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DATE 30/6

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of application for Resource Consent 65750 by the Trust Power Limited for Activities associated with the operation of the Matahina Dam.

UNDER S42A OF THE RESOURCE MANAGEMENT ACT
REPORT OF WILLIAM JOHN LANGDON PHILPOTT, CONSULTING ENGINEER

A Qualifications / Experience

1. My name is William John Langdon Philpott, and I am a Consulting Engineer based in Palmerston North.

2. I hold a Master's Degree in Civil Engineering and have 31 years postgraduate experience in engineering design, project management and construction supervision, specialising in the field of river and drainage engineering.

3. Prior to establishing John Philpott & Associates Ltd in 2000, I held the positions of Resource Information Manager and prior to that Operations Manager with Manawatu-Wanganui Regional Council. My work over the 15 years with Horizons Regional Council and its former authorities included river and drainage operational engineering, investigation and design engineering work.

4. I currently provide consulting engineering services to a range of local authorities, companies and private individuals throughout New Zealand specialising is river and floodplain engineering.

5. I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Notes. I agree to comply with this Code of Conduct. This report is given within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

B Introduction

6. The Consents Section of the Bay of Plenty Regional Council has requested an independent opinion on how the proposed changes to the operating regime of the Matahina Hydro Electric Power Scheme will affect the Rangitaiki River erosion and flood control assets downstream of the dam. A mitigation option for these effects is a contribution to the Rangitaiki River Scheme (RTRS) and TrustPower have been negotiating with the applicant on an appropriate contribution. Therefore, the Consents Section have asked me to provide an opinion on an appropriate level of contribution that the dam owner should contribute to the ongoing cost of managing the River, if that is the mitigation option.

C Background

7. The Matahina Hydro Electric Power Scheme (Matahina Scheme) was constructed on the Rangitaiki River 36 kilometres upstream of the mouth. The river flows down the centre of the Rangitaiki Plains past the township of Te Teko, 12.8 km downstream of the dam, and Edgecumbe a further 12.8 km downstream.

8. The river is managed by The Bay of Plenty Regional Council, Rivers and Drainage (BOPRC R&D) as part of the Rangitaiki – Tarawera River Scheme. The river has a mean flow of 71 cumecs and a 1% Annual Exceedence Probability event of 780 cumecs.

9. The Matahina Scheme was commissioned in 1967 and is now operated by Trust Power Limited (TPL) under conditions imposed by consent granted in 1990. An application was made to renew the consent prior to it expiring in 2009.

10. The existing consent controls aspects of Lake Matahina and the level and nature of outflows from the dam into the Rangitaiki River. The consents currently: limits the low flow to 40 cumecs except when inflow is less than this; restricts the number of peaks to two operating peaks per day with no peaks allowed when the inflow is less than 40 cumecs; and controls upward and downward ramping rates. There are also controls on flood flows.

11. To avoid the dam's turbines running in their rough running range of approximately 29 and 41 cumecs, TPL matches the inflows and outflows over a 24-hour period when inflows are in this range. Typically this sees higher flows discharged during the day with lower flows being discharged at night.

D Information Provided and Reviewed

12. Both TPL using expertise provided by Beca Infrastructure Ltd (BECA) and BOPRC R&D using both in-house expertise within their Operations Group and Gary Williams of G & E Williams Consultants Ltd, have studied and reported extensively on the impacts on the Rangitaiki River of the existing and the proposed dam operating regimes.

13. I have reviewed the information provided by TPL involving Biennial Monitoring and inspection reports, the Consent Application and the AEE and Beca Report titled – Matahina HEPS – Hydrological Basis for Monetary Contribution to RTRS.

14. I have reviewed the detailed reports prepared by Gary Williams regarding the Rangitaiki River and Matahina Consent dated 19 May 2009, 28 September 2009, 13 October 2009, and the report on the January 2011 flood.

15. I have also examined in detail the maintenance and flood damage estimate spreadsheets developed by BOPRC R&D Operations Group and funding model developed for the Operations Group by Watershed Solutions Ltd.

E My Opinion

16. In my opinion there is no doubt that there is a negative impact on the Rangitaiki River arising from existing operating regime of the Matahina Scheme and that the proposed changes to the operating regime will not only continue to cause these negative impacts but will increase them.

F TPL's Proposed Changes to Operating Regime for the Matahina Scheme

17. No change is proposed to the manner in which Lake Matahina is controlled or on how the dam is operated during flood conditions.

18. There are however five instances where TPL are seeking approval to make operational changes. These are:

- to allow peaks in operation when inflows into Lake Matahina are equal to or greater than 20 cumecs (rather than 40 cumecs as at present). If flows drop below 20 cumecs, TPL would match outflows from the powerhouse to the inflows into Lake Matahina;
- to peak the Scheme as often as required to better meet the varying demand for electricity;
- to operate within a constraints envelope when inflows into Lake Matahina are equal to or exceed 20 cumecs. This would establish a series of maximum and minimum discharge limits from the powerhouse based upon the average outflow from the Scheme over the previous 72 hours;
- to steepen the downward ramping rate to 30 cumecs per hour; and
- to steepen the upward ramping rate to 97 cumecs per hour.

