entry point is to direct traffic associated with construction away from established residential areas. Main truck movements throughout the site will use the existing gravel road on the property. Where necessary, internalised tracks will be formalised (i.e. covered with gravel) to avoid bogging and dust emissions.

6.3 Impacts on Traffic and Pedestrians

6.3.1 Assessment of Impacts

As detailed in section 6.2.1 above, traffic volume increases are expected to be minor, and mainly associated with arrival and departure of workers. This would increase traffic volumes during peak traffic hours. Delivery trucks are not anticipated to be frequent.

Traffic impacts on pedestrians as a result of the Project Application proposal is not anticipated to affect any pedestrians crossing the site access road to the site.

6.3.2 Proposed Mitigation Measures

In order to minimise traffic impacts on the established residential developments, traffic will be directed to enter the site via Ocean Drive, away from the Rainbow Beach Estate Stages 1, 2 and 3.

To control traffic and pedestrians, traffic will be managed in accordance with the Port Macquarie - Hastings Council Aus-Spec Development Construction Specification C201 - Control of Traffic.

A Construction Environmental Management Plan (CEMP) included in Appendix E details specific methods of managing impacts on pedestrians and traffic. Measures include:

- media releases to local residents and the wider community to advise of the nature of the proposed works and any likely traffic disruptions;
- appropriate scheduling to minimise impact to traffic from activities that may cause traffic disruptions; and
- traffic controllers at the site entrance to control traffic and pedestrians around delivery trucks.

6.4 Amenity Impact - Noise

6.4.1 Assessment of Impacts

Construction to establish the open-space corridor will involve the use of powered mechanical equipment and internal vehicle movements to achieve the desired landform. It is acknowledged that these factors have potential to affect noise amenity in the locality. It is relevant to note that the noise increases will be within allowable limits.

6.4.2 Proposed Mitigation Measures

Construction will be managed to ensure minimise noise nuisance to surrounding residents as much as possible.

Construction noise will be managed via implementation of:

- AS2436 – 1981 - Guide to Noise Control on Construction, Maintenance and Demolition Sites; and
- The current Port Macquarie Hastings Council Aus-Spec Development Construction Specification C101 – General; specifically clauses C101.17 and C101.18 which detail noise limits.

Working hours at the site will be limited to between 7am and 6pm Monday to Saturday or as required by Port Macquarie Hastings Council. There are to be no works conducted at the site on Sunday or during public holidays.

The controlled access point located on Ocean drive, an existing arterial road, will ensure noise associated with all vehicles entering or leaving the site vehicle is located away from established residential areas.

All vehicles entering or leaving the site or used at the site shall be operated and maintained in a manner which ensures that the noise levels produced by the vehicles are within the limits of the Commonwealth Department of Transport and Regional Services Federal Office of Road Safety Australian Design Rule *ADR28- External Noise of Motor Vehicles*.

6.5 Amenity Impact - Dust

6.5.1 Assessment of Impacts

Construction of the proposed development will involve the use of powered mechanical equipment for movement of sandy earth material to achieve the required landform for the proposed development. The bulk handling of this material has the potential to create air impurity nuisances by release of dust as suspended then deposited particulate matter.

6.5.2 Proposed Mitigation Measures

Earthworks will be undertaken in accordance with relevant requirements of Port Maquarie-Hastings Council Aus – Spec Development Construction Specification C101- General and C213 – Earthworks which details measures to ensure dust associated with earthworks is managed.

In addition, a Construction Environmental Management Plan (CEMP) will be prepared at the detail design phase which will detail measures to ensure compliance with the *Protection of the Environment Operations (Clean Air) Regulation 2002 Act*, Council By-Laws and health and safety requirements and to ensure acceptable amenity for construction of the development.

Measures will include, but will not be limited to:

- formalisation of internalised tracks (i.e. cover with gravel) to avoid bogging and dust emissions;
- seal or cover of all parking areas within the site shall with gravel during construction;
- where necessary (i.e. leaving site)covering of trucks transporting materials that are subject to loss by wind;
- progressive stabilisation of areas requiring vegetation clearing in order to minimise the area of open ground exposed at any one time;
- watering of exposed areas as required;
- locating of stockpiles within designated areas;
- where necessary provision of windbreaks and silt fences to prevent loss of soil by wind and water suspension;
- stabilisation of all stockpiles that are to be left for longer than 1 month using suitable vegetation/grass cover species; and
- removal of all stockpiles upon completion of works at the site.

