

REPORT TO THE ASSOCIATION OF BAYSIDE MUNICIPALITIES

Assessment of Supplementary Environmental Effects Statement (SEES) on the Channel Deepening Project

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Qualifications and Experience:

Dr Harris was previously Chief of CSIRO's Division of Land and Water, and Head of CSIRO's Environmental Projects Office.

Dr Harris was leader of CSIRO's Port Phillip Bay Environmental Study 1996, which has since prompted similar in-depth studies in Sydney and Adelaide. He was also the leader of CSIRO's Coastal Zone Program and involved in CSIRO's Blue-Green Algal Research Program.

Dr Harris was born in the UK and graduated from Imperial College, London, in Botany. He joined CSIRO after a distinguished career as a biology professor in Canada.

Dr Harris is now Director of a private consultancy firm ESE Systems Pty Ltd and participates on various Federal Government Scientific Advisory Committees.

Expert Area of Expertise:

Ecologist, freshwater and marine biologist with an international reputation for work in aquatic and terrestrial ecology, freshwater biology, pollution monitoring, biological oceanography and remote sensing and has published more than 100 papers and four books.

Introduction

I provide the following comments in the context of my previous assessments. The issues I raised in my assessments of previous EES documents are largely still unanswered and while, on the face of it, this new set of documents are more thorough and impressive than we have seen before, they still do not address fundamental issues that have existed from the outset. Indeed it now seems that the proponents are either unwilling or unable to address fundamental issues of risk and cost: benefit assessment.

The SEES documents are more professionally prepared and contain more detail than before. This means that the "devil is in the detail" and that a very thorough

analysis of methods and assumptions is required in order to assess the adequacy of the risk analysis presented. Given the size of the documentation this makes the job difficult within the time constraints of the public submission period.

The SEES documents are still the proponent's business plan, not a true integrated risk assessment of the project. My best judgement is that this document tends to downplay key risks associated with human and environmental impacts and assumes more rapid recovery of the Bay after the project than may be the case. Hence the documents cast the proposed project in the best possible light.

SEES documents do not conform to the Guidelines

The document does not, however, appear to conform to SEES guidelines in many respects. The SEES guidelines specifically require consolidation and integration of the impacts of the project (p. 9 of the SEES Guidelines), a consideration of short and long term effects and a reliable basis for impact prediction and a holistic and integrated approach (p. 12). The SEES guidelines also required a system based approach (p. 14), a focus on interactions between effects and the development of an integrated assessment (p. 14). There is also a requirement to demonstrate that full recovery of marine protected areas will be achieved within 0-2 years (p. 27). The SEES Guidelines also required no net long term change in the marine protected areas (p. 33).

In my view the SEES documentation does not give an integrated risk analysis, nor does it provide a system based approach. It does not provide a reliable basis for impact prediction, nor does it give a full cost-benefit analysis of the project, including the full impact on ecosystem services provided by the Bay. In many places it asserts (without supporting evidence) that impacts will recover within two years, whilst also providing evidence of drastic changes in marine protected areas as a result of the trail dredging programme. Detailed analysis of the Technical Reports indicates that the recovery process in marine ecosystems is not properly assessed or understood. I therefore do not believe that the SEES is compliant with its Guidelines.

One significant departure from past documents is the admission and acceptance of most of the public objections to the previous EES; e.g. admissions of rock falls and damage to important biodiversity assets during trial dredge activities at the Heads, acceptance that there will be impacts on diving and ecotourism activities, acceptance that channel deepening will increase nutrient loads to the Bay by about 300 tonnes of nitrogen, acceptance of visual impacts and environmental risks through better modelling of sediment plumes and extent, acceptance of risks associated with the movement and disposal of contaminated sediments from the Port and Hobson's Bay etc.

Granted, there is now an acknowledgement in this document and in the political process that there are risks involved here. So the debate has moved on significantly – but the fundamental issues remain. This document actually changes very little. The

questions still are; are these risks properly assessed and how do we manage and/or contain those risks? Remember; we are trying to answer these questions in an environment of considerable uncertainty – we do not have all the knowledge required to answer key questions. This Channel Deepening Project (CDP) pushes the boundaries of our predictive powers so we must consider a precautionary approach.

I have some serious questions concerning this SEES. These are detailed below.

