

Edithvale and Bonbeach Level Crossing removal project

Report of Surface Water Impact Assessment

1 Introduction

The AECOM-GHD Joint Venture prepared the technical report titled **Surface Water Impact Assessment (Technical Report)** which is included as Technical Report E to the Environment Effects Statement (EES) for the Edithvale and Bonbeach Level Crossing Removal Project (**Project**)

The role that I had in preparing the Technical Report was to undertake the assessment and prepare the written report and associated figures.

I adopt the Technical Report, in combination with this document, as my written expert evidence for the purposes of the Edithvale and Bonbeach Level Crossing removal project Inquiry and Advisory Committee's review of the EES and draft planning scheme amendment.

2 Qualifications and experience

Appendix A contains a statement setting out my qualifications and experience, and the other matters raised by Planning Panels Victoria 'Guide to Expert Evidence'.

A copy of my curriculum vitae is provided in Appendix B.

3 Further work since preparation of the Technical Report

Since the Technical Report was finalised, I have not undertaken any further work in relation to the matters addressed in the Technical Report relevant to the Project.

4 Written Submissions

4.1 Submissions Received

I have read the public submissions to the EES and draft planning scheme amendment and identified those that are relevant to the Technical Report and my area of expertise. These include the following submissions:

1, 207, 216, 235

4.2 Summary of Issues Raised

The submissions have raised the following issues relevant to my area of expertise:

1 - That LXRA need to be careful about flooding issues as they have an impact on residential housing

207 - The EPA submission listed the relevant guidelines and legislation. They indicated the Best Practice Environmental Guidelines should be considered during the construction phase as well as the operational phase.

216 - This submission largely focused on groundwater but did comment on not altering flows, which could also include surface water.

235 – That the project has the potential to alter flow patterns, volume and direction of groundwater

4.3 Response to Issues Raised

There is known flooding to the east of the Project sites which are indicated by planning scheme flood overlays. Furthermore the local stormwater network has limited capacity which results in frequent minor flooding in the road networks. The design has identified numerous options to prevent existing flooding from being exacerbated, including retaining runoff from the trench and discharging to the local stormwater network after the storm event has ceased.

Incorporating the Best Practice Environmental Guidelines into the construction phase is likely to be difficult to achieve as the document is primarily written for management of urban stormwater once development has been completed. Some aspects of sizing sediment basins may be relevant. The most appropriate guideline to manage water quality during the construction phase is EPA Publication 480, Environmental Guidelines for Major Construction Sites. The Best Practice Environmental Management Guidelines are better suited to managing water quality during the operational phase.

The issue raised by submission 216 was considered and the direction of surface water flow will not be significantly impacted by this project as lowering the rail will not interrupt overland flow paths.

Alteration of surface flows can impact groundwater recharge and flow as indicated by submission 235. The Project will not alter surface flow as stormwater runoff currently flows away from the rail corridor under current conditions and this will continue to occur.

EPR_SW1, EPR_SW2, EPR_SW3, EPR_SW4, EPR_SW5, EPR_SW6 with respect to surface water, are appropriate to manage or mitigate adverse environmental effects arising from the development of the Projects.

I note that in the second paragraph of EPR_SW2 publication 480 should be removed. As 480 is the publication number of the construction phase document. Also consultation should be with Kingston City Council rather than Melbourne Water.

Declaration

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Inquiry and Advisory Committee.



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Signed

Date: 23/5/2018

Appendix A Matters Raised by PPV Guide to Expert Evidence

- (a) the name and address of the expert;
- Peter Meyers
- (b) the expert's qualifications and experience;
- Peter is a Civil Engineer with 20 years of experience in civil engineering and water resources. Peter has extensive experience in hydrological and hydraulic analysis including flood estimation, Integrated Water Cycle Management, Water Sensitive Urban Design, stormwater master planning and urban development, water balance modelling and civil design.
- (c) a statement identifying the expert's area of expertise to make the report;
- Peter has significant experience in developing and designing stormwater solutions for urban transport projects. Peter has worked on a number of large rail projects including the regional rail link and the Epping to South Morang Rail extension. Peter has been part of the LXRA Technical Advisor Team since its inception and has discussed the stormwater strategy with Melbourne Water.
- (d) a statement identifying all other significant contributors to the report and where necessary outlining their expertise;
- There were no other contributors to the report other than the checker and verifier both of whom have been working with the LXRA Technical Advisor Team since its inception.
- (e) all instructions that define the scope of the report (original and supplementary and whether in writing or oral);
- The scope is listed below:
1. Review the public submissions referred to me to the extent relevant to my area of expertise.
 2. Prepare an expert report that:
 - a) responds to the public submissions relevant to my area of expertise
 - b) addresses my Previous Report and any changes required arising out of the issues raised in the public submissions: and
 - c) addresses any other matter that I consider relevant to my area of expertise.
 3. Prepare a short (no more than 30 minute) Power Point presentation for presenting at the hearing.
 4. Attend the hearing to give evidence in relation to my report.
- (f) the identity of the person who carried out any tests or experiments upon which the expert relied in making this report and the qualifications of that person;
- Not Applicable

