Te Awarua-o-Porirua Whaitua Committee

Managing contaminants in Te Awarua-o-Porirua whaitua

Sediment

4 October 2018 Whaitua Committee workshop

Contents

Background and context

1. What is the problem with sediment?

Background

Sediment discharged into rivers, streams and Te Awarua-o-Porirua harbour (the harbour) can negatively impact a range of values, including ecosystem health and the way people use water for spiritual, cultural and recreational purposes. Sediment affects ecosystem function in rivers and streams through:

- Reducing the ability of light to penetrate water affecting the ability of plants to grow,
- Impacting the health of fish by abrading skin and gills and making predators and prey difficult to see, and
- Filling the interstitial spaces (spaces between rocks and pebbles etc.) in stream beds, making them less suitable for macroinvertebrate communities to survive and thrive.

In the harbour, sediment:

- Alters and degrades habitat and community composition by smothering invertebrates, shellfish and seagrass
- Changes the depth of water and flow patterns
- Reduces clarity
- Changes the feel of substrate underfoot

Sediment and erosion are recognised as issues particularly for the harbour and many studies have been carried out on the rate of sedimentation of the harbour. Excessive sedimentation rates in the harbour is one of key issues identified in the Te Awarua-o-Porirua Harbour and Catchment Strategy and Action Plan. The aim of the strategy and action plan. Developed in 2012, aims to restore the environmental health of the harbour by targeting three key issues; excessive sedimentation rates, pollution and ecological degradation.

Values

Te Awarua- o-Porirua Whaitua Community values[1] developed by the Committee that are the most relevant to sediment are:

Kai kete – The harbour, streams and coast can be used to gather and catch kaimoana and mahinga kai for food

Hauora kaiao – the harbour, streams and coast are clean and brimming with life and have diverse and healthy ecosystems

Ka taea e te tangata – the harbour, streams and coast flow naturally with energy, attracting people to connect with them

Whanaketanga tauwhiro o te whenua – land is developed, used and managed sustainably, recognising its effect on water quality and quantity.

[1] http://www.gw.govt.nz/assets/Whaitua/TAoPWC-values-poster.pdf

This memo lays out the most recent information on the sources of sediment and which water management unit (WMU) within the whaitua they are coming from. The memo briefly covers the relative sources of sediment across the whaitua sources and explores the estimated changes in sediment through the scenario mitigations. Key options for improving sediment management in Te Awarua-o-Porirua whaitua are outlined and, based on a set of identified principle and drivers, some options for a policy approach are set out for discussion at the 4 October 2018 meeting. These will all ultimately inform the draft Whaitua Implementation Programme (WIP).

2. Where is the sediment coming from?

Overview

The harbour edge and its surrounding catchments were once forested in tall dense lowland podocarp forest and hardwood trees (kaihikatea, totara, rimu) prior to European settlement. Conversion of forest to farmland and later the development of significant areas of urbanisation have contributed to an increased sediment load in our streams and sedimentation rate in the harbour.

Farmland has a continual on-going contribution (from grazed pasture, especially on steeper slopes) to the sediment load, while urban development contributes a significant increase in sediment load during the construction phase (during both large/bulk earthworks and small/individual site development) and then a smaller on going contribution once development is completed.

Stream bank erosion in urban areas is increased due to large impervious zones (house roofs, concreted driveways, roads) causing higher flows (larger shorter peakiness) during rainfall events. Stream bank erosion also occurs in the rural setting with run off from pasture occurring at a greater rate than forest or scrub cover.

The temporal and spatial variability of sediment in the harbour was discussed and described in the technical report entitled Technical Report associated with Te Awarua-o-Porirua Harbour Modelling Results and further qualitative information and presentation at the committee workshop on 23 August 2018.

Sediment loads in the Water management units

Modelling by Jacobs using SedNetNZ suggests that under the current state the total load of sediment lost from land and moving through water to the harbour is approximately 8,100 tonnes per year (based on a ten year average); 5,200 tonnes per year in to the Pauatahanui Arm and 2,900 in to the Onepoto Arm (Table 1)[2].

The Pauatahanui WMU and the Porirua WMU are the two largest contributors to the the total sediment load reaching the harbour. The Pauatahanui, Horokiri and Duck Creek WMU's are collectively responsible for approximately 90% of the sediment load in to the Pauatahanui arm of the harbour. The wider Porirua catchment (incorporating the subcatchments of Rangituhi, Takapau, Belmont, Stebbings, Kenepuru) is responsible for over 90% of the sediment load in to the Onepoto arm.

[2] Note: the sediment loads shown in relation to a WMU are based on a ten year average of the sediments calculated by the SedNetNZ model. However, the sediment load data used for the harbour modelling was for the 2010 year (representing a single year that is illustrative of the 10 year average). Therefore, there is a difference in the total loads for each arm of the harbour in Table 1 and Table 4.