6.6 Sediment and Erosion Control

6.6.1 Assessment of Impacts

Construction of the open space corridor will involve excavation of soils and the alteration of landform at the site. Environmental vectors including wind and stormwater coming in contact with this material has the potential to transport sediment and/or other contaminants off site.

6.6.2 Proposed Mitigation Measures

To ensure erosion and sedimentation control is executed in an approved manner and any sediment released from site is within approved limits, construction works will be planned and undertaken in accordance with relevant aspects of the:

- *Soil Erosion and Sediment Control Guidelines, Institute of Engineers Australia*;
- most current Port Macquarie - Hastings Council Aus-Spec Development Construction Specification C211-Control of Erosion and Sedimentation;
- most current Port Macquarie - Hastings Council Aus-Spec - Development Construction Specification C213 – Earthworks; and
- the Hastings Development Control Plan No. 17 - Subdivision Code, which is available at the following internet address: http://www.hastings.nsw.gov.au/www/html/564-development-control-plans.asp?intSiteID=1

Additional measures to control sedimentation and erosion will include:

- installation of Stormwater Quality Improvement Devices (SQIDs) to improve the quality of stormwater discharging into receiving waters;
- schedule of earthworks to retain as much ground cover vegetation as possible and limit the duration for which disturbed areas are exposed;
- early construction of stormwater drainage works and earthworks for erosion and sediment controls;
- designation of a stabilised entry/exit point to/from the site so that access for construction vehicles and equipment is limited to a single control point, this area shall include a shakedown area and wheel wash to prevent soil-tracking onto external roads;
- reinforcement of the controlled access point with geotextile fabric and blue-metal to allow all-weather access;
- redirection of stormwater away from the site in a controlled manner to minimise water flow across disturbed areas;
- installation of sediment traps at inlets to stormwater pipes;
- filtering of sediment laden waters through a grass buffer or a suitable silt trap prior to discharge from the site;
- installation of sediment fences on downhill slopes around all stockpiles to prevent mobilisation of stockpile materials into waterways;
- maintenance of grassed areas downslope of sediment fences to trap excess materials;

- construction of batters should be at a minimum grade of 1 in 3 (where existing ground slopes allow);
- limiting of stockpile heights to no more than 1.5m;
- stabilisation of all stockpiles that are to be left for more than 1 month using suitable vegetation/grass cover species;
- location of all stockpiles away from drainage lines and watercourses to prevent stormwater entrainment;
- Revegetation of exposed areas with local native species within one month after completion of earthworks to stabilise exposed areas and in accordance with the approved Open Space Landscape Plan and most current Port Macquarie - Hastings Council Aus-Spec Development Construction Specification C273 – Landscaping.

6.7 Water Quality Management of the Natural Wetland During Weir Construction

6.7.1 Assessment of Impacts

The construction of the weir at the eastern outfall of the natural wetland has potential to increase turbidity levels throughout the natural wetland via disturbance of sediments.

6.7.2 Proposed Mitigation Measures

The weir will be constructed in dry conditions to prevent direct release of disturbed sediment into surrounding waters. Dry conditions will be established via the following methodology.

1. a floating sediment fence will be established around the weir construction area;
2. a watertight barrier will be installed around the weir construction area;
3. the weir construction area will be dewatered;
4. the water tight barrier will not be removed until the weir is stabilised appropriately.

6.8 DGR Item Responses

PROJECT APPLICATION – OPEN SPACE CORRIDOR & CONSTRUCTED WETLAND (PA)

Item	Topic
PA9.1	Provide an assessment of the potential impacts during construction of the proposal. The assessment should include, but not be limited to, consideration of: • Truck movements required and traffic routes proposed for use; • Impacts on traffic and pedestrians; • Impacts on the amenity of adjoining properties including noise, dust and sediment, and erosion controls; • Where relevant, mitigation measures to manage identified impacts.

Response:

- No regular truck movements are necessary external to the site (apart from infrequent deliveries) since fill is sourced from the site and there will be no importing of fill to the site.
- There will be a single entry point to the site from Ocean Drive with construction traffic directed away from established residential areas.
- Traffic volume increases on adjacent roads will be minor associated with arrival and departure of workers in peak hours. There will be no impact on pedestrian facilities.
- Powered mechanical equipment and transport vehicles will be used for earthworks internal to the site. Vehicles will be fitted with noise controls such that noise increases at adjoining properties will be within allowable limits. Operations will only be carried out during normal allowable working hours.
- Dust nuisance will be avoided by implementing measures required by Port Macquarie Hastings Council AUSSPEC Construction Specifications including restriction to designated haul routes, sealed pavements, covering truck loads, water spraying and revegetation of exposed surfaces.
- Erosion and sediment movement at construction sites will be avoided by control methods required by Port Macquarie Hastings Council AUSSPEC Construction Specifications including diversion drains, sediment traps, sediment fences and revegetation of surfaces.
- The mitigation measures above will be implemented by means of a Construction Environmental Management Plan incorporated into construction contracts.