- (g) a statement setting out the key assumptions made in preparing the report;

A detailed hydraulic analysis was not undertaken as part of this technical report. It was assumed that existing local stormwater assets already have insufficient capacity to cater for Council's design storm event. This assumption is based on the age of the catchment, a desktop review of existing drainage assets and discussions with Council

I have also received and read all submissions.

- (h) A statement setting out any questions falling outside the expert's expertise and also a statement indicating whether the report is incomplete or inaccurate in any respect.

Issues relating to groundwater have been addressed in Technical Report A "Groundwater Impact Assessment" and will be addressed by other experts.

Appendix B CV

Career Summary

Peter is an Associate Director with 20 years of experience in civil engineering and water resources. Peter has extensive experience in hydrological and hydraulic analysis including flood estimation, IWCM, WSUD, stormwater master planning and urban development, water balance modelling and civil design. Peter has managed water resources teams of up to 12 people and has also lead projects where he has been responsible for managing various technical disciplines subcontractors and clients.

AECOM

Team Leader, Water Resources, Associate Director – Water 2009 – current

Parsons Brinckerhoff

Team Leader Water Resources, Principal Engineer 2005 - 2008

Hyder Consulting

Senior Water Engineer, Team Leader, Water. 2001 - 2005

Meinhardt

Senior Infrastructure Engineer. 2000 - 2001

WBCM

Engineer, Design Manager 1996 - 2000

Detailed Technical Experience

Flood Assessments

Birregurra Creek Flood Frequency Analysis

Preparation of a flood frequency analysis to determine design flow events based on historical stream flow data. The complex nature of the catchment, which included a number of large natural storages made determining design flow events from first principles unreliable. The flood frequency analysis provided more certainty and was used to determine the 100 and 2000 year flows to provide scour protection for proposed bridge abutments.

Climate Change Adaptation Project for Department of Defence, Phase 2 and 3

Technical lead for the development of flood maps and coastal erosion estimates due to climate change and sea level rise for defence sites in Exmouth, Learmonth, Cocos Islands Brisbane and Newcastle. The project involved using RORB and TuFlow to estimate flow rates and determine flood extents, taking into consideration future climate change and the impact of storm surge due to tropical cyclones. The flood inundation maps were used developing adaptation options, schematic designs and cost estimates and presenting the findings to the client's stakeholders in Canberra.

Melbourne Water Flooding Panel.

Project lead for flood mapping projects for Melbourne Water in Melbourne's eastern suburbs. The work included reviewing hydrology and hydraulic models, GIS outputs and acting as project manager and coordinating with Council and Melbourne Water stakeholders. The work resulted in the production of flood and inundation maps for numerous major waterways which were incorporated into future planning overlays. A climate change assessment was also undertaken.

Mackay Flood Resilience Project

Project Manager for the preparation of a flood resilience strategy for Mackay Regional Council. The project included identifying a list of structural and non-structural projects to improve flood resilience, developing and executing an MCA to prioritise projects, undertake community and stakeholder engagement and develop a governance strategy to implement and monitor the strategy.

Mt Buller Water Storage.

Project Manager for the hydrological investigation and catchment yield assessment for a 100ML water storage at Mt Buller. The project involved undertaking a detailed hydrological investigation to determine potential yields from Boggy Creek to support the dam as well as undertaking preliminary geotechnical and civil engineering investigations.

Blackburn Station Grade Separation Flood Mitigation.

Concept design of flood mitigation works to maintain water surface levels across the floodplain after the rail grade separation has been constructed. The works included develop a concept to manage flood water and testing the design using two dimensional flood models. Melbourne Water approvals were also obtained as part of the design.

Canterbury Road Flood Assessment.

Determination of existing flood levels to enable the construction of a nursing home in Canterbury. The project required the development of a detailed TuFlow model that was used to identify site flood levels and develop a strategy to lower the predicted flood level to enable development.

