Before the Commissioner / Hearing Panel appointed by Canterbury Regional Council

IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Application CRC120223 by Christchurch City Council for a discharge permit to discharge contaminants (being stormwater) onto and into land and into water associated with the South West Area of Christchurch City.

Section 42A Officer's Report

Date of Hearing: 14 November 2011.

Report of Graham Levy

TABLE OF CONTENTS

INTRODUCTION

1. Christchurch City Council (CCC) has applied for resource consent to discharge water and contaminants to land and water where the discharge is associated with all current and future stormwater as described in the Stormwater Management Plan (SMP) August 2011 for South-West Christchurch that forms part of the South-West Area Plan (SWAP).

2. I am a Technical Director (Water and Environment) of Beca Infrastructure. I hold a Masters in Engineering (Civil) and am a Chartered Professional Engineer (NZ). I am responsible for input to and management of studies in stormwater and flood hydrology, water supply source investigations, environmental effects assessments of large infrastructure projects, hydrology and hydraulics in New Zealand and overseas. I am involved in providing technical guidance and peer review for many urban and industrial site stormwater management projects including catchment management plan discharge applications to New Zealand regional authorities.

3. My report will provide information and advice related to the development of the integrated catchment management plan and the approach adopted, and on issues and effects of the stormwater quality and quantity management proposed. I do not provide comment on the proposed construction discharge that is subject to this application.

4. My report is supplementary to the Overview Section 42A report prepared by Brent Hamilton, for the above application by CCC.

5. I have read the Code of Conduct for Expert Witnesses in giving evidence to the Environment Court. I agree to comply with that code when giving evidence to the Hearing Panel in this matter. All my evidence is within my expertise and I have considered and stated all material facts known to me which might alter or qualify the opinions I express.

6. I have also read the *Joint Christchurch City Council and Environment Canterbury Stormwater Management Protocol* (Revised November 2010).

SUMMARY

7. The 7,975 hectares of land covered by South-West Christchurch lies in the headwaters and upper mainstem reaches of the Heathcote and the Halswell Rivers. Disposal of stormwater in this area, as with much of the wider Christchuch City area, is by combination of soakage to ground and discharge into surface water networks. The SWAP will enable future development of this area. Current land uses include industrial / commercial land in the Hornby area, some residential to the north of the plan area, but approximately half of the land is in rural land use zonings.

8. Future development will allow an increase in the impervious surface coverage, which in turn will lead to increases in the discharge of stormwater quantity, both peak flows and volumes, and associated contaminants. This has the potential to adversely affect downstream flooding and to increase the discharges of contaminants into waterways and the groundwater. In recognition of this potential, CCC has worked with ECan to develop an integrated approach to catchment management for this area.

9. The study area is divided by the two river catchments and further divided into 37 sub-catchments. These sub-catchments are then grouped into 9 Stormwater Management Areas (SWMAs) and the application states that the preliminary Stormwater Management Scheme (SWMS) for each of SWMAs will be finalised following completion of the Area Plan and City Plan processes.

10. CCC has developed a preliminary SWMS based on land use assumptions and a design philosophy and approach for each SMWA. Although the approach taken is reasonable, the final land use determined for the area will need to be used as the basis for the final modelling for the SWMS.

11. The purpose of my review has been to review and comment on the SMP document as a management tool, to comment on the approach to the water quantity and water quality assessments carried out, and the proposed management options chosen. I have also made suggestions to Brent Hamilton about conditions which would assist in the implementation of the SMP through the discharge consent (if granted). I have not reviewed the hydrological or hydraulic modelling of the catchment, nor the use and application of the water quality data and standards. However, I have reviewed the contaminant load modelling approach and the data used for this modelling.

12. Overall, there has been a significant amount of information gathered for this consent application, and, in my opinion, it is generally to a level of detail which corresponds to the scale and significance of the effects that the activity might have on the environment.

13. The joint CCC and ECan Protocol has been an important foundation document in setting up the requirements for the SMP documentation and process. It has established a base for collaboration between the Councils in working through the first SMP of this magnitude for Christchurch City.

14. This SMP project started before 2003, with the publication of the Pilot Study Stage 1 in October 2003. Given the timeframe over which the project has developed, it is not realistic to expect that the application should be ‘perfect’ in every detail, but rather that the approach is correct and that conditions can be applied that give certainty to the on-going updating of information into the management plan.

15. I believe that, in the aspects of the application that I have assessed, sufficient detail can be required by the conditions of consent and the implementation phases of the SMP to give certainty to ECan that CCC will meet the required environmental outcomes, apart from some concerns still surrounding the timing of retrofitting existing areas.

16. The use of sedimentation basins, soil adsorption basins, wetlands and attenuation basins for stormwater quantity and quality management is an appropriate combination for the overall issues identified in the study area, particularly for residential and commercial land. The exact configuration of these in relation to the existing industrial land is of concern due to the higher risk of spill, particularly into the groundwater, and the risk of entrainment of on-site contaminants into runoff, which may need site specific treatment at source, rather than downstream “catch-all” methods. This might require alternative approaches to the implementation and enforcement of stormwater management for this industrial land and options such as site audits, site-specific management plans, and proprietary filtration treatment devices have been proposed as options where required.

17. The preservation of sufficient land to achieve the required outcomes for both water quantity and quality management is paramount. It is important that calculations informing the land use requirements take into account future planned changes in landuse.

18. The recent earthquakes in Christchurch have introduced a level of uncertainty in future land use and will likely influence design of soakage and detention as well as development areas and timing. As areas come up for development then detailed design will need to be completed with regard to these matters to give confidence that consent conditions will be achieved.

19. The SMP prepared by the applicant formed part of the application lodged, however the applicant is not proposing that the SMP form part of/or be attached to the consent (if granted).

20. The proposed consent conditions do not require detailed implementation plans which would provide more certainty on implementation timeframes for devices to address existing water quantity and quality concerns.

21. Given that the SMP will not form part of or be attached to the consent then it is recommended that detailed design and implementation information be developed as a condition of consent (if granted) for each of the 9 SWMAs before any development in a SWMA occurs. This information should be made available to ECan upon request. This is recommended not from a lack of trust in CCCs ability or willingness to implement the SMP – rather it is to provide CCC with a strong consenting framework to support them in effectively managing increasing development pressures and timeframes.