Table 1: Current state sediment loads attributable to each Water Management Unit and agregated to Te Awarua-o-Porirua Harbour

	WMU name	Total Load per WMU (t/yr)	Sub catchment load t/yr	Sub catchment load (t/yr)	Total Load to each arm of Porirua Harbour (t/yr)	Total Load to whole Harbour (t/yr)	Total load from whole of Whaitua (t/yr)
Pauatahanui Arm	Horokiri and Motukara	960	960		5210	8090	8200
	Kakaho Stream	250	250				
	Ration	200	200				
	Judgeford Stream	630	3210				
	Pauatahanui	3210					
	Lower Duck Creek	530	530				
	Upper Duck Creek	380					
	Pauatahanui Fringe	60	60				
Onepoto Arm	Rangituhi Stream	30	30	2660	2880		
	Takapu Stream	650	650				
	Belmont Stream	270	270				
	Stebbings Stream	110	110				
	Kenepuru	820	820				
	Upper Kenepuru	530					
	Porirua	2660	2660				
	Hukarito Stream	10	10				
	Mahinawa Stream	40	40				
	Onepoto Fringe	160	160				
	Whiteria	10	10				
Open Coast	Pukerua	10				110	
	Hongoeka to Pukerua	10					
	Taupo Stream	90					
	Titahi	0					

The colours in the 'Total Load' column in Table 1 give an indication of the relative degree of sediment load with red indicating higher sediment loads and green lower sediment loads

The Pauatahanui WMU and the Porirua WMU are also both the largest in land area so it is useful to look at the amount of sediment generated on average per hectare in each WMU. (Table 2). Analysing the modelling results in this way indicates Pauatahanui and Upper Duck creek are significant contributors to the Pauatahanui arm and Upper Kenepuru and Takapu are the significant contributors to the Onepoto arm.

Table 2: Sediment loads from each WMU on a per hectare basis

	WMU name	Total Load per WMU (t/yr)	kg/ha
Pauatahanui Arm	Horokiri and Motukaraka	960	289
	Kakaho Stream	250	200
	Ration	200	289
	Judgeford Stream	630	538
	Pauatahanui	3210	767
	Lower Duck Creek	530	513
	Upper Duck Creek	380	716
Onepoto Arm	Rangituhi Stream	30	356
	Takapu Stream	650	843
	Belmont Stream	270	582
	Stebbings Stream	110	451
	Kenepuru	820	649
	Upper Kenepuru	530	1957
	Porirua	2660	496
	Hukarito Stream	10	102
	Mahinawa Stream	40	158
	Whiteria	10	102
Open Coast	Hongoeka to Pukerua	10	74
	Taupo Stream	90	80
	Titahi	0	0

The modelling has estimated three main erosion processes from which sediment is derived; hill slope erosion, land slide and stream bank erosion. Sediment contribution from hill slope is from the surficial flow of water over the land that entrains sediment as the water moves down the catchment in to the streams and then the harbour. The land slide component occurs when there is a mass movement of land usually when vulnerable soils have exceeded their threshold to absorb water and remain stable. As with the hill slope contribution, sediment is entrained in water making its way to the streams, however, due to the soil having lost its structure it is more easily picked up and carried by the water. Stream bank erosion occurs when flow begins to 'eat away at' or erode the banks; this process increases at higher flows and with more frequent high flows. Table 3 below shows the breakdown by erosion process for each WMU. (Note: the Pauatahanui and Onepoto Fringe WMU's contain a number of small catchments and only have total WMU loads reported with no further breakdown of loads from the three erosion processes.)

Streambank erosion is a major sediment source in Pauatahanui and Horokiri sub-catchments, hill slope erosion is important in all sub-catchments and land sliding in most sub-catchments. The modelling indicates there is a high potential for sediment to be generated from landslide erosion processes in the Horokiri, Kakaho, Upper Kenepuru and Takapu WMU's (i.e. from the steeper land in these catchments)

Table 3: Modelled catchment sediment contribution to harbour from the different erosion processes

	WMU name	Current state			
		Annual average sediment load (t/yr)	% load from different erosion processes		
			Hillslope	Landslide	Streambank
Open Coast	Hongoeka to Pukerua	10	88%	9%	3%
	Titahi	1	99%	0%	0%
	Taupo Stream	90	55%	25%	19%
Pauatahanui Arm	Horokiri and Motukaraka	960	31%	36%	33%
	Kakaho Stream	250	43%	41%	16%
	Ration Creek	200	91%	0%	9%
	Judgeford Stream	630	76%	13%	11%
	Pauatahanui Stream	3210	41%	6%	53%
	Lower Duck Creek	530	69%	26%	6%
	Upper Duck Creek	380	62%	35%	3%
	Pauatahanui fringe streams	60	0%	0%	0%
Onepoto Arm	Hukarito Stream	10	100%	0%	0%
	Mahinawa Stream	40	92%	7%	1%
	Onepoto Fringe	160	0%	0%	0%
	Whitireia	10	100%	0%	0%
	Rangituhi Stream	30	98%	2%	0%
	Takapu Stream	650	42%	56%	1%
	Belmont Stream	270	76%	23%	0%
	Stebbings Stream	110	99%	0%	1%
	Upper Kenepuru	530	22%	78%	0%
	Kenepuru	820	48%	50%	2%
	Porirua	2660	59%	32%	9%

Figures 1 and 2 below show the variability in the load of sediment generated from the different erosion processes. During rainfall events, erosion processes resulting in the release of sediment in to waterways increases. Significant rainfall events can cause large 'pulses' of additional sediment to be released, particularly from landslides and additional stream bank erosion. In a big rainfall event, these large pulses of sediment can be released in a period of hours or days adding a significant proportion to the annual sediment load (Figure 1).