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APPENDIX A

Acid Sulfate Soil Management Plan

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A1. ASS MANAGEMENT PLAN OBJECTIVES AND METHODOLOGY

This ASS (Acid Sulfate Soils) Management Plan (ASSMP) has been compiled to-

- Ensure that the construction of the proposed development does not result in release of acidic leachate and subsequent environmental harm;
- Provide appropriate design, management, monitoring and corrective action measures required to minimise the potential impact on the environment.
- Comply with relevant legislation and regulations.

The ASSMP has been prepared in accordance with the NSW Acid Sulfate Soils Manual 1998 prepared by the Acid Sulfate Soils Management Advisory Committee (ASSMAC) (ASS Manual) as required under the Hastings Local Environment Plan 2001.

The ASSMP is designed to assist construction staff in complying with their obligations under the NSW Protection of the Environment Operation Act 1999 (PEOA 1999).

A2. PROPOSED CONSTRUCTION ACTIVITIES

Construction activities associated with the subject development may cause potential oxidation of the PASS materials. These include:

- bulk earthworks including the excavation of material from the waterways at the site;
- dewatering associated with the above; and
- excavation associated with the construction of stormwater, sewer and other buried infrastructure during civil works.

Detailed control measures, in line with the construction activities listed above, are provided in the following sections.

A3. RESPONSIBILITY OF THE CONTRACTOR

The Contractor(s) for earthworks and civil works on the site shall conduct operations in accordance with this ASS Management Plan. Prior to the commencement of works, the Contractor shall provide the following information to the Consultant:

- Contractor's environmental policy.
- Names and responsibilities of supervisory staff involved with the implementation of the ASS Management Plan.
- Schedule of site inspections (and personnel responsible) to identify environmental problems, and maintenance actions to remedy any environmental problems identified.
- An Incidents and Events Register, in which all environmental problems identified during inspections and monitoring, and complaints received are recorded and acted upon.
- Environmental Training Plan and Training Record Plan for all personnel involved in development of the site.

Emphasis shall be placed upon the timely resolution of any complaints received in relation to development of the site and the development and implementation of corrective actions in response to non-conformities to the Management Plan (identified by the monitoring process).

The Performance Objective regarding complaint resolution is for the issue causing each complaint to be resolved in such a manner that there is no further complaint for the same reason.

The Contractor is to maintain an "Incidents and Events Register" which lists the date of the incident or complaint and the type of incident or complaint. For each incident, an incident/complaint log is to be completed nominating:

- Date of incident;
- Nature of incident and associated information;
- Location of incident;
- Name of person or body which reported incident;
- Employee who received notice of incident;
- Project Manager's review and comment;
- Recommended action to resolve incident;
- List of organisations to be contacted with regard to incident;
- Outcome of actions undertaken subsequent to incident being recorded; and
- Date of resolution of incident.

Each incident is to be assigned a number to be entered on the master Incident and Event Register. Further, Council and the Environment Protection Agency are to be notified with regard to corrective action sought for incidents which have the potential to cause environmental harm.

A4. POLICY STATEMENT

- To avoid detrimental impact on the water quality through the effective identification, treatment and management of acid sulfate soils at the site.

- To comply with the *NSW Protection of the Environment Operation Act 1999 (PEOA 1999).*

- To manage acid sulfate soils in accordance with the NSW *Acid Sulfate Soils Manual 1998* prepared by the Acid Sulfate Soils Management Advisory Committee (ASSMAC) (ASS Manual).

A5. PERFORMANCE OBJECTIVES

The objectives of the ASS Management Plan are to ensure the following:

- Implementation of additional assessment procedures during earthworks operations to confirm neutralising dosing rates for the effective treatment and management of any drained, disturbed or excavated ASS in accordance with the *ASS Manual*.
- Remediation of acid trend waters if discovered, and provision of control structures to prevent leachate discharge off-site which does not meet specific water quality criteria.
- The control of erosion and sedimentation of ASS during earthworks.
- Where possible all site water shall be reused on site. If it is necessary to discharge site water off site it shall comply with the following criteria:

Table A1 Water Quality Release Criteria

Water Quality Parameter	Release Criteria
pH	6.5 - 8.5
Oil and grease	No visible film. No detectable odour.
Iron floc and scum	None visible
Floating matter	None visible
Suspended Solids	< 50 mg/L
Dissolved Oxygen	80-100 %
Iron	300 µg/L
Aluminium	Equal to background levels

The performance criteria for hydrosluiced materials are specified below.