Hydrological assessment and flood mapping of Ely River in the United Kingdom.

A hydraulic model was developed and modified to account for proposed filling on the floodplain to facilitate future development. The impact on existing railway bridges and upstream infrastructure need to be assessed to ensure that the proposed works would not cause increased flooding or be detrimental to the existing structures.

MIKE 21 modelling of Wallan airfield.

Preparation of a Mike Flood model to determine existing flood levels for a 75ha development site on low lying land. The site is affected by a high railway line embankment and flows are constricted by a number of fixed outlets. The model was used to generate flood maps of the area, which assisted development of the site.

Hydroelectric Power Station Improvement works, Victorian Alps, Snowy Hydro

Rubicon Hydroelectric Power Station Assessment – Hydraulic analysis of tail bay of a hydroelectric power station in country Victoria to assess flow conditions and recommend works that could lower the tail water and improve the efficiency of the power station.

Mining and Industry*Rolleston Coal Water Management Plan.*

Development of a water management strategy for Xstrata Coal to manage pit and raw water. The strategy involved developing a detailed water balance model using Goldsim to assess rainfall, groundwater seepage and mine uses. The model was used to inform mining operations, size additional storages to limit the number of uncontrolled releases to the environment while ensuring there is sufficient supply to support mine operations.

Stockmans Mine Pre-Feasibility

Water balance modelling and surface water risk assessment for a Zn/Cu/Ag/Au mine in the Victorian Alps. The purpose of the analysis was to determine the portion of raw water demand that could be met from local catchment runoff and to ensure that once the mine was closed the local catchment could sustain and environmental water cover over the tailings. The project required a detailed analysis of all components of the water cycle within the mine so that infrastructure could be size to ensure a particular reliability of water supply throughout the life of the project.

Collinsville Coal Water Management Plan.

Detailed water management plan for Xstrata Coals Collinsville mine in northern Queensland to support and Environmental Agreement. The plan aimed to improve water management on site and in particular identified ways to reduce the volume of acidic mine water on site. The plan quantified the likely accumulation of acidic water and through various water management strategies, identified how this could be reduced.

Rolleston Coal Pit Water Storage.

Detailed design of a 1.0GL pit water storage to store mine effected water prior to controlled discharge. The storage included designing a release system which complied with environmental regulations to limit flow rates relative to flows in the receiving waterway and required the management of structural and geotechnical inputs.

Rolleston Coal Levee and Diversion Design.

Design of diversion and levee system to protect pits from catchment runoff and from inundation from neighbouring watercourses. The design included 2D floodplain modelling, waterway realignment, levee design and obtaining in principal agreement from State Government agencies.

Wesleydale Mine Rehabilitation Corangamite Catchment Management Authority

Rehabilitation of an existing open cut mine in country Victoria. Flood routing techniques were used assess dam outlet conditions to attenuate flows and reduce flow down an existing gorge. The outcome of the project was a reduction of sediment and polluted water discharging into existing natural waterways.

Woodside Gas Plant, Water Quality Ponds.

Industrial Wetlands sizing of artificial wetlands to treat stormwater runoff and process water from gas processing site in the Otways.

Dam Break Analysis*Stockyard Creek Dam Break Analysis, Southern Rural Water*

Dam break analysis of an existing earth dam upstream of Foster in eastern Victoria. The analysis determined the PMF from the contributing upstream catchment and used the simplified method to determine a hydrograph to represent the dam failure. Sunny and rainy day scenarios were assessed using RORB to route the flow to the township. HEC RAS was used to determine the increase in flood extent, depth and hazard and identify population at risk so a risk category could be identified.

Bella Vista Dam Breach Analysis

Preparation of a dam break assessment for a combined large retarding basin and underground storage that was located upstream of a residential estate. The project used XP storm to determine the upstream hydrographs including the PMF to assess a rainy day failure. TuFlow was used to model an instantaneous failure of the concrete retaining structure and flood inundation maps were prepared for the downstream waterway. The analysis was submitted to the Dam Safety Committee so the risk category could be adopted.

Rolleston Coal Mine Water Dam

Preparation of a dam break analysis for a 1000ML mine water storage at Rolleston Coal in the Bowen Basin. The analysis was used to assign a risk category and obtain a water storage license. The work was also used by the mine operator to develop operating and emergency response procedures.