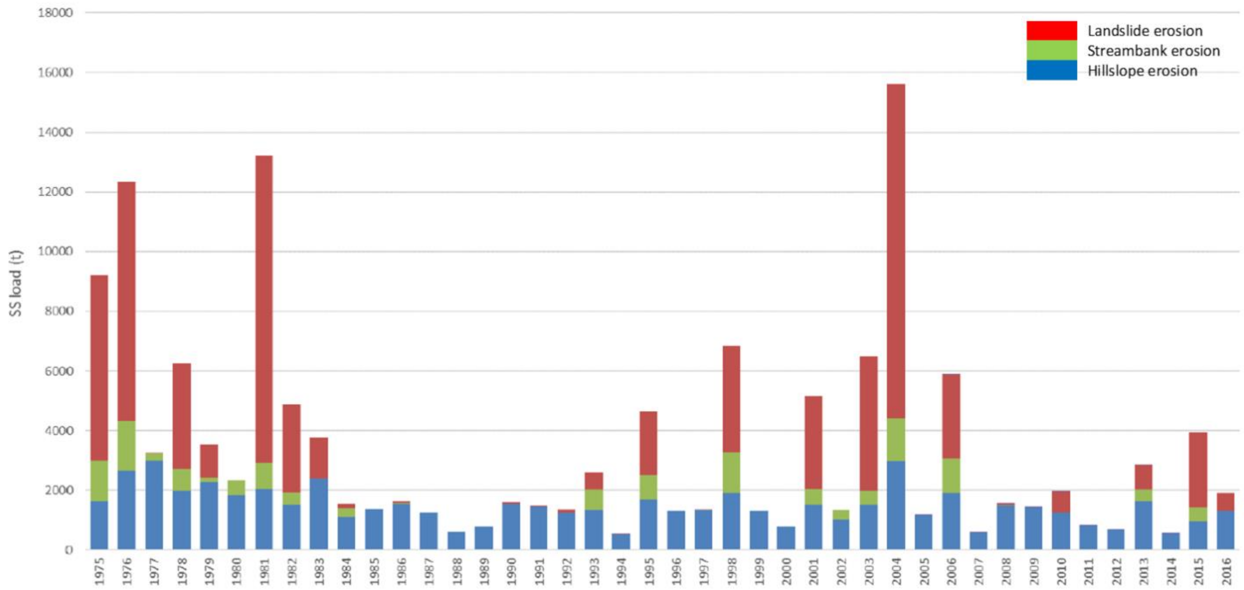


Figure 1: Modelled sediment erosion sources for Porirua Stream

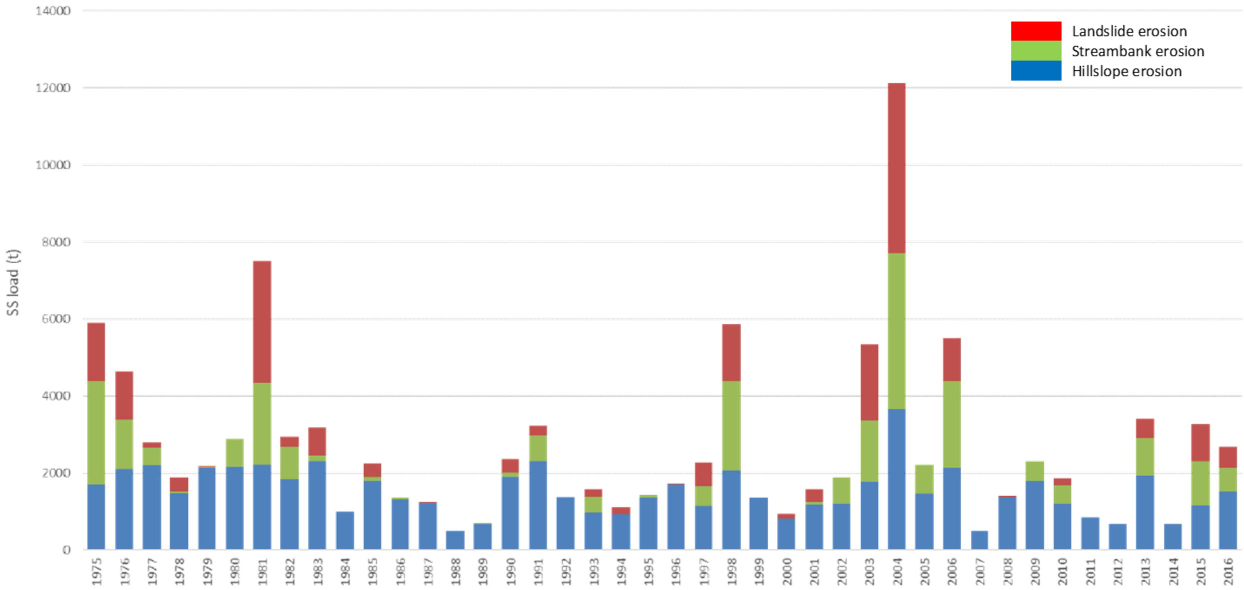


Figure 2: Modelled sediment erosion sources for Pauatahanui Stream

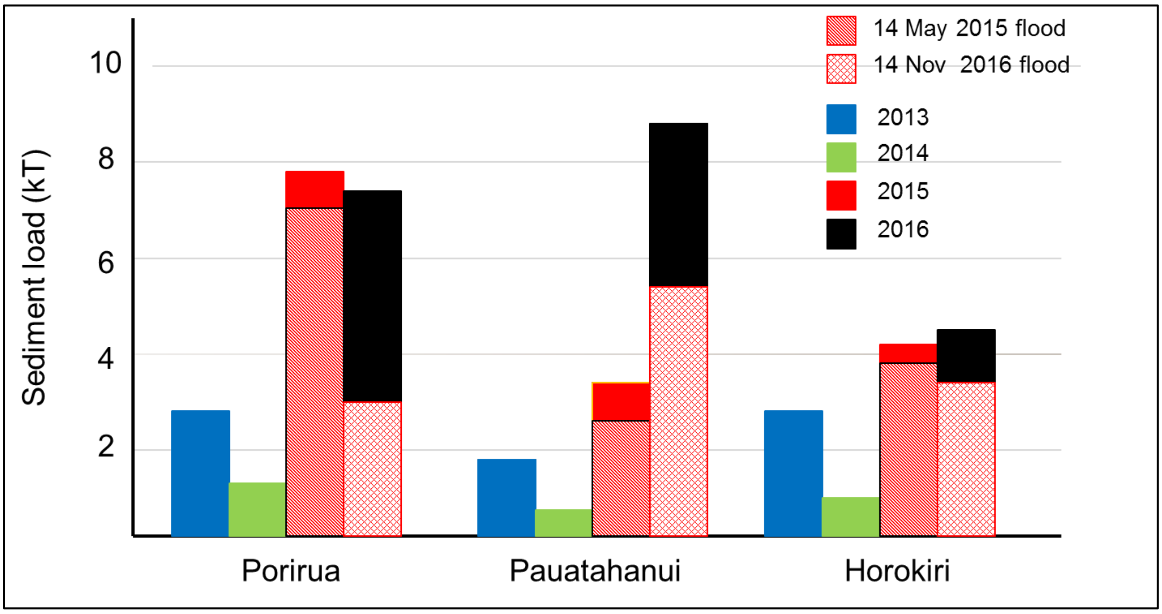


Figure 3: Monitored sediment loads since 2013. Including two storm events in 2015 and2016, for the three largest catchments in Te Awarua-o-Porirua

Sedimentation rates in Te Awarua-o-Porirua Harbour

Within the harbour itself, not all sediment is deposited on the harbour floor: some is exported directly out to sea and some can be re-suspended and deposited in a different location in the harbour or exported out to sea. Harbour modelling shows that around a quarter of the sediment entering the harbour from streams is exported out to sea, the remainder depositing on the harbour bed or remaining suspended in the water column (Table 4).

Table 4: Sediment budget illustrating modelled sediment loads and sedimentation rate for current state

	Catchment Inputs	Export	Deposition	Sedimentation Rate
	t/yr	t/yr	t/yr	mm/yr
Pauatahanui Arm	5, 500	1, 500	4, 000	4.7
Onepoto Arm	3, 300	750	2, 550	4.1

3. What have we learnt from scenario modelling?

As part of the scenario modelling, a series of sediment mitigations were applied across the whaitua to explore the likely effects of sediment reductions on in-stream and harbour sediment conditions.

Summary of sediment related mitigations used for modelling scenarios

	IMPROVED MITIGATIONS	WATER SENSITIVE MITIGATIONS
RURAL	• Fencing and riparian planting in pastoral areas with 5m width • Retirement of the steepest pastoral slopes - Retired lands revert to scrub/native cover • Space planting of steep to moderate pastoral slopes	• Riparian planting is increased to 10m width • Moderately erodible slopes are retired from grazing instead of space planting
URBAN	• Treatment of stormwater runoff in new urban developments, generally with catchment scale soakage devices such as wetland areas	• Onsite treatment of stormwater and smaller use of catchment scale treatment in new development areas
	• Incorporating rainwater tanks on some dwellings	• Higher uptake of rainwater tanks with onsite reuse of that water
		• Changes to new urban development form, larger green space and smaller hard surfaces

Table 5 shows the reductions in sediment loads in to the harbour for each of the scenarios. Overall, the scenario modelling estimates **the improved and water sensitive scenarios provide some sizeable reductions in sediment loads**. There is however, a relatively small marginal reduction in sediment load from the improved scenario to the water sensitive (i.e. **most of the sediment reduction is achieved under the improved scenario**).

