An Approach to managing the impacts of contaminants from urban and rural residential development on the marine area

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Introduction

The purpose of this talk is to explore one approach to coastal management and policy development which addresses two common consequences of development, namely sediment and urban stormwater discharges. Coastal management, like all policy areas, requires an understanding of a wide range of factors and processes to make wise decisions. Information on social, economic, political, cultural and natural environment factors are typical of that required. Science is an important component and often an absolutely fundamental source of information for managing natural resources. Experience has shown that in the past the value of scientific input is often overlooked or underestimated by many involved in resource management decision-making. In this paper two examples are presented of how the scientific approach has contributed significantly to the establishment of sound policy.

Where Does Science Fit in the Scheme of Things?

It provides the understanding of the natural processes and responses to both anthropogenic stresses and natural changes and interactions. Such information, linked with the other relevant inputs, provides for a robust, credible *decision support system* to underpin policy development, implementation and review. Without the input from science based monitoring, investigations and research, we are merely guessing. The saying 'Don't let facts get in the way of a good guess' is a recipe for disaster – we of course have to avoid the opposite of 'paralysis-by-analysis'. As always a balance is required.

The simple fact is that the natural systems resource managers are charged with managing are largely too complex, too extensive and knowledge limited to be able to be dealt with by a best professional judgement approach. Locally and world wide we have learnt this lesson through numerous bad experiences.

Science input is but one component of the decision making process and simply provides a mechanism for better clarifying issues and options in decision making, rather than forming the sole basis of the decision process.

How Can Science Contribute?

Both the following case studies utilise sophisticated computer modelling of rainfall induced runoff from the land and the distribution and settling of contaminants in marine receiving systems, coupled with detailed ecological monitoring. These information streams interact to provide an output in the form of an ecological risk assessment based on known sensitivities of biota to the various contaminants.

Case Study 1:

The first example arises from the question of what is an acceptable pattern and density of development in a 'greenfields' situation. Such situations occur commonly around Auckland on the perimeter of the Metropolitan Urban Limit (MUL) where previously low-density habitation associated with traditional pastoral farming is being

considered for development as more intensive rural lifestyle. The proposal to develop the Whitford embayment catchment is one of a number of examples.
After consideration of what were some of the key issues, it was decided that the risk of acute adverse effects occurring from the land clearance activity and associated sediment discharges to the estuary during the site development phase was the greatest concern. In the past, managers had to rely on sediment control Best Management Practices (BMPs), and could only advocate their application to whatever development scenario the developers proposed. The management approach adopted for Whitford was based on the objective of optimising the development opportunities while minimising the risks to the estuarine values from sediment discharges. The use of sophisticated computer modelling of both the land and receiving water systems coupled with ecological mapping and risk assessment was adopted. The output was in the form of a series environmental risk curves superimposed over ecological values. As with all computer models, their greatest advantage is in being able to process large quantities of information in a robust and repeatable way. This is particularly useful in 'scenario' testing, as is the case when looking to optimise development options.

Case Study 2:
Consider the example of the ecological threat posed by contaminant build-up in the environment from urban stormwater runoff, a well-documented outcome of urban growth. This case study involves urbanisation of areas of the Upper Waitemata Harbour catchment. Assessing the significance of this threat is far too complex to make decisions simply using existing best professional judgement. One of the management solutions to this threat involves intercepting contaminated stormwater and treating it before discharging it to the environment. This process is, on average, far less than 100% efficient, and in fact treatment efficiencies can range from as low as 20% to 95% depending on many factors. The costs of implementing treatment for a city like Auckland can easily involve hundreds to thousands of millions of dollars, and so the benefits of doing this must be carefully weighed. Past management response to this problem has been to adopt overseas solutions involving treatment of stormwater and the implementation of BMPs, "to do the best that's practicable" with no questioning of whether this will deliver agreed environmental outcomes. This question was only answered by the application of an extension of the modelling approach used in Case 1 but with the inclusion of long term contaminant build-up components, a first for such an application. The output was in the form of contaminant accumulation curves projected out over one hundred years for a range of development scenarios and contaminant reduction options. The thresholds of acceptability were based on standard environmental response criteria obtained from the literature.