22. The SMP should be maintained and updated to outline the stormwater management for South West Christchurch. This should be made available to ECan as updates are approved so that ECan can understand and track on-going changes and development within the SWMAs.

23. Provided that the final design philosophy and approach does not change significantly, I have no problem with the final design detail being carried out when land uses are decided on and development is imminent. However, all such detail should be required as a condition of this consent (if granted) and which should require agreement between CCC and ECan.

ASSESSMENT OF EFFECTS - WATER QUANTITY MANAGEMENT

24. I have read Technical Report Number 4 (Appendix E), Water Quantity Assessment, the water quantity aspects of the AEE and the SMP. I have also read Tony Oliver's s42A report.

25. The stormwater quantity management measures proposed are soakage basins with overflow chambers and detention basins. On the flat sub-catchments, these are to be designed to have a storage capacity of 2% Annual Exceedance Probability (AEP) (50 year) rainfall event for the critical storm duration of 36 hours and 60 hours for the Heathcote River catchment and Halswell River catchment respectively. For development on the hill sub-catchments of the Heathcote, the detention basin or soakage device will be sized to store the volume of water in excess of the volume of the 2% AEP event resulting from the existing land use. Tony Oliver has commented on this criteria.

26. The applicant has specified that stormwater soakage will be used where site conditions are suitable, which is the appropriate approach for recharge of the groundwater and reduction in flows to the surface water receiving environments. CCC aim to have fewer, larger devices, and to attenuate and manage runoff generated on a catchment wide basis rather than with individual developments, to avoid ad-hoc stormwater management. This is one of the main benefits of integrated catchment management planning, and is especially appropriate where there is existing downstream flooding.

27. The critical water quantity issue identified in both catchments is that severe flooding occurs in the lower catchments downstream of the study area boundary. The attenuation devices are intended to be sized so that, once development within the catchment is complete, flood levels in the Heathcote will be at or less than the 1991 levels.

28. While there is no model for the Halswell, the same approach has been used for both the Heathcote and the Halswell. The assumption is that if modelling shows this approach works for the Heathcote, it will be a similarly conservative approach for the Halswell, and should achieve similar results. Tony Oliver, ECan, confirms that this approach is acceptable and that a model is available to assist with better understanding of the catchment and its response to land use changes.

29. It is understood that there are concerns relating to the capacity of the Halswell River to accommodate increased discharges (rate, volume and quality), given that the Halswell River discharges into the receiving environment of Lake Ellesmere. While it is considered the general approach that outlined above is acceptable, it is recommended that the final management strategies adopted for water quantity and quality design within the Halswell catchment should make specific consideration of management of nutrients and sediments.

30. The applicant summarises the receiving environment in Section 4.2 of the Water Quantity Assessment (Technical Report No. 4) while Section 5.2.2 of the AEE summarises the receiving environment's response to large rainfall events and subsequent flooding of the area. Section 7.5 of the AEE discusses the effects on the surface water quantity. Table 16 of the AEE sets out the model results for the peak flood levels for six locations within the Heathcote catchment. Water levels are given for (modelled) 1991, for the defined existing scenario (2002), and for the post-development scenario with full mitigation as per the preliminary SWMS. Through the lower Heathcote, the change is indicated as in the order of 10 mm increase from 1991 to the SWMS results for a 2% event. It also shows that current land use, including some existing flood mitigation systems, will not achieve the 1991 flood levels as required by the "The Heathcote River Floodplain Management Strategy (CRC 1998)" for four of the locations.

31. Given changes in the Canterbury region due to the earthquake, it is recommended that surveyed levels of monitoring points be resurveyed as soon as practicable (if this has not already been carried out) so that benchmarking of levels can continue.

Stormwater Management Scheme (SWMS)

32. The SWMS has been developed based on the Development Scenario 2, future land uses. This is described in both Technical Report 4 (Appendix E), Water Quantity Assessment and Technical Report 5, Water Quality Assessment (Appendix F). Scenario 2 is a hypothetical scenario, which reflects possible land use in 2024. The SWMS is founded on a set of design principles, a design approach and a contingency mitigation provision.

33. The 6 design principles are (in summary):

- that the stormwater system is a natural system;
- that significant areas of land will be set aside to accommodate the mitigation, and integrated into other land uses;
- that large facilities will be used, rather than proliferating many small facilities;
- that several facilities will mitigate adverse effects of earlier developments;
- that a continuous network of pipes, swales and waterways connecting all facilities; and this could form the basis of a 'green corridor'
- that some of the standards being used will 'raise the bar' in level of mitigation and resultant cost.

34. Section 5.3.3 of the SMP, Design Approach, sets out the general design approach, including the following key aspects:

- the water quality mitigation will provide treatment of the Water Quality Volume (WQV) by either filtration through soil adsorption basins and disposal to ground or sedimentation within first flush basins followed by wetlands (or wet ponds) and surface water discharge;
- water quantity mitigation will be based on Full Flood Attenuation (FFA) of 2% AEP events on the flat and on Partial Flood Attenuation (PFA) basis on the hillside developments, requiring the detention of the volume of water in excess of a 2% AEP event prior to development

35. The SWMS then has a section for each of the nine SWMAs shown on Figure 3 in the SMP. It is stated that the SWMS in this SMP Report is a preliminary scheme "to provide an example of how the proposed mitigation approach responds to development, provide preliminary indications of facility locations and outline how facilities are sized for the level of development in each project area." Final sizings will be dependent on the final land use zonings applied across the SWMAs, but the design approach and methodology will not be altered, unless further information identifies that this is required in order to achieve the desired outcome.

36. For each SWMA there is a brief description of the stormwater features of the area, followed by a table of proposed (or existing) facilities for both water quality and quantity. Where locations for facilities have been identified (six out of nine SWMAs) these are shown indicatively on a plan of the area.

37. The section 92 response relating to FFA and PFA basins (Question 6 and 8) provides a sound discussion of the SWMS and the design approach used.