Economics

I question the basis of the economic analysis provided. The benefit:cost ratio is low, even on the most optimistic scenarios. It is estimated that the benefits of the CDP are of the order of \$60M p.a. and these are weighed against the project costs. Furthermore the economic modelling seems to require some calculation of the flow through of benefits - a calculation method which has been questioned. If the values of the ecosystem services provided by the Bay are included (estimated to be of the order of \$300M p.a. if we use Costanza's published methodology) then we are putting these valuable services at risk on the basis of a contested benefit estimate and a flawed risk assessment. Also the SEES document indicate that less than 5% of container ships entering the Bay require a tidal assist, also placing the case for the CDP in doubt.

As we have seen before the SEES for the Bay does not address larger system level impacts on regional transport and urban services, neither does it address larger strategic issues to do with national transport strategies, rail infrastructure – or even the rapid migration of the global economy to what has been called a “carbon and water light” economy. The economic analysis does not include important (and changing) externalities – costs which society and the environment will have to bear. Over the next 25 years I foresee a rapid change towards the inclusion of externalities into the market. If the present drought continues it will have major economic impacts in the State balance of trade. In a period of such very rapid change (which is what we are in right now) 25 year projects of trade and economic benefits are uncertain.

Toxicology

It would appear that the true extent of the contaminated sediment in the port and the lower Yarra River has not yet been revealed. The core sampling methodology may not have been representative – a factor raised by the project's peer reviewer. The assessment of the contamination did not adequately consider bioaccumulation or impacts on sediment in-fauna – both critical features of any adequate risk assessment. Short-term toxicological analysis was accompanied by the use of dilution factors to determine if the dispersed sediment would meet water quality guidelines. Dilution factors of 100 were used, and these were also questioned by the

peer reviewer. We are assured that the bunds will be adequate and that dispersal of the dredged material will be minimal.

It would appear that the 5M cubic metres or so of contaminated sediment and water to be dredged out of the harbour area reduces to approximately 1/3 of this after setting and consolidating in the disposal bund (a bulking ratio of 3 is quoted). This therefore estimates that about 2M cubic metres of contaminated waters from these sediments will be released into the Bay during and after the dumping period. I am concerned that the release of this water through what is called the “consolidation flux”, together with the inevitable resuspension of fine sediment by wave action and wind induced currents during the 140 day period before capping of the bunds, may result in impacts on critical ecosystem components and bioaccumulation. Furthermore dilution factors of 100 seem to be designed to underestimate the potential risk.

The projected areas of impact are large. The area of the contaminated plume at the DMG and in Hobsons Bay is projected to be 32 km² in total over a four week period. This indicates a high likelihood of benthic in-fauna impacts. The area of impact of the Port Melbourne Channel and South Channel dredging (150 and 600 km² respectively for 16 and 40 weeks) also implies ecosystem impacts. I have further concerns that if the dredged material contains the resting cysts of potentially harmful algal blooms then moving them and disposing of them with the sediments might stimulate germination and the development of toxic blooms.

Biodiversity, seagrasses and micro-phytobenthos (MPB)

The CDP SEES shows the extensive plumes of suspended material in the Southern part of the Bay during dredging activity. There will clearly be major visual and aesthetic impacts. It is admitted that these sediment plumes will damage ecotourism revenues and impact on diving activities. Much turbidity modelling has been done, and it seems that risk analyses are based on averages and percentiles when we know that the major impacts will come from the effects of intermittent extreme events spread over time. [This is the case, for example, in Adelaide coastal waters where there has been extensive seagrass loss.] Whilst the SEES acknowledges that there will be impacts on seagrasses, it asserts that the impacts on those seagrass beds in shallow water will be minimal. Impacts on seagrasses in deeper water will be greater – and I can find no map which gives an indication of the proportion of seagrasses in deeper waters.

I am not sure that we fully understand the effects of increased turbidity during dredging. As required by the SEES Guidelines I would like to have seen an analysis of the effects of intermittent perturbations in the underwater light field on the full coupled Bay ecosystem – plankton photosynthesis in the water column (including the risk of harmful algal blooms), seagrasses, micro-phytobenthos, denitrification and feedbacks on nutrient cycling and on system behaviour. This is the only way to assess the risks of the CDP – and the SEES Guidelines required this approach. To

my knowledge only the CSIRO Port Philip Bay Study model can do this. The SEES asserts that this model was rerun for this study – however I can find no-one who can corroborate this statement. If the model was run what were the driving parameters, which climate and rainfall period was simulated and why are we not shown the results? System performance was not fully assessed in the SEES – for example in the case of light and turbidity effects on the micro-phytobenthos I can find only assessments of the impacts on denitrification efficiencies, no assessments of the impacts of toxic sediment disposal on the important invertebrates in the sediments and no long term assessment of bioaccumulation. What then are the effects of the CDP on absolute rates of denitrification over time – which, after all, is the critical factor that we need to know?