G Relevant issues raised by TrustPower Limited

19. Section 2.10 of TPL's Consent Application very briefly discusses the issue of river bank erosion and concludes that riverbank erosion is a natural phenomenon that, in the case of the Rangitaiki River, is principally associated with floods flows. BECA, having assessed the existing operation of the Matahina Scheme, conclude that its existing contribution to erosion in the lower Rangitaiki River, taking into account the existing mitigation measures of contributing to the BOPRC R&D river bank erosion program, is minor.

20. Section 5.7 in the Assessment of Environmental Effects summarises the BECA report entitled "Matahina Hydroelectric Power Scheme Re-consenting Project: River Hydrology, Hydraulics and Bank Erosion".

21. This section notes that the initial commissioning of the Matahina Scheme resulted in a variety of river morphology changes, some of which had environmental effects and concluded that the environment had adapted to the existence of the Scheme and no mitigation is proposed in this regard.

22. However since commissioning they have identified a variety of morphological effects arising from the Matahina Scheme. These are:

- that the fluctuating river levels (which occur as a consequence of the Matahina Scheme's operation) prevent the establishment and maintenance of vegetative bank protection. This effect extends from the Matahina Dam to Edgecumbe. Of note is that BECA conclude that this effect does not apply to over-steep banks where fluvial erosion at the toe of the bank leads to mass failure. This effect is ongoing;
- that the entrainment of sediment in Lake Matahina has, at worst, halted or substantially reduced the historical rising of the river bed, and the consequential rise in the level of the Rangitaiki Plains. BECA advise that this is a positive effect of the Scheme's existence as without the Matahina Scheme the Rangitaiki-Tarawera Rivers Scheme would otherwise require regular dredging and / or the height of the stopbank would have to be increased to counter the effect of a

rising river bed level. Having assessed the nature of this effect, BECA conclude that it has reached equilibrium and there is no ongoing trend that necessitates proactive remediation and / or mitigation;

- that flood attenuation in Lake Matahina has caused a notable reduction in the frequency and duration of flood peaks in the range of 160-200 cumecs downstream of the Dam. BECA note that this beneficial effect is also likely to apply to larger floods, but note that there is insufficient data available to draw a statistically valid conclusions;
- that there has been bank erosion (during flood flows) in the reach of the Rangitaiki River from the Matahina Dam to Te Teko. BECA concluded that a cause for the erosion could have been the sediment deficit caused by sediment entrainment in Lake Matahina but notes that there is no proven 'cause – effect' relationship. In assessing the nature and magnitude of any effect, BECA conclude that it is minor. BECA also recommend against formal mitigation (in the form of hard protection works) noting that protecting the banks would merely transfer the problem elsewhere.
- that there is potential for bank erosion as a consequence of vegetation being unable to establish on the riverbank downstream of the Matahina Dam (due to river level fluctuations). BECA recommends that this effect be mitigated and in the same manner as it is presently, being by TrustPower continuing to contribute to the river bank protection program implemented by BOPRC R&D.

23. In summary, TPL conclude that the river morphology effects of the current operating regime are minor and can, where necessary, be mitigated. Observed bank erosion is predominantly the result of flood events, the frequency and duration of which has been reduced and attenuated by Lake Matahina.

24. The AEE goes on to confirm that the existing operation of the Scheme is contributing, to the erosion occurring downstream of the Matahina Dam principally due to the flow fluctuations associated with the generation of electricity limiting riparian vegetation. Mitigation, via the existing measures of contributing to BOPRC R&D river bank erosion program is recommended and has been accepted by TPL.

25. TPL also state that no identified river morphology effects (that are different from the existing operating regime) are anticipated as a result of the proposed operating regime. They propose that an inspection of the river be undertaken two years after the introduction of the proposed operating regime to identify any unanticipated change to the pattern or rate of erosion which could be attributable to the modified operating conditions.

26. In their June 2011 report, BECA state that *"TrustPower does not receive any benefit from the Flood protection works, nor does the HEPS operation contribute to any risk associated with the natural river flood flows."*

27. Under the subheading Erosion in the June 2011 report they state that *"While there has been some monitoring of river cross-sections for many years, recent monitoring (as part of the twin peaking trial and thereafter, i.e. since mid 2001) did not find a correlation between the power station operation and river bank erosion. There was no identified increase in erosion as a result of the twin peaking trial which started in late 2002."*

28. Under the sub heading Bank vegetation they include a table that indicates relatively low percentage of lower banks bare of vegetation and conclude that the banks are well vegetated with only small percentages of bare banks.

29. The June 2011 report also includes an analysis of any TrustPower contribution to the RTRS. This is discussed in Section U below.

H Discussion of matters raised by TrustPower Limited

30. With all due respect to TPL's technical river experts, I would conclude that their understanding of river processes are either very limited or that they have consciously chosen to draw conclusions from their findings that support their apparent goal of no additional contribution from TPL to the management of the Rangitaiki River.

