Western Port Modelling Review of Responses to Request for Further Information - peer review

Technical Report A - Annexure K

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[redacted]
AECOM
Collins Square,
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727 Collins Street,
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Dear [redacted],

Re: Western Port Modelling Review of Responses to Request for Further Information

Introduction

My name is [redacted]. I am a director and coastal scientist at eCoast Marine consultancy. I hold Bachelor of Science degree (Hons) in Physics with Computing from the University of Bath, a graduate diploma in Statistics from the University of Auckland and a Masters degree in Evolutionary and Adaptive Systems from Sussex University. I have 11 years' experience in marine research and consulting, have co-authored 17 peer-reviewed scientific papers, and have solely or jointly produced many technical reports pertaining to physical oceanographic processes, many of which focus on dispersion modelling.

I have also worked extensively on modelling Western Port Bay, Victoria, including modelling freshwater inputs from rivers and sediment transport over multiple years.

Scope

In an earlier report (15 November 2019), eCoast provided a review of the following reports:

Hydronumerics, 2019a, Hydrodynamic Modelling Report, Working Draft, Report prepared for CEE Pty Ltd, October, 2019

Hydronumerics, 2019b, Hydrodynamic Modelling Report, Appendix A, Hydrodynamic Modelling, Report prepared for CEE Pty Ltd, September, 2019

Hydronumerics, 2019c, Hydrodynamic Modelling Report, Appendix B, FSRU Discharge and Intake Modelling, Report prepared for CEE Pty Ltd, September, 2019

And the following documents were used as sources of supporting information:

Hydronumerics, 2016, Western Port SEPP Loads Modelling Strategy, Development and Scenarios, Prepared for Victoria EPA

CEE, 2018a, AGL Gas Import Jetty Project Crib Point, Western Port: Plume Modelling of Discharge from LNG Facility, Prepared for Jacobs Group (Australia) Pty Ltd

CEE, 2018b, AGL Gas Import Jetty Project Crib Point, Western Port: Modelling and Assessment of Biological Entrainment into Seawater Heat Exchange System, Prepared for Jacobs Group (Australia) Pty Ltd

Yeates, P, Okely, P., 2016, Western Port SEPP Loads Modelling Strategy, Development and Scenarios, Prepared for Victorian EPA, DRAFT

The review concluded that for both for the Hydronumreics and CEE work, overall, the methodologies were sound and modelling approaches were deemed to be suitable for assessing behaviour of the plume in the marine environment. However, some questions and requests for further information for the reports were included in the eCoast review.

Since then, the reporting of the CEE nearfield modelling and Hydronumerics far field modelling have been modified, taking into account initial comments. Details of the updated modelling work are now presented in the following documents:

Hydronumerics, 2020a, Hydrodynamic Modelling Report, Working Draft, Report prepared for CEE Pty Ltd, March, 2020

Hydronumerics, 2020b, Hydrodynamic Modelling Report, Working Draft, Appendix A, Report prepared for CEE Pty Ltd, December, 2020

Hydronumerics, 2020c, Hydrodynamic Modelling Report, Working Draft, Appendix B, Report prepared for CEE Pty Ltd, December, 2020

Hydronumerics, 2020d, Hydrodynamic Modelling Report, Working Draft, Appendix C, Report prepared for CEE Pty Ltd, December, 2020

AECOM 2020, Crib Point Gas Import Jetty EES: Marine Environment Hydrodynamic Modelling, Report prepared for AGL Wholesale Gas Ltd and APA Transmission Pty Ltd, March 2020 Chapters 6 to 8

In the case of the CEE reporting, the CEE 2018a and 2018b documents remain unchanged and this document provides a review of the updated and summarised CEE methodology presented in AECOM (2020, Chapters 6 to 8). In the case of the Hydronumerics modelling, this review focuses on Hydronumerics 2020a to 2020d which are updated revisions of Hydronumerics 2019a to 2019d.

This review provides an assessment of the new reporting in light of the requests for further information from the November 2019 eCoast review, and also provides a review of new information presented in the latest CEE and Hydronumerics reporting.

As part of this review details of the updated reports were discussed with Peter Yeates (Hydronumerics) on 3 April 2020 and Ian Wallis (CEE) on 9 April 2020.

General Assessment of Updated Reports

AECOM (2020)

The bulk of the reporting on the nearfield modelling is contained within Sections 6.1 and 6.2 of AECOM (2020), although there is also relevant information in Chapters 7 and 8. The information in Chapter 6 is largely a condensed reproduction of the methodology CEE 2018a. However, the results have been updated to reflect the modified proposed discharge regime in the nearfield marine environment. As in the initial review of CEE (2018a), overall, the methodologies are sound and modelling approach is suitable for assessing behaviour of the plume in the marine environment.

The discharge has been increased from 450,000 m^3/d to 468,000 m^3/d and additionally the modelling was extended to include open loop, closed loop, ballast water and minor discharges that are represented in the far field modelling.

Some of the results reflect the analysis based on the old discharge (450,000 m^3/d) rate, although the open loop discharge output has only increased by 4%, so the conclusions around the effect of discharge depth (Figure 6.1) and discharge angle (Figure 6.2) remain valid.

Conclusions from this modelling are that the optimum configuration for the open loop discharge are using up to 6 high velocity jets with a horizontal discharge angle. The modelling supports this, and these conclusions are reasonable based on the model output.

The nearfield model results have been schematised for inclusion in the regional modelling. The nearfield modelling is 'stationary' meaning that the results are steady state and the model output is used as a lookup table for generating 'non-stationary' boundary conditions for the regional model. This is an appropriate methodology for coupling the two models. As discussed in the request for more information below, the initial dilution results in the nearfield modelling are shown to be consistent with the results in the regional modelling (e.g. Figure 6.16).

