REPORT

Tonkin+Taylor

Resource Consent Applications

River Management Activities in the Wainuiomata River

Prepared for
Greater Wellington Regional Council
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Executive summary

Context

Flood protection works (both publicly and privately funded) have been undertaken in the Wainuiomata River for many years. Greater Wellington Regional Council (GWRC) actively manages the approximately 5 km urban section of the river from just upstream of the Hine Rd car park to just downstream of Ngaturi Park. The works and maintenance are undertaken in accordance with the Watercourses Agreement between GWRC and Hutt City Council (HCC)[1].This section of the river will continue to require management to protect the communities living adjacent to it for the foreseeable future.

The requirement to address the flood hazard associated with rivers is enshrined in legislation[2], with GWRC assuming responsibility for this function in the Wellington Region. Flood protection and control works make up 6% (or nearly $12 M) of GWRC expenditure for the current (2012/13) financial year.

Many of the activities applied for are undertaken on a relatively infrequent basis, but all of the activities identified collectively form part of the 'toolbox'. Only those works that are deemed necessary will be undertaken, and GWRC is committed to operating in a manner that reflects good practice and results in the avoidance and minimisation of adverse effects. GWRC also seeks to ensure that the new consents will allow for the use of new methods over time, via an agreed process as explained further below.

GWRC does not currently use gravel extraction as a management tool in the Wainuiomata River and has no immediate plans to do so, but it is important to note that this activity may be required some time in future during the term of the new resource consent. In keeping with the 'long-term tool-box' approach that is being taken to the resource consent renewals GWRC therefore wishes to include the ability to extract gravel in its suite of available tools for channel management. Note however that this application seeks to allow the extraction of gravel in the dry only, whereas the consent applications for the Hutt, Waikanae and Otaki Rivers seek both wet and dry gravel extraction.

Specific large capital works (such as the construction of new stopbanks) and the use of herbicides for control or removal of vegetation are not included in the application.

The application is one component of a wider GWRC consent renewal project, which covers eight consents for flood protection operations and maintenance activities and three gravel extraction consents, all of which are due for renewal between April 2013 and September 2016. The existing consents cover several rivers in the western and eastern parts of the Wellington Region. Work on re-consenting the western consents started in April 2012, while work on the eastern consents (with the exception of one short-term consent for the Waingawa River) started in late 2014.

Included in the consent renewal project is the development of region-wide environmental monitoring to better understand the effects of river management activities. To assist this, a 'Science

[1] This watercourses agreement was developed after significant flooding events in 1976, when local government agencies in the Wellington Region decided to take responsibility for maintaining the capacity of certain critical waterways rather than relying on landowners to do the work. The agreement determines which agency has responsibility for identified reaches of urban streams and rivers, cost sharing mechanisms between the agencies and the standard to which watercourses will be maintained.

2 GWRC has statutory responsibility for the minimising and preventing of flood and erosion damage under the Soil Conservation and Rivers Control Act 1941 (sections 10 and 126), and avoidance or mitigation of natural hazards under section 30 of the Resource Management Act 1991 (RMA). By definition, 'natural hazards' include flooding.

Group' drawn together from representatives from Department of Conservation, Fish & Game NZ, Massey University and GWRC Biodiversity and Science staff, has been established by GWRC to help design and oversee monitoring work and provide feedback and input into the consent applications, including this Wainuiomata River application. The work of the Science Group has resulted in the initiation of a number of new environmental investigations focused on flood protection activities, particularly channel management and gravel extraction. It has also given rise to further new studies to address areas where general biological resource information was lacking, particularly in relation to the distribution of native fish and river birds in the western rivers. It should be noted that the statements in this report do not necessarily reflect the opinions of individual members of the Science Group.

Another key component of the resource consent project is focused on updating GWRC's existing Code of Practice (COP) for undertaking river management activities. The new COP will be region-wide and will inform all river management activities undertaken by GWRC. A working draft of the COP has been prepared and work on COP development will continue throughout the processing of the resource consent applications and beyond, in response to on-going consultation.

A term of 35 years is sought for the new resource consents, assessment of effects and on-going development of good practice is proposed. Central to this is the idea that the new and comprehensive COP will sit alongside the Wainuiomata River Floodplain Management Plan and Environmental Strategy, annual works and maintenance plans and environmental monitoring, to guide and direct GWRC's works and maintenance activities. In particular, the COP, rather than the conditions of the resource consents, will provide specific detail and direction on the methodology to be adopted for individual activities. The resource consents will provide for a review process by which the COP may be updated on an agreed basis, based on the information supplied by on-going monitoring and engagement with iwi and key stakeholders. In that way, the COP will be a living document that drives good practice while also remaining flexible and responsive to the dynamic nature of the river environment.

At this stage, environmental monitoring is based on work undertaken principally in other Wellington rivers, but which will be generally applicable to the Wainuiomata River.

Proposed activities

GWRC proposes to have a comprehensive range of operations and maintenance activities available in its 'toolbox' for management of the flood risk in the urban section of the Wainuiomata River. These will include the construction and maintenance of structures, establishment and maintenance of vegetative plantings and river bank protection, a variety of channel management and maintenance activities including bed recontouring and gravel extraction. Although the range of activities is extensive, in practice most of the activities will be undertaken only infrequently. GWRC intends to continue its current level of maintenance and operations activities, in accordance with the Water Courses Agreement that GWRC has with the territorial authorities in the Wellington Region. Having said this, all of the activities included in this application are deemed to be necessary for the work that may be required over the life of the consent, even if they have not been undertaken frequently in recent years in the Wainuiomata River. Having these tools available does not signal an intention to increase either the level of service currently provided in the Water Courses Agreement or the quantum of work currently planned for the Wainuiomata River.

The potential effects of the activities individually, and as a whole, have been assessed using existing environmental information, and new information made available through the environmental investigation work currently being undertaken by GWRC.

The positive effects of the works are significant and include the direct reduction of the flood hazard and risks to life, property and the economy of the Wainuiomata area. They are a key component of the continued economic and social well-being of this area in particular and Hutt City as a whole.

Five key aspects of the environment are potentially affected by the proposed activities:

- Water quality;
- Aquatic ecology;
- Recreation;
- Neighbouring community; and
- Cultural.

Details of these effects are as follows:

- **Water quality**. These effects arise from the input of suspended sediments to the water column as a result of the direct disturbance of the bed, or from works on banks or in culverts. The operation of machinery (particularly bulldozers) in the river bed associated with bed recontouring give rise to the greatest effects in this regard. Generally such work will be undertaken when banks are eroded by flood events; as such the frequency of work is driven by these occurrences and such may not be necessary every year (or even for a period of several years). Suspended solid concentrations of up to 700 mg/l can be generated for short periods when bed recontouring work is undertaken. The aquatic biota are naturally adapted to cope with such variations in turbidity; available information to date suggests that in general the overall effect of increased suspended solids in the water is relatively minor and can be mitigated to a reasonable degree by restrictions of operations to no more than half of every 24 hour period. Gravel extraction will only be undertaken from beaches above the active channel, and any adverse effects on water quality from this activity are expected to be minor.
- **Aquatic ecology**. These effects arise from direct disturbance of the river bed habitat associated with construction activity or bed recontouring. Mitigation is currently focused on incorporating final shaping of affected reaches to provide for more complexity of habitat to assist recovery. GWRC is committed to continued investigations into the impacts of in-river works on aquatic ecology which will ultimately help to improve practice and enhance mitigation.
- **Recreation**. Adverse impacts on recreational activities are most likely to be relatively infrequent and minor, involving temporary restriction of access to small sections of the river or river berms.
- **Neighbouring community**. Residential areas lie close to many parts of the application area and there is some potential for noise effects arising from the operation of machinery in the river corridor. Based on past experience the adverse effects on the neighbouring community are anticipated to be less than minor in this respect and significantly positive in terms of the flood protection benefits that they will deliver. Mitigation measures such as communication with affected residents, restrictions on operating hours and management of traffic have been incorporated into the COP.
- **Cultural**. Reports from Te Runanga o Toa Rangatira Inc. and the Port Nicholson Block Settlement Trust & Wellington Tenths Trust prepared for GWRC have identified cultural issues of importance to iwi. These have been taken into account in the preparation of this application. Although some cultural issues and concerns are not easily accommodated or satisfied within the current river management paradigm, GWRC has an established relationship with iwi and will continue to work with them to better understand their concerns, share knowledge and make provision for recognition of cultural values within the COP. This will be achieved via an iterative consultation process that will continue beyond the processing of this application.

Other potential adverse effects of the works on river birds, the landscape and visual amenity values of the river corridor are considered to be less than minor.

The proposed suite of activities has overall status as a Discretionary Activity (based on the principle of bundling activities to the highest activity status).

1 Introduction

1.1 The need for river management activities

Flood protection works (both publicly and privately funded) have been undertaken in the Wainuiomata River for many years. Greater Wellington Regional Council (GWRC) actively manages the approximately 5 km urban section of the river from just upstream of the Hine Rd car park to just downstream of Ngaturi Park. The works and maintenance are undertaken in accordance with the Watercourses Agreement between GWRC and Hutt City Council (HCC)[3].This section of the river will continue to require management to protect the communities living adjacent to it for the foreseeable future.

The requirement to address the flood hazard associated with rivers is enshrined in legislation[4], with GWRC assuming responsibility for this function in the Wellington Region. Flood protection and control works make up 6% (or nearly $12 M) of GWRC expenditure for the current (2012/13) financial year.

GWRC's flood protection and erosion control programme is outlined in the regional council's Long Term Plan, Asset Management Plan and annual work programmes. The level of maintenance work currently undertaken by GWRC in the Wainuiomata River has been agreed in the Watercourses Agreement, and mainly involves work such as removal of obstructions in order to maintain the flood carrying capacity of the river channel. GWRC does not intend to change the level of service provided in this regard for the foreseeable future. However, the works undertaken by GWRC are in response to the challenges of a dynamic river system; these include the propensity of the river to change its alignment by eroding its banks, the transport of gravel through the river system, leading to fluctuating patterns of deposition and erosion in the river bed, and damage caused by periodic flood events. In recognition of the fact that the proposed lifetime for the new resource consent is 35 years and that the consent must be able to provide for the need to respond to changes and events in the river system that may occur over that time (without the need to continually seek variations for every new eventuality over that time); GWRC is seeking approval for its full 'toolbox' of available methods in this application. This approach is consistent with that adopted for GWRC's applications for resource consents in other rivers in the western part of the Wellington Region, as is discussed further below. It should be stressed that making the full toolbox available is not intended to create an expectation that all methods available in the toolbox will necessarily be employed over the life of the consent; rather, it is to ensure that the Council is able to select the most appropriate method or methods at any time over the life of the consent to provide appropriate responses to flood and erosion control issues.

1.2 The wider context of this application

This application is one component of a wider GWRC consent renewal project, which covers eight current operations and maintenance consents and three gravel extraction consents, all due for

[3] This watercourses agreement was developed after significant flooding events in 1976, when local government agencies in the Wellington Region decided to take responsibility for maintaining the capacity of certain critical waterways rather than relying on landowners to do the work. The agreement determines which agency has responsibility for identified reaches of urban streams and rivers, cost sharing mechanisms between the agencies and the standard to which watercourses will be maintained.

4 GWRC has statutory responsibility for the minimising and preventing of flood and erosion damage under the Soil Conservation and Rivers Control Act 1941 (sections 10 and 126), and avoidance or mitigation of natural hazards under section 30 of the Resource Management Act 1991 (RMA). By definition, 'natural hazards' include flooding.

renewal between April 2013 and September 2016. The existing consents are spread between rivers in the western and eastern parts of the Wellington Region.

The project comprises five work streams as follows:

Work Stream 1: To re-consent GWRC's existing Operations and Maintenance resource consents in the western and eastern parts of the region.

The western rivers consents include those for the Hutt [WGN 980255 and WGN 060334], Stokes Valley Stream [WGN 060291], Waikanae [WGN 980256], Otaki [WGN 980254] and Wainuiomata [WGN 020143] Rivers.