38. I have some concerns regarding the timing/implementation of retrofitting within the upper catchment, as the retrofitting appears to be tied to development proceeding. Attenuation in the upper catchment should be provided for to account for increases in overall catchment imperviousness which have occurred to date, as discussed in the Heathcote River Floodplain Management Strategy. In the event that no development occurs then there is no trigger within this SMP to provide attenuation to address existing issues.

39. Tony Oliver is of the view that the changes in flood levels given in the AEE are within the tolerance levels for accuracy of modelling, and therefore do not necessarily show that there has been an increase in flood levels. He has also commented that the changes in level indicated would not change the general pattern of existing flooding, i.e. it is unlikely that more houses would be inundated than currently. I agree with these comments. Nevertheless, CCC has a good understanding of the flooding problems in the lower Heathcote, and the need to limit any increases in flood potential. The Heathcote River Floodplain Management Strategy refers to enhancement of the Cashmere/Worsley's sub-catchment attenuation capability to assist with this problem, and the need for the upper catchment storage potential to be used for the benefit of the lower catchment. Furthermore, development in the middle of the Heathcote River catchment has continued over the last couple of decades, which includes the Westmorland subdivision, without any attenuation (i.e. water quantity mitigation).

40. It is my understanding from the CCC's response to Question 2 of the s92 request that several of the stormwater management facilities (e.g. Douglas Clifford Facility at Halswell and the large Awatere Road North Facility in Wigram) have recently been constructed and commissioned. Further facilities are in design phase or are being constructed. Updated information on commitments to these and other attenuation facilities in the CCC's Long Term Council Community Plan (LTCCP), were also provided which is encouraging.

41. Although the preliminary SWMS could change dependant on the final zonings, and although modelling shows minimal increases in flood levels in the lower Heathcote, it is important for the long term management of the Heathcote River floodplain and the Halswell River floodplain for that matter, that development of flood storage be provided for within the parameters of this consent (if granted). This is the opportunity to ensure that land required for future flood mitigation is set aside, and it is important that ECan has this assurance.

42. The detail of this can be adequately addressed by including this specific issue as a condition of consent.

43. No details of the detention basin design, including outlet design, were provided by the applicant. Outlet structures will need to be designed to achieve flood level, and peak flow restrictions, based on whole-of-catchment modelling, to ensure that the combined released flows do not increase flooding downstream. Tony Oliver has also commented on the need for final design of attenuation basins to be based on detailed flood modelling, once the land uses and development patterns have been determined, and secondary flowpaths be identified and protected. I fully endorse this approach.

44. Where stormwater is proposed to be discharged to soakage systems then there needs to be sufficient detail provided in the design as to how the soakage system will be monitored and managed long-term to maintain capacity. This has been partly addressed in the Monitoring Programme in response to the section 92 request. I will discuss monitoring requirements in more detail later in this report.

45. The recent earthquakes in Christchurch may result in changes to the detailed design requirements associated with developments and consents. Detailed design of water quantity management options (soakage, flow attenuation) should take into account the suitability of these devices with regard to on-going earthquake risk. If these management options cannot be used then alternative approaches will need to be

developed to meet the water quantity and quality objectives of the SMP and this consent (if granted).

46. More level monitoring sites need to be used in the Monitoring Programme for water level than that proposed by the applicant. At *minimum* there should be one for each main catchment (Heathcote *and* Halswell) and their locations submitted to ECan for approval within the Monitoring Plan to allow baseline monitoring to commence immediately. It is my understanding that Tony Oliver is also recommending a t least a site be established in the Halswell catchement.

ASSESSMENT OF EFFECTS - WATER QUALITY MANAGEMENT

47. I have read Technical Report Number 5 (Appendix F), Water Quality Assessment. In particular I have read Appendix D of that report, Contaminant Load Assessment July 2007 prepared by Golders Associates ('Contaminant Load Report') which describes the approach to the Contaminant Load Modelling (CLM). Within the body of the Water Quality Assessment report, the CLM results are used as input to the mitigation options analysis.

48. The water quality mitigation devices are proposed to be a combination of sedimentation basins, soil adsorption basins where ground conditions are appropriate for soakage, and wetlands where stormwater discharge is to surface water. This most closely relates to Mitigation Option 8 which has been used for testing and reporting purposes, which is discussed later in this report. Where attenuation is required for stormwater quantity purposes, required wetlands will be incorporated into the footprint area of the attenuation area.

49. I have not assessed the water quality or groundwater information which is given in Section 3 of the Water Quality Assessment report. These are dealt with by Michele Stevenson and Lisa Scott respectively.

50. I have commented on the data used for the contaminant load model.

51. I have also commented on some aspects of the approach taken to industrial stormwater management. Brett Mongillo, ECan has also addressed the industrial site management approach.

Contaminant Load Assessment

Use of the Simple Method

52. The applicant has used the Simple Method, (Scheuler, 1987), to determine the total contaminant load for each of the catchments within the SWAP area. The applicant considers that this is an appropriate method to use, even though it is primarily intended for sites less than approximately 260ha. The applicant states that this is because the Simple Method only estimates contaminant loads generated during storm flow and does not account for contaminants in baseflow. The applicant then states that contaminant loads in baseflow are generally low and therefore constitute only a small fraction of the total pollutant load. They later state that the groundwater quality is generally high with the exception of elevated nitrate levels.

53. I agree with the applicant that there are elevated nitrate levels in a number of locations (wells) in the South-West Christchurch area. They are mostly below the Maximum Allowable Value (MAV) of 11.3 g/m^3 specified in the Drinking Water

Standards for NZ (DWSNZ). There also appear to be a number of wells that have elevated Total Dissolved Solids (TDS) although these are all well below the aesthetic guideline value of 1,000 g/m^3 in the DWSNZ. The presence of TDS is an indicator of the dissolved chemicals in the groundwater. This information, drawn from the Pattle Delamore Groundwater Quality Assessment (PDP 2006) for this application, is presented to show the impact of stormwater on the groundwater, from the perspective of compliance with the Drinking Water Standards. It does, however, give some information relevant to the stormwater, as the groundwater surfaces in South West Christchurch through springs, and flows into the surface water receiving environment.