- No sample shall exceed 25 moles H^+/tonne (0.04% S).
- If any single sample exceeds 18 moles H+/tonne (0.03% S), then the average of any 6 consecutive samples (including the exceeding sample) shall have an average not exceeding 25 moles H+/tonne (0.03% S).
- If more than one sample in any 6 consecutive sample exceeds 25 moles H^+/tonne (0.03% S), then the average of any 6 consecutive samples (including the exceeding samples) shall have an average content not exceeding 16 moles H^+/tonne (0.03% S).

The following best environmental management practices shall also be employed:

- The area of disturbance during construction shall be limited to the immediate construction area and access routes.

- All earthworks areas shall be isolated by the provision of perimeter cutoff drains or bunds.
- Excavated material shall be retained within secure bunded areas until it has been assessed for acid sulfate potential and treated as required.
- Runoff shall be contained within the construction site for treatment prior to reuse on site, or if necessary discharge off site. This will require the construction of catch drains, perimeter bunds, temporary sediment ponds, etc.

A6. SITE MANAGEMENT PROCEDURES

A6.1 Introduction

Management of both excavated and in-situ soils are required under this Plan to ensure that the impacts of disturbance are within acceptable limits.

A6.2 Training

The Contractor shall employ suitably qualified personnel during all earthworks operations to supervise and monitor acid sulfate assessment, management and treatment, so as to comply with this Plan. These personnel shall be trained in the recognition of possible ASS.

A6.3 Excavation Techniques

Excavation shall be undertaken in stages to ensure that groundwater drawdown associated with dewatering of the excavation areas is minimised.

Only a single excavation cell within the waterways shall be completely dewatered at a time. Each excavation cell will be separated by a section of unexcavated material and once excavation of each cell is complete the cell will be re-flooded to reduce the potential for groundwater drawdown associated with the dewatering and excavation of the adjacent cell.

Excavated slopes shall be inspected on a daily basis and shall be treated by surface sprays and liming to prevent any acid formation.

All excavation and treatment areas shall be isolated from external areas by perimeter drains and/or bunds. All waters collected on the site shall be contained, collected, tested and treated prior to disposal to external areas. All excavated material shall be subjected to appropriate testing, and treated where required.

All soils including sands and the clay strata shall be sampled during excavation. The sampling frequency shall be 1 sample per 500 cubic metres. The soils Acid Neutralising Capacity (ANC) shall also be undertaken throughout the construction phase. The samples shall be tested in accordance with the Acid Sulfate Soils, Laboratory Methods Guidelines. The location and depth of all test samples shall be accurately recorded on a plan of the works area.

A6.4 Treatment

All soils indicated to exceed the oxidisable sulphur criteria shall be treated with fine agricultural lime after excavation. If ANC is included in calculations for liming rates, a fineness factor of at least 1.5 must be applied to account for likely lower acid neutralising capacity in the field.

The base of any stockpiling areas of excavated PASS shall be limed with a guard layer of at least 5kg/m^2/m depth of material excavated.

Mixing shall be carried out by spreading in layers of not more than 300 mm, and use of an agricultural spreader and disc plough, rotary hoe or similar. Care shall be taken to ensure that mixing occurs throughout the depth of the layer prior to placement of new material. The rate of lime application shall be determined in accordance with the Acid Sulfate Soils, Laboratory Methods Guidelines.

Following the successful treatment of the lot (as determined through the verification testing), the material shall be compacted and the next layer of excavated material to be treated shall be placed over the already treated material. This process shall be continued until the required site elevation is achieved.

A6.5 Validation Testing

The treated PASS shall be subject to validation testing at a rate of 1 test per 500 m^3 of treated soil (as per the QASSIT *2003 Laboratory Methods Guidelines*). The validation testing shall consist of the measurement of Scr, TAA, the pH of the soil (pH_{KCL}) and the measurement of excess acid neutralising capacity (ANC). A soil may be deemed to be effectively treated when it has no net acidity.

An excess ANC of 0.5 times the existing + potential acidity shall be used as the criteria for adequate neutralisation of ASS.