The eastern rivers consents cover those in the Waingawa River [WAR970137], Waiohine/Mangatarere/Kaipatangata Rivers [WAR000363], Waipoua River [WAR000364], Upper Ruamahanga River [WAR000365], Ruamahanga River [WAR 990026] and Kaipatangata Stream [WAR 990313].

Work on re-consenting the western consents started in April 2012 and includes seven smaller tributaries of the Hutt, Waikanae and Otaki Rivers. Work on the eastern consents (with the exception of the Waingawa River short-term consent- see Work Stream 2 below) will start in late 2014.

Work Stream 2: Waingawa Short-term Consent Application

Application was made in 2012 and consent granted in April 2013 for a short-term consent to enable works in the Waingawa River to continue until the Floodplain Management Plan (FMP) work for this river (currently underway) is sufficiently advanced to support a long-term consent application.

Work Stream 3: Environmental Monitoring

This work stream involves developing a region-wide Environmental Monitoring Plan (EMP) to better understand the effects of flood protection works. Environmental monitoring has been undertaken to characterise existing biological resources of these river systems and enable the potential effects of the proposed activities to be adequately assessed. To help in this process a 'Science Group' drawn together from external and internal parties, including representatives from Department of Conservation, Fish & Game NZ, Massey University, GWRC Biodiversity and Science staff, and involving a consultant ecologist and a consultant river engineer, has been established by GWRC to help oversee monitoring work and provide feedback and input into the consent applications, including the Wainuiomata River application. The work of the Science Group has resulted in the initiation of a number of new environmental investigations focused on flood protection activities, particularly gravel extraction. The group also identified areas where general biological resource information was lacking, particularly in relation to the distribution of native fish and river birds in the western rivers, leading to the development or re-focusing of studies by GWRC.

In addition, GWRC funds annual trout surveys by Fish & Game NZ in the Hutt and Waikanae Rivers and has undertaken a review of recreational use in Wellington's western rivers (including the Wainuiomata River) to update resource information for the consents project. The Science Group is also supporting work to develop a "natural character index (NCI)" for Wellington's western rivers, which will be extended to eastern rivers in due course. This is a means of quantifying a number of the natural features of a river to provide a measure that might eventually enable assessment of the effects of activities.

Work Stream 4: Code of Practice

Updating GWRC's existing Environmental Code of Practice for undertaking flood protection works forms a key part of the work required for all of the consent applications. The new Code of Practice (COP) will be region-wide and will inform all activities undertaken by GWRC. A draft Code has been

prepared, and is included as Annex 1 to this application. Initial comment from iwi and some key stakeholders has been sought and considered in the development of this draft, and it is anticipated that further development of the Code will continue in response to on-going consultation throughout the processing of the resource consent applications, and beyond.

Work Stream 5: Floodplain Management Plans

FMPs already exist for the Hutt, Waikanae and Otaki Rivers. Under this work stream, additional information to support either a resource consent renewal process or plan process will be prepared as necessary for the western rivers. In addition, development of FMPs for the Waiohine River and those rivers in the upper part of the Wairarapa Valley (Kopuaranga, Waingawa, Waipoua, Whangaehu, Taueru and the upper reaches of the Ruamahanga River) in the eastern part of the region is underway and will continue.

1.3 Term and scope sought for new consent

Since the introduction of the Resource Management Act (RMA) in 1991, GWRC has been required to undertake its rivers works and maintenance activities according to resource consents that have been used to prescribe and set the parameters for these activities. To date, the timeframe for these consents has been less than the maximum currently allowed.

The application which is the subject of this report seeks new resource consents over a 35 year term for GWRC's operations and maintenance activities. In conjunction with this, it proposes an approach whereby much of the detail and prescription for the methods to be employed is to be included in the COP, rather than in the resource consent itself. The COP will be a living document representing good environmental practice. It will be supported by an on-going programme of investigation and monitoring and amended accordingly. Such an approach will allow greater flexibility to test and refine methods and improve practice over time without the need to vary and/or seek new resource consents.

1.4 Existing consents held

GWRC employs a variety of structural and non-structural methods to manage the flood and erosion hazard from the Wainuiomata River within the application area. The Council's Flood Protection Department (Flood Protection) has particular responsibility for planning and undertaking this work. GWRC currently holds resource consents WGN 020143 (1) & (2) for these works, as described more fully below.

Consent No WGN 020143	Purpose	Granted	Expiry
(01) Land Use	To undertake routine operations and maintenance works in the bed of the Wainuiomata River for the purposes of flood and erosion mitigation, including construction of permeable and impermeable erosion protection structures, removal or demolition of structures, and channel shaping activities.	26 March 2002	26 March 2017
(02) Water Permit	To temporarily and permanently divert the normal flow of the Wainuiomata River during, and as a result of, undertaking routine river operations and maintenance activities.		

1.5 Applicant and area covered by application

The required forms for this application are included in Appendix A.

The application covers the bed and adjacent banks of the Wainuiomata River from approximately 200 m upstream of the footbridge at cross section survey line XS 1530[5] to approximately 200 m downstream of cross section survey line XS 1050 at Ngaturi Park, as shown on Maps 1 – 7 in Appendix B. The area covers a total area of 27 ha approximately and includes:

- the active channel of the river
- the design channel alignment , which may differ from the current position of the active river channel
- a buffer zone either side of the design channel within the river bed and within which willow planting or erosion protection structures may be established to assist with maintenance of the design channel alignment
- stopbanks (where they exist)
- land between the buffer zone and any stopbank

As can be seen from the maps, the width of the application area varies depending on the physical constraints of the topography (e.g. high river banks), the location of the stopbanks (where they exist) and the location of adjoining residential boundaries. The majority (81%) of the land in the application area is in Crown or local council ownership, being river bed, land administered by both Wellington Regional Council and Hutt City Council and part of the Wainuiomata Primary School. The remaining 19% of the application area affects a small number of land parcels in private ownership. Further details of land ownership are included in Appendix C.

Relevant administrative information is summarised in the table below.

Applicant	Wellington Regional Council[6]
Owner of application site	The Crown, Wellington Regional Council, Hutt City Council and others. Certificates of Title are included in Appendix C[7].
Site address / map reference	Bed and adjacent banks of the Wainuiomata River lying between a line crossing the river at NZTM grid reference 5990464.43 N approximately and a line crossing the river at grid reference NZTM 5989095.41 N approximately.
Address for service and invoicing	Greater Wellington Regional Council Flood Protection Department Attention: Tracy Berghan

1.6 Summary of regional resource consent requirements

Resource consents are sought to cover all of the operations and maintenance activities undertaken by GWRC that require consent under the Operative Regional Plans. These are summarised below.

A variety of activity statuses apply across the range of activities. The most onerous is Discretionary and accordingly the entire suite of activities should therefore be considered a Discretionary Activity.

[5] Cross section survey lines are 100m apart and are defined in terms of distance (x 10 m) from the Wainuiomata River mouth; XS 1530 thus lies at 15300 m or 15.3 km upstream of the river mouth.
[6] Note that this is the correct legal name for the regional council. Elsewhere in this application document, the council is referred to by its promotional name of 'Greater Wellington Regional Council'.
[7] The official copy of the application includes a Schedule of the Certificates of Title and copies of each title; other copies only include the Schedule.

Table 1: Resource consent details

Type of Consent	Relevant Plan & Rule	Activities
Land Use	Regional Freshwater Plan (RFP): Rule 43 – Maintenance, repair, replacement extension, addition to, or alteration of any structure Rule 44 – Removal or demolition of structures Rule 48 – Placement of impermeable erosion protection structures Rule 49 – All Remaining Uses of River Beds	Construction in/on the river bed of: • impermeable erosion protection structures • rock/concrete grade control structures • drainage channels and minor culverts associated with walkway developments Construction in/on the river bed of: • permeable erosion protection structures: • debris fences • debris arresters Planting of willows in the river bed Layering, tethering and cabling of willows in the river bed Recontouring of the river bed Disturbance of river beds by mechanical ripping Cutting of diversion channels Shaping and repair of bank edges Trimming or removal of vegetation from the river bed Clearance of flood debris from the river bed and stream culverts Extraction of gravel from the river bed from dry beaches Maintenance, repair, replacement, extension, addition, alteration of structures on the river bed Demolition and removal of structures from the river bed Construction of footbridges Undertaking of urgent works in the river bed Operation of machinery in river bed for all the above purposes and for trimming and mulching vegetation growing on the banks Entry & passage on river bed for operations & maintenance purposes Maintenance of drains
	Regional Soil Plan (RSP): Rules 1 - 4	Repairs etc. of banks, berms and stopbanks Construction of earth training banks, concrete flood walls or retaining walls (not in river bed) Construction of walkways or cycle ways on the river berms Construction of fences Disturbance of vegetation on berms, including mowing Lowering of berms
Water Permit	RFP Rule 16	Diversion of water associated with the above activities as necessary.
Discharge Permit	RFP Rule 5	Discharge to the river of silt and sediments associated with: • all construction works

		• all planting works • all maintenance works • all demolition works • all urgent works • repair of structures on the river berms Discharge of stormwater into surface water associated with works outside the river bed

Consent is sought for GWRC's complete suite of flood protection operations and maintenance activities, as outlined in the table above, and more fully explained in Section 3.2. It should be noted that some of these activities are classed as permitted activities to a certain threshold. For information purposes these are listed in the table below.

Table 2: Permitted activities

Relevant Plan & Rules	Permitted Activities
RFP Rule 1	Discharge of water and minor contaminants from maintenance (e.g. water blasting) of structures
RFP Rule 2	Discharge of stormwater into surface water (provided it doesn't originate from an area of bulk earthworks greater than 0.3 ha)
RFP Rule 9A	Diversion of water from an artificial watercourse or drain
RFP Rule 31	The erection and maintenance of any bridge over a river bed (less than 6m in length)
RFP Rule 35	Entry or passage across river bed not covered by any use specified in Rules 22 - 48 or s.13 of the Act
RFP Rule 36	Disturbance of river beds associated with clearance of flood debris.
RFP Rule 37	Recontouring of beaches in the river bed Removal of vegetation/ 'scalping' of beaches in the river bed
RFP Rule 39	Maintenance of drains
RFP Rule 40	Removal of vegetation from river bed (including cutting of stakes and poles for re-planting)
RFP Rule 42	Urgent works within 10 days of a natural hazard event, including: • Repair of any bank protection works • Recontouring of the river beds • Disturbance of the river beds • Deposition on the river beds
Regional Soil Plan Rules 1, 2 & 3	Repairs of stopbanks and berms (outside the river beds) Construction of walkways or cycle ways on the river berms (outside of the river beds) Construction of fences Disturbance of vegetation on berms, including mowing Landscaping and/or planting on berms

1.7 Interpretation

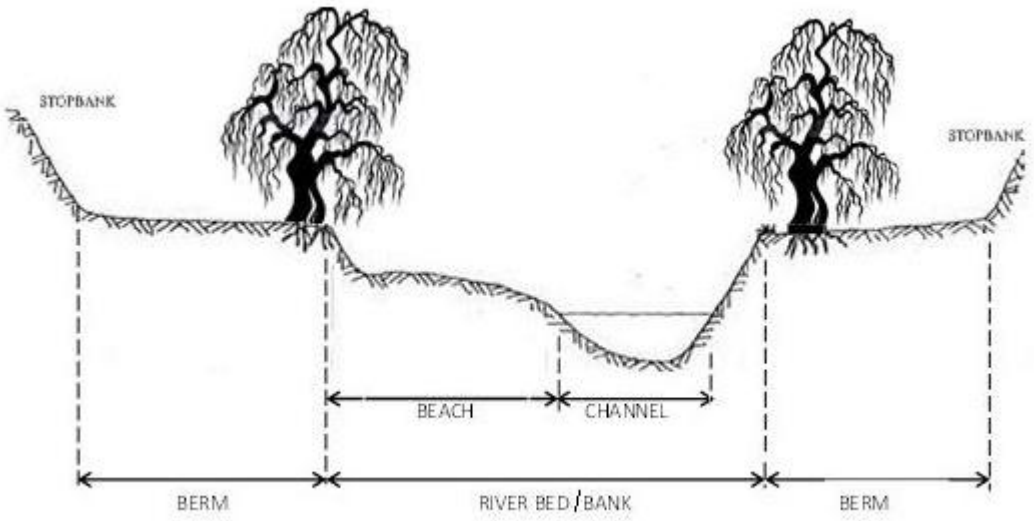

Figure 1: Explanation of terms

Bed	The RMA and the Regional Freshwater Plan for the Wellington Region (RFP) define the bed of a river (for purposes other than esplanade reserves, esplanade strips and subdivision) as: '**the spaces of land which the waters of the river cover at its fullest flow without overtopping its banks.'** See Figure 1 for a visual representation.
Bank	The RMA does not define this; the RFP defines bank in relation to the bed of any river as having **'the same meaning as in the interpretation of "bed" in the Act.'**
Beach	Neither the RMA nor the RFP define 'beach', but based on the definition of 'beach recontouring' in the RFP (see below) it can be assumed to be **'the part of the river bed not covered by water at any particular time**.**'** See Figure 1 for a visual representation.
Beach ripping	Neither the RMA nor the RFP define this. For the purposes of this application it is defined as **'mechanical disturbance of beaches above the active channel for the purpose of loosening the gravel material to enable its mobilisation during flood events'.**
Berm	Neither the RMA nor the RFP define this. For the purposes of this application it is defined as **'the area of land between the river bed and the inner toe of a stopbank.'** See Figure 1 for a visual representation.