We do not adequately understand the factors which influence the speed of recovery after dredging. There was much more damage at the Heads than was admitted during and after the trail dredge program. Anecdotal evidence tells of rubble fields at the Heads which are quite mobile, and of continual rock falls from unstable walls. Yet we are told (without supporting evidence) that all will be well within two years. Similarly attempts to model the recovery of the micro-phytobenthos after dredging appear to have failed – this is a critical failure in the context of the assessment of impacts on the nutrient cycling within the Bay..

I take particular exception to the frequent assertion that even if there are environmental impacts from the CDP, then these will all be naturally fixed within two years – and that this is therefore acceptable. This is merely arguing by assertion – and the absence of evidence from the CSIRO model and other quantified arguments I do not accept the assertions. I do not think that we have sufficient knowledge of either the magnitude of the impacts or the restorative powers of these systems to be able to make such sweeping statements. The two year time limit was, of course, was one of the conditions of the SEES guidelines.

Risk assessment methodology

In my previous briefings to you I questioned the risk assessment methodology. This view has not changed as a result of the SEES. The risk assessment methodology does not conform to the Guidelines. The methodology relies heavily on expert judgements and is not an integrated assessment of potential interactions and synergies. While it conforms to Australian Standards (and much is made of this in the report), it is flawed by not adequately treating system level interactions and potential synergies. Individual risk assessments in the SEES – factor by factor – are based on averages and percentiles and do not include synergistic or interactive effects. [A “fudge factor” allowance is merely made for possible interactions.] The true risk is associated with the synergistic effects of extreme events. Causal chains of concatenated events – e.g. equipment failure and mistakes in management occurring at the same time as extreme weather events– are what drive the ecological responses. We know that the behaviour of these coastal ecosystems is decidedly non-linear and therefore an assessment of risks factor by factor is invalid

and optimistic. Only a coupled physical, chemical and biological model, like the CSIRO model, can be used to look at coupled non-linear interactions within the Bay system and approaches to “tipping points”. Even so we do not fully understand the potential risks associated with system level “tipping points” in coastal ecosystems. An “issue by issue” approach based on subjective judgements and averages does not tell us how “precarious” the present state of the Bay is, nor inform us about how close to a threshold we might be. We know that these systems show this kind of behaviour – indeed this was the major outcome of the CSIRO study of the Bay. This is precisely why this approach was rejected and the Guidelines were written the way they were. The risk assessment significantly underestimates the risk of long term damage to the Bay and to the community.

Adaptive management

I have long been of the view that this project may well go ahead whatever the risks and costs – and whether or not the review process is adequate. So the only available “fall back” strategy therefore is to adaptively manage the impacts while the project proceeds. I was appalled that the trial dredging project was shrouded in such secrecy – and we can now see that public scepticism was justified – failures and mistakes during that program are now admitted. An adequate adaptive management program would, as I have said before, require much greater transparency and speed of response than we have seen heretofore. For example, I have not yet been able to find out how input from the science reference group that was appointed to advise the project has been included – or what impact that advice might have had on the risk analysis. Their assessment would be a critical input to the public assessment of the CDP risks.

Adaptive management of the CDP would require an independent panel of experts and community members to assess the project as you go along – informed by real time data on the state of the Bay. At no time in the past have the CDP proponents displayed a sufficient regard for transparency or speed of response. Indeed, I am told that much of the turbidity monitoring data from the trail dredging program remains unanalysed. There is therefore a matter of public trust here. Based on the past behaviour of the project proponents do we believe the new SEES conclusions, and do we believe that an adaptive management regime would protect the Bay and the community?

Assessment of Independent Expert Group (IEG) Report

Appendix 1 outlines my assessment of the IEG report on the Channel Deepening Project SEES.