Verification testing shall include retained acidity where pH is < 4.5.

A6.6 Treatment of Fill Areas

The base of all fill areas where treated PASS are to be placed shall be treated with a guard layer of 5 kilograms per square metre of fine agricultural lime per metre depth of fill prior to the placement of any fill soils.

A6.7 Control of Discharge

All water generated from dewatering activities, seepage and site runoff shall be held on site. Ponded water shall be tested for pH on a daily basis, and no water shall be discharged from site unless it complies with the requirements of Table 1.

Treatment may include the addition of flocculating agents to reduce the suspended solids concentration, and the addition of hydrated or agricultural lime to control pH.

A6.8 Groundwater Monitoring and Treatment

Groundwater monitoring bores shall be drilled approximately 50 metres beyond the excavated area to monitor the effect of the earthworks operations on the surrounding groundwater. In addition, a baseline groundwater monitoring bore shall also be drilled at the boundary of the site remote from the excavations.

The groundwater level and pH in the bores shall be monitored prior to commencement of dewatering of the water body at the site and shall be monitored on a daily basis during excavation to determine if any remedial works are required. The groundwater pH value shall be maintained to within 1 of the baseline monitoring bore pH reading.

Remedial works may include temporary halt of excavation works to allow sufficient time for groundwater recharge, the construction of recharge trenches and addition of soluble lime to the water in recharge trenches.

A6.9 Storage of Lime

A sufficient supply of agricultural lime ($CaCO_3$) shall be retained at the site at all times for treatment of ASS. The supply shall be stored in a covered and bunded area to prevent accidental release to waters.

A quantity of hydrated lime shall be retained at the site at all times for treatment of acidic waters. Storage requirements for hydrated lime shall be identical to that specified above for agricultural lime.

A6.10 Monitoring

The Contractor shall monitor the works on a daily basis for evidence of:

- yellow efflorescence on soil surfaces
- sulfurous odour.

Laboratory analysis of soils during construction shall be in accordance with the ASS Manual.

Excavated soils subjected to analysis shall be sampled and tested at the rate of one test per 500 m^3 of placed material.

Satisfactory completion of treatment shall be validated in accordance with the ASS Manual. Validation testing of PASS material shall be undertaken at the rate of one test per 500 m^3 of placed material.

Lime delivery dockets are to be collected and checked against calculated amounts of lime used.

Daily on-site monitoring of water quality shall be required. All discharges from the site shall be continuously monitored for pH and turbidity. All water discharged from the site shall comply with the requirements of Table 1. Specifically, pH level must be between 6.5 and 8.5, and suspended solids (or equivalent turbidity) must not exceed 50 mg/L.

A7. REPORTING

The Contractor shall submit monthly reports on his activities to the Consultant and the Council including any non-conformances with this plan.

A8. CORRECTIVE ACTION

Corrective action shall be implemented if any complaints are received by the Contractor, Council or EPA.

Non-conformance with this plan shall be documented and a Corrective Action Request (CAR) issued. All CARs shall be included in the Non-Conformance Register.

The Contractor shall implement the corrective action as required within the agreed time frame noted on the CAR.

The Contractor shall advise Council and the Consultant upon completion of the corrective action.

APPENDIX B

Groundwater Monitoring Plan

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B1. GROUNDWATER MONITORING OBJECTIVES

Groundwater levels and groundwater quality shall be monitored at all times to ensure the sustainability of the coastal floodplain ecosystems including native flora and fauna and groundwater resources.

B2. PERFORMANCE CRITERIA

B2.1 Groundwater Levels

Groundwater levels measured at the Monitoring Bores (Figure 18) should be shown to comply generally with the levels predicted in this Management Plan under Section 2.11.9.

B2.2 Groundwater Quality

Measured groundwater quality should comply with the criteria given in the following table at the 90 percentile level.

Table B1 Groundwater Quality Compliance Criteria

Parameter	Groundwater Quality Trigger Value
PH	6.5 to 7.5
Turbidity	1 – 20 ntu
Salinity	0.02 – 0.03 mS/cm2
Dissolved Oxygen	90 – 100 % saturation
Total Nitrogen	0.35 mg/L
Total Phosphorus	0.01 mg/L

B3. GROUNDWATER MANAGEMENT PROCEDURES

B3.1 Construction Period

There are no recommended management activities with regard to groundwater required under this Monitoring Plan during the construction phase of the development.

The construction manager shall ensure that construction activities comply with all other applicable Management Plans so far as groundwater is concerned; (an Acid Sulfate Soil Management Plan is included in the Plan as Appendix A).