Water Sensitive Urban Design*Bicentennial lakes Mareeba*

Preparation of a management strategy to improve water quality and reduce maintenance requirements for a series of artificial wetlands in northern Queensland. Prolonged residence times and the lake bathymetry was causing excessive weed and algal growth leading to poor water quality and increased maintenance. The strategy recommended methods to create better defined shallow and deep zones so that aquatic vegetation could be better controlled and reducing lake turnover to reduce nutrient loads.

Cedric Archer Park Wetland Strategy, Rockhampton.

Review of an existing tropical wetland system that was not performing as required and was impacted by poor water quality and prolific weed growth. The assessment included undertaking a site inspection with elected local government representatives to discuss management strategies that could improve lake aesthetics while maximising community benefits.

Basin Prioritisation Project. ACT

Site identification and analysis of potential water quality treatments as part of the Murray Darling Basin Prioritisation Project. The work has involved selecting sites and assessing the performance of proposed treatments against a base case scenario. The work has also included community consultation forums and input into a MCA and CBA workshop to rank the best performing options. Grace Park wetland and stormwater water harvesting design. Detailed design of a water quality treatment wetland and stormwater harvesting system including catchment yield and reliability assessment and design of wetlands, hydraulic structures, pump and pipe distribution system and electrical controls.

Elsternwick Park wetland and stormwater harvesting system.

Detailed design and construction supervision of a stormwater harvesting system to capture and treat stormwater from Elster Creek to us for irrigating local sporting fields.

Ballarat Wetland.

Project Manager for the detailed design and construction supervision of an artificial wetland in Ballarat. The wetland will also act as a retarding basin to provide flood attenuation to the major storm event to reduce downstream flooding. Stormwater harvesting was also incorporated into the design to provide a non-potable water source to irrigate nearby sporting fields.

Water Sensitive Urban Design Guidelines – South East Councils.

Preparation of planning design operation and maintenance guidelines for WSUD for Councils in the south east of Melbourne. The guidelines were facilitated by Melbourne Water and included design criteria, methodology checklists, flow charts and references to other design material. The work also included developing a sample of rainfall data that could be used in MUSIC to represent the longer historical record.

Rigby Wetland, Melbourne Water

Detailed design and documentation of a 40ha wetland on the Dandenong Floodplain. Once constructed, this will be the largest wetland in Melbourne and will have a significant impact on reducing nutrients entering the bay. The project involves complicated floodplain hydraulics, the design of in stream diversions to divert flows into the wetland and the design of environmental features such as fish passages. Hourly flow data for Dandenong creek was used as an input to the water quality model to more accurately assess pollutant removal.

Yarraman Creek Wetlands, Melbourne Water

Detailed design of a 200,000m² wetland on Yarraman Creek to treat a total catchment area of 370ha. The wetland was constructed in the base of an existing retarding basin which provided the opportunity to increase the level of flood protection of downstream properties

Gardiners Creek wetland, Clearwater

Detailed design and documentation of a 3,500m² wetland and biofilter in a council reserve in Glen Waverly. A biofilter was included within the wetland to increase pollutant removal as the size of the wetland was limited due to available space within the reserve.

Clause 56 Implementation Guidelines, Melbourne Water.

Preparation of guidelines to assist with the implementation of Clause 56. The primary focus of the report was to examine the implications that the new legislation would have on water quality within development and make recommendations on how water quality could be managed to improve overall waterway health rather than only considering water quality.

Melbourne Airport water quality works

Detailed design of WSUD features to treat stormwater runoff from expanded areas at Melbourne Airport. The primary treatment was a large ephemeral wetland and biofilter. A system of swales was also used to treat some sections of road runoff.

Trinity Grammar School wetlands, Kew sporting grounds

The wetlands have been constructed to treat stormwater runoff from a large urban catchment. Additional storage allowed for in the wetlands provided the school with additional water to irrigate sporting fields.

Midway Wood Chipping water quality improvement works

Design of settlement ponds for a Victorian wood chipping company to remove suspended solids from production wastewater prior to discharging to trade waste. The process also involved reducing the pH and turbidity of the wastewater and also incorporated treatment of polluted stormwater runoff.

Water Quality Wetlands, Kingston, Kingston City Council

Design and construction supervision of artificial wetlands in Sir William Fry Reserve for Kingston City Council. The works involved the design of two artificial lakes with macrophyte planting to treat stormwater runoff before discharging into an existing formal lake. The system also allowed for the lakes to be artificially fed from a local bore when stormwater runoff was not sufficient to maintain water levels.