31. My river management experience has been gained over the last 27 years working on the management of both large and small river systems, initially within the Manawatu and in more recent years throughout New Zealand. Whilst there are theoretical principles that can be applied to the management of large rivers, a full understanding of their management requirements can only be gained through on the ground observation of rivers, floods, protection works, successes and failures over an extended period of time.

32. TPL does acknowledge that the fluctuating river levels which occur as a consequence of the Matahina Scheme's operation prevent the establishment and maintenance of vegetative bank protection but appear to avoid taking any responsibility for the effect on over steep banks. There clearly are some naturally over steep banks on the river especially on the outside of sharp bends in the river but at other locations these banks may well have become steep as a result of erosion of the toe of the bank where vegetation could not be established whilst the upper bank has been more stable due to vegetation cover.

33. Care must be taken in reviewing cross sections of the river and drawing a conclusion that the riverbanks are generally steep. Cross sections of large rivers are usually drawn with a distorted scale. The cross sections included in TPL's (BECA) Biennial Monitoring reports have a 1:3.6 distortion. In reality the banks on many of these cross sections are not steep and erosion could easily be controlled with good vegetation cover.

34. The discussion on the benefits derived by the River Scheme from the reduction of sediment build up in the lower Rangitaiki River fails to recognise the negative impacts arising from the removal of the rivers natural bed load on the river between the Dam and Edgecumbe. It is well understood that the over extraction of material from an active river system will result in some negative impact on the river and this generally shows up as bed degradation and then riverbank erosion as the riverbanks are undermined and become steeper.

35. I cannot conclude from the river cross sections included in the Biennial Monitoring reports that the riverbed in the upper reach has degraded but it must be noted that these cross sections are only shown for the river since 2001 and are many kilometers apart. It is likely that degradation of the river started to occur soon after the Dam was constructed and degradation has slowed in more recent times. It is also possible that the cross sections do not pick up the degradation.

36. I make this point to demonstrate that the trapping of sediment in the Dam, whilst it may have a positive impact on the lower river, will almost certainly have a negative impact on the river from the Dam to Edgecumbe. The River will still be reacting to the deeper and steeper banks and it would be wrong to conclude that there is no need for proactive remediation and/or mitigation.

37. It could be argued that the positive effects in the lower river could offset the negative effects in the upper river. Unfortunately erosion control works required to protect steep banks in a deep river channel are much more expensive than stopbank raising in the lower river and therefore it would not be reasonable to offset one with the other.

38. BECA do conclude that sediment deficit could be causing erosion but notes that there is no proven cause-effect relationship. As noted above it is well understood that the over extraction of material from an active river system will result in some negative impact on the river. If the sediment deficit arising from the existence of the dam is not causing an adverse effect in the Rangitaiki River, it would be one of very few rivers where a significant change in the natural movement of bed load was not having an adverse effect. The over extraction of bed material in the past from six large rivers in the Manawatu Wanganui Region has resulted in significant adverse effects on those rivers requiring ongoing expensive mitigation works. Extraction of bed material in these rivers is now severely restricted but in the case of the Matahina Scheme, it is not possible to remedy this sediment deficit without removing the dam.

39. The lack of sediment passing downstream of the dam also reduces the natural deposit of sediment on the riverbanks. Without the dam, sediment would deposit on the banks even in the reaches above Edgecumbe and this sediment would provide many benefits to the Scheme. It will provide a seal to the riverbanks and reduce the risk of piping and heave failures that result in flooding, and it would also enhance the establishment and integrity of good river edge vegetation.

40. TPL acknowledge that there is potential for bank erosion as a consequence of vegetation being unable to establish on the riverbank downstream of the Matahina Dam due to river level fluctuations. The river fluctuations are clearly preventing the establishment of vegetation on the riverbanks and are thus an influence on the damage that occurs during flood events. Well vegetated riverbanks are used throughout New Zealand as a means of preventing or at last limiting erosion that can occur in a big flood event.

41. In the June 2011 report, BECA include a table that shows that the percentage of lower bank that is bare of vegetation is low. Further analysis of these figures however shows that there is approximately **3,700** metres of riverbank bare of vegetation. In my opinion this is an alarmingly large length of bare bank which would have to be vulnerable to erosion. Large lengths of bank that used to be bare have been rock lined over relatively recent years due to failures that have arisen to some degree because they were bare. These lengths are in addition to the 3,700 metres of bare bank. I understand from the BOPRC R&D engineers that prior to the Matahina Scheme, there was very little rock riprap used to control river bank erosion as willow vegetation works generally provided the protection required.

42. TPL implies in the AEE, that as most damage occurs during flood events, the damage that occurs is not caused by the reduction in river edge vegetation that arises from the frequent river level fluctuations.

43. BECA states that the operation of the Matahina Scheme does not contribute to any risk associated with the natural river flood flows. Whilst I would agree that they do not have any significant impact on the size of large floods and thus the requirement for flood defenses, the condition of a riverbank prior to a large flood has a definite bearing on nature and extent of flood damage that occurs during a large flood. This is often most evident when two floods occur in relatively close succession and minor damage caused by the first flood becomes major damage in the second, even if the second flood had a smaller magnitude.

44. In the many river controls Schemes that I have been involved with over the years, there would be very few significant lengths of river bank that are not either well vegetated or rock protected because without well maintained protection measures in place, significant erosion in flood events is almost certain to occur.