Beach recontouring	The RMA does not define this; the RFP defines it as **'disturbance of any river bed by the mechanical movement of sand, shingle, rock, gravel or other natural material, to realign that part of the bed that <u>is not</u> covered by water at the time of disturbance, for the purpose of remedying or mitigating the adverse effects of flooding or erosion.**'
Bed recontouring	The RMA does not define this; the RFP defines it as **'disturbance of any river bed by the mechanical movement of sand, shingle, rock, gravel or other natural material, to realign that part of the bed that <u>is</u> covered by water at the time of disturbance, for the purpose of remedying or mitigating the adverse effects of flooding or erosion.'** This activity is also referred to as 'cross-blading'. It covers any work that comes in contact with the active channel and results in reshaping of the active channel.
Flooding	The RMA does not define this; the RFP defines it as having **'the same meaning as in the interpretation of 'natural hazard' in the Act. Reference to the flood hazard or flooding in the Plan includes erosion associated with river beds and their banks.'**
Flood Mitigation works	The RMA does not define this; the RFP defines it as **'any structure or work that is used for the purpose of mitigating the adverse effects of flooding. Flood mitigation works include (but are not limited to) any stopbank, bank protection structure, training wall or groyne.'**
Flood debris	The RMA does not define this; the RFP defines it as **'material deposited on the river bed as a result of wreckage or destruction resulting from flooding. Flood debris can include trees, slip debris, collapsed banks, and the remains of structures but does not include the normal fluvial build-up of gravel.'**
Removal of flood debris	is any work where flood debris is required to be cleared to remove or reduce a flood or erosion hazard or to protect structures from damage.
Floodplain	The RMA does not define this; the RFP defines it as **'the flat or gently sloping portion of a river valley that is or has the potential to be covered with flood water when the river overflows during flood events.'**
Gabion	The RMA does not define this; the RFP defines it as **'an erosion or flood mitigation structure that is a wire mesh basket filled with small rocks and extending more or less parallel to, and against, the river or stream bank.'**

Groyne	The RMA does not define this; the RFP defines it as **'an erosion or flood mitigation structure that extends from the bank into the river bed and is designed and constructed to deflect the direction of the flow of water in a river or stream.'**
Natural Hazard	The RMA defines this as **'any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.'**
Rock rip-rap structure	The RMA does not define this; the RFP defines it as **'a structure that is built from large rocks extending more or less parallel to and against the river or stream bank to resist erosion.'**
Stopbank	The RMA does not define this; the RFP defines it as **'a structure constructed on a floodplain, or alongside a river, designed to contain flood flows and prevent high river flows flooding onto adjacent land.'**

2 Existing Environment

2.1 Catchment overview

The Wainuiomata River catchment lies to the east of Wellington Harbour, and covers approximately 133 km ² over parts of the Orongorongo and Rimutaka Ranges – see Figure 2. The highest point in the catchment is 800m, and the majority of the land within it is very steep, with 81% of the area being over 20^{o}. The application area lies in the middle of the Wainuiomata catchment, more or less between Richard Prouse Park and Leonard Wood Park indicated on Figure 2.

Figure 2: Wainuiomata catchment

The surface geology is predominantly greywacke, with a narrow thread of alluvial material along the valley floors.

Two decommissioned water supply dams are also located on the upper river. The lower dam, lying approximately 2 km upstream of the application area, lies within the Wainuiomata Recreation Area (see Section 2.7) and is associated with a wetland development. The former upper dam (Morton Dam) lies approximately 1 km further upstream. Water for the Wellington municipal supply is now

taken through 'run of the river' intake galleries at two locations upstream of the application area: one on the main stem of the upper river, and one on Georges Creek, an upper catchment tributary.

The Wainuiomata River is approximately 22 km long. The main tributaries are:

- the Wainuiomata Stream ,which joins the main stem at Richard Prouse Park
- Black Stream, which flows southwards through the main urban area and joins the river at the major bend in the middle of the application area
- Catchpool Stream, several kilometres downstream of the application area.

Upstream of the application area the catchment is mostly covered by indigenous forest, and is managed for water supply. Land use adjacent to the river corridor within the application area is largely urban (residential and urban recreation), while further downstream land use includes plantation forestry, low productivity pasture and scrub.

2.2 River morphology

According to (Williams, G, 2007)- see Appendix D, the section of the Wainuiomata River within the application area consists of a narrow channel within a small alluvial floodplain that is comprised of relatively coarse gravels. Upstream of Black Stream the channel is relatively entrenched with a few gravel beaches that become exposed during low flows. Williams notes that there has been some channel degradation in this area, which he attributes to reduction of the supply of bed load gravel caused by the upstream water supply dams. Downstream of Black Stream the channel is less entrenched, with longer bends and a wider active channel of exposed gravels.

2.3 Hydrology and flood hazard

The location of the catchment and its aspect makes it particularly responsive to southerly-based rainstorm events. The flood hydrology of the Wainuiomata River was assessed by Opus International Consultants in 1998, as part of a GWRC flood hazard study that was subsequently published in 2000. More recent modelling work has been undertaken by GWRC in 2011 (Gardner, M, 2011).

Table 3 lists the six largest flood events recorded at the GWRC water level recorder at Leonard Wood Park since 1977. The table also shows the current estimated return period of these floods, and an estimate of their return period allowing for the effects of climate change (up to 2090). It can be seen that the largest flood in recent years was the event that occurred in February 2004.

Table 3: Major floods in the Wainuiomata catchment (at Leonard Wood Park)

Date	Maximum flow (cumecs)	Estimated flood return period (years)	
		Current	With climate change
21 May 1981	116	12	7
10 June 2003	127	19	9
16 Feb 2004	192	97	42
19 Aug 2004	111	11	6
7 July 2006	129	18	10
24 Oct 2006	100	8	5

Source: (Greater Wellington Regional Council, 2012)

The maps in Appendix E show the estimated extent of flooding that would be associated with the 100 year return period flood (with the effects of climate change factored in).

2.4 Water quality

Surface water quality has been routinely monitored in the western half of the Wellington Region by the regional council since 1987.

There are two RSoE[8] monitoring sites in the Wainuiomata River catchment: RS 28, which lies approximately 4.5 km upstream of the application area within the forested part of the catchment, and RS 29, lying several kilometres downstream of the application area. Details are included in Table 4.

Table 4: RSoE Monitoring Site Details – Wainuiomata River Catchment

Site No.	Site name	Site co-ordinates (NZTM)		Date started
		Northing	Easting	
RS 28	Wainuiomata River at Manuka Track	5430634	1768242	June 1987
RS 29	Wainuiomata River u/s of White Bridge	5415724	1757316	July 1997

Note: both sites lie outside the application area. Source: (Perrie A, Morar S, Milne JR, Greenfield S, 2012)

Water quality at each site is assessed monthly from a range of physico-chemical and microbiological variables measured at each site. These include:

- Temperature
- Dissolved oxygen (DO)
- pH
- Conductivity
- Visual clarity, turbidity and suspended solids
- Total organic carbon
- Nitrogen (total ammoniacal nitrogen, nitrite, nitrate, nitrate+nitrite, total Kjeldahl nitrogen, total nitrogen)
- Phosphorus (Total phosphorus, dissolved reactive phosphorus)
- Faecal coliforms and E coli
- Heavy metals (dissolved copper, lead, zinc)

Summary statistics for selected core water quality variables measured from 2008 -2011 are given in Table 5.

Table 5: Summary of water quality data sampled monthly July 2008 –June 2011 for Wainuiomata River

Determinand	Wainuiomata River at Manuka Track (RS28)			Wainuiomata River u/s of White Bridge (RS29)			ANZECC guideline
	median	min	max	median	min	max	
Water temp. (^{o}C)	9.5	5.7	15.1	12.6	8.1	19.6	$\leq$19

[8] "Rivers State of the Environment"

Determinand	Wainuiomata River at Manuka Track (RS28)			Wainuiomata River u/s of White Bridge (RS29)			ANZECC guideline
	median	min	max	median	min	max	
DO (%saturation)	99.3	91.5	110.0	101.0	85.0	140.0	>80
pH	7.0	6.2	7.4	7.1	6.6	8.7	6.5-9.0
Visual clarity (m)	2.48	0.35	4.70	1.31	0.13	2.32	>1.6
Turbidity (NTU)	0.9	0.5	14.1	2.3	0.7	38.0	<5.6
Suspended solids (mg/L)	1.0	<2.0	19	2.0	<2.0	86	--
Conductivity (µS/cm)	105.5	76	117	138	111	155	--
TOC (mg/L)	1.9	0.9	10.4	1.8	1.2	3.1	--
NNN (mg/L)	0.070	0.008	0.230	0.205	0.002	0.610	<0.444
Ammoniacal N (mg/L)	0.005	<0.010	0.014	0.008	<0.010	0.046	<0.021
Total N (mg/L)	0.14	0.10	0.49	0.31	0.10	1.40	<0.614
DRP (mg/L)	0.010	0.005	0.018	0.012	0.004	0.020	<0.010
Total P (mg/L)	0.013	0.009	0.940	0.020	0.012	0.110	<0.033
E. coli (cfu/100ml)	4	<1	140	89	24	7400	<550

Note: Median values that did not meet a guideline are shown in bold font. Source: (Perrie A, Morar S, Milne JR, Greenfield S, 2012).

GWRC's water quality index for RSoE sites measures the median values of 6 key water quality variables against relevant guidelines and assigns an overall grade (poor, fair, good or excellent). Over the three year period that was measured Site RS 28 was rated as having 'excellent' water quality, while Site RS 29 was ranked as 'fair'. These sites were ranked 6th and 26th respectively, of the 55 RSoE sites monitored for water quality in the Wellington Region. Although there are no water quality monitoring sites within the application area, the data from these two sites can be used to give an indication of the range within which water quality parameters within the application area are likely to fall.

2.5 Aquatic ecology

Ecosystem health is assessed at each of GWRC's 55 RSoE sites in the Wellington Region through biological monitoring. This includes:

- Annual monitoring of periphyton biomass and macroinvertebrate communities during stable/low flows in summer/autumn
- Monthly assessment of Periphyton cover in conjunction with the water quality sampling programme
- Monitoring of aquatic macrophyte cover at selected sites with soft sediment substrates (this does not apply to the application area)

Biological assessment methods have remained largely unchanged since 2003, except that the number of invertebrate samples at each site was reduced from three to one in 2010. Formal monitoring of aquatic macrophyte cover at selected sites has been undertaken only since July 2011;

prior to this only general observations of nuisance growth were recorded during monthly water sampling.

2.5.1 Periphyton

Periphyton assessments are only undertaken at sites with hard substrates (gravel and cobbles), including the sites of relevance to this application.

Summary data taken from (Perrie A, Morar S, Milne JR, Greenfield S, 2012) for these sites are given in Table 6. For a detailed analysis of the results, refer to the source report.