Table 5: Reduction in sediment loads in to Te Awarua-o-Porirua Harbour

	Current	BAU		Improved		Water Sensitive	
	t/yr	t/yr	% change from Current	t/yr	% change from Current	t/yr	% change from Current
Pauatahanui Arm	5210	5150	-1%	3150	-40%	2840	-45%
Onepoto Arm	2880	2500	-13%	1530	-47%	1460	-49%
Total harbour	8090	7650	-5%	4680	-42%	4300	-47%
Total catchment	8200	7760	-5%	4750	-42%	4360	-47%

Modelling of the 2010 year by DHL illustrates the change in sedimentation rate in the harbour for the current state and BAU and Water sensitive scenarios (Table 6). The modelling estimates that a 45% reduction in the sediment load input into the Pauatahanui arm results in a sedimentation rate of around 2mm/yr. For the Onepoto arm, reducing sediment inputs by 58% results in a sedimentation rate of around 0.3mm/yr. These illustrate that sediment reductions of this magnitude should go a long way to diminishing, or avoiding, serious ecological impacts in the harbour.

Table 6: Change in sedimentation rate in Te Awarua-o-Porirua Harbour

PAUATAHANUI INLET[3]								
	Catchment Inputs[4]		Export		Deposition		Sedimentation Rate	
	t/yr	% change	t/yr	% change	t/yr	% change	mm/yr	% change
Current State	5, 500		1, 500		4, 000		4.7	
BAU	5, 400	-2	1, 500	0	3, 900	-3	4.4	-6
Water Sensitive	3, 000	-45	1, 450	-3	1, 550	-61	2.0	-57
ONEPOTO ARM								
Current State	3, 300		750		2, 550		4.1	
BAU	2, 800	-15	750	0	2, 050	-20	2.5	-39
Water Sensitive	1, 400	-58	650	-8	710	-72	0.3	-93

As discussed above, significant rainfall events can cause pulses of sediment to be released into waterways, resulting in large depositions of sediment in the harbour. These appear to be particularly related to increases in sediment from landslide and streambank erosion sources, with relatively smaller changes in the amount of sediment from hillslope erosion (Figures 1 and 2 above).

Stabilising higher erosion risk slopes plays a large role in reducing sediment from landslide sources under both the improved and water sensitive scenarios. Examples of this are shown for Horokiri, Pauatahanui, Duck Creek and Porirua WMU's in Table 7. In rural areas, the modelling assumes that space planting or retiring land vulnerable to landslides is effective at reducing the landslide component by up to 90% from current levels. These actions also make reductions to the hillslope erosion in these areas.

[3] Table from Technical report associated with Te Awarua-o-Porirua Harbour Modelling Results and further qualitative information 23 August 2018 workshop

[4] Improved scenario was not modelled for harbour outcomes. Catchment sediment input for improved scenario to Onepoto Arm were 1500 tonnes per year and for Pauatahanui inlet were 3200 tonnes per year. This suggests the improved scenario harbour outcomes are likely to be similar or have slightly higher deposition than the water sensitive scenario.

Table 7: Reductions in sediment load attributable to the different erosion processes

	WMU name	Current state				Improved				Water Sensitive			
		Annual average sediment load (t/yr)	% load from different erosion processes			Annual average sediment load (t/yr)	% load from different erosion processes			Annual average sediment load (t/yr)	% load from different erosion processes		
			Hillslope	Landslide	Streambank		Hillslope	Landslide	Streambank		Hillslope	Landslide	treambanl
Pa	Horokiri and Motukaraka	960	31%	36%	33%	490	53%	20%	27%	465	55%	19%	26%
	Pauatahanui Stream	3210	41%	6%	53%	2120	54%	3%	43%	1843	59%	3%	38%
	Lower Duck Creek	530	69%	26%	6%	238	91%	0%	6%	227	93%	0%	6%
	Porirua	2660	59%	32%	9%	1400	80%	3%	16%	1335	82%	3%	15%

Economic implications of mitigations

The total cost of the modelled sediment reducing mitigations for the improved and water sensitive scenarios is shown in table 8[5]. The memo and presentation to Committee for the 13 June 2018 meeting further described the costs associated with the modelled sediment mitigations and the impacts on rural properties. In summary, following the assumptions of where rural mitigations are applied, some rural property owners do not incur any costs, while others incur a significant portion of the costs.

Table 8: Total cost of sediment mitigations

		Whaitua wide costs	
Mitigation		Improved	Water sensitive
Stock exclusion and riparian planting	Length treated (m)	53,200	34,200
	Fencing, planting and maintanance expenses	$11,054,000	$8,745,000
	Land cost	$550,000	$706,000
Space planting	Area treated (Ha)	2,500	-
	Planting expenses	$18,000	-
Retirement	Area treated (Ha)	1,800	4,300
	Fencing expenses	$2,377,000	$7,371,000
	Land cost	$18,167,000	$44,024,000
TOTAL		$32,166,000	$60,846,000
TOTAL per year		$643,000	$1,217,000

The most significant costs are associated with the retirement of land. Table 9 gives an indication of the degree of land use change (from grazing to space planting/retirement) for the rural catchments of the Pauatahanui arm of the harbour. Table 10 illustrates the extent of riparian planting for the improved and water sensitive scenarios. The amount of riparian planting (and associated costs) decreases under the water sensitive scenario due to the increase in retired land i.e. riparian planting is not required on retired land.

[5] Further information on the per unit mitigation costs was included in the memo entitled Key messages from life cycle cost analysis of Te Awarua-o-Porirua Whaitua Committees' scenarios and presentation to Committee on 21 June 2018.