45. It is important to note however that fully protected riverbanks also sustain flood damage in large flood events and it would therefore be unreasonable for TPL to be expected to fund all flood damage repair works.

46. The loss of river edge vegetation, erosion of the berm land that reduces the distance from the stopbank to the rivers edge, and the steepening of the riverbank will generally require the construction of a different type of protection work than was lost in a flood event. In the Rangitaiki River, this generally involves the use of rock riprap that is many times more expensive than the protection work that was lost.

47. The existing level of contribution was agreed to in 1998 prior to which there had been a period when there was very little flood activity in the river and was based on a vegetation management approach. Since 1998 there has been a marked increase in the number and magnitude of flood events in the river and on the adverse effects on the river arising from the Matahina Scheme. It is therefore clear that the low level of contribution is now nowhere near adequate to offset the adverse effects arising from the Matahina Scheme.

I Discussion of matters raised in the Gary Williams' Reports

48. I have read through the reports prepared by Gary Williams' (GW) and I have no reason to contradict or appose any of the comments or statements made in these reports.

49. I have extracted a number of relevant paragraphs from GW's 19 May 2009 report that assist in clarifying the important issues that need to be well understood before appropriate conditions can be set on the consent should it be granted including comments about appropriate levels of contribution. In my opinion the extracts from his report are well considered, accurate and should be taken into full consideration when assessing the application for Consent.

50. In response to references in TPL's AEE in regard to the reduced frequency and duration of flood peaks, GW made the following comment:

51. *Reducing flood peaks may have no real advantages, as the flood duration would be extended. A better use of available storage would be to even out flow fluctuations on the flood recession. It is flow* variation *on recessions that is really aggravating in terms of channel migration and its associated erosion and deposition activity. This would, though, require a drawing down of the reservoir after the flood peak, and a management of (spillway and turbine) outflows based on inflows to the reservoir.*

52. In respect to failure modes and river bank pre-condition, GW comments:

53. *The Beca report only deals with some of the erosion processes of rivers, and does not discuss the dynamic nature of rivers and river processes. The analyses undertaken are not set within a wider context of the complex variations in river conditions that occur over time, and which affect channel migration and erosion and deposition processes.*

54. *River channel and bank pre-conditions prior to a flood event have major impacts on the magnitude of channel movements during flood events, and the associated erosion and deposition activity. The amount of erosion depends more on the pre-conditions of*

channel shape and bank exposure and flood flow variations (especially above about a 2 year return period flow), than on the flood peak or duration. After a quiescent period, it is the later flood events that, in general, give rise to more activity and cause more damage, not the larger floods. A large flood event will also be much more destructive when it closely follows aggravating small to medium flood events.

55. *Hydro-power generated flow fluctuations can have aggravating effects through low level destabilisation and the maintenance of rawer banks. This gives rise to more adverse pre-conditions. Thus, while there may be very low levels of river activity during the hydro flow fluctuations, and virtually all significant erosion occurs during flood events, the hydro operation can still be having adverse effects.*

56. *Both the channel migration and piping processes can be aggravated by low level flow fluctuations. The stopbank breach in 2004 was generated by a combination of piping development, heave failure and back scouring, and the pre-conditions of the river banks and berms would have had a significant impact on the rate and extent of flood water inflows into the adjacent ground. There is a natural process of silt build up on river banks and then removal of this material by bank collapses or erosion. Hydro level fluctuations could have reduced the amount of silt deposition and increased the removal of silt, especially on the lower bank. The lack of vegetation in the zone of flow fluctuation, would have reduced silt build up, as this vegetation is especially important in trapping silts and buffering flows away from the bank, which increases lower bank deposition.*

57. With respect to the impacts and the mitigation of those impacts, GW comments:

58. *The impact of the Matahina HEPS will be different in periods of flood intensity, compared to quiescent periods, while river management programmes and costs will also be different.*

59. *The overall impact, including both beneficial and adverse effects, can not be quantified. River systems are much too complex and dynamic, and our analysis tools are very simplistic for such systems. A fair and reasonable contribution must be based on a qualitative judgement, but one informed by an understanding of river processes and the full range of potential effects of hydro operations within this environment.*

60. *There has been a major change in river bank protection measures since the earlier years of the river scheme, from vegetation to rock works. The difficulties in establishing and maintaining vegetation on a critical part of the river banks due to hydro flow fluctuations would have been a reason for this change. However, a vegetation approach may have been inadequate, at least at the more severe bends, during periods of high flood intensity. Rock work repairs and extensions after a large flood event, such as that of 2004, would still, then, have been required, without the aggravating effects of the hydro-power scheme.*

61. *The impacts of the Matahina HEPS operation on the river downstream, and in particular on river management can not be determined from quantitative analyses. Instead a qualitative judgement must be made based on the nature of river processes and the likely effects of the power scheme operation on these processes.*

62. *The present contribution from TPL was based on a vegetation management approach to river management, and an assessed proportion under greater stress because of the hydro operation. This assessment is no longer relevant, given the changes in the river and river management, and the damage caused by more recent large floods, which have necessitated the change in management approach.*