Table 6: Streambed periphyton cover[9]

Site no & name		Periphyton stream bed cover (%)							Chlorophyll a (mg/m²)				MfE Quality class
		Mat			Filamentous			n	2009	2010	2011	Mean	
		Mean	Max	%n>60	Mean	Max	%n >30						
RS 28	Wainuiomata River at Manuka Track	0	1	0	0	0	0	34	6.8	10.2	1.4	6.1	Excellent
RS 29	Wainuiomata River u/s of White Bridge	7.5	43	0	2.8	19	0	28	40.2	236.3	78.6	118.4	Fair

Source: (Perrie A, Morar S, Milne JR, Greenfield S, 2012)

In general, the study found a negative correlation between periphyton cover/biomass and the amount of indigenous forest cover in the catchment. Similarly there was a positive correlation with pastoral land use, nutrient concentrations and water temperature. The key thing to note is the overall classification of "Excellent" based on the MfE (2000) guidelines for periphyton cover and biomass for Site RS28, which is indicative of a high level of compliance with the guidelines in the upper catchment, and the deterioration to 'Fair' in the lower catchment. (Cameron, 2015) considers that this deterioration is likely to be driven by an increased concentration of dissolved nutrients in the lower river (see Table 3) and by reduced shading associated with the loss of forest cover from the middle and lower catchment, resulting in increased algae growth rates.

2.5.2 Other aquatic plants

(Cameron, 2015) reports that the nationally endangered[10] pygmy clubrush (*Isolepsis basilaris*) has been recorded at locations between the coastal carpark and the Wainuiomata River mouth, and also in Turakirae Head Scientific Reserve.

It has not been recorded in the application area.

2.5.3 Macroinvertebrates

Data on macroinvertebrate communities in the Wainuiomata River are available from analysis of samples collected annually from 2009 -2011 at the RSoE sites (Perrie A, Morar S, Milne JR, Greenfield

[9] Based on monthly assessments July 2008 –June 2011 and biomass chlorophyll *a* based on annual assessments 2009 - 2011. An overall periphyton "class" for each site is also presented based on compliance with MfE (2000) periphyton guidelines. Source: (Perrie A, Morar S, Milne JR, Greenfield S, 2012).

[10] According to the New Zealand Threat Classification System, managed by the Department of Conservation

S, 2012). This study used a Macroinvertebrate Community Index (MCI) as a measure of instream habitat quality, plus three other measures: Quantitative MCI (QMCI), %Ephemeroptera-Plecoptera-Trichoptera (EPT) taxa and %EPT individuals. The results are summarised in Table 7.

Table 7: Mean macroinvertebrate metric scores at selected RSoE sites, based on samples collected annually in 2009, 2010, 2011

Site no.	Site name	MCI	QMCI	%EPT taxa	%EPT individuals
RS 28	Wainuiomata River at Manuka Track	135.5	7.2	71	60
RS 29	Wainuiomata River u/s of White Bridge	101.8	4.33	45.2	38.1

Source: (Perrie A, Morar S, Milne JR, Greenfield S, 2012)

When the results in Table 7 were compared with the values noted in Table 8, Site RS28 was assessed as having an overall MCI quality class of 'Excellent', while site RS 29 was assessed as 'Good'. This decrease in overall MCI scores with distance downstream from the headwaters reflects a general pattern observed throughout the larger rivers of the region. High MCI values have been shown to have a strong correlation with the lack of intensive agricultural or urban development of the upper catchment. Land cover in the catchment contributing to RS28 is 99.9% indigenous forest & scrub, whereas the lower site, RS29, has a more developed catchment, with 79.6% indigenous forest & scrub, 3.7% exotic forest, 2.9% high production pasture, 7.5% low production pasture and 6.2% urban.

Table 8: Interpretation of MCI-type and QMCI scores

Quality class	MCI	QMCI
Excellent	≥120	≥6.00
Good	100 -119	5.00 – 5.99
Fair	80 - 99	4.00 – 4.99
Poor	<80	<4.00

Source: (Perrie A, Morar S, Milne JR, Greenfield S, 2012)

2.5.4 Fish

Records in the New Zealand Freshwater Fish Database (NZFFD) for the Wainuiomata River are summarised in Table 9. They indicate that the Wainuiomata River has a typical assortment of the fish found in moderate sizes, low elevation, low gradient, gravel bedded NZ rivers. One of the native species have a threat status of 'Nationally vulnerable', while seven others are classified as 'At Risk – Declining', due to declining numbers nationally (Goodman *et al* 2014).

Table 9: NZFFD records for the Wainuiomata River (1980 -2013)

Scientific name	Common name	Number of records (from a total of 42)	Migratory species	Threat status (Goodman et al 2014)
Anguilla australis	Shortfin eel	5	yes	Not threatened
Anguilla dieffenbachii	Longfin eel	27	yes	At risk (declining)
Galaxias maculatus	Inanga	1	yes	At risk (declining)

Galaxias brevipinnis	Koaro	3	yes	At risk (declining)
Galaxias divergens	Dwarf galaxias	19	no	At risk (declining)
Galaxias argenteus	Giant kokopu	1	yes	At risk (declining)
Gobiomorphus breviceps	Upland bully	3	no	Not threatened
Gobiomorphus cotidianus	Common bully	11	yes	Not threatened
Gobiomorphus huttoni	Redfin bully	18	yes	At risk (declining)
Gobiomorphus hubbsi	Bluegill bully	2	yes	At risk (declining)
Gobiomorphus gobioides	Giant bully	1	yes	Not threatened
Geottria australis	Lamprey	3	yes	Nationally vulnerable
Salmo trutta	Brown trout	25	yes	Introduced & naturalised

Source: (Cameron, 2015)

The fish species most commonly recorded were longfin eel and brown trout, at 64% and 53% of sites surveyed, respectively. Dwarf galaxias and redfin bully were also common, being recorded at 40% and 38% of sites, respectively. Longfin eel, brown trout and redfin bully were relatively widespread, occurring in both upper tributaries and the main-stem of the river, whereas dwarf galaxias are found mostly in the upper river within the water supply catchment and within Catchpool Stream (Cameron, 2015).

Cameron also reports that within the urban section of the Wainuiomata River the following species have been recorded (mostly in surveys undertaken in the 1980's):

- longfin eel
- shortfin eel
- redfin bully
- common bully
- brown trout

Most of the fish species recorded are diadromous, requiring access to and from the sea to complete their life cycles. (Cameron, 2015) - see Appendix F - notes that the old water supply dam, located approximately 2 km upstream of the application area, presents a significant barrier to upstream fish migration. Species recorded above the dam include brown trout, dwarf galaxias, koaro and longfin eel. While brown trout and dwarf galaxias do not have an obligatory marine phase, koaro and longfin eel are diadromous and presumably are able to overcome the barrier. The gravel bar at the river mouth may limit fish access to the river at times.

For galaxiids (whitebait) and bullies the main period of migration upstream from the sea into the river occurs during late winter and spring, especially from September to November. Inanga have occasionally been recorded in the lower river and an extensive area suitable for inanga spawning was identified near the river mouth in a report by Taylor & Kelly (2001). The Regional Policy Statement (RPS) - (Greater Wellington Regional Council, 2013) - identifies the tidally influenced reach as inanga spawning habitat. This area is over 10 km downstream of the application area.

(Cameron, 2015) reports that mature brown trout migrate to (mostly) headwater streams during autumn where they spawn during winter, mostly from May to September. They emerge into spawning streams at the beginning of spring. A report by Smith (1986) notes that trout spawning occurs throughout the main-stem of the Wainuiomata River, except in the lower reach near the coast. However, the highest density of spawning occurs in the Catchpool Stream which provides excellent trout spawning habitat.

The reach covered by this application is modified by urban development to a greater extent than elsewhere on the river, with extensive commercial and residential land use within the local area. The riparian zone is predominantly in grassed playing fields and recreational reserve, typically with willows and other exotic species immediately adjacent to the river. While this reach evidently provides habitat for eel, bully and brown trout, it is less likely to provide good habitat for more cryptic species such as the galaxiids, which occur predominantly in forest streams.

2.6 River birds

Recent river bird surveys undertaken by GWRC as part of Environmental monitoring work associated with Workstream 3 (see Section 1) and reported in (McArthur, 2013) has not included the Wainuiomata River. The Wainuiomata River is not recognised in the working draft Regional Plan as a significant habitat for birds. (Cameron, 2015) reports that the Wainuiomata River mouth is considered to be the only area of habitat of sufficient size and quality to support breeding populations of riverbed-nesting bird species in this river. The limited extent of gravel beaches and the narrow river channel within the application area (and in the reaches upstream and downstream of it) mean these areas are unlikely to support populations of riverbed-nesting birds.

2.7 Access and recreation

A number of urban parks and reserves lie adjacent to the Wainuiomata River within the application area. These include:

- Richard Prouse Park
- Leonard Wood Park
- Naturi Park
- a number of other reserves on both sides of the river, including Poole Crescent Reserve, Wood Street Reserve.

These reserves are managed by Hutt City Council. They provide access to the river and offer opportunities for both active and passive recreation (walking, jogging, picnicking etc) alongside the river. There is a sealed walkway/cycleway approximately 800 m long on the true left bank between Richard Prouse Park and Peel Place.

According to a recent assessment of recreation in Wellington rivers (TRC Tourism, 2013), the Wainuiomata River is associated with a number of recreational activities and opportunities. Summary details are given below, and the full report is included in Appendix G.

Fishing

(TRC Tourism, 2013) notes that Fish & Game NZ manages the Wainuiomata River for trophy brown trout, and only fly fishing is permitted in the river. The best fishing occurs in the mid to lower reaches (i.e. downstream of the application area). The 2009 National Angling Survey (NIWA, 2009) indicates that annual angling visits to the river have fluctuated over the years from approximately 2,400 in 1995/95, to 750 in 2001/02 to 1,560 in 2007/08.

Whitebaiting is undertaken by a small number of individuals during the permitted season (15 August – 30 November) in the lower reaches of the river as far upstream as Khyber Pass. This point lies well downstream of the application area.

Wainuiomata Recreation Area (WRA)

The Wainuiomata Recreation Area, managed by GWRC, encompasses the Wainuiomata River and land lying to the south of the river immediately upstream of the application area (see Figure 3). Covering approximately 340 ha, the area includes river pools, picnic facilities and walking/biking

tracks as far upstream as the Lower Dam. According to (TRC Tourism, 2013) the typical number of users varies from less than 10 per day at low usage times (mid-week, winter) to over 100 per day during summer weekends. The Wainuiomata Harriers annual road race (attracting around 600 competitors) is hosted in the area.

The GWRC Parks Network Plan (Greater Wellington Regional Council, 2011)shows that the upper parts of the WRA offer opportunities for wilderness camping and hunting, and provide links through to tracks in the adjacent Rimutaka Forest Park.

Wainuiomata Golf Club

The Wainuiomata Golf Club lies approximately 1.5 km downstream of the application area, and is bisected by the river. The club has approximately 465 members and hosts up to 20,000 rounds annually.

Figure 3: Wainuiomata Recreation Area. Source: GWRC

2.8 Neighbouring community

The application area lies within the township of Wainuiomata, which forms part of Hutt City.

From the aerial photographs in Appendix B it can be seen that residential areas lie close to the river along the majority of the left bank within the application area, and along the right bank between Richard Prouse Park and the Black Stream confluence.

2.9 Existing flood protection works

The key flood protection works within the application area consist of:

- An 800 m long stopbank on the true left bank at the 90^{o} bend in the river opposite the Black Creek confluence, protecting the residential area west of Peel Place
- A 500 m long stopbank at the southern end of Leonard Wood Park, which affords protection to the residences west of Parenga St
- Stormwater outlet drains, some of which pass under the stopbanks and are fitted with steel floodgates
- A 15 m length rock rip-rap lining on the true left bank in the vicinity of Poole Crescent
- Willow lining along 73% of the right bank and 45% of the left bank
- A few areas of historic debris fences and timber groynes, which are associated with areas of willow plantings.