Table 9: Changes in land use under the different scenarios

	WMU name	Land area (Ha)	% of land under grazing				% of land area under retirement				% of land area under space planting			
			CS	BAU	Imp	WS	CS	BAU	Imp	WS	CS	BAU	Imp	WS
Pauatahanui Arm	Horokiri and Motukara	3320	42%	37%	22%	14%	0%	0%	14%	23%	0%	0%	9%	0%
	Kakaho Stream	1251	66%	61%	37%	17%	0%	0%	24%	44%	0%	0%	20%	0%
	Ration Creek	692	33%	8%	8%	4%	0%	0%	0%	5%	0%	0%	5%	0%
	Judgeford Stream	1171	45%	42%	37%	25%	0%	0%	5%	17%	0%	0%	12%	0%
	Pauatahanui Stream	4183	54%	42%	40%	20%	0%	0%	3%	23%	0%	0%	20%	0%
	Lower Duck Creek	1032	49%	31%	23%	15%	0%	18%	26%	35%	0%	0%	9%	0%
	Upper Duck Creek	531	89%	53%	39%	28%	0%	35%	50%	60%	0%	0%	10%	0%

Table 10: Riparian planting

WMU name	Reporting point name (from modelling)	Total stream length (km)	Stream length with riparian planting or forest cover	Additional riparian planting length (km)	
				Improved	Water sensitive
Hongoeka	Hongoeka to Pukerua	2.4	2.1	-	-
Taupo Stream	Mouth	17.7	8.6	7.7	6.4
Horokiri and Motukaraka	Horokiri Mouth	48.8	23.7	12.7	10.3
Kakaho	Kakaho Stream	18.3	3.6	4.4	2.6
Ration	Ration Creek	12.1	6.9	3.0	2.9
Pauatahanui	Judgeford Stream	18.7	10.3	4.8	3.4
	Pautahanui Mouth	68.8	31.5	30.7	21.3
Duck Creek	Upper Duck Creek	8.5	1.3	0.3	0.3
	Lower Duck Creek	16.9	7.6	1.3	1.1
Whitireia	Whitireia	1.3	1.0	-	-
Hukarito	Hukarito Stream	1.3	1.2	-	-
Mahinawa	Mahinawa Stream	4.2	3.3	-	-
Onepoto Fringe	Elsdon	2.5	0.9	-	-
Upper Porirua	Belmont Stream	6.2	5.2	0.7	0.7
	Stebbings Stream	2.7	-	2.4	2.4
	Takapu Stream	12.5	3.0	6.5	3.5
	Rangituhi Stream	1.6	1.2	-	-
	Mitchell Stream	6.7	4.1	-	-
Kenepuru	Kenepuru Drive	58.7	30.9	10.4	7.1
	Upper Kenepuru	4.1	2.7	-	-
Porirua	Porirua Mouth	83.9	47.1	11.3	7.4

Other sources of sediment

Approximately 13% of the land in Te Awarua-o-Porirua Whaitua is estimated to be in **forestry**, most of which is due to be harvested within the next (*Richard?*) years. Harvesting activities that are not undertaken using good practice standards can result in significant increases in sediment loads. The National Environmental Standard for Plantation Forestry (NES-PF) permits most forestry activities as long as foresters meet specific conditions to prevent significant adverse environmental effects. The regulations are based on existing good practice standards for the forestry industry.

The **development of land**, for a subdivision, small site earthworks or a new road, also has the potential to increase sediment loads while the construction activity is taking place. The proposed Natural Resource Plan (PNRP) permits earthworks of less than 3000m^2 provided certain conditions are met. As with forestry activities, construction activities that are not undertaken using good practice standards can result in significant increases in sediment loads.

Climate change considerations

Climate change predictions are indicating that we are likely to experience more extreme events more often, including longer drier summers, more frequent storms and greater rainfall during heavy rainfall events. We have discussed that landslide and stream bank erosion processes are significant contributors of sediment during extreme events and strongly influence sedimentation rate in the harbour (e.g., see variability in sediment load between years in Figures 1 and 2 (above) influenced by interannual variability in heavy rain events). In other words, it is likely that climate change will exacerbate these key existing sediment contributors even though we can't predict by exactly how much. Our knowledge of climate change therefore further reinforces the importance of ensuring appropriate mitigations are put in place to minimise landslide and streambank erosion processes. Not acting to progressively reduce sediment loads would make us increasingly vulnerable to the effects of climate change on sediment loads through time.

Committee decisions

4. Objectives

In developing an approach to maintain and improve water quality in Te Awarua-o-Porirua whaitua, the main approach has been to use freshwater quality attributes to set objectives for change, understanding what the current state is, how water is valued and cared for, and understanding something of what different mitigation practices might give us by way of impacts on a range of values. In addition, the Committee has looked at what the changes in freshwater quality will mean for the harbour and whether the actions in catchments to achieve freshwater objectives will also achieve the desired objectives for the harbour or whether further effort might be needed to achieve these.

In the case of sediment, reducing loads of sediment lost from land will benefit both freshwater and harbour environments. The benefits for freshwater streams include improving clarity and reducing the amount of habitat smothering fine sediment deposited on the stream bed, but arguably the main driver for reducing sediment loads in the case of Te Awarua-o-Porirua Harbour Whaitua is to reduce the sediment rate in both arms of the harbour.