63. *Given the type of failures that can occur along the lower Rangitaiki River, and the likely impacts of the hydro operation on pre-conditions as well as vegetation and soil cover on the river banks, a 10% TPL contribution is considered to be on the low side. The contribution should apply to all the river management costs of mitigating failures along the lower Rangitaiki River, including flood damage repairs and additional capital costs. The capital costs of rock lining banks and stabilising and de-watering the river berm land will both reduce the failure potential and the adverse effects of the hydro operation. There will be on-going maintenance costs associated with these works, but the overall costs of the river management programme in the longer term should be reduced by the works, which would reduce any percentage contribution from TPL.*

64. *While a TPL contribution could be determined from present river management costs, of maintenance and programmed capital expenditure, actual costs will depend on the pattern of future floods and the effective degree of protection gained from the measures in place along the river. Any fixed contribution should then be subject to review, if river conditions and actual management expenditure significantly changes (for better or worse).*

Effect of the proposed operational changes to the Matahina Hydro Electric Power Scheme on the Rangitaiki River

65. With respect to the operational changes to the Matahina Scheme I make the following comment.

66. Very frequent peaking that allow flows to rise quickly from 20 cumecs and fall quickly back to 20 cumecs will continue to cause the same vegetation growth restrictions that currently occur and will increase the number and size of rapid drawdown failures.

67. Significant bank slumping can occur on river banks following high flows when there is a natural fast fall off in the flood hydrograph. The proposed change in the ramping rate will more than halve the drawdown time in flows greater than 150 cumecs. For generation flows greater or less than 150 cumecs, the drawdown time will be more or less than halved respectively but will depend on the particular reach of the river.

68. This will almost certainly result in an increase in bank collapses and therefore the need for a greater expenditure on river erosion control works.

69. In the June 2011 report, BECA explain that they have undertaken geotechnical investigations at several locations on the river and have concluded that the proposed operating regime will not increase the risk of internal erosion or bank instability. The soils on the Rangitaiki Floodplain are highly variable and it is very unlikely that the geotechnical investigations were extensive enough to draw the conclusion that they have drawn and it is therefore quite likely that the potential adverse effects caused by the very regular fluctuations in river level are quite significant. It is therefore quite possible that an increase in peaking will affect river bank stability. The quantum of increase is very difficult to determine however and will probably be less significant that than the change from a natural flow regime to the existing operating regime.

70. Depending on the operating flows and the actual use of frequent peaking, the damage that could occur may be greater than could be addressed in a practicable time frame.

71. Consideration should therefore be given to phasing in a change to the number of peaks and the changes to the ramping rates.

K Summary – River Management Issues

72. The operation of the Matahina Hydro Electric Power Scheme has and will continue to adversely affect the management of the Rangitaiki River and the proposed changes to the operational regime for the Scheme will not alleviate any of the problems currently being encountered. They will most likely cause even more river control problems that will require an even greater level of expenditure than is currently required.

73. TPL have proposed a condition of consent which requires them to pay a contribution to the Rangitaiki River Scheme, to mitigate the effects of their operation on the scheme. If TPL were not to make a contribution to the scheme, other conditions of consent would be required to mitigate the effects of the Matahina operation on the River Scheme, which may include restricting the operation of the dam. My analysis here is limited to considering an appropriate contribution, as the applicant appears to consider that this is the most appropriate way to mitigate effects in this case.

74. The existing contribution made by TPL to the management of the Rangitaiki River has most likely been inadequate since the day it was agreed to and definitely since the large flood in 2004.

75. The future level of contribution would best be determined by reference to present river management costs, forecasted future cost, and maintenance and programmed capital expenditure including the repair of flood damage.

76. The actual costs of managing the River and thus the level of contribution will depend on the pattern of future floods and the degree of protection gained from the measures in place along the river. The level of contribution should then be subject to change on a regular basis determined from an analysis of actual expenditure.

77. Consideration should be given to phasing the proposed changes to peaking, ramping and low flow regimes.

L Flood Damage

78. TPL have made many references in their report to flood damage. They accept that the operation of the Matahina Scheme does have an effect on the maintenance requirement for the river but is reluctant to accept any responsibility for its impact on damage caused during flood events.

79. In my opinion the repair of damage caused by floods is necessary to maintain the integrity of a river control scheme. The term maintenance is generally used to describe foreseeable/routine activities that are generally carried out on a regular programme such as the planting and layering of willows, stopbank maintenance and floodgate maintenance, to name a few. The term flood damage is used to describe maintenance works that are not predictable, as in any one year you may get many floods or no floods. Some scheme managers include within their maintenance budgets an allowance for the repair of damage arising from small floods as these always appear to occur, and this work is called maintenance. Another reason for the use of the term flood damage is historical in that subsidies from central government were available for works categorised as flood damage.

80. Therefore in reality all work, except capital improvement works, undertaken on a river scheme is undertaken to maintain the scheme and could all be classified as maintenance.

81. I make this point to counter TPL's assertions that whilst the Matahina Scheme does impact on the need for river channel maintenance, it does not directly contribute to the damage caused in flood events and should therefore not contribute to its cost. In reality it is all maintenance.