2.10 Other infrastructure & services

In addition to the flood protection works described in Section 2.9, other infrastructure and services within the river corridor include:

- Footbridge at XS 1530
- Water Main crossings at XS 1370 and XS 1450 (Richard Prouse Park)
- Main Road Bridge at XS 1280
- Grade Control structure in bed immediately below Main Road Bridge (XS 1280) to protect HCC road bridge
- HCC sewer crossing at XS 1255 (the new crossing is approximately 30 m downstream of the old crossing)
- Minor bridges at XS 1185 (just downstream of Faulke Ave) and XS 1460 (Richard Prouse Park)
- Electricity supply lines crossings at:
- XS 1370 (Richard Prouse Park)
- XS 1280 (Main Road bridge)
- XS 1210 (Burden Ave)
- GWRC River gauge and associated edge protection works at 1080

The Wainuiomata Sewerage Treatment Plant is situated adjacent to Naturi Park, immediately to the south of the application area. Sewerage from the Wainuiomata area is collected at this point and pumped via a pipeline to Seaview. At times when the capacity of the plant is exceeded, overflow is collected, settled and screened at the plant before being discharged to the Wainuiomata River.

2.11 Tangata whenua

The area covered by the application lies within the takiwa (or tribal area) of Taranaki Whanui ki Te Upoko o Te Ika.

The takiwa has been known as the 'Port Nicholson Block' since the negotiation of the "Port Nicholson Deed" by the New Zealand Company in 1839; see Figure 4.

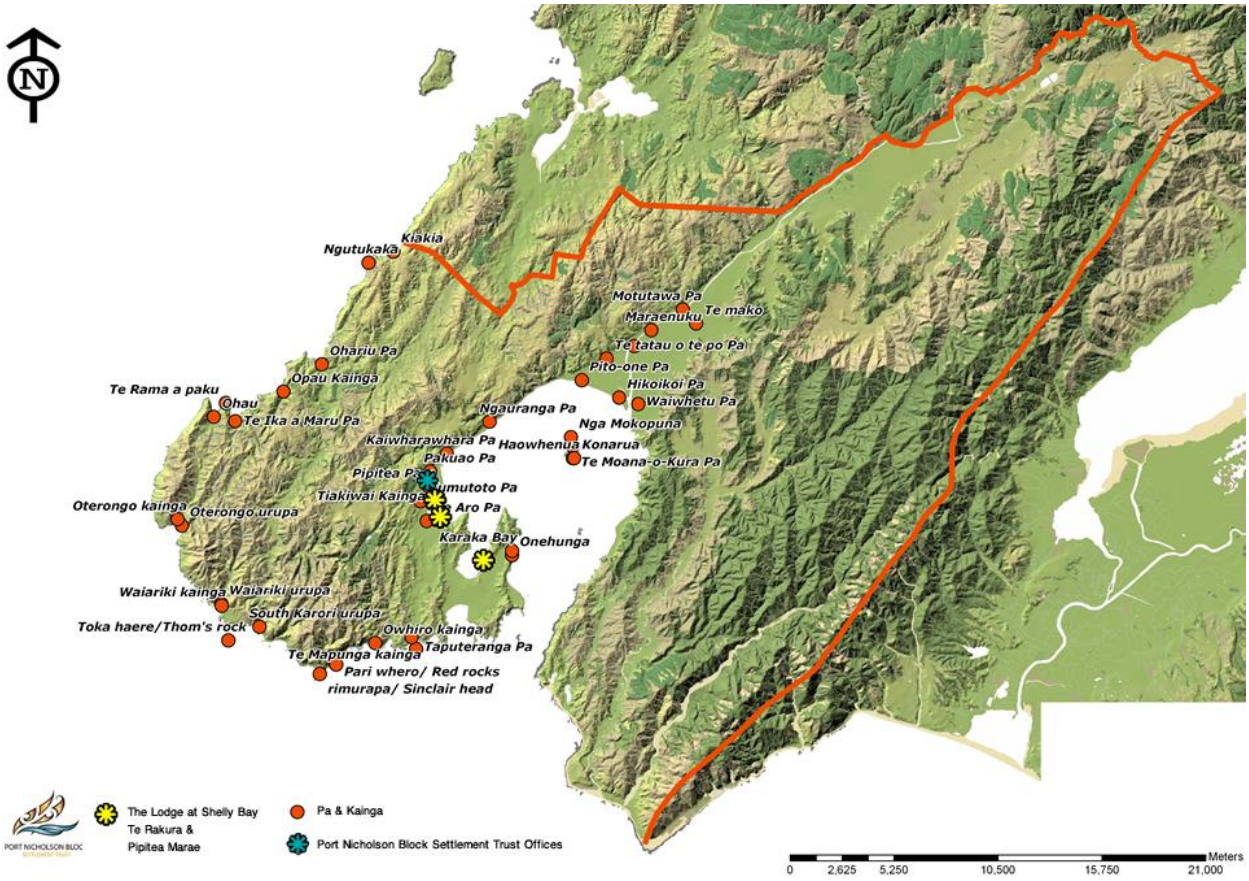

Figure 4: The Port Nicholson Block (Source: Port Nicholson Block Settlement Trust website)

Taranaki Whanui is a collective group of individuals who descend from:

- Te Atiawa
- Ngati Tama
- Taranaki
- Ngati Ruanui
- Other iwi from the Taranaki area, e.g. Ngati Mutunga
- Other individuals identified in the Port Nicholson Block Deed of Settlement (2008).

Taranaki Whanui's assertion of mana whenua over the Port Nicholson Block area is based on rights of take raupatu (conquest) arising from conquest by taua (war parties) in the early 19th century, and ahi ka roa (continuous occupation) as a result of subsequent heke (migrations).

The Port Nicholson Block Settlement Trust (PNBST) is an organisation that was established in August 2008 to receive and manage the Treaty settlement package for Taranaki Whanui ki Te Upoko o Te Ika. The Port Nicholson Block (Taranaki Whanui Ki Te Upoko o Te Ika) Deed of Settlement was signed on 19 August 2008 and the Port Nicholson Block (Taranaki Whanui ki Te Upoko o Te Ika) Claims Settlement Act 2009 came into force on 2 September 2009.

The Deed of Settlement and the subsequent Act include a statutory acknowledgement by the Crown of the statements of association made by Taranaki Whanui of their particular cultural, spiritual,

historical and traditional association with the areas included in Schedule 1 of the Act. The Rimutaka Forest Park (which lies adjacent to the northern edge tip of the application area) and the Wainuiomata Scenic Reserve (which lies outside the application area) are included in this Schedule.

The effect of this acknowledgement is that Taranaki Whanui ki Te Upoko o Te Ika, as represented by the PNBST, must be regarded as a stakeholder in matters concerning these areas. The PNBST represents Taranaki Whanui as an iwi authority for the purposes of the RMA[11].

Another organisation that also represents tangata whenua (and is an iwi authority) is the Wellington Tenths Trust, which was established to administer Maori Reserve lands largely in urban Wellington, although it also administers a rural block in Kaitoke, Upper Hutt. According to its website, the beneficial owners of this Trust are descendants of hapu of Te Atiawa, Ngati Tama, Taranaki and Ngati Ruanui who were living in the rohe (tribal area) in 1839. Many of the registered members of the Tenths Trust are also beneficiaries of the PNBST (and vice versa).

Te Atiawa (Wellington) is also represented by the Te Atiawa ki te Upoko o Te Ika a Maui Potiki Trust and is also an iwi authority for the purposes of the RMA.

The rohe of Ngati Toa Rangatira extends over the lower western parts of the North Island, as shown in Figure 5. Ngati Toa maintains customary rights within this rohe, based on the principles of take raupatu (conquest) and ahi kaa (occupation/settlement). The Wainuiomata River lies within this area.

Ngati Toa Rangatira is represented by Te Runanga o Toa Rangatira, which is an iwi authority for the purposes of the RMA. A Deed of Settlement between the Crown and Te Runanga o Toa Rangatira (in relation to Treaty claims) was signed on 7 December 2012, and the Ngati Toa Rangatira Claims Settlement Act 2014 came into effect on 23 April 2014. This legislation gives effect to certain provisions of the Deed of Settlement that settles the historical claims of Ngati Toa Rangatira. The Wainuiomata River is not included in the areas named in Schedule 1 of the Act which are covered by the statutory acknowledgement and deed of recognition in Part 2 of the Act.

[11] Te Puni Kokiri website: http://www.tkm.govt.nz. Iwi authorities are also noted in Section 2.2 of the Regional Policy Statement for the Wellington Region.

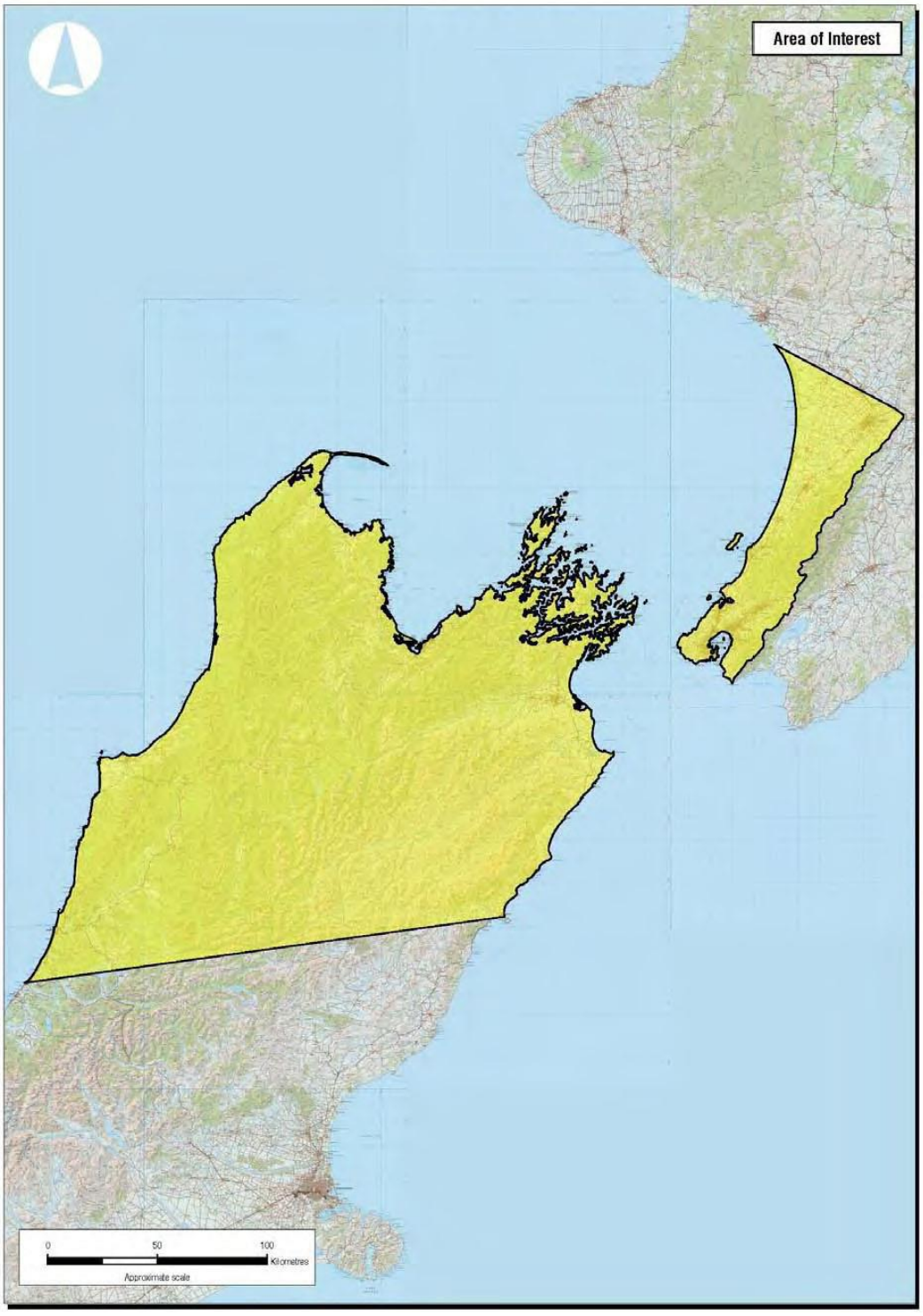

Figure 5: Ngati Toa rohe (source: www.tkm.govt.nz)

2.12 Archaeological sites

The New Zealand Archaeological Association online database does not record any archaeological sites within the application area.