The Committee has already reached agreement to set high level narrative objectives that relate to sediment, and more specific (and measureable) objectives for freshwater (periphyton, MCI and native fish) and for sedimentation rate and mud content in the harbour.

The more specific draft objectives determined by the Committee for sedimentation rate and mud content in the harbour[6] can be used to drive the determination of load limits (and/or load reduction targets) of sediment from the freshwater sources. It is anticipated that the load limits (and/or reduction targets) will achieve both the harbour objectives and also contribute to achieving freshwater objectives the Committee has set for periphyton, invertebrates (MCI) and native fish.

[6] 23 August 2018 workshop

High level objectives that relate to sediment[7]

Restore ecological health and water quality	Improve water quality for human health	Sustainable urban development	Sustainable rural land use	Te mana o Te Awarua-o-Porirua
Reduce sedimentation rates Reduce pollutant inputs: - reduce toxicant inputs - cap nutrient inputs Restore habitats: - estuary re-vegetation - riparian and habitat enhancement	Improve access Improve amenity	Achieve sustainable urban development: - maintain and improving water quality - provide housing stock and built environment that meets the communities needs	Achieve sustainable land management and land use practice	Provide for Māori use including mahinga kai Restore the mana of Te Awarua-o-Porirua

Summary of draft objectives[8]

Draft objectives
Reduce the amount of sediment reaching the harbour in both the Pauatahanui and Onepoto arms to reduce annual average sedimentation rates, reduce harbour infilling and support improved ecosystem health. Significantly reduce the amount of fine sediments reaching the intertidal areas of the Pauatahanui Inlet to reduce the extent of soft mud in the intertidal areas and prevent potential worsening of ecosystem health in the Inlet.
What is driving this and what might it mean?
Expand and improve the effectiveness of erosion control and sediment management work, in both urban and rural areas. This erosion control and sediment management work needs to reflect at least the level of the 'Improved scenario', and possibly better, in order to address the fine sediment reduction challenge. Sediment is also a key transporter of contaminants. Improved management will also contribute to reducing contaminants entering waterways and the harbour.

[7] Committee meeting minutes 19 May and 16 June 2016
[8] ENPL-6-2812 confirmed with committee on 23 August 2018

Specific harbour sedimentation objectives[9]

Sedimentation rate objectives

The ~~annual~~ average sedimentation rate is less than 2mm per year ~~[and no more than double the natural sedimentation rate]~~ in the Pauatahanui Arm (assessed as the rolling average over the most recent five years of data).

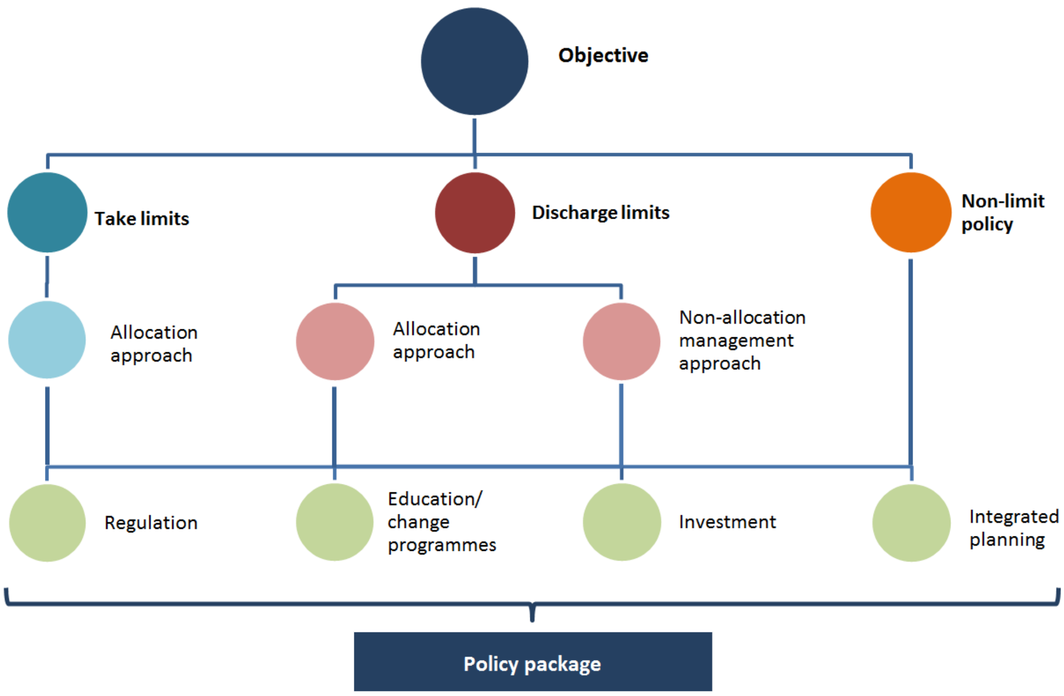
The ~~annual~~ average sedimentation rate is less than [1mm ~~or 2mm]~~ per year ~~[and no more than double the natural sedimentation rate]~~ in the Onepoto Arm (assessed as the rolling average over the most recent five years of data).