Naar Maen Wetland Maroondah City Council

Detailed design and construction supervision of an artificial wetland constructed in the base of an existing Melbourne Water retarding basin. The wetland was designed to remove water pollutants in accordance with Melbourne pollutant reduction targets and also provide improvement to the immediate local amenity

Melba Creek Rehabilitation and Wetland, Hume City Council

Design of wetlands and sediment traps to treat low flows in the base of an existing creek and rehabilitate eroded creek banks with rock lining, geotech fabric and planting. The design also required us to reconfigure drainage outfalls to the creek to reduce erosion.

Integrated Water Management*Northern Growth Corridor. GIS Water Planning Tool.*

Development of a GIS tool to identify waterway values and areas of significant habitat to assist in urban development planning. The tool uses a combination of values, threats and physical waterway characteristics to suggest land use planning measures to better manage urban runoff to protect the identified values.

Evans Road Residential Development IWC Strategy.

Preparation of a stormwater master plan to support preliminary planning of a residential development in south east Melbourne. In addition to considering flood management requirements, the project had a particular focus on

incorporating integrated water management into the design to reduce demand on potable water and provide environmental benefits to downstream waterways.

Water Future North Planning Investigation.

Hydrological and water balance assessment of the northern growth area of Melbourne to accommodate an additional 145,000 lots. The investigation assessed the inclusion of IWM features within the catchment including rainwater tanks and WSUD works and measured the impact on the overall water cycle. In addition to seeking to reduce the demand on potable water, a key objective of the investigation was to develop a strategy that minimised the effect of development of flow characteristics on local waterways. Frequency, duration and rate of flow within the waterways was compared for pre and post development scenarios to enable the impacts to be quantified.

Water Future Central Planning Investigation.

Detailed investigation of each whole of water cycle management options including: system water balance and MUSIC modelling; developing concept designs, assessing impacts of waterways, quantifying potential stormwater yield and developing cost estimates for resulting infrastructure. The investigation will be used to identify effective management of stormwater to provide economic, social and environmental benefits.

Cobbler Creek Hydrological Investigation.

Detailed hydrological and catchment yield assessment for the Cobbler Creek Dam north of Adelaide. The project involved investigating the opportunity to harvest stormwater from a 10km² rural catchment within the Cobbler Creek Dam prior to pumping to a series of wetlands prior to reusing. The investigation also assessed the impact of harvesting stormwater on downstream flows in Cobbler Creek and the effect that the reduced storage capacity may have on attenuating flood events. Its impact that storing water within the dam on the ability to prevent downstream flooding was also assessed. The analysis resulting in recommendations to alter the dam outlet structure to maximise the volume of water that could be harvested.

Urban Development and Planning

Huntlee Stormwater Master Plan Review.

Reassessment of an existing stormwater strategy for a 7500 lot residential development with the objective of optimising the required infrastructure. The analysis has resulted in proposed changes to lakes and wetlands that will increase the amount of developable land on the site.

Dohertys Creek Strategy, Melbourne Water.

Preparation of a strategy to facilitate the development of an industrial precinct including the design of retarding basins and floodways, water quality works, stakeholder consultation and consideration of the future Regional Rail alignment. The schemes are used to plan for future development and enable key water infrastructure to be identified and funded.

MacArthur Wind Farm.

Design of Drainage and water supply infrastructure for a \$1.0 billion wind farm south of Hamilton, Victoria. An important part of the project involved with the contractor to source a suitable water supply in sufficient quantities to produce concrete on site. Options considered included groundwater, stormwater harvesting and purchase of existing extraction licenses.

Hyderabad Airport Stormwater Management Strategy

Functional design of a stormwater collection system for Hyderabad Airport to capture stormwater runoff to prevent flooding of neighbouring residential and commercial properties. Captured water was treated to remove hydrocarbons prior to discharging to an existing groundwater aquifer.

Drainage schemes, Melbourne, Melbourne Water

Management of various drainage strategies for Melbourne Water. Primary tasks include the development of hydrological models (RORB) flood mapping, water quality analysis, assessment of stormwater reuse opportunities, developing a strategy to facilitate future development and preparing cost estimates.

Ningbo Urban Development Planning, Ningbo, China

Strategic planning water related issues for a new urban centre in China. The centre was to be approximately 40 km² and accommodate 1 million people. The project primarily involved determining a strategy that would allow stormwater runoff to be temporarily stored within a large canal network during a storm event prior to being discharged to a nearby river. The river was tidal and the water level was higher than the town on a daily basis. Floodgates, levees and a pump system were to be used to manage stormwater runoff.