3 Proposed Activities

3.1 Purpose and intended outcomes

The main aims of the river operation and maintenance work programme for the small section of the Wainuiomata River managed by GWRC and covered by this application are primarily to maintain the river channel in accordance with the Watercourses Agreement as noted in Section 1.2 which includes:

- maintaining the flood capacity of the river channel by removal of obstructions and gravel build-ups as necessary
- maintaining the integrity and security of the existing flood defences (including stopbanks and bank protection works)

The range of tools that GWRC employs currently in the Wainuiomata River to achieve these objectives is relatively limited, and this is not anticipated to change in the foreseeable future. However, in accordance with its desire for a consistent and holistic approach in resource consents for the work undertaken in all the Wellington Rivers, GWRC wishes to include its full 'toolbox' of methods in the consent currently sought, to ensure that the most appropriate methods are available throughout the life of the consent if and when required.

The purpose of the 'toolbox' is to address four broad objectives of the flood protection and erosion control works and maintenance activities undertaken by GWRC. These are the maintenance of channel alignment, channel capacity and flood defences, and the maintenance (and where possible, improvement) of the riparian environment. The range and types of activities that are used to achieve these objectives are discussed further below.

3.1.1 Maintenance of channel alignment

Without active management the river would erode its berms and develop meanders in a similar way to that which existed prior to settlement of the area. However the need to protect the private properties, urban infrastructure, utility services, bridges and floodway assets that are located adjacent to the river today means that the river must be actively managed within its existing alignment.

The tools available for maintenance of channel alignment include:

- Hard edge protection works such as rock rip-rap linings or groynes,
- Soft edge protection such as willow planting, or willow layering and tethering (where willows already exist)
- Mechanical shaping of the beaches and channel – either by 'ripping' (i.e. dragging a tine through the gravels), or by recontouring (more extensive movement and redistribution of the gravels)
- Channel diversion cuts

Hard edge protection works provide a high degree of bank protection but are expensive and can only be justified at points on the river which are particularly vulnerable to erosion and/or where strategic assets are at an unacceptable level of risk.

In contrast, soft edge protection works are less expensive and provide a moderate degree of berm security during flood events. They are suitable where there is a wide berm and they contribute to the relatively 'natural' appearance of the river. Often soft edge protection will need to be supported by channel shaping (e.g. beach and bed recontouring) particularly if they are located on the outside of a bend or other vulnerable points.

Ripping is used to maintain mobility of river gravels, and thus maintain a more uniform channel form and lessen the risk of channel distortions forming during flood events. Recontouring and diversion cuts are means of realigning the low flow channel where it has moved too far from its design alignment, or a means of deflecting the channel where it is creating a bank erosion problem.

3.1.2 Maintenance of channel capacity

The tools used to maintain channel capacity may include:

- Clearance of vegetation from gravel beaches ('scalping')
- Removal of unwanted willows
- Clearance of flood debris
- Removal of sediment and gravel deposited on berms by flood events
- Gravel extraction from aggradation zones in the river bed

3.1.3 Maintenance of existing flood defences

This includes all of the works necessary to maintain the existing in-river structures, and repairs to flood defence structures outside the river bed – principally the stopbanks.

3.1.4 Environmental improvement

Improvement of the in-river environment may also be achieved by the on-going development of good practice by GWRC through better understanding of the effects of works and maintenance activities (as discussed in Section 6).

3.2 Description of activities

3.2.1 Overview

The operations and maintenance activities included in this application are summarised in:

- Table 10: Summary of operations and maintenance activities

Further details are given in:

- Table 11: Description of construction activities
- Table 12: Description of activities involving demolition or maintenance of structures
- Table 13: Description of other works

Photographs of the activities are included in Appendix H.

Relevant additional information is given in:

- Section 3.2.2 Formation of access
- Section 3.2.3 Diversion of water
- Section 3.2.4 Gravel extraction

While these methods form the 'tool box' for GWRC's operations and maintenance works, it may be that different, more suitable methods are developed in the future. Accordingly, GWRC is seeking to ensure that the new consents that are granted do not restrict the methods to those listed here, but allow for new methods to be used provided that they are first incorporated into the COP via the agreed process. This may include an initial trial period in selected areas..

The activities have been assessed overall as having Discretionary Activity status according to the principle of bundling to the highest activity status. It is important to note however that some elements of the activities for which consent are sought are provided for as permitted or controlled activities (either in whole or in part, depending on the scale of the activity) within the regional plans, for example:

- Maintenance and repair of structures
- Extensions of rock rip-rap
- Disturbance of a river bed associated with clearance of flood debris
- Beach recontouring
- Trimming and removal of vegetation including any associated disturbance of the river bed or temporary diversion.

Table 10: Summary of operations and maintenance activities

Type of Activity	General Description	Typical Individual Components
Construction of "Impermeable" Erosion Protection Structures on & in the river bed	Erosion protection structures are classified as both 'impermeable' and 'permeable' because of the way current rules in the Regional Freshwater Plan (RFP) are written, but this is largely arbitrary because some so-called "impermeable" structures are not impermeable in the true sense of the word. 'Impermeable' structures are constructed of hard materials and are generally designed to give long-term protection to the river banks. Structural works involve activities that disturb the river bed (including movement of material, and may involve placement of additional gravel and removal of vegetation associated with formation of access) – all of which require approval under s 13 of the RMA. They may also involve disturbance or shaping of the bank edges and berms, and removal of vegetation, which require approval under s 9 RMA. Structural works may also involve temporary diversion of the river channel, and this requires approval under s 14 RMA. Any discharges of sediment from disturbed areas or discharges of water from temporarily bunded zones back to the river require approval under s 15 RMA. Details of structural works in or on the river bed, including the specific activities that are included in this application are given in Table 11.	Groynes constructed of rock and/or concrete block Rock linings (rip-rap and toe rock) Gabion baskets Driven rail and mesh gabion walls Reno mattresses Rock or concrete grade control structures
Construction of "Permeable" Erosion Protection Structures on & in the river bed	Permeable structures are of lower structural strength than the 'impermeable' works, and can be semi-permanent in nature or designed as temporary measures giving protection to willow plantings while they are established. Details are included in Table 11. Construction of these structures requires the same RMA approvals as those noted above.	Debris fences Debris arrester Permeable groynes

Type of Activity	General Description	Typical Individual Components
Construction of other works outside the river bed (on berms and stopbanks within the river corridor)	The construction of new stopbanks or the driving of new culverts under the stopbanks is not included in this application. Works outside the river bed are mostly associated with the development of the paths and trails within the river corridor. New structural works outside the river bed may include new stormwater culverts under trails, small floodwalls, and drainage channels constructed across the river berms to carry stormwater to the river. Minor works associated with management or improvement of the riparian margins are also included, e.g. erection of footbridges and boundary fences. All these activities involve uses of land that require approval under s 9 RMA. Works involving diversion and discharge of water may also require approval under s 14 and s 15 RMA respectively. Details of structural works outside the river bed, including the specific activities that are included in this application are given in Table 11.	Cycleway/walkway construction and associated new stormwater drainage, culverts, footbridges and access ways Fences Floodwalls Shaping of river banks and berms
Demolition and removal of existing structures on & in the river bed	This refers to the permanent removal of erosion protection structures that have served their purpose. The partial demolition of a structure in order to effect its repair or upgrade is covered under maintenance, which is discussed below. Demolition work assumes removal of all material (other than that derived from bed material) from the river bed. Demolition works involve disturbance of the river bed, demolition and removal of material from the bed which all require approval under s 13 of the RMA (shaping of the river banks, vegetation removal, and placement of gravel associated with the formation of access may also be involved). If temporary diversion of the river channel is necessary then approval under s 14 RMA is also required. Any discharges of sediment from disturbed areas or discharges of water from temporarily bunded zones back to the river require approval under s 15 RMA. Details of demolition works in or on the river bed, including the specific activities that are included in this application are given in Table 12.	Demolition by mechanical and/or hand methods. Removal of demolition material from river bed.
Maintenance of existing structures on & in the river bed	This includes the maintenance, repair, replacement, extension, addition to, or alteration of, any existing bank protection structures and outlet structures. Such activities, that disturb the river bed and may involve removal of vegetation and formation of access, require approval under s 13 of the RMA.	Structural repairs and maintenance to: • Existing erosion protection

Type of Activity	General Description	Typical Individual Components
	Any temporary diversion of the river channel requires approval under s 14 RMA. Any discharges of sediment from disturbed areas or discharges of water from temporarily bunded zones back to the river require approval under s 15 RMA. The specific activities included in this application are given in Table 12. (Note that the control of vegetation associated with any structure by the application of herbicide is not included in this application).	structures in the river bed • Existing culverts and outlet structures that discharge directly to the Wainuiomata River (including clearance of debris)
Structural maintenance work outside the river bed	This may include intermittent repairs of damage to structural works such as stopbanks that has been caused by flood events, stormwater runoff or vandalism. It also may include repairs, enhancements or extensions to walking tracks and cycle ways, and upgrade or repair of any stormwater culverts and drainage channels on the berms. These activities are uses of land requiring approval under s 9 RMA. The specific activities covered by this application, are given in Table 12.	Structural repairs and maintenance to: • Stopbanks & training banks • Flood walls • Stormwater culverts (including clearance of debris) • Stormwater drainage channels • Footbridges located on the river berms • Fences located on the river berms • Banks and berms
Development of vegetative bank protection	Willows are used extensively on the banks alongside the Wainuiomata River to stabilise and bind the banks and also afford additional protection to structural works. The introduction of any plant material onto a river bed, together with the disturbance of the bed associated with planting works (including the formation of access where necessary) requires approval under s 13 RMA. Works may also involve temporary diversion of the river channel, and this requires approval under s 14 RMA. Any discharges of sediment from disturbed areas or discharges of water from temporarily bunded zones back to the river require approval under s 15 RMA. The specific activities included in this application are given in Table 13.	Tree Planting Willow layering, cabling & tethering
Maintenance of vegetative works	This may include trimming, removal, repair and re-cabling of layered or tethered willows, or trimming and additional planting to established willow stands. As noted above, the introduction of any plant material onto a river bed, together with the disturbance of the bed associated with planting works (including the formation of access where necessary) requires approval under s 13 RMA.	Trimming and mulching of trees Removal of old trees Removal of damaged structures Additional planting New layering of trees

Type of Activity	General Description	Typical Individual Components
	Any temporary diversion of the river channel requires approval under s 14 RMA. Any discharges of sediment from disturbed areas or discharges of water from temporarily bunded zones back to the river require approval under s 15 RMA. The specific activities included in this application are given in Table 13. (Note that the control of vegetation by the application of herbicide is not included in this application).	Re-cabling of tethered willows
Channel shaping or realignment	This includes movement of the bed material by mechanical means – both beach recontouring and bed recontouring (which used to be referred to as "cross-blading"). Machinery used in these operations can include bulldozers, excavators, tractors and dump trucks. It also includes shaping or contouring banks to improve channel profile (as opposed to shaping work associated with construction of specific structures) and reshaping/re-filling of bank edges that have been eroded or damaged. These works involve disturbance of the river bed and possibly removal of vegetation and disturbance of plant and animal habitat, all of which require approval under s 13 RMA. In addition, any temporary diversion of the river channel requires approval under s 14 RMA, and any discharges of sediment from disturbed areas or discharges of water from temporarily bunded zones back to the river require approval under s 15 RMA. The specific activities included in this application are given in Table 13.	Mechanical: • Beach ripping • Beach recontouring • Channel diversion cut • Ripping of the bed in the wet channel • Bed recontouring • Recontouring (shaping and/or infilling) of bank edges
Channel maintenance	This covers activities that remove obstructions (such as vegetation or flood debris) from the channel and bank edges, as well as periodic removal of gravel from the river bed (i.e. beaches). These works involve disturbance of the river bed and possibly removal of vegetation and disturbance of plant and animal habitat, all of which require approval under s 13 RMA. In addition, any discharges of sediment from disturbed areas require approval under s 15 RMA. The specific activities included in this application are given in Table 13.	Removal of vegetation Beach scalping Clearance of flood debris Gravel extraction
Non-structural maintenance works outside the river bed	This includes regular maintenance works on berms or stopbanks such as mowing, and other activities such as riparian planting (with willows or native vegetation). The control of vegetation by the application of herbicide is not included in this application. These activities are uses of land requiring approval under s 9 RMA. The specific activities included in this application are given in Table 13.	Mowing stopbanks & berms (not involving machinery in river bed) Drain maintenance Water blasting Trimming and mulching of vegetation Planting & landscaping

Type of Activity	General Description	Typical Individual Components
Urgent works	Any of the above activities that are undertaken in response to a flood or emergency situation and may need to be undertaken outside of regular methodologies and operating conditions. The COP will contain a protocol for undertaking urgent works.	