54. In determining whether it is appropriate to not consider baseflows in the contaminant load modelling, it must be noted that compliance with surface water quality standards have been determined at the downstream point in the Halswell and Heathcote catchments where they discharge from the South-West Christchurch area rather than at locations within the catchments. The combination of surface water contaminant loads, added to by high nitrates from the groundwater will have implications for the final surface water quality in the receiving environment.

Rainfall

55. In calculating the contaminant loads for each of the catchments, the applicant has used a single average annual runoff value of 700mm/year. The applicant states that this value is an average of values for the study area, shown in Figure 3.9 provided in the Contaminant Load Report. On visual inspection of Figure 3.9, a reasonable portion of the South West Christchurch area, the Port Hills Catchments, is within the zones receiving between 750 mm and 850 mm/year. This particularly applies to catchments 16, 17a, 21 and HA10 of which a significant proportion are of rural and open space land use, and areas for development in each of the scenarios are reasonably small in comparison.

56. While the use of 700mm/yr is conservative for the flatter parts of the South-West Christchurch area, it would underestimate contaminant loads from the hills, and therefore predict a higher water quality than reality. Provided that the land use remains the same in these catchments, this would not be important in the case of zinc, copper, hydrocarbons or litter. However, it will mean that the total suspended sediment loads are being under-predicted for the existing land use, and this would also influence the nitrogen and phosphorous loadings.

Runoff Coefficients

57. In determining the runoff coefficients used in the contaminant load modelling, a variety of sources and methods have been used. The primary source of runoff coefficients has been the Waterways, Wetlands and Drainage Guide, CCC, 2003. Since the preparation of the Contaminant Load Assessment, CCC have revised their runoff coefficients. While it is not suggested that the contaminant load modelling be revised at this time, the new runoff coefficients are to be used in any final design, as they will have an impact on the size requirements of the final stormwater quality devices. Sample calculations to support this should be available for this as part of the detailed design for each SWMA.

EMC and Load Data

58. The use of the Simple method requires selection of appropriate Event Mean Concentrations (EMC) from relevant literature. The applicant has carried out a detailed literature review of both New Zealand and Australian data, as well as other international data. The applicant states that local (NZ and Australian) data has been used in the model. However where insufficient local data is available, international data has been used. In general, the data sources that have been used are well respected, therefore I have no concerns in this regard. I do however have a number of comments about the application of some of the values to the different land use categories used in the model.

59. While most of the values used for roads seem appropriate, a separate EMC value for motorways might be appropriate for the proposed Christchurch Southern Motorway. The applicant has modelled two landuses for new (local and motorway) and existing roads, with the same EMC values. This distinction would be of most relevance to Total Suspended Solids (TSS), where higher traffic numbers have a dramatic influence on TSS discharge rates, ie the load from the motorway is likely to be significantly higher than local roads. I note, though, that the total road area makes up a relatively small contribution to the overall area, hence any increases in loadings for a "motorway" landuse are unlikely to significantly affect the results. In addition, the Southern Motorway has its own treatment requirements for runoff so the approach used by the applicant is slightly conservative.

60. In comparing the TSS loads in the Auckland Regional Council's (ARC) contaminant load model (CLM) for commercial and industrial land use, for areas that are paved but not roads, the ARC model has a value for commercial that is twice as high as industrial. The effect of this difference in relation to the CCC modelling is hard to determine given that no distinction has been made between areas that are roofs or paved or carparks within a commercial area.

61. In the case of TSS and Litter data, the applicant states that there is insufficient EMC data available, therefore load data in kg/ha/yr has been referred to. The lack of TSS EMC data is due to the fact that the sediments from the Ports Hills have high erosion rates due to the characteristics of the loess. A study by Hicks of the erosion and sedimentation in the Avon and Heathcote (Hicks, 1993) reports sediment yields in kg/ha/yr, which has been used in this application). The use of this sediment load data is entirely appropriate. A back calculation has been carried out to determine an EMC value for presentation.

62. The calculations used by CCC would be useful for detailed checking. This could be made available as part of the detailed design required for each SWMA as a condition of consent.

Results

63. The results are in line with expectations given the contaminant load data used. I am also satisfied that the relationships between the various scenarios appropriately represent the changes that are identified in each development scenario.

Control of Roofing Materials

64. The applicant has discussed the use of controls on certain building products e.g. Zincalume, to provide source control reductions of contaminants. As the applicant and URS as peer reviewer have both pointed out, introducing restrictions on certain building products may result in opposition, particularly from manufacturers of those products. I am in agreement with this comment. The applicant has chosen to continue with current educational programmes which promote the use of more environmentally sound products. I agree that this is likely to be the most appropriate way to control this issue and given that no consideration of controls of certain products have been used in the contaminant load modelling, I agree also with the applicant that the results are conservative in respect of this aspect.

Water Quality Mitigation Modelling

65. The contaminant load results from the modelling have been tabulated in Section 5 of the Water Quality Assessment report, in Table 17 for the Heathcote and Table 18 for the Halswell. These are given in T/year for total suspended solids (TSS), and kg/year for copper, zinc, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), total nitrogen, total phosphorous and litter.

66. Appendix E Treatment Devices, of the Water Quality Assessment report is a review of the available treatment devices for urban stormwater management. For each of the 15 device / treatment options chosen, the typical efficiency has been documented, maintenance requirements have been described and a per unit cost for capital and maintenance has been derived.

67. Zinc and copper have been chosen as the key stormwater contaminants of concern. Table 19 of the Water Quality Assessment Report lists the 22 mitigation options chosen for analysis, and calculations performed show the post-mitigation loads for zinc and copper for each of the 22 options. (The mitigation options include combinations of different treatment devices). These results are given in Tables 20 to 24 of the Water Quality Assessment Report.

68. Costs have been determined for the total life cycle costs of each option. These costs have then been used to determine the cost required to mitigate the stormwater discharges to achieve compliance with water quality standards for zinc and copper – a cost-compliance analysis. Although contaminant loads and water quality are not directly related, the approach taken by CCC of “bench-marking” the predicted unmitigated loads against the known water quality is logical. However, as pointed out by CCC, there is limited water quality information for total metals, and therefore assumptions have been made for copper and zinc.