Melbourne Airport Business Park

Master planning and detailed design of Annandale and Sharps Road retarding basins and wetlands as part of the Airport Business Park development. The works involved undertaking a detailed hydrological assessment of the airport and the catchments leading to Steele Creek and developing a stormwater management strategy that enabled the development of the business park without increasing downstream flooding. An ephemeral wetland system was also designed which would not impact airport safety.

Moonee Valley Drainage Improvement Study, Melbourne

Reported to Moonee Valley City Council to accompany a detailed drainage capacity assessment advising on how to prioritise and fund future works, establish a contribution schemes, set development criteria and develop a maintenance program to assist with implementing a drainage improvement strategy.

Little River Earth Sanctuary

Engineering Manager for the Little River Wildlife Sanctuary project. The project involved designing an environmentally sustainable ecotourism resort using ESD principles. Responsibilities included coordinating structural, mechanical and electrical design in addition to overseeing road and drainage design. The project also involved coordinating the design of a wastewater treatment plant and designing an onsite disposal system.

Transport and Major Projects*LXRA Technical Advisor.*

Lead stormwater advisor to the Level Crossing Removal Authority for the interim technical advisor role. The work included undertaking reference design for a number of rail grade separation projects, a reference design for 8km of new rail to Mernda, input into alignment options to determine preferred grade separation format, stakeholder engagement, tender evaluation and owners engineer through construction phase.

Melbourne Metro.

Stormwater lead for the Melbourne Metro tender design including tunnel drainage, dewatering and disposal, protection of portal entrances, floodplain management, WSUD and civil drainage at 5 new stations. The work has involved working with contractors, estimators and various design disciplines to develop solutions that consider value, constructability and compliance with the scope.

RRL Package C.

Lead stormwater designer for stage C of the Regional Rail Line project in Victoria. The work included designing track drainage, structure drainage and various cross drainage elements for major waterways.

Superway stormwater verification.

Verification of stormwater design for the Superway project in South Australia including road drainage, structure drainage, floodway assessments and WSUD.

Epping to South Morang Rail Extension

Lead drainage engineer for the \$380M, 13km rail alignment through the northern suburbs of Melbourne. The project includes three major waterway crossings as well as tuck drainage and the realignment of local roads. Primary responsibilities included undertaking the hydraulic assessment of the bridge crossings to ensure no increase in upstream flood levels, determining the 2000 year load impacts, providing scour protection for the bridge abutments, detail major waterway connections to minimise the impact natural stream geomorphology and providing WSUD to treat track runoff.

Gawler rail extension tender design.

Design of a stormwater strategy to service the extension and duplication of the Gawler rail line in Adelaide. The project included managing surface flows and floodway's to ensure the rail was operable during extreme rainfall events.

Anthony's Cutting (Western Highway Realignment Project)

Lead Drainage engineer for the detailed design of drainage infrastructure related to the Western Highway realignment east of Bacchus Marsh. The project involved using "Drains" to model the local pit and pipe networks and assessing the capacity of the existing council network. Detailed hydraulic models were also prepared for the major creek crossing to determine the impact of the proposed bridges on upstream water levels. WSRD and stormwater harvesting was also incorporated into the road design.

Desalination Plant

Site hydrology Review and verification of catchment hydrology for the Victorian desalination plant. The task include verifying flows determined by RORB, assessing the PMF and advising the client on a suitable level of risk

when setting the floor level of the plant. Also responsible for managing the running of various Tuflow scenarios to assess the sensitivity of different boundary conditions such as climate change and the effect of sand bar movement.

Eastlink

Melbourne, Thiess John Holland Joint Venture. Hydrological and hydraulic design. Engineer responsible for the completion of hydraulic design of various components of the Eastlink project including bridge sizing, scour protection, afflux assessment and channel realignment and wetland design.

Geelong Bypass stage 3, Tender design

Tender design of all road drainage including cross culverts swales, pipes and WSUD retarding basin sizing and assessment of the Barwon River.

Melbourne Airport long term car park extension.

Functional design of drainage network and on site retarding system for the expansion of Melbourne Airports long term car park Officer Drainage Scheme, Pakenham, Melbourne Water.

North Ryde to Epping rail tunnel.

Design verification for the project which included reviewing track drainage, groundwater management systems, protection of entrances, pump systems and disposal of wash down water.