Muddiness objectives

Sediment mud content does not exceed 20% in the intertidal sediments and should not increase from current state.

Spatial extent of soft mud shall not exceed 15% of the available intertidal area and no increase in soft mud area from current state.

The objectives are then delivered on by a broader set of policy levers, as described in the policy package diagram below.



[9] Recommended harbour objectives memo discussed with committee 23 August 2018. Changes to recommendations from the memo are shown.

5. Limits and targets

While sediment reductions are important factors in the values of freshwater and ecosystem functions, the main basis for sediment limits and reduction targets in this whaitua is reducing the sedimentation rate in both arms of the harbour.

In order to achieve the harbour sedimentation rate objectives, the project team recommends setting harbour scale sediment load reduction targets within the following ranges.

Table 11: Sediment reduction targets for Te Awarua-o-Porirua Harbour catchments

	Current total sediment load	Sediment Limit	Sediment Target
	Annual average t/yr	Annual average t/yr	% reduction from limit
Pauatahanui Arm	5210	5210	40-45%
Onepoto Arm	2880	2880	40-45%

6. To allocate or not to allocate?

There are two key questions in consideration of allocation approach for discharges. These are:

1. Can you allocate the contaminant? Are there conditions which mean you can't allocate?
2. Should you allocate the contaminant? I.e. what are the pros and cons of using an allocation approach vs a non-allocation approach?

The project team consider it is currently not possible to measure or model the amount of non-point source sediment lost from a person's current or proposed future activities, with sufficient accuracy to consider implementing a load allocation system. This is the case for both Te Awarua o Porirua Whaitua and nationally despite the significant modelling effort and work underway in this area nationally. As such, the only option available to the Committee to achieve sediment load limits is to take a 'non-allocation approach'.

7. Policy decisions

Stabilising higher risk slopes is vital to reducing sediment from landslide sources. Stock exclusion and riparian planting stabilises stream banks, reduces erosion, assists in reduce *E. coli* levels as well as providing benefits (such as shading) for MCI and native fish.

It is also important to consider policy approaches to address potential sediment inputs from earthworks associated with development (both large scale and smaller scale e.g. subdivisions and small sites, road construction) and forestry.

It is expected the policy approaches to reduce sedimentation rates will also work towards achieving the muddiness objectives.

In thinking about the policy approach options, the Committee needs to consider whether the options and different levels available (regulation, education, investment, integrated planning) will achieve the sediment objectives i.e. will the policy package achieve, over time, the required sediment load reductions in order to meet the sedimentation rate and muddiness objectives.

Rural policy approach options

Investment: Retirement of steep slopes/afforestation* Integrated planning: Farm, life-style block or property scale planning and implementation*	Look for opportunity to increase investment and advisory activity in rural land use space, including to: - Increase retirement and planting rates - Produce better integrated farm planning services (e.g. GWRC – Land Management Advisors) Options: • Is the Committee interested in regulating land use activities that are at high risk of generating sediment? • What role do farm management plans play? Could they be required for properties greater than a certain size, or in locations where there are steep slopes (high risk locations)? Farm plans provide the opportunity to find solutions specific to individual properties. • Prioritise largest sediment load WMU's for investment or regulation? • Is there a need to have different regulation for smaller lifestyle blocks to larger blocks? • Are there opportunities within the Regional Parks?

Integrated planning: Sub-catchment community groups*	Assist in set up and support of sub-catchment scale group processes to meet sub-catchment limits, particularly for sediment Can identify most efficient opportunities for sediment mitigations across sub-catchment and more

Regulation: Stock exclusion*	Amend PNRP rules for exclusion to protect smaller streams, particularly in non-hill country? Look for opportunities to implement when change in land use (e.g. to rural residential or lifestyle block) Consideration needs be given to the ability of farmers to water stock and constraints on fencing steep areas.

Investment/Education: Riparian	Riparian planting could be incentivised through best practice

planting	information and subsidies. Need to consider how much this could be or who would paying for the subsidy. Prioritise areas where modelling has indicated high levels of stream bank erosion e.g. Pauatahanui, Horokiri and Porirua

*Handout Commentary on new and big change parts of draft policy package 29 June 2017

Earth Disturbing Activities

Regulation: discharges from new development*	Consent required for new development, must meet contaminant and hydrological limits identified in regional plan - Consent needed to assess how this will be done - Consent could cover construction and post-construction discharges and land use change (i.e. earthworks needed to provide for subdivision layout) parts of new development Regulates the 'what you want to achieve', not the how, allowing for innovation and change in practice Options: • look at if/how an offset mechanism could operate requires further work • Is the 3000m^2 threshold in the PNRP appropriate?

Integrated planning: discharges from development	Consider how the district plan provisions (PCC and WCC) address sediment discharges from small site works and whether this is adequate

Education: discharges from new development	Is there benefit in developing further education resources on good practice standards for sediment mitigation for both small and large scale earthworks and forestry?

Regulation: discharges from forestry activities	Consider whether the NPS-PF regulations are strong enough to work towards achieving the required sediment load reductions

*Handout Commentary on new and big change parts of draft policy package 29 June 2017