Answers to some criticisms of this approach.
Critics argue that the uncertainties are too great to justify taking such an approach. The uncertainties are acknowledged by practitioners but two considerations give credibility to the approach in contrast to others. Firstly, the uncertainties are no greater and possibly significantly less than alternative approaches. Secondly recent empirical research aimed at testing the models against measured sedimentation and contaminant build-up rates has leant support for the approach.

A second major area of criticism is that of the high cost of applying the approach. The Upper Waitemata Harbour modelling cost around $450,000 and the Whitford study cost $818,000. While these are significant costs it needs to be kept in perspective e.g., for Whitford this equates to approximately $800 - $1800 per new lot (depending on housing density adopted) – not very significant when the other costs of subdivision and statutory compliance are considered along with the potential permanent damage to ecological values.

A third criticism is that the modelled effects are only a limited subset of the full issues to be considered. This is obviously true but the science input is only intended to be used as part of a decision support framework. A further point is that the need for modelling is not a given, but a component that needs to be considered in determining the approach in any given circumstance.

A fourth criticism relates to the need to run modelling for each new area as against extrapolating across similar resources. The fact is that generalising results from research conducted at any single level is likely to lead to errors and unsupported expectations when extrapolated to other levels or circumstances. Again common sense and best professional judgement need to be employed to decide whether extrapolation is justified or not.

How does the science become policy?
The main output from the modelling is an integrated set of environmental risk curves of the type shown in Figures 1 & 2.

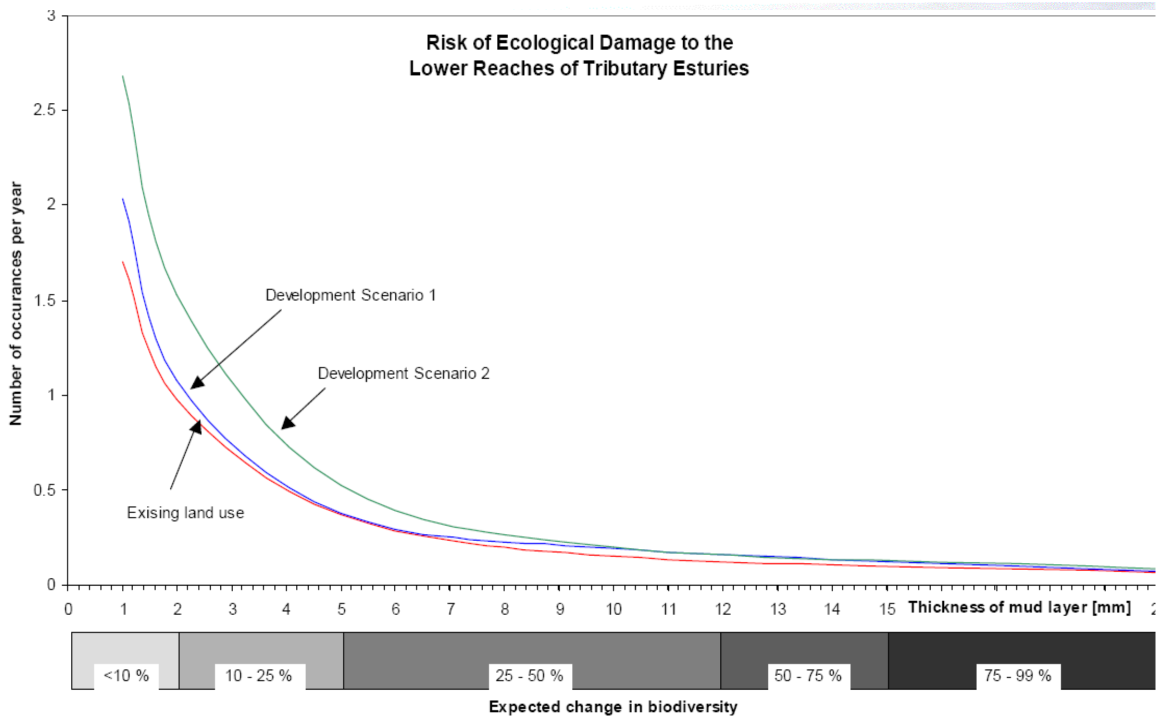

Figure 1: Risk of damage resulting from various development scenarios.
(Source: NIWA)