Conclusions

In my report to you on the initial EES I wrote “The present publicly available EES documents are, in my opinion, deficient in respect of their integration and “systems”

overview, in respect of their lack of consideration of the proposed works on ecosystem services provided by the Bay, and in respect of the lack of detail about the hydrodynamic modelling and potential impacts on ecosystems and biodiversity in the Bay. Overall there does not yet appear to be an adequate risk management tool by which both the proponents of the project and other interested parties may judge the risks of the proposed dredging works. Coastal embayments like Port Phillip Bay are subject to long term (sometimes irreversible) change arising from individual extreme events, so it is necessary to be able to assess both the short term risks arising from the resuspension of sediments and spoil disposal during dredging activities, as well as the long term risks of irreversible ecosystem impacts. This is a very challenging task that will require integration and synthesis of the many EES tasks as well as sophisticated modelling of dredging activities, plume dispersal, water movements and potential ecosystem damage.” This conclusion stands today. Only the shortcomings in the hydrodynamic modelling appear to have been rectified – and over \$100M has been spent to get us very little further. The requirements of the SEES Guidelines appear to have been ignored and we are instead presented with a restatement of the proponent’s intentions wrapped up in ever more impenetrable prose.

It is now accepted that the CDP is a risk to the integrity of the Bay ecosystem. This SEES has, once again, failed to correctly assess that risk. The Bay is a valuable asset to the community, both in terms of aesthetic and community values and in terms of its provision of a number of valuable ecosystem services. Given that the risks and values are not adequately assessed and costed in these documents I do not believe that we have an adequate case for the project to proceed.

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 panel.

APPENDIX 1.

Assessment of the Independent Expert Group (IEG) on the Channel Deepening Project (CDP) SEES.

Question 1 – Conceptual approach of the SEES

The IEG concludes that the risk assessment approach of the SEES is sound, whilst recognising that the Bay is a complex system. Significantly, the IEG notes that the SEES has not explicitly modelled the complexities, non-linearities and thresholds of the Bay response to the CDP but has relied, instead, on expert judgement. Models like the CSIRO Port Phillip Bay model have not been used, despite assertions to the contrary in the SEES. Granted the risk assessment has taken a conservative view, but I have said before, and I repeat, the expert judgements used in the SEES do not adequately consider synergistic and highly non-linear responses in the Bay system and therefore the approach recommended by the IEG, that of a beefed up EMP, does not provide adequate protection against sudden and unexpected threshold responses to the CDP. In my view the conceptual basis of the SEES is flawed.

Question 2 – Dredging technology and dredging methods options

The IEG finds inconsistencies in the assumptions regarding the use of various dredging configurations and recommends altered source terms for suspended matter and even different starting dates for dredging activities. Turbidity levels resulting from dredging may have been underestimated. The ecological impacts of this underestimate are dealt with below. Again the IEG recommends that such inconsistencies be dealt with through an improved EMP process.

In relation to dredging at the Heads, the proposed dredge technology has not been fully tested in action, and the SEES is based on laboratory simulations of the proposed “ripper” heads. Astonishingly the IEG accepts that “rockfall” cannot be monitored during the dredging process and therefore cannot be used to control the works. The IEG goes on to note that “rockfall” at the Heads is not presently proposed as a measurable environmental parameter in the EMP, and recommends that it be added. Once again the emphasis is on risk mitigation after the fact. The track record of the proponents shows that this is a dangerous strategy.

The IEG concludes that the proposed method of capping the disposed material is sound, but again recommends the development of an expanded monitoring program.

Question 3 – Hydrodynamic modelling

The IEG carefully skirts around the issue of whether the 2-D modelling used in the SEES is entirely adequate by concluding that the use of 3-D models would have resulted in “some reduction in uncertainties of model forecasts for the ecological impact assessment”. I would have thought that this statement was critical!

The models conclude that high and low tide sea levels will change by no more than 19mm and that the residence time of water in the Bay will be reduced by 7%. Current speeds in the Sands region will increase.

Question 4 – Turbidity modelling

The IEG finds many shortcomings in the turbidity modelling, particularly in the assumptions about sediment re-suspension and in the source terms used, and finds shortcomings in the calibration and validation of the models used. A number of inadequacies in the assumptions, data and model outputs are identified and the IEG concludes “that it is difficult to forecast the exact implications of these uncertainties”. The IEG concludes “that the turbidity modelling is not suitable as a sole risk management measure during the project”. Once again an improved and “robust” EMP is recommended. The question is whether or not this is an adequate measure for environmental protection in the Bay.

The IEG report contains a lengthy discussion on the uncertainties in the relationships between total suspended solids the water (as measured by filtering the water and weighing the solids collected) in and turbidity (which is measured optically as the cloudiness of the water). There are uncertainties here which have implications for the ecological impacts discussed below. Not all these uncertainties appear to have been resolved.