Table 11: Description of construction activities

Activity	Description	Historical and Likely Quantum	Typical Activity Components
Impermeable Groyne Construction	Groynes are structures that extend from the bank into the river bed and deflect the direction of the flow of water- see photographs in Appendix H. They are designed to slow flow velocities and gravel bed movement in the immediate vicinity of the river bank and hence prevent bank erosion. Impermeable groynes are constructed from impermeable material, such as rock or concrete blocks and/or gravel. An impermeable groyne may be constructed entirely from rock boulders, or have a gravel or concrete block core. Concrete blocks are typically 1.6 x 0.8 x 1 m and weigh approximately 3 tonnes each. They have no exposed reinforcing steel and have a cast-in lifting eye to allow them to be cabled together. Groynes are typically constructed using a hydraulic excavator to excavate a trench typically 1.0 -3.0 m deep. Rocks (and/or concrete blocks) are placed in the trench and keyed into the adjacent bank to form the base of the groyne. Additional rock is then placed as a capping to shape the groyne. Typically groynes vary from 350 to 750 tonnes of rock, but smaller groynes (approximately 150 tonnes) may also be constructed. Generally an area of less than 100 m² of river bed would be disturbed in the construction of a groyne.	Currently there are no rock or concrete groynes within the application area. Although GWRC does not currently need to construct any groynes, it wants to retain the ability to do so in over the 35 term of the new consent should the need arise. Groynes would only be constructed where it is determined that such structures were the most appropriate and cost-effective response to changes in the river morphology and behaviour.	Remove vegetation if required Formation of access onto river bed (if required) Use excavator to batter bank to specified slope, prepare/contour bed or construct trench. Bulldozer may also be used to form a building platform Excavate to foundation level Place hard material & filter cloth if required Rock stockpiling on bed River crossings Diversion of water Discharge of sediment
Rock Rip-rap Lining Construction	Rock rip-rap consists of rock boulders placed against a section of river bank to form a longitudinal wall - see Appendix H.	Currently there is one 15 m long section of rock lining on the left bank adjacent to Poole Crescent. This was constructed in 2004 and used 200 tonnes of rock (see Appendix I).	Extension of rock rip-rap (and associated disturbance, deposition on bed, diversion of water) – applies to small works

Activity	Description	Historical and Likely Quantum	Typical Activity Components
	Constructed using hydraulic excavators shaping a section of river bank to a specified slope and excavating a trench in the river bed to a design scour depth. (This may necessitate temporary diversion of the river away from the works area by forming a low bund in front of the work area and dewatering the working area with a pump). Filter cloth or a filter material (usually gravel sourced in-situ) can be placed on the prepared slope prior to placement of the rock in the trench and up the slope batter. A full rock wall typically extends up to a height equivalent to a 2 year return period flood. Toe rock linings are constructed in a similar way but generally are not as deeply founded in the river bed and do not extend higher than approximately 1 m above low flow water levels.		Remove vegetation if required Formation of access onto river bed (if required) Use machine to batter bank to specified slope, prepare/contour bed or construct trench. Bulldozer may also be used to form a building platform Excavate to foundation level Place rock & filter cloth/gravel if required Rock stockpiling River crossings Diversion of water Discharge of water and/or sediment
	Gabions are wire mesh baskets (typically 2m x 1m x 1m) filled with rock (either quarry rock or locally	Gabion baskets and reno mattresses have been used in some locations historically, although none	Remove vegetation if required

Activity	Description	Historical and Likely Quantum	Typical Activity Components
Gabion basket/ Reno mattress Construction	sourced riverbed material). They are generally used to provide isolated protection for banks and services such as stormwater outlets, service crossings, bridge abutments or access tracks. Reno mattresses are wire mesh baskets that have wider and thinner dimensions than the more blocky gabions. They are filled with stones or pebbles generally derived from the in-situ bed material but quarry rock may also be used; they can be used for both bank protection and channel linings. Construction involves excavation of a trench at the toe of the bank to a depth of one basket. Baskets are lowered into the trench, and filled with rock, then empty baskets are placed on top laced together and filled to form the required protection structure. Sometimes the baskets are anchored to driven railway irons concealed in the bank. Construction is undertaken in the dry and may thus require temporary diversion of the river away from the works area by forming a low bund in front of the work area; generally dewatering of the working area (with a pump) is not required.	have been constructed over the term of the current consent (i.e. since 2002). They are a useful tool in the right situation and as such, could be employed occasionally in the future.	Formation of access onto river bed (if required) Use machine to contour bank to specified slope, prepare/contour bed or construct trench. Bulldozer may also be used to form a building platform Place baskets and fill with rock and lace together Diversion of water Discharge of water and/or sediment
Driven Rail & Mesh Gabion Walls Construction	This is a continuous rail-iron founded gabion structure used to protect and stabilise bank edges. Willows are normally planted behind the back irons and over time the willow roots extend through the structure and assist in binding it together, while the willows grow over the works and hide the irons and basket work. Construction involves driving of railway iron piles at 1 m spacings along the inner (river-side) edge of the structure, and typically an iron is also driven 1 – 1.5 m behind these irons at 3 m spacings (to provide a back	There are currently no gabion walls in the Wainuiomata River bed; however they are a useful tool in the right situation and as such, could be employed occasionally in the future.	Remove vegetation if required Formation of access onto river bed (if required) Prepare/contour bed Form building platform if required Drive piles/posts

Activity	Description	Historical and Likely Quantum	Typical Activity Components
	anchor). Piles normally only extend 1 -1.5 m above low flow level. Longitudinal cables are strung along the piles to create a 'fence'. Gabion or chain link mesh is then laid behind the irons and wired to the longitudinal cables. A flap is left at the base to form the bottom of the basket work. Gravels are then placed in the baskets and mesh is usually placed to cap the structure. The main limitation of the work is the difficulty in founding to an adequate depth to avoid scour.		
			Place mesh & fill with gravel
			Plant willows
			Diversion of water
			Discharge of water and/or sediment
Grade control structure Construction	Grade control structures (either rock or concrete block) are constructed across the width of a watercourse to control gravel deposition with the goal of maintain the river bed level or to protect bridge piles.	There is one grade control structure across the river immediately below the Main Rd (this protects the bridge piles from scour and is owned and maintained by HCC). Grade control structures are a useful tool in the right situation and as such, could be employed occasionally in the future.	As for Impermeable Groynes
Debris Fence Construction	Debris fences are iron and cable fences that extend from the bank into the river channel. They are used to create or re-establish a willow buffer zone along the edge of the river channel, and so maintain channel alignment. Willows are interplanted between debris fences and the fences afford protection to them by trapping flood debris and slowing flows (and gravel movement). Willows planted in a river bed without debris fences	There are debris fences at a few locations along the banks (e.g. adjacent to Leonard Wood Park) within the application area; none have been constructed over the term of the current consent (i.e. since 2002). They are a useful tool in the right situation and as such, could be employed occasionally in the future.	Remove vegetation if required
			Prepare/contour bed Form building platform if required
			Drive piles/posts into riverbed
			String cables
			Diversion of water

Activity	Description	Historical and Likely Quantum	Typical Activity Components
	are very vulnerable to flood damage and are much less likely to establish than those planted with fences. Fences are constructed by driving railway iron posts (or similar) 3 -5 metres apart into the river bed in a series of discrete lines generally at a 45^{o} angle from the channel alignment. The posts stand approximately 1.2 m above the bed. Three to four steel cables are strung through the posts to form the fence. It is usually necessary to contour the site with a bulldozer to create a smooth construction platform and also to divert the flowing channel away from the works site. The irons are driven with a hydraulic hammer mounted on a large excavator.		Discharge of water and/or sediment
Debris Arrester Construction	A debris arrester is generally constructed from railway irons, steel beams or pipe that is driven into the bed and tied together with horizontal irons. More robust than a debris fence, it is designed to catch flood debris and prevent it from travelling downstream where it may cause damage to bridges or other structures.	Currently there are no debris arresters in the Wainuiomata River. Although used infrequently, debris arresters are a useful tool in the right situation and their suitability for future use will be considered on a case-by-case basis.	Remove vegetation if required Prepare/contour bed Drive steel/timber piles into riverbed Attach horizontal iron rails Diversion of water Discharge of water and/or sediment
Permeable Groyne Construction	Permeable groynes act in a similar way to debris fences but are more robust and give greater control of flow direction. They are used to establish or maintain willow buffer zones. Generally timber groynes have been constructed in the Wainuiomata River. See Appendix I.	There are timber groynes at a few locations along the banks (e.g. on the true left bank downstream of Richard Prouse Park) within the application area; none have been constructed over the term of the current consent (i.e. since 2002). There are no immediate plans for any new structures, but they remain a useful tool in the	As for Debris Fence

Activity	Description	Historical and Likely Quantum	Typical Activity Components
		right situation and their suitability for future erosion control will be considered on a case-by-case basis.	
Construction works outside of the river bed	Minor works associated with management or improvement of the riparian margins are also included, e.g. construction of pathways or cycleways, footbridges and boundary fences. All these activities involve uses of land that require approval under s 9 RMA. Associated with this work there may be a requirement for new stormwater culverts under trails, and drainage channels constructed across the river berms to carry stormwater to the river. These works also involve diversion and discharge of water requiring approval under s 14 and s 15 RMA respectively.		Formation of new drainage channels Construction of cycleways or walkways, and access ways. Construction of flood walls Erection of boundary fences Removal of vegetation Diversion of stormwater drains Discharge of stormwater

Table 12: Description of activities involving demolition or maintenance of structures

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
Demolition & Removal of Structures	Structures are most likely to be removed following partial or total failure, and a decision being taken not to reconstruct. Removal is necessary to prevent creation or aggravation of erosion of the adjacent river banks, to remove danger to river users, and for visual reasons.	Removal or demolition of structures is not a major activity on the Wainuiomata River. It is undertaken on an as-required basis.	Machinery on bed; bed disturbance; demolition & removal of structure from river bed; deposition of material on river bed; disturbance of plant & animal habitat
Maintenance of 'impermeable' structures (in the river bed)	This work includes repair and maintenance of all existing 'impermeable' erosion protection structures in the river bed noted above. It also includes repair and maintenance of existing head walls, wingwalls, culverts, and steel grilles, flap gates etc associated with outlet structures.	Maintenance of structures is not a major activity on the Wainuiomata River. It is undertaken on an as-required basis.	Remove vegetation if required
			Add rock/concrete
			Rebuild
			River crossings
			Diversion of water
			Discharge of water and/or sediment
			Water blasting

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
Maintenance of debris fence/ debris arrester/permeable groynes	This includes repairs to any damage, and clearance of flood debris build-up as required.	This is not a major activity on the Wainuiomata River. It is undertaken on an as-required basis.	Remove debris
			Disturbance of bed associated with removal of debris
			Rebuild
Maintenance of structural works outside the bed	This covers repair and maintenance of all structures within the river corridor that lie outside the river bed, including stopbanks, cycle ways & paths, fences, floodwalls etc. It may include intermittent repairs to structural works (stopbanks, floodwalls, culverts, drainage channels, paths and trails) caused by floods, stormwater runoff or vandalism and enhancements or extensions to such structures.	This is not a major activity on the Wainuiomata River. It is undertaken on an as-required basis.	Repair of stopbanks and berms, floodwalls etc. – recontouring, re-establishment of vegetation
			Repair of stormwater drainage channels and culverts,
			Repair/upgrade of cycle ways or walkways
			Repair of boundary fences
			Removal of vegetation (i.e. outside of the river bed)
			Diversion of stormwater drains
			Discharge of stormwater
Urgent Works	This covers repair of any bank or bed protection works damaged by a flood event when an immediate response is necessary to protect existing permanent dwellings, network utility	Varies in response to need; driven by flood occurrences. The actual type of work undertaken under urgency will depend on the flood damage that has been	

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
	structures or flood mitigation structures from imminent threat of erosion. Such work may necessitate working outside the normal operating conditions, such as outside usual hours of operation, working in the channel during fish spawning periods etc.	sustained; it may include temporary or permanent repairs to structures or banks.	