Several subsections of Chapter 7 of AECOM (2020) are also relevant to this review. Section 7.5.2 (AECOM, 2020) presents the optimum open loop discharge configuration and accurately interprets the results of the nearfield modelling in Chapter 6. Section 7.6.3 to 7.6.5 summarise the particle entrainment modelling (Hydronumerics, 2020a) and do so faithfully. Sections 7.7 and 7.8 interpret the temperature and chlorine modelling results (Hydronumerics, 2020a) and provide an accurate summary of the findings. Note that no comment is provided in this review as to the ecological interpretations of the results in Chapter 7.

Hydronumerics (2020a, 2020b and 2020c)

The updated Hydronumerics 2020 reports are similar to the original 2019 reports but now include results from a range of new scenarios and several sections have been rewritten to provide more clarity, as discussed below. As in the previous review of Hydronumerics (2019a, 2019b and 2019c), overall, the methodologies are sound, and the modelling approach is suitable for assessing behaviour of the plume in the wider marine environment.

The results of in Hydronumerics (2020a) now include a much wider range of scenarios including open loop (at a range of discharge rates), closed loop, ballast water and minor discharges and with the LNG vessel docked alongside the FSRU. These results are reported to all use a consistent methodology.

The results show a considerably bigger plume impact in terms of temperature and chlorine when LNG vessel is docked as would be expected. The pattern of spatial variability of particle (larvae) entrainment is also in line with expectations.

The conclusions drawn as to the worst-case impact of the operation in terms of the plume are presented Section 8.1.1 of AECOM (2020) and provide an accurate summary of the results presented in Hydronumerics (2020a).

Review of Requests for Further Information

A number of requests for further information were included in the previous review. Below we provide updates to these requests based on the updated reporting and discussions with the report authors.

Nearfield Modelling Approach (AECOM, 2020)

1. The near field modelling results were undertaken using with the vessel at half load. if the nearfield modelling were carried out assuming a fully loaded vessel, the plume dilution may be reduced. Discussion around this point and/or additional sensitivity analysis in the far field model would enable a better understanding of this.

Discussions with Ian Wallis confirm that the finalised modelling was carried out using the conservative fully loaded vessel case. This is implied by the results shown in Figure 6.5 which show dilutions consistent with the fully loaded case in Figure 6.1.

2. The erosion rate has units of m/30 minutes which seem arbitrary (Figure 13), so it is not clear why the blue line dropping below the pink line indicates total mixing. Extra information about this is required.

This Figure is not presented in the summarised results presented in AECOM (2020), which is acceptable as it does provide necessary information and does not materially change the conclusions of the work.

3. Future reporting should include the results of the LNG vessel (communications with CEE indicate that these results will be included).

These results are now included in the nearfield and far field model reporting.

4. Discussions with CEE (Ian Wallis, pers. Comm., 8 Nov 2019) indicate that tests have been undertaken comparing the dilutions in the nearfield model and the far field model. These results need to be presented.

Cross-sections of temperature (e.g. Figure 6.16) demonstrate that the dilutions in the regional models are consistent with the results of the nearfield modelling.

5. Further communication with CEE (Ian Wallis, pers. Comm., 8 Nov 2019) indicated that additional model runs are underway to simulate additional ballast and miscellaneous discharges from the FRSU vessel. Results from this modelling should be included in the final reporting.

These results have now been simulated and are presented briefly in Section 6.4.11.

Far Field Modelling (Hydronumerics 2020a, 2020b and 2020c)

1. Are the discharge volumes justified and presented in reports outside of those reviewed here? If so a reference to the relevant report should be included.

These are presented in AECOM (2020).

2. A more thorough description of how the nearfield model is represented in the far field model is needed. This should include how the plume footprint changes over time in the far field model.

This is now presented in Section 3 in Hydronumerics (2020a).

3. Analysis of plume induced temperature anomaly through the water column should be included.

This is illustrated through the inclusion of cross-section plots of temperature anomaly. Additionally, plots of Chlorine concentration are now shown as ‘highest for all depths’

4. Results of the presence of the LNG vessel in the far field model should be included in this report (once the model runs have been completed).

These results have now been included and provide results that seem reasonable.

5. A more thorough description of particle release and entrainment in the far field model is needed.

This has now been included and provides a much clearer description of the methodology.

6. More detail is required to describe the re-count and re-distribution of particles in the model.

Details of re-count and re-distribution have been removed as they were not needed. The count description is clearer now.

7. Sensitivity analysis results need to be updated to reflect the present discharge scheme.

The sensitivity runs have been updated accordingly and are presented in Appendix A.

8. The model has some difficulty reproducing the measured excursion at the ADCP deployment locations. Comment on how this influences the particle modelling results would be of use.

Excursions are no longer included in the calibration. This is acceptable as excursion analysis is not usually a requirement for model calibration.

9. The percentage of particles being entrained still increases after 28 days. Some discussion of this is required.

The biological context for the use of 28 days is presented in 7.12.3 of AECOM (2020)

10. Appendix B tables showing plume layout should be clarified with discussion and/or labels on the diagrams.

The presentation of these results has been modified and it is now clearer.

Conclusion

Responses from the previous request for further information have been provided through the updated reporting and adequately address concerns raised. A further review of the updated reports find that overall, the tools and methods used for the nearfield and regional modelling are appropriate and the results seem reasonable.

Please let me know if you require any further details or clarification.

Yours sincerely,

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