69. The key point being made by CCC here is that the cost to comply with the Natural Resources Regional Plan (NRRP) toxicant criteria, as listed in Table WQL16 and based on ANZECC (2000) is considerably more than the cost to comply with the USEPA (2006) criteria.

70. There is a description of the chosen mitigation strategy, in Section 6 of the Water Quality Assessment, and the preliminary Surface Water Management Scheme (SWMS). The SWMS is based on Mitigation Option 8. It is stated that the design of the basins and wetland has been based on the water quality volume approach as defined in TP10 (ARC, 2003). However, in Section 5.4 of the Water Quality Assessment, it is stated that the load data supplied in Tables 14 to 18 has been derived from information given in Appendix D. This information is real monitoring

data which has been published as the result of various studies. It is difficult to determine how this load data compares with the anticipated final design efficiency that might result when the SWMS is implemented or how the SWMS will actually reduce contaminant loads and relate to water quality criteria. Example calculations would have provided a better understanding of the links between the gross loads and the mitigated loads. It is also noted here that the current review of the CCC runoff coefficients will also impact on the final calculations for the treatment volumes.

Summary Comments

71. The use of the Simple Method for contaminant load modelling is appropriate. During final design, and in accordance with conditions related to implementation of the SMP, the details raised above should be checked and confirmed or corrected as appropriate. In particular, the runoff coefficients should be in accordance with CCC's own latest information, and the contribution of nitrogen entering surface water in the base flows from groundwater should be considered.

72. An example calculation of all aspects of the links from the CLM to the choice of mitigation options would have been useful to assist with understanding how treatment efficiencies, load data, sub-catchment areas, runoff coefficients etc have been applied.

73. The cost-compliance analysis gives a picture of the costs associated with the discussed water quality criteria. However, it is not clear how the treatment efficiency data in Appendix D is used, or how it relates to the final choice of Mitigation Option 8 and its application to the SWMS, where it is stated that the water quality volume approach has been used to determine size of devices.

Industrial Stormwater Management

74. Section 5.4 of the SMP sets out the basis for industrial site management. CCC has proposed that this consent (if granted) include the land use of both the existing and future industrial activities.

75. CCC sets out a proposed management strategy for long term improvements on industrial sites in the AEE which is summarised in the proposed consent conditions. This strategy suggests a proactive approach by both CCC and ECan to identified industrial sites, including education and source controls. It suggests that control through e.g. building consents, land use consents, could be developed. There is also discussion of CCC developing requirements for discharge into the stormwater network, and the suggestion that this process will be part of a proposed protocol between ECan and CCC. Should existing industries fail to comply with the requirements of the SMP, CCC will use the partial surrender provisions of the Resource Management Act 1991 to surrender the industrial sites' land parcels, which in effect will exclude that industry from the consent.

76. The practical implementation of this exclusion needs to be developed further as stormwater will continue to runoff from a site, with or without consent. There needs to be a mechanism to allow problem sites to be quickly identified to ECan and compliance measures implemented.

77. The applicant proposes that by assessing their monitoring results (based on the proposed conditions of consent), and by relating these back to the stated objectives for the receiving environment, they will be able to determine whether the industrial site audit programme is achieving the objectives which will form part of the consent.

The water quality monitoring sites however will make this assessment difficult as it will be very difficult to assess contributions from industry in relation to other sources.

78. The application lacks detail of the types and concentrations of contaminants expected to occur from the existing industrial areas. Brett Mongillo discusses this further in his s42A report. The issue is that some contaminants, eg dissolved metals, require specific forms of treatment to be removed, and therefore identification of the industries by contaminant type would be useful. Neither does it address the issue that there may be contaminants of concern other than those being tested for in the water quality monitoring samples and modelled. Provision for treatment according to contaminant type is achievable and should be required. Use of the Ministry for the Environment Hazardous Activities and Industries List, 2004 (HAIL) will provide a good starting point for identifying these industry / contaminant links.

79. The overall management approach set out by CCC is an appropriate starting point. Site auditing, education and guidance to land owners is critical in a programme to introduce a new approach to stormwater management. I note that ECan already has a Pollution Prevention Guide (June 2003) as a resource for education for industrial activities.

80. It is understood that the first stage of implementation will be monitoring and measuring. The second stage will occur with greenfield development (if development occurs) to allow retrofitting of some industrial catchments, although as discussed earlier CCC may stage mitigation facilities to be only sized in proportion to the area of the SWMA that is being developed. In addition to this, the monitoring results will trigger an alert to any industries contributing to poor water quality.

81. This approach appears to ignore the existing industrial land use issues, and any commitment to retrofitting for the sake of treating existing discharges. Given that some of this existing industrial activity occurs over the unconfined aquifer, a higher priority should be assigned to this stormwater quality mitigation. Further, Michele Stevenson will discuss in her report that water quality sampling provides evidence that the industrial sites are already contributing to poor water quality. The reliance on discussions, agreement with ECan and education for high risk industrial sites does not guarantee action or a timeframe for constructing appropriate stormwater treatment facilities to treat this existing stormwater prior to its discharge to the groundwater. There would appear to be no need to wait for more monitoring before implementing mitigation.

82. It is also of concern to me that there is no adequate spill contingency provided for in the SWMS. Although current HSNO legislation requires bunding of hazardous substances for spill containment, some existing sites will not yet have retrofitted to this requirement. In addition, for environmental protection, reliance cannot be placed solely on this bunding requirement for spill contingency, as there are substances which are not hazardous, (and therefore not covered by HSNO) which are environmentally degrading, for example, milk.

83. By way of an example from another region, in Auckland, the Regional Council retains control over the industrial sites by way of rules in the regional plan. Industrial land use is not included in the network discharge consents granted to local councils. ARC requires a combination of an environmental management plan and stormwater treatment for scheduled sites, and “high risk” sites need consenting, with the same requirements. ARC has a different approach for existing sites than for new sites. For existing operators, they accept a strategy and a forward plan for the implementation of the treatment devices, owing to the costs of installation, rather than requiring that

the device be installed immediately. Also, of interest is that, in the absence of a treatment device guideline, ARC requires that the treatment device installed for a particular site be appropriate for the contaminants of concern generated by that site. Overall, where land is available, wetlands provide the greatest range of treatment mechanisms, and therefore in general, the best treatment efficiencies.

