FUTURE STATE OF AUCKLAND'S WATERSHEDS: INPUTS TO FWMT FUTURE SCENARIO MODELLING

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ABSTRACT

Auckland Council is responsible for the management of freshwater quality and quantity in Auckland region. To help understand the current state of the hydrology and water quality of the region's catchments a coupled process based continuous simulation model and stormwater management model, the Freshwater Management Tool (FWMT) is being developed.

The FWMT enables the simulation of the potential effectiveness and cost of structural and non-structural interventions that could be implemented to manage water quality for future state conditions. In order to implement and set objectives for the National Policy Statement for Freshwater Management (NPS-FM), strategies to achieve water quality objectives are also required to be set in regional plans. The FWMT is being developed to deliver evidence for both decision-making on objectives and strategies to achieve the former. Doing so necessitates scenario-capability, simulating the effects on water quality of altered management actions (e.g., stormwater devices, management practices and land use change). In line with NPS-FM reporting, any such changes need to be determined on the distribution of contaminant concentrations requiring robust hydrological and loading forecasts of options.

The process-basis of the FWMT is being developed for optimization routines to simulate a range of scenarios on flow and contaminant concentration, spanning differing mixes of mitigation actions. From this, developing optimized mitigation or abatement curves for each of the 5,465 sub-catchments delineated within the FWMT and for their larger coastal-draining catchments (e.g., Tier 1 and 2 of optimization, respectively). The FWMT will thereby enable effective engagement with stakeholders in decision-making on future contaminant targets or limits to set as objectives and also, optimal management strategies to adopt.

To ensure accuracy of scenario modelling outcomes and optimal strategies, the FWMT requires robust data inputs and accurate configuration. Key elements of scenario capability in development for the FWMT, include:

- A future land use layer (FLUL) to represent the best estimate of future land use distribution in Auckland Region. This has drawn from existing sources including Auckland Regional Transport (ART) growth model predictions, Future Urban Zones (FUZ), Special Housing Areas (SHA's), Transport for Future Urban Growth, identified brownfields redevelopment areas and estimated redevelopment rates for development undergoing renewals. The land use layer is discriminated into up to 106 land types or Hydrological Response Unit (HRU), the fundamental typology for process-configuration within the FWMT. From this alone, the future projected extent of change in various land cover and activity type is now better resolved and

able to support wider future state modelling of a range of outcomes beyond water quality and simply the FWMT.

- A menu of structural interventions applicable to individual property and public resources (roads, reserves, stormwater network). For new developments and redevelopments in the FLUL, treatment trains complying with the Auckland Unitary Plan and GD01 have been developed – assigned by HRU to enable the FWMT to estimate not simply how to reach instream or downstream targets, but equally the spread in effort and reduced loading reported to land cover and use (i.e., across stakeholders whether local government or private land holder to support discussion of split in effort to achieve improved or maintained future state). From adoption of treatment trains the effects on future equivalent or altered contaminant loading and hydrology can also be resolved by the FWMT to determine if best practice guidance will be sufficient to maintain or improve water quality under projected growth and climate change in the Auckland region. Retrofit of devices to development areas for improved water quality can also be directed by the FWMT and its optimized selection of devices, to better enable targeted regulation and/or rate-payer investment.
- The potential for retrofit opportunities has been estimated using a Maximum Opportunity Screening process. For each structural intervention, GIS models are used to define opportunity locations with access to existing networks and suitable catchment area for the harvesting of contaminated water for treatment. Wastewater interventions will also be represented through modified overflow time series to represent growth and network upgrades to meet levels of service projected by Watercare. Thereby integrating contaminant outcomes across users and regulatory agencies for their cumulative instream or downstream effects.
- The cost and benefit of rural and urban interventions will be represented within the FWMT by SUSTAIN. Within SUSTAIN, mitigation actions are classified as source controls (land use or practice-based change) or devices (green and grey infrastructure to alter hydrology and contaminant attenuation). This includes the development of source control scenarios to compare various policy instruments and operational programs such as street sweeping, brake pad materials replacement, inert roofing, retiring land into native cover and good farming practice adoption on-farm. The available methods for representing the benefit of source controls include the ability to "swap" activities in the catchment from high to low impact land use categories and compare the costs to one another and structural devices (e.g., along gradients of reducing instream and downstream concentration or load). Our development of future state costing, efficacy and opportunity for mitigations is a valuable addition to the knowledge base being produced to guide the FWMT's use.

This talk is one of three delivered on the FWMT, demonstrating in addition to current state capability and economic inventories, the necessary development of future land use, practice and device capability within the FWMT. In this talk, we will discuss how costs and benefits will be allocated to the various interventions based on local, national and international examples. These will be managed through a framework approach to support long term financial planning and allow clear comparison of the various intervention options and approaches through the SUSTAIN optimization process. This paper provides access to a range of information being developed under the FWMT work stream to help deliver Auckland's hydrological and water quality planning processes.

Keywords

water quality, stormwater, contaminants, modelling, hydrology, treatment devices, source controls, national policy statement for freshwater management