M Flood Risk

82. As the Matahina Scheme does not impact adversely of flood flows or flood levels, the control of flooding by the construction and general maintenance of stopbanks, floodways and overflow weirs should not be included in any analysis to determine the appropriate level of contribution from TPL.

N Review of the Proposed Rangitaiki River Cost Allocation Model

83. In general I believe that a cost allocation model of the type proposed will provide a fair and equitable method of determining the appropriate level of contribution from TPL towards the ongoing management of the Rangitaiki River.

84. Predicting future expenditure on a river system is difficult and dependent on many factors outside the control of the river managers. Flood frequency and size can be predicted statistically and whilst these will be relatively accurate over the long term could be very inaccurate over the short term.

85. Material and labour costs, the reaction of the river to the works undertaken, and the actual short and long term impacts from the operation of the Matahina Scheme will all have a marked affect on the cost of river management.

86. Considering these issues, a cost allocation model that makes a prediction based on all known factors but which can be adjusted regularly to account for both actual expenditure and revised predictions should produce a fair result.

87. Like any model however, there needs to be a number of base assumptions made, and assumptions generally result in an outcome that is not perfect.

The 25% TPL Share

88. The proposed model takes an estimate of all regular maintenance, capital works, and flood damage costs including the cost of loan repayments arising from past flood damage repair works on the reach of the river downstream of the dam and calculates the revenue required to recover these costs over a 35 year period and allocates 25% of this to TPL. Adjustments are then made for changes to peaking and low flows but I will discuss these later.

89. I have considered the fairness of the 25% allocation.

90. Some works are required on the Rangitaiki River as a result of the Matahina Scheme that would not be required without the Scheme. Some works would be required even with no Scheme but the size and cost of these works are greater as a result of the Scheme and some works are required whether there is a Scheme or not and the cost is not affected by the presence of the Scheme.

91. If it was possible to separate out all the costs that are required as a result of the Matahina Scheme and not use the simple percentage allocation model, the final allocation would be the fairest possible. However separating out the cost of the in-channel works to determine the proportion applicable to TPL would be very problematic, but this could be considered in relation to works associated with the

provision of flood protection. For example, river scheme costs associated with stopbank maintenance, upgrading required due to settlement, or the provision of a higher flood protection standard should not be a cost to TPL, whereas erosion of stopbank may well be. In the current model however, it is likely that these costs especially the stopbank maintenance cost do affect TPL's share of river scheme costs.

92. I have analysed the costs associated with river scheme maintenance and as far as possible the capital works, and past and future flood damage costs. If the need for rock riprap work on the river is to a large degree as a result of damage arising from the presence on the Matahina Scheme, I believe that the allocation of 25% of all the costs to TPL favours TPL and could not be considered to be unfair allocation.

93. With further discussions with the River Scheme managers and access to a fully operational cost allocation model, it would be possible to determine a fairer allocation percentage. It could well be higher than 25%. However because the cost included in the model calculations include costs that are not impacted on by the Matahina Scheme, the use of the 25% allocation to TPL could be considered to be reasonable.

The Inclusion of the 2004 Flood Damage Repair Debt

94. Whilst the inclusion of the debt arising largely from the repair of flood damage that occurred in 2004 into the allocation model would seem fair from a logical point, bringing past costs into play in a new agreement when there was already an existing agreement in place, could be considered to be unfair from a business perspective.

95. The existing agreement however for contribution to the river scheme that results in a contribution of only about $15,000 per annum is, in my opinion, grossly out of date in light of the current pattern of flood flows. When considering that the Matahina Scheme had an impact on flood damage sustained in 2004 it would be reasonable to expect TPL to contribute to the repair of this damage.

Cost of Capital

96. The cost of capital included in the model whilst it is a figure that can be changed, is much higher than is currently being charged by BOPRC for capital loaned to Schemes. Whilst the figure used will give a worst case example, an interest rate figure much closer to that currently applied would reduce the TPL share significantly. This may facilitate an easier transition from the current low level of contribution to the required level.

Flood Reserve

97. The model includes an allowance for a contribution to a flood reserve as part of general maintenance. The model however also factors in the cost of future flood damage works that will be funded in part from the reserve but no allowance is made in the model to recognise that TPL will have already contributed to this reserve.

98. If however the flood reserve was just used to fund the regular small flood damage that occurs but has not been programmed within the regular maintenance budget, then its inclusion in the calculations is appropriate.

99. Depending on how this reserve is used in reality, it should be either retained or removed from the model.

Dynamic Nature of Model

100. The dynamic nature of the model which will allow actual costs and operating regimes to be fed into the model to determine the next year's contribution is, in my opinion, an excellent method of ensuring a fair contribution is made. It could however make it difficult for long term financial planning for TPL. An alternative could be to modify the model and reconcile it every 3 to 5 years.

Weighting for Peaking and Low Flows.

101. The model calculates the TPL share based on 25% of the costs of managing the river downstream of the dam.

102. The model then adjusts the share by taking into consideration the number of peaks over and above the existing peaking regime and similarly for the change in the low flow regime.