84. Where CCC intends 'picking up' the treatment for existing industrial activities, then more consideration should be given to the actual activity, the contaminant types on each individual site, the risk of spill, and more detail in the SWMS to allow for these aspects. Some of the site management aspects need to be enforceable back to the site operator, as CCC cannot have control over site operations. ECan should require that, at the least, the detail of enforcement mechanisms should be agreed and a condition of this consent could indicate that spill protection is required for industrial sites.

85. Through the development of land use controls for newly zoned land under the SWAP, CCC has the opportunity to write rules for industrial site requirements for stormwater. Where a new site is being developed, source controls can be included and management practices allowed for. However, with existing sites, there is often a significant capital expenditure required to improve the site, so that source controls can be implemented or management practices adopted. The timeframe for implementation of a treatment device might be dependent on the contaminant type and the assessed risk to the receiving environment.

86. In summary, the existing industrial activity is included in the SMP and this consent (if granted), and water quality monitoring is the proposed mechanism for finding out any problems as they arise. CCC has undertaken to take a proactive stance in auditing industrial sites, and in advising industry owners of the need to improve stormwater management. Mitigation of existing industrial activities needs to be implemented as soon as practicable. To achieve this, CCC needs to develop a method (such as a Bylaw) or rules which provide a statutory mechanism, rather than a protocol. This mechanism should apply to both new industrial developments and to existing developments.

INTERGRATED CATCHMENT MANAGEMENT PLANNING

87. CCC has delivered a suite of documents in support of the application for the discharge consents. Essentially, the documentation is appropriately constructed. The first document is the Assessment of Environmental Effects, (AEE) which is, under the RMA, the key information required for any application. This AEE has many appended documents, the first being the Stormwater Management Plan (SMP) – the document which is to be the guiding management approach for the discharge consent. The remainder of the appendices to the AEE contain information gathered about the study area from which the conclusions about the potential effects on the environment have been drawn. From the appended information and the assessment of the effects, management options have been synthesised, tested and chosen – and written into the SMP.

88. Although catchment management plans have been around for years, especially with respect to understanding hydrological and hydraulic characteristics through computer modelling, true integration of management in a catchment via an SMP is relatively

new in NZ and particularly so for Christchurch. CCC and ECan have set up the "Joint Protocol for Stormwater Management". This Protocol has been developed jointly between the two councils. It is intended to be consistent with the NRRP. The Protocol firstly sets out agreed principles and practices for land use planning and for SMP development and consent applications. Secondly it sets out the information requirements and methodology related issues. The Protocol is quite detailed in this regard.

89. While the Protocol has been developed with good intention between ECan and CCC, a concern I have about its use is the fact that it is a non-statutory document. Significant issues in the implementation of the SMP rely on the agreements set out in the Protocol. As a non-statutory document, there is no ability for submissions from other parties, other than by the goodwill of ECan and CCC to consult where they choose.

90. As the guiding document for the long term management of the catchment, the SMP should be able to stand alone - along with the consent and its conditions. However the SMP is not proposed to be attached to the consent itself. While this provides CCC with the flexibility to respond to within catchment changes quickly without the need to continually go back to ECan for approval, it is considered that there is a risk that the SMP could be altered in a way that is not consistent with the basis/intent of this consent application. Either the SMP forms part of the consent, or the design basis outlined in the SMP becomes part of the consent, or the conditions of consent require detailed implementation plans be developed for each of the SWMAs.

91. If implementation plans are considered to be not practicable as an alternative as a minimum I recommend conditions that require the applicant to complete detailed design in advance of any new development in a SWMA. This gives CCC the flexibility to consider separate sub areas as they come up for development and pull together all of the more detailed design information at the same time, without the need to necessarily report back to ECan. This information will be available to ECan if required but most importantly can be provided to developers along with the consent as a clear design basis.

92. The background information in the other AEE appendices is there to support the AEE, and to justify that the granting of the consent is appropriate when considering the evaluation criteria of the RMA. It also provides baseline data against which to assess future monitoring – where it is available. My following comments are based on this premise.

Development of Objectives

93. In the last few years, there has been significant work being carried out through PUCM (Planning Under a Co-Operative Mandate – University of Waikato) and the FRST funded Landcare Research/University of Auckland LIUDD (Low Impact Urban Design and Development) research programme. This work has involved the assessment of plans written under the Resource Management Act and Local Government Acts and has led the Auckland Regional Council to apply this research to their requirements for the writing of ICMPs in Auckland (Stormwater Action Team, Good ICMPs: Telling the Story, ARC 2008). This work has indicated the importance of writing plans with clear linkages between issues, objectives, methods, monitoring and implementation, so that the planning and implementation lead to better environmental outcomes.

94. Clearly CCC has the best intentions of integrating this SMP with the Waterway Enhancement programme, the GreenPrint initiatives and the Natural Asset

Management Strategy that they have developed. The current CCC approach is to develop a drainage network based on waterways along green corridors, and to limit the amount of pipe networks. CCC is committed to a progressive approach to surface water management, and the Executive Summary of the SMP clearly states that Option 8 (the chosen mitigation option) will also provide for the values of recreation, ecology, landscape, heritage and culture.

95. The receiving environment objectives for the South-West Christchurch have been developed through a thorough and comprehensive process. They have been derived from the results and recommendations of the supporting technical studies, past knowledge, such as the Heathcote Floodplain Management Strategy, and through a series of workshops between CCC and ECan. There is one set of objectives for the groundwater and a second for the surface water and aquatic ecology.

96. It is stated in Section 4.1 of the SMP (Receiving Environment Objectives – Background) that the objectives "are statements of intent for which action plans and time frames have yet to be defined."