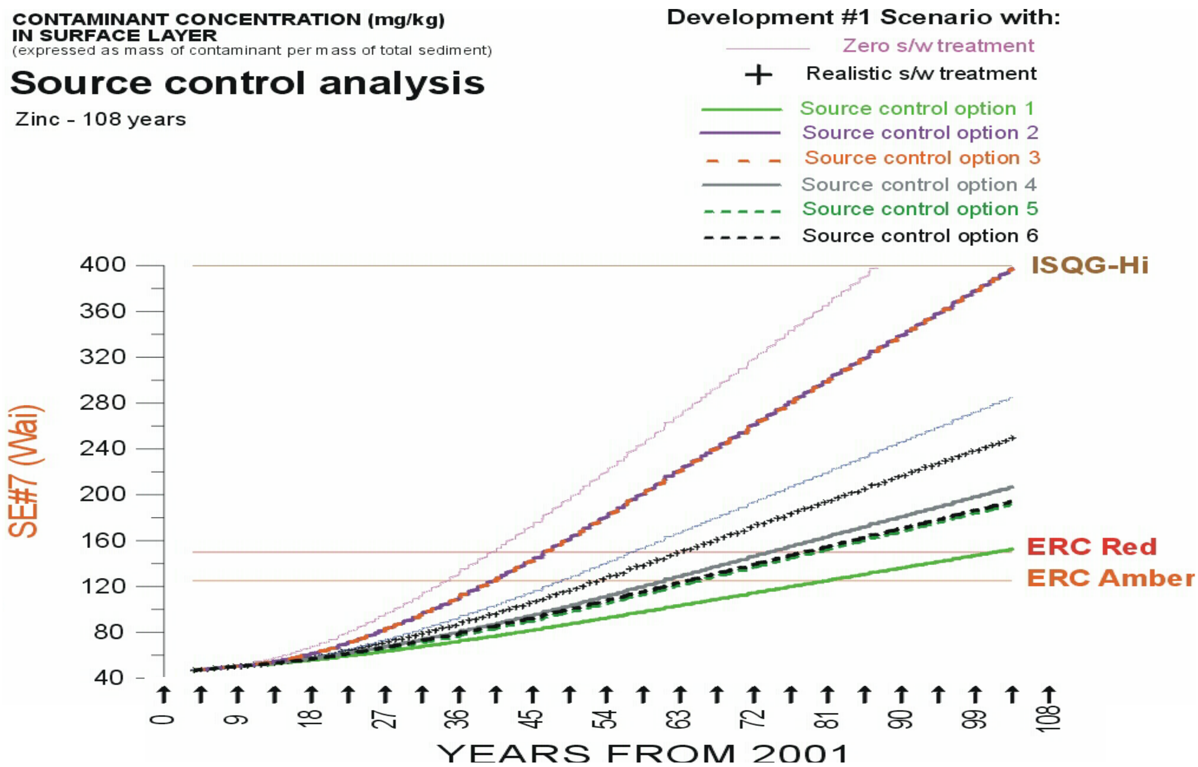

Figure 2: Risk as time to reach environmental criteria for various development & source control scenarios. (Source: NIWA)

From these outputs experienced ecologists are able to advise policy makers of the implications of accepting any particular risk in terms of environmental consequences. This is far from an exact science. Also included in the mix is the opportunities to mitigate identified adverse effects. Ultimately the final decision comes out of the standard RMA processes for the balancing of conflicting issues against community expectations for development and environmental protection.

Conclusions

These are but two examples of how the scientific approach has added substantial value to major strategic policy development processes. Making decisions involving these issues was not just ‘more difficult’ or ‘less certain’ without science input, it was impossible to carry out in a meaningful way. The implications of these decision making processes were far reaching to the ratepayer and the environment.

Does this mean we have all the answers? Absolutely not! Our understanding of cumulative effects, impacts on food chains and multiple contaminant interactions is incomplete. However we have come a long way recently in our understanding of these matters and are in a much better position to advise resource managers than even a short time ago.

The important point here is that science contributes to, not drives, the complex decision framework operating in resource management and is not a replacement for precautionary approaches and sound policy. Also, the best science and policy in the world will deliver nothing unless it is delivered on the ground. This remains a major issue for achieving desired environmental outcomes.