103. This assumes that the costs associated with managing the scheme are directly proportional to the number of peaks and the periods of low flow. Whilst I agree that increased peaking will increase the cost of managing the Scheme, I do not believe that the cost increase will double if the peaking rate doubles but could depend on the size of the flood peaks and their frequency.

104. The model as currently presented increases the TPL share by more than 60% from $272,774 to $441,420 as a result of the proposed operating regime changes that increase the peaking from 1.8 per day to 2.4 per day and reduces the low flow to 20 cumecs. In my opinion this increase is too high.

105. The model is designed to be adjusted annually by inputting the actual costs of managing the river and the share paid by TPL will reflect these costs if this approach is adopted. The impacts of the changes to the operating regime will therefore be taken into account with the inclusion of the actual costs. In future years the proposed model will adjust the TPL share without having to add an additional amount to deal with peaking and low flow scaling.

106. As there may be some delay in the impacts and the actual costs showing up, an initial adjustment could be made in anticipation of an increase in costs, and if this proved to be incorrect, one way or the other, it would be readjusted when the actual costs are included in the calculations for future years.

107. Whilst there is expected to be an increase in cost arising from the changes to the operating regime, as long as the final cost allocation model was dynamic, increases in cost would be picked up in future years and for that reason I see no need to make an adjustment in year 1.

O Summary – Proposed Cost Allocation Model

108. In general the proposed cost allocation model provides a mechanism by which a fair level of contribution to be made by TPL towards the ongoing Management of the Rangitaiki River can be determined.

109. Whether or not the TPL share should be 25% could be subject to much discussion and analysis but it is likely to be reasonable. In theory it would be possible to determine by way of a detailed examination of past and future costs what the precise figure should be, but defining precisely what the cause for each item of work was and who the beneficiaries were would be very difficult and because of this, any agreement reached may not be any more acceptable to either party.

110. The scaling calculation to allow for peaking and low flows should be removed from the model but the year one share could be increased above that level calculated by the model to recognise that there will be some increase in cost. Future effects will be addressed by using actual costs in the model.

111. The use of 8% as the cost of capital is, in my opinion, too high as it is well above the current cost for the Scheme and whilst this may change, the figure produces a very unfavourable TPL share at year 1. The model should be rerun with the current cost of capital used. TPL should however be advised of any proposed changes to the Council policy on the cost of capital loaned to Schemes.

U Discussion of TrustPower's Analysis of Costs and Share Basis

112. TPL have developed a simple costs and share analysis calculator to determine the level of contribution to the maintenance of the Rangitaiki Scheme. I will discuss each part of this analysis.

113. TPL are in general agreement with the work and activities involved with routine maintenance but have removed fencing costs from the list of activities. I would agree with this move unless fence replacement is required because of damage caused to flood defences arising from riverbank erosion. The impact of this change is relatively minor.

114. TPL appear to be in general agreement with the need to contribute to Scheme Management and flood reserves but appear to disagree with the method of allocating the proportion of the total River Scheme costs for these activities to the reaches of the river affected by the Matahina Scheme. TPL have first discounted most of the costs determined by BOPRC R&D by 50%, and the basis for this is not at all clear, but presumably on the basis that the costs are associated with other Scheme activities not affected by the Matahina Scheme. TPL have then allocated the amount of these costs based on the relative proportion of the cost of routine maintenance for each of the lower reaches of the river compared to the total River Scheme costs of routine maintenance. This would appear reasonable at first glance, but BOPRC R&D section note that there is a greater incidence of damage in the lower three reaches of the river and this will require more management input. I would agree with TPL's approach in regard to the allocation of the flood reserve funds but not in the allocation of management costs and for the allocation of these costs I support the approach taken by BOPRC R&D. The decision on the allocation of flood reserves needs to refer back to the matters raised in Paragraphs 97 to 99 above.

115. TPL then discount all of these costs by a further 15% and 25% for flood reserves for reaches 2 and 3 respectively and to 7.5% or management costs for each reach. For the flood reserve component, I suggest that TPL do not have sufficient information to make the decision they have made and would support the judgment made by BOPRC R&D. For the Scheme management costs, that have further reduced their share because of the flood damage component of the management activity there is a need to refer back to the matters raised in Paragraphs 78-81 above.

116. TPL's analysis as presented considers that flood reserves are not relevant and they are still waiting for information on where the flood reserves are spent. If the flood reserves are only spent on repair of flood damage associated with erosion then the cost is relevant. Again however I refer to the matters raised in paragraphs 97 to 99 above.

117. In TPL's analysis the 2004 flood damage data provided by BOPRC R&D has been discounted on the basis that the repair costs were not all related to erosion. It is not

clear on the damage detail tables and more analysis with input from BOPRC R&D will be required to finalise the appropriate 2004 flood damage costs relevant to TPL.

118. TPL's analysis does not consider that TPL should contribute to the repair of 2004 flood damage on the basis that they are historical works and the bank erosion component is now complete. I would refer here back to Paragraphs 94 and 95 which discuss the matter of past costs but conclude that TPL should still contribute. I understand that the majority of this work has been completed and the current costs are involved with servicing the loan taken out to fund these works. In my opinion TPL should contribute to the cost of this activity.