97. The purpose of objectives is that they set the framework for methods which will be employed to resolve issues. The issues have not been identified in this SMP, although they are identified and discussed in the AEE – Section 4 discusses Surface Water Quality, Surface Water Quantity, Sediment Quality, Ecology, Groundwater Levels, and Groundwater Quality. Under each of these headings, and several sub headings, the key issues are identified. It is important that they be included in the SMP. The methods set out in Chapter 5 of the SMP then provide the means by which to resolve the issues.

98. I understand that there has been an effort to separate the various activities that appropriately fall under different documents and policies. The SMP should not be expected to give effect to all the waterway issues that are already covered by other documents, and that are not required for the purposes of a discharge consent granted under the RMA.

99. However, a SMP needs to set out a clear plan (objectives), a clear implementation strategy (methods) to give effect to the plan, and monitoring of the receiving environment to test the success of the plan, objectives are needed which describe, or provide links for, the integration with other relevant documents and strategies. A widely used approach to setting objectives is the use of the acronym SMART – which stands for specific, measurable, achievable, realistic and time bound.

Stormwater Management Plan for South-West Christchurch

100. The purpose of carrying out integrated catchment management studies is to determine issues of significance to the local area, and to provide for integrated solutions within a framework of relevant objectives in the SMP. In the South West Christchurch SMP, integration of issues is across the aspects of proposed land use changes, contaminant generation potential from the different and changing land uses, the quantity and quality of stormwater being discharged to groundwater, and the quantity (flooding) and quality of stormwater being discharged to streams.

101. The aim of a catchment management plan is to set out a plan for the management of stormwater related issues for development in the area for some years into the future. CCC has applied for this stormwater discharge consent for a 35 year term – until about 2044. The SWAP has recently been confirmed, and has proposed future land uses which are expected to be established by the 2041 planning horizon set in the

SWAP. It is usual practice to develop future land use scenarios for use in modelling for catchment management planning, as a way of determining the effects of options used in the management approach. In this case, the modelling scenarios were determined based on future planning. One was established for 2024, and one for 2054. The 2024 scenario was chosen by CCC for modelling purposes.

102. As with other aspects of this application, the final land use determined for South West Christchurch will need to be used for final modelling of the SWMS when implementation details are being determined. This aspect reinforces the importance of securing sufficient land for future stormwater management.

103. CCC has integrated the issues of importance to this area into a proposed management strategy, which is set out in Section 5 of the SMP. This strategy is comprehensive – CCC includes the following methods to achieve their identified objectives: design criteria for level of service and infrastructure design, environmental education, industrial stormwater and site management, stormwater quality and quantity mitigation, sediment and erosion control, low impact design and source control, waterway enhancement programmes, Green Print initiatives, monitoring and reporting, further investigations, Sub-Project Area reports, operations and maintenance of stormwater systems, and finally SMP reviews. The anticipated actions for each of these methods is set out and discussed in Section 5 of the SMP.

104. The key method is the preliminary Surface Water Management Scheme (SWMS), which is set up to provide a management approach to the mitigation of potential stormwater quantity and quality effects.

105. Irrespective of my comments about aspects of the detailed information provided in relation to the specific studies, I believe that the overall management strategy, including the SWMS is described at an appropriate level of detail. The proposed management regime includes methods for linking with other programmes already being undertaken by CCC. The linkages are discussed, and a monitoring regime has been set up which covers the key aspects for receiving environment monitoring (again subject to detail of recommended consent conditions). I am satisfied that all the important topics for implementing and monitoring of the Plan have been covered, and that it will be possible to determine over time the improved environmental outcomes achieved by this Plan.

106. The amount of information required for these catchment management plans is huge and the timeframe required to achieve all of the studies is over several years. Although the people responsible for these plans know all of the relevant information, it must be sufficiently well documented to allow for changes in personnel during the implementation of the plans over the years.

107. The SMP will be the guiding management document for the catchment and must stand alone. I believe that the issues which have been identified in the South-West Christchurch catchment need to be clearly stated in the SMP Report, and that the objectives should be expanded to give better direction and a commitment by CCC to timeframes.

Monitoring

108. Section 5.1 of the SMP specifies that alternative structural measures will be implemented on a reactive basis following monitoring and reporting on SMP against the SMP objectives. Although proposed conditions for water level monitoring and long term management monitoring are identified, there are no details of trigger values or how these will be actioned. Again, with more specific objectives in place, the link from a specific trigger to the objective would provide more certainty of a commitment to the reduction of flood levels. Section 6.5 – Further Investigations should include a link with the modelling as modelling will be an integral part of the future more detailed design and review of management options, and it clarifies that this is part of the intended process.

109. Section 3.1 of the Monitoring Programme specifies the location of water level monitoring sites for the Heathcote River but not the Halswell River. As also recommended by Tony Oliver, it is recommended that additional long term flow/level monitoring sites be set up – at least one in each of the Halswell and the Heathcote. These should be set up at locations immediately downstream of anticipated attenuation devices, and should be set up as soon as possible. This will then provide data for the existing level of development, which can be used to understand the changes due to urbanisation, and for calibration of future modelling.

110. The Section 92 Response (Question 21) identifies water level recorders on the attenuation basins at Wigram and Halswell – these should aslo be included in the Monitoring Programme.

111. Soil infiltration rate monitoring is described in Section 6.4 of the Monitoring Programme. This outlines routine testing to identify minimum and maximum allowable infiltration rates. The plan recommended three representative sites to tested within 12 months of commissioning – it is suggested however that *all* new sites be tested within 12 months of commissioning and then 3 representative sites at 5 yearly intervals thereafter unless a problem with infiltration rate is reported.

112. The lower infiltration rate is established as a basin that does not drain down over seven days. If a basin has a depth of around 1m then this equates to an average infiltration rate of 6mm/hour. A time to drain down of 7 days would suggest to me that there is a problem with the system and may result in grass-die off. It is recommended that in addition to the monitoring proposed, where a site is reported to take more than five days to drain down then an inspection be carried out by CCC and infiltration testing be undertaken to determine if design infiltration rates are being achieved and, if not, what remedial actions are required.

113. If the Monitoring Programme is not updated in time for the hearing or subsequently prior to the hearing closing these items should be included as conditions of consent.