It is recommended that groundwater conditions within the constructed wetlands zone be measured before and during the construction period in accordance with Section B4, recorded and compared with the performance criteria given in Section B2.

B3.2 Operational Period

There are no recommended management activities with regard to groundwater required under this Monitoring Plan during the on-going operational phase of the development.

It is recommended that groundwater conditions within the constructed wetlands zone be measured in accordance with Section B4, recorded and compared with the performance criteria given in Section B2 for a minimum period of five years from the completion of the wetlands construction or until the end of the final defects rectification period for the whole development, whichever is longest. (It is expected that the latter condition will apply since it is proposed that the wetlands be established early in the development program.)

B3.3 Reporting

The proponent shall submit annual reports on groundwater conditions and measurements to Council during the monitoring period including any non-conformances with the performance criteria.

B4. GROUNDWATER MONITORING PROCEDURES

Monitoring Bore locations are shown in Figure 18.

Each bore should be sampled in accordance with the following program.

Table B2 Groundwater Sampling Schedule

Project Stage	Frequency	Tests
Pre-construction (see Notes * and **)	Weekly (for 2 months); then Monthly if consistent (**)	WL (groundwater level) Conductivity / Salinity Temp (temperature)
	Monthly	pH DO (dissolved oxygen)
	Quarterly (*)	Total N, P
Construction	Weekly	WL(groundwater level) Conductivity / Salinity Temp pH
	Monthly	DO
	Quarterly	Total N, P
Operational	Monthly	WL (groundwater level) Conductivity / Salinity pH Temp DO
	Quarterly	Total N, P

Notes (pre-construction phase):

(*) Pre-construction quarterly tests should provide at least three sets of samples at quarterly intervals over six months prior to construction activities on site.

(**) Pre-construction weekly tests for water level, conductivity and temperature can be reduced to monthly frequency if results over 2 months show consistent data.

Testing of groundwater for suspended solids (SS), herbicides, and pesticides (organochlorides and organophosphates) has not been included in the monitoring program. It is considered that these contaminants are likely to be managed and monitored as part of surface water management programs conducted by regulatory agencies.

It has been assumed that pH testing of groundwater is sufficient to monitor acid soil conditions. Associated contaminants which may be influenced by soil acidity such as dissolved metals, alkalinity etc. are more appropriately monitored as part of surface water management programs conducted by regulatory agencies.

APPENDIX C

Surface Water Monitoring Plan

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C1. SURFACE WATER MONITORING OBJECTIVES

Surface water quality in the wetlands flow zone should at all times be suitable for –

- Sustainability of the coastal floodplain ecosystem
- Passive recreation use
- Irrigation of native vegetation species

C2. SURFACE WATER QUALITY MONITORING CRITERIA

Measured surface water quality should comply with the criteria given in the following table at the 90 percentile level (refer to ANZECC 2000).

Table C1 Surface Water Quality Compliance Criteria

Parameter	Surface Water Quality Trigger Value
PH	6.5 to 7.5
Turbidity	1 – 20 ntu
Chlorophyll a	0.005 mg/L
Salinity	0.02 – 0.03 mS/cm2
Dissolved Oxygen	90 – 100 % saturation
Total Nitrogen	0.35 mg/L
Total Phosphorus	0.01 mg/L

C3. SURFACE WATER MONITORING PROCEDURES

Surface water should be sampled in the existing western tributary lagoons and the constructed wetlands flow zone at suitable locations near the centre of the water bodies and at sufficient depths to characterise the vertical profile.

Each location and depth should be sampled in accordance with the following table.

Table C2 Surface Water Sampling Schedule

Project Stage	Frequency	Tests
Pre-construction	Fortnightly (for 2 months); then Monthly if consistent (**)	Turbidity Conductivity / Salinity Temp (temperature) pH DO (dissolved oxygen) Total N, P ORP
	Monthly (*)	Chlorophyll a
Construction	Weekly	Turbidity Conductivity / Salinity Temp pH DO
	Monthly	Chlorophyll a Total N, P ORP
Operational	Quarterly	Turbidity Conductivity / Salinity Temp (temperature) pH DO (dissolved oxygen) Total N, P ORP Chlorophyll a

Notes:

(*) Pre-construction quarterly tests should provide at least three sets of samples over six months prior to construction activities on site.

(**) Pre-construction fortnightly tests can be reduced to monthly frequency if results over two months show consistent data.

APPENDIX D

Open Space Management Strategy