119. TPL appear to accept that TPL contribute to the 2010/11 flood damage but at very low rates.

120. As I note in Paragraphs 88-93, the allocation of 25% of all River management costs (including flood damage) to TPL would be a fair allocation. However if the model proposed by TPL were to be adopted that separates out the cost of activities not affected by the Matahina Scheme, the percentage share should be higher. A simple analysis would indicate that this figure would need to be close to 30%. As the process of precisely determining which works are required as a result of the Matahina Scheme will not always be straight forward, a simple percentage of all costs associated with the management of Rangitaiki River affected by the Scheme excluding costs clearly associated with improvements to the control of flooding (stopbank upgrading and the like) should be set at say 25%.

121. TPL's analysis does not consider any additional allowance for peaking or lower low flows. In this matter, I refer to Paragraphs 101 to 107 above that concludes that whilst there will most likely be an increase in cost, a dynamic allocation model will pick these costs up in the future.

122. Taking the issues and conclusions from the discussion in the section above and feeding these into TPL analysis spreadsheet, I have roughly calculated that TPL should pay approximately $47,000 to cover the annual operation and routine maintenance costs.

123. With respect to the 2004 and 2010/11 flood damage costs I have used the current debt and current repair figures from the BOPRC R&D analysis and considered that they will be funded from loans over a 25 year period at 5%. The total annual cost of debt servicing would be $232,000. Taking 25% of this as it was an all inclusive works estimate, the TPL share would be $59,000.

124. This calculation assumes that the current debt for the 2004 flood damage has already had the Government share taken off and that 25% of this is applicable to reaches 2 and 3. It also assumes that the 2010/11 flood damage did not attract Government input and the full $1,500,000 was applicable to reaches 2 and 3.

125. I have also considered the TPL model. I have assumed that Flood reserves are not relevant and that both routine maintenance and Scheme management should be 30% share to TPL for reaches 2 and 3 but 10% for reach 1 because of its location. This gives a total annual cost to TPL of $47,000 as note above in paragraph 122. I have used 30% and not 25% because TPL had already removed, as they saw it, the not applicable items of work. I have then taken 30% of the $2,224,301 and $901,925 for the 2004 flood damage less govt subsidy and determined an annual cost of loan servicing a 5% for 25 yrs to arrive at an annual cost of $32,540. Similarly for the 2010/11 damage but at 25% because it is an all inclusive cost to generate an annual cost of $26,600. Total = $59,140 ~~which is amazingly close to the $58,000 from paragraph 123.~~

Comment [RU1]: Increase from $40,000 to $47,000 by allowing for 10% of the maintenance costs of the Reach 1

Comment [RU2]: Increased from $58,000 to $59,000 changed from monthly to annual repayments

Comment [RU3]: Added this to recognise that the adeverse effects of the Matahina Scheme will not stop abruptly at Edgecumbe.

Comment [RU4]: As above

Comment [RU5]: Refer to Comment RU2

Comment [RU6]: Refer to Comment RU2

Comment [RU7]: Revised total

126. Adding these to the $47,000 for annual routine cost, the total year one share to be paid by TPL should be $106,000.

Comment [RU8]: As above

Comment [RU9]: Revised total

127. The BOPRC R&D model also includes capital works but it is unclear what proportion of these is related to the Matahina Scheme and I have allowed only 10% to recognise that there will be some effect. The year 1 impact from the capital works will therefore be $14,000.

Comment [RU10]: This change follows from deciding to include an allowance for 10% of the cost of future capital works

~~127.~~128. The TPL model does not make any allowance for the funding of the more regular, say 5 yearly, flood damage as this can be added to the TPL model when damage occurs.

W CONCLUSION

~~128.~~129. The operation of the Matahina Hydro Electric Power Scheme by Trust Power Limited is having an adverse effect on the ongoing management of the Rangitaiki River.

~~129.~~130. The reports prepared by Beca do not adequately consider all the river processes and understate the impacts of the Matahina Scheme on the River. Beca do agree however that a contribution towards the management of the river is appropriate but they do not believe that many of the adverse effects on the river are caused by the operation of the Scheme.

~~130.~~131. Gary Williams" reports address the very complex nature of river processes and explain how the Scheme affects the river and the nature of those effects. He concluded that these effects are not minor.

~~131.~~132. As the effects on the river from the operation of the Scheme will vary over time depending on floods and the operational regime adopted, the level of contribution to be made by TPL to the Scheme, must be reviewed regularly to ensure it remains equitable to both parties.

~~132.~~133. BOPRC R&D needs to provide further information on the proposed capital works and where appropriate the share to be funded by TPL amended.

~~133.~~134. With some modification, the proposed Cost Allocation Model which should probably be called a Contribution Model could very effectively be used to determine a fair level of contribution.

~~134.~~135. That subject to final analysis and discussions with both parties to clarify some finer details, the year one share to be paid by TPL to fund the works required as a result of the Matahina Scheme should be $120,000.

Comment [RU11]: Adjusted for changes in Paragraph 127

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Modified 27 June 2011 – annotated changes on 30 June 2011