Implementation

114. In implementing the SMP, it is intended that reference will be made to other key CCC documents. One of the aspects of concern is the Level of Service (LOS) for the waterway system and the attenuation basins. Although CCC's Infrastructure Design Standard (IDS) and the Waterways, Wetlands and Drainage Guide (WWDG) are listed in the methods and implementation, there is no clear statement relating the SMP implementation to the LOS from these design documents. An objective giving a clear link between these documents would be useful.

115. The LOS in these documents applies to primary system capacity, overland flowpaths, and 50 year flood management. The applicant states that LOS may change in the future, depending on changing climatic effects. Given CCC's proactive approach to green corridors along waterways, it is unlikely that a change in the primary system LOS will be critical in terms of adverse effects. However, given the flooding problems in both the Heathcote and Halswell catchments in the 50 year event, and given that this SMP is a future planning document, allowance should be made at this stage for future enlargement of attenuation devices, based on rainfall data and include future climate change predictions. Section 5.3.3 of the Appendix E states that the SWMS has been updated using the 16% increase in rainfall with future predicted climate change (the design rainfall inputs is discussed in detail by Tony Oliver). It is imperative that sufficient land be protected through both this SMP process, and the SWAP. This should be reflected in the detailed design for the SWMAs and in any future updates of the SMP.

116. It is recognised that the purchase of land is a significant cost. However, without sufficient land it is not possible to provide the required protection. This is seen clearly in existing catchments, and the lower Heathcote is an example. There is little ability to retrofit either water quality or quantity facilities into the middle or lower Heathcote, and the cost of land combined with the existing fragmentation and use of it, makes the purchase difficult, expensive and most likely not possible.

117. I understand that CCC has avoided duplicating information and requirements from other CCC documents into the SMP in an effort to let the jurisdiction lie where it falls, and to prevent the need to update the SMP if other standards change. Not only that, but should the IDS or WWDG change, the criteria written into the SMP would remain valid. Therefore, they have not set design criteria into the SMP, as these are in the IDS and the WWDG. However, once consent is granted, based on this application, the SMP becomes a stand-alone document and will not form part of the consent. Sufficient information should be contained within it that a developer / interested party can read the SMP and the consent conditions, and have certainty over what is required by the consent. This provides confidence for CCC that, into the future, anyone reading this document will have all the information they require. This could be achieved with an objective that states that the requirements of these documents, set out in Section 5.1 of the SMP, are to be complied with.

118. The links set out in the implementation section of the SMP, Section 8, show clearly how the implementation will be influenced by the many programmes that CCC has already underway, e.g. Green Print initiatives. This is easy to follow and understand, and is a reflection of the methods set out at the beginning of Section 5, Integrated Catchment Management. From a plan logic perspective, the circle would be completed if each of these implementation methods clearly linked to an objective, and therefore provided solutions for the identified issues.

119. I suggest that an implementation plan be developed for each SWMA taking into account the finalised SWAP. The implementation plans should set out in detail the timing of the construction of the mitigation facilities relative to development occurring, the exact locations of facilities, preliminary design of the facilities, and modelling to show that required objectives will be achieved. Brent Hamilton has dealt with the detail of this suggestion in his recommended conditions of consent.

CONCLUSIONS

Stormwater Quantity and Quality Mitigation

120. The approach to stormwater quantity and quality mitigation, encapsulated in the SWMS, is appropriate for the area, and provides sufficient understanding of the way in which the desired environmental outcomes will be achieved. There are aspects of detail which will need to be included in the final SMP and the detailed design for each of the Stormwater Management Areas.

121. In particular, the stormwater management approach and the possible retrofitting of stormwater devices for existing industrial sites requires further work. A method which would enable CCC or ECan to enforce this needs be developed.

Integrated Catchment Management

122. The SMP is the base document supporting the consent application. I believe that sufficient information is available to provide a good SMP for this consent (providing that details raised by ECan are resolved).

123. CCC is clearly committed to managing their surface water in an integrated manner, and in a way which reflects the values and aspirations of the community. The SMP and the consent must have committed actions and timeframes for dealing with the identified issues, so that these can be converted into the anticipated environmental outcomes.

124. If the SMP is to remain outside of the consent then sufficient detail needs to be provided in the consent conditions to allow the principles, objectives and methods outlined in the SMP to be consistently applied over time and to support CCC's decision making processes.

125. As mentioned earlier, while it is understood that CCC require a degree of flexibility in reporting and implementation, it is important that they have a strong design and consenting framework to support development decisions. This is particularly important post-earthquake as there will be significant pressures with regard to development areas and timeframes for development.

CONDITIONS OF CONSENT

126. I have made some general recommendations in this report relating to conditions of consent. These in include:

- CCC notifying ECan of an unacceptable industrial site when identified.

- Demonstrating that scaled versions of facilities can be scaled up to accommodate future new development and retrofitting of existing land use.The land required for stormwater management must be identified in the SWAP and Plan Change processes so that sufficient land is protected for future flood control and stormwater quality management. The area of land should be based on calculations which include an allowance for climate change and future land use changes.

- The final design of all facilities should be carried out using the updated computer model, rather than relying on the Rational Method.

- A detailed implementation plan should be developed for each of the identified nine Stormwater Management Areas. The implementation plan should include (but not be limited to) the following:

  - future land use change predictions

  - proof of land protected from development;

  - detailed outlet designs with calculations showing that flows will achieve the desired flood protection outcome;

  - preliminary design of treatment and attenuation devices sufficient to show feasibility and practicability;

  - designated overland flowpaths for all flows up to the 50 year event;

  - the computer model showing how the combination of treatment devices and hydraulic structures achieve flood attenuation;

  - proof that the levels indicated in Table 8.3 of the AEE can be achieved.

  - freeboard allowances to building floor levels;

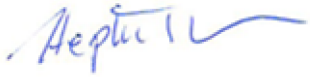
  - timing of mitigation relative to zoning / development;

  - justification for any changes to the overall design approach;

  - a method for the retrofitting of management and treatment for existing industrial sites.

Signed: _____ Date: 1 November 2011

Graham Levy
Technical Director

Reviewed by: 

Signed: _____ Date: 1 November 2011

Stephen Timms
Principal Consents Planner

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