Question 5 – Sediment transport

The IEG notes that the models used to predict sediment transport around the Great Sands were uncalibrated and were not reproducing actual sediment transport rates. Furthermore the models were not able to predict the new dynamic equilibrium that will arise in the Sands after the CDP dredging – and this has major implications for ongoing maintenance dredging activities. In short the SEES treatment of these matters appears to be inadequate.

Question 6 – Nutrient cycling processes

The IEG notes that this very important aspect of the SEES has not been dealt with by comprehensive numerical modelling (as was required by the TORs of the SEES). The SEES did not explicitly model the non-linear feedbacks in the nutrient cycles of the Bay; instead an experimental and risk-based approach was used. The IEG

concludes “that it is difficult to gain an overall sense of dredging impacts on nutrient cycling” from the SEES despite this being one of the key goals of the entire program.

The SEES underplays the potential impact of the CDP on nutrient cycling in the Bay by making a number of assumptions of limited extent and brief impact as well as by downplaying the uncertainties in the cause-effect relationships (see page 29 of the IEG report). The present EMP for the CDP does not even propose to monitor any key aspect of nutrient cycling in the Bay despite the fact that this is one of the most important risks. The CDP conclusion is based on the methodology used in the CDP SEES and not on rigorous modelling of possible impacts.

I noted discrepancies in the assumptions concerning the dynamics of the micro-phytobenthos in my previous report.

Question 7 – Marine ecological communities

The IEG identifies some of the uncertainties that I had previously identified; namely the problem of lack of knowledge of ecosystem recovery times, spread of turbidity plumes under different weather conditions and the impact of the CDP on key ecological communities. The IEG document contains a lengthy discussion on the potential impact of plumes of suspended sediment on the underwater light conditions and the potential impact on seagrass communities. The IEG notes that there are still major uncertainties about the possible impact of the CDP on seagrasses and, once again, recommends an enhanced EMP in this regard.

As I noted previous the many statements in the SEES that recovery of marine communities will recover within five years is not based on sound science. The IEG agrees. Issues remain around “rockfalls” at the Heads and their impacts on the ecological communities there. The IEG concludes that the SEES documents are “optimistic” in this regard. The IEG report notes that there are unresolved uncertainties around the impact of the CDP on fish species in the Bay. It notes “a failure to recover on the part of an important commercial species might necessitate adaptive response post dredging” (p. 40).

Question 8 – Environmental management plan

The IEG found shortcomings in the proposed EMP design, especially the proposal to conduct limited performance monitoring (turbidity and noise) as the CDP proceeds and then to undertake six-monthly reviews of possible secondary impacts. The IEG notes that this is an inadequate strategy, especially when the design of the six-monthly review process is not yet determined. The proposed EMP is inadequate and incomplete so the IEG was not able to comment on this.

This section of the IEG report reveals severe deficiencies in the CDP project design and certainly reveals an inability to detect and properly attribute potential impacts

and ecosystem changes. When this is coupled with the inadequacies of the overall risk-based methodology we are left with an SEES with severe flaws.

The IEG disagrees with the proposed methodology and environmental criteria for assessing impacts on seagrasses and is concerned about the effects of turbid plumes on other ecological assets. Risks to deeper seagrass populations remain and the IEG states that environmental limits for other species must be reviewed. It should be remembered that the SEES uses optimistic assumptions about the potential spread and impact of the turbid plumes, so that the IEG recommends modifications to ensure greater adaptive feedback in the EMP to control potentially damaging effects from the spread of plumes of sediments.

Other aspects of the EMP in relation to oil spills, toxicant bioaccumulation and impacts on biota are also found wanting. The IEG also discusses the feedback mechanisms between impact monitoring and dredging operations and finds that in many cases the clear links between environmental monitoring and changes in dredging practices are lacking. The key areas are sediments, turbidity, and ecological impacts at the Heads. In the case of the Heads the environmental impacts are controlled by operational procedures not by environmental control limits.

Conclusions

The IEG report identifies many of the risks and uncertainties identified in my earlier reports to the ABM. It also identifies many additional shortcomings in the SEES and concludes that significant uncertainties and risks remain.

There is nothing in the IEG report that would cause me to modify my earlier recommendations to the ABM and nothing that would cause the ABM to radically modify its position on the risks and benefits of the CDP. This assessment does not alter my previous advice that the SEES is not a proper risk assessment of the CDP, but is instead a proponent's business plan which attempts to put the CDP in the best possible light.

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