Table 13: Description of other works

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
Establishment of bank protection plantings	This involves planting vegetation along the edges of river banks generally within the design buffer zone, in order to bind and support the bank edge and so maintain a stable river alignment. Branch growth also reduces water velocities at the bank edge which assists in erosion protection. Trees may be used to further reinforce structural works. Willow trees are the species considered most suitable for front-line flood protection. Planting is generally carried out between June and September. Four planting methods are used: By hand, using a crow bar. Willow stakes are cuttings 1 – 1.5 m long and approximately 2.5 cm in diameter. Stakes or poles (i.e. large cuttings more than 3 m long) are usually cut from existing stands. 'Rip planting' using an excavator or planting tine. The tine is dragged through the soil at up to 1 m depth and the stakes/poles or rooted stock planted behind the moving tine. The movable arm of the excavator allows planting to be undertaken on quite steep banks and amongst established trees. This is most commonly used where large areas of planting are required. 'Trench planting' using a digger. Willow poles are planted in a trench dug and backfilled by the excavator. This method is used where willows are planted in very dry areas or immediately adjacent to fast flowing water. Planting using a mechanical auger to prepare holes for stakes or poles. See Appendix H for photographs of these activities.	Currently approximately 3.5 km (or 73%) of the true right bank and 2.1 km (45%) km of the true left bank within the application area is willow-lined; this equates to approximately 59% of the total bank length. It is not proposed to significantly extend these areas over the life of the new consent. On-going work will largely be focused on maintenance and renewal of existing areas of planting. GWRC records show that between 2002 and 2011 a total of 4,897 willow poles and 3,150 willow stakes were planted. This equates to an annual average of 490 poles and 315 stakes. See Appendix I for details. Willows are an important and necessary tool for stabilisation and protection of banks on the Wainuiomata River.	Cut stakes or poles from existing willows as required Remove vegetation if required Prepare/contour bed Hand planted poles Rip planted using an excavator Trench planted Re-tethering, cabling, layering Re-planting of willows

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
	Tethering (or cabling) involves cutting large willow or poplar trees and laying them in a shallow trench excavated along the bank to be protected. The trees are bundled with wire rope and securely fixed to driven railway irons and/or buried concrete block weights. The base of the trees are covered with gravel to encourage root growth, and willow poles are planted behind the tethered layer. The structure has sometimes been referred to as fascine. Layering is similar, except that in-situ willows are felled (or bent and snapped using a digger) obliquely, generally towards the river in a downstream direction. The intent is to allow the willows to sucker from branches on the ground once they are covered in silt and gravel. The tree is wired to its stump to prevent it breaking off in a flood. Layering is normally completed in the August – September period following completion of planting work.	GWRC records show that between 2002 and 2011 a total of 170 m of layered and tethered willow structures was established. This equates to an average of 17 m per year. See Appendix I for details.	Tethered, cabled, layered
Maintenance of vegetative plantings & structures	Maintenance of willow plantings on the river edge would generally involve removal of unstable trees, replanting with new poles, or layering and tethering of mature trees. Mulching is used to rejuvenate old trees; preventing them from getting too large or unstable while maintaining bank stability. Maintenance of existing layered and tethered trees usually involves strengthening by cabling-in additional tree material, and inter-planting with additional poles. If existing vegetative structures (cabled willows & tree groynes) start to show signs of failure a decision may be made to remove them to reduce the potential for them to create a hazard during future floods. This would involve excavation using a hydraulic excavator, and removal from the river bed.		Remove, thin, mulch trees using excavator Re-tethering, cabling, layering Re-planting of willows

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
	Periodic trimming of willows is also required to clear survey sight lines and to maintain access to the river. Clearance may be done by excavator and/or by hand.		
Channel shaping or realignment	Beach recontouring is undertaken in the dry bed, away from the flowing channel. Carried out as a discrete activity, its purpose is to streamline the beaches to avoid any future obstructions to flow. It can also be undertaken as part of site preparation associated with establishment of structures, or in conjunction with bed recontouring. Beach ripping involves dragging a tine behind a bulldozer to loosen the upper surface layer (armour) of the beach; this encourages gravel movement. See Appendix H.	Beach recontouring would be undertaken only very occasionally in the Wainuiomata River. However it is a useful tool in the right situation and will be undertaken on an as-required basis. Ripping of beaches downstream from the Black Stream confluence is undertaken approximately once a year.	Beach recontouring Beach ripping
	Bed recontouring (formerly referred to as 'cross-blading') is mechanical shaping of the active channel to realign the low flow channel so as to reduce erosion (typically at the outside of a bend) or to prepare the bed for construction or planting works. Straightening of the channels increases the hydraulic efficiency of a reach and thereby reduces flood levels. Bed recontouring is done by cutting a new channel through the dry beach on the inside of a bend, leaving a bund at both ends to minimise silt discharges. Excavated material is placed at the outside edge of the new channel. When the new channel is completed, the end bunds are removed, and the excavated material pushed across the old channel alignment to the required finished profile.	To date bed recontouring in the Wainuiomata River has been undertaken as a relatively short-term solution to protect bank edges from further erosion. At present three areas in particular continue to require attention : • the right hand bend adjacent to Richard Prouse Park, • the right hand bend adjacent to Wood St reserve • the left hand bend adjacent to Leonard Wood Park. The channel alignment created by bed recontouring will often remain effective for up to 2 years; however a large flood can reduce the effectiveness at any stage. Hence the quantity of bed recontouring undertaken in any year is very dependent on the occurrence of flood events and the effectiveness of other control measures such as gravel extraction. The largest requirement for bed recontouring will be after flood events.	Bed recontouring

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
		GWRC records show that from 2003 to 2008 a total of 690 lineal metres of bed recontouring ('cross-blading') was undertaken in the Wainuiomata River. This equates to an average amount of 138 lineal metres per year, although the actual amount has varied between 0 m and 275 m per year (note that since 2008 no work has been necessary). See Appendix I for further details.	
	Channel diversion cuts are typically undertaken through beach areas, away from flowing water, to create a new low flow channel within the design alignment. Undertaken either as a discrete activity or in conjunction with other works, a diversion cut assists in the establishment and maintenance of a more uniform and better aligned channel form.	Diversion cuts would only be undertaken very occasionally in the Wainuiomata River, in response to a major channel distortion arising from a flood event.	Excavation of new channel across beach
	Ripping in the wet channel involves dragging a tine mounted on a bulldozer through riffle sections of the low flow channel, in order to encourage mobility of the gravels and thus encourage a more uniform channel form.	This activity is a new method that in the right circumstances may offer an alternative to, or reduce the need for, more extensive and invasive bed recontouring.	Ripping with a tine in the flowing channel
	Shaping or reconstruction of berm edges will normally occur following flood damage. The river is diverted away from the affected bank, and the bank edge is then rebuilt by placing fill in layers. Fill is generally sourced from a suitable adjacent beach where available; otherwise weathered overburden sourced from a quarry would be used. The intention is to reconstruct the berm to a similar height and alignment prior to erosion. Following reconstruction, the new bank edge will be stabilised by construction of one or more appropriate bank protection works.		Batter/shape banks Repair scalloped areas

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
Channel Maintenance	Removal of vegetation involves removal of excessive or unwanted willows or other tree species from the channel, so as to minimise potential for blockages during floods, or to prevent dislodged willows re-growing in the channel. Trimming of willows is also required to clear survey sight lines and to maintain recreational access to the river. Clearance may be done by excavator and/or by hand.	Removal of willows is not a major activity on the Wainuiomata River, and is usually done when machines are present for other works. Typically may involve a machine for a few days once or twice a year.	Removal of vegetation
	Beach scalping involves mechanical clearance of woody and herbaceous weeds and grasses from gravel beaches. This is necessary to prevent reduction in flood flow velocities and gravel aggradation. Mechanical clearance is typically performed using a bulldozer, large excavator or front end loader to strip the vegetation and loosen the armouring layer. The vegetation is crushed and left to break down or become light flood debris. The activity involves excavation or disturbance of bed material but does not typically result in a discharge of sediment to the flowing channel.	Clearance of vegetation is not a major activity in the Wainuiomata River and is undertaken on an as-required basis. Other minor areas of vegetation build-up would be removed using an excavator while other work was taking place, e.g. willow planting.	Beach scalping (clearance of vegetation)
	Flood debris is defined in the RFP as 'material deposited on the river bed as a result of wreckage or destruction resulting from flooding', and it can include trees, slip debris, collapsed banks, the remains of structures, and other foreign material including abandoned vehicles, but does not include the normal fluvial build-up of gravel. Removal of flood debris is necessary because blockages reduce channel cross-sectional area which result in higher flood levels. In addition, if allowed to occur, build-up of obstacles may deflect flood flows into banks, causing lateral erosion. Removal of flood debris covers only the minimal amount of work needed to clear the bed or structures within the bed of flood debris; any beach or bed contouring completed at a	Uprooted trees, large logs and car bodies etc. are removed using an excavator. Smaller debris items and general rubbish are often removed by hand or with the assistance of a 4WD utility vehicle or tractor. This activity is normally undertaken after each significant flood event.	Clearance of flood debris

Activity	General Description	Historical and Likely Quantum	Typical Activity Components
	location where debris removal occurs is accounted for as beach or bed recontouring.		
	Extraction of gravel from the channel is a tool that is useful for maintaining the capacity to convey flood flows. The general aim is to maintain a balance between flood capacity (which is reduced by higher bed levels) and the threat of undermining bank protection works (which is increased by lower bed levels).	GWRC does not currently extract gravel from the Wainuiomata River, however it wishes to add gravel extraction to the tools available for channel management. Accordingly, GWRC seeks the ability to extract 1,500 m^3 per annum on average from exposed gravel beaches (i.e. above the active channel) using the method discussed in Section 3.2.4. It is anticipated that gravel extraction would be undertaken on an intermittent basis according to need. The actual amounts extracted in any one year would be determined in response to movements in bed material through the river system. This is likely to be driven principally by the size and frequency of flood events.	Gravel extraction Temporary stockpiling of excavated material on river bed
Maintenance of non-structural works outside the bed	This may include any works required to maintain the stability of the river berms, and general maintenance such as mowing of the river berms. Non-structural maintenance works, such as cleaning /water-blasting of any flood protection structures lying outside the bed, are also included.	HCC generally mow river berms and stopbanks, but GWRC may also undertake this work from time to time. Mowing is undertaken from the river banks.	Repair of berms Mowing of berms Water blasting
Urgent Works	This covers repair of any non-structural bank protection works and any bed recontouring after a major flood event where immediate action is required to protect existing permanent dwellings, network utility structures or flood mitigation structures from imminent threat of erosion. Such work may necessitate working outside normal operating conditions, such as outside usual hours of operation, working in the channel during fish spawning periods etc.	Varies in response to need; driven by flood occurrences, level of damage and the level of risk posed to adjacent assets.	

3.2.2 Formation of access

Although existing access points will be used wherever possible, works to enable access may need to be undertaken as a precursor to many of the activities noted in Table 11, Table 12 and Table 13. These works may involve trimming or clearance of small amounts of vegetation on the river banks, shaping of a localised area of the river bank and/or river bed to permit vehicle access to the river bed. All such disturbance (where required) would be confined to the minimum necessary to allow the proposed activities to be undertaken in a safe and effective manner.

3.2.3 Diversion of water

Several of the activities noted in Table 11, Table 12 and Table 13 would require diversion of part of the river flow. This includes permanent diversion of normal low flows as a result of:

- Bed recontouring
- Gravel extraction
- Construction of new structural works or bank reconstruction.

It also may include temporary diversion of normal low flows to allow construction of new works, demolition of obsolete or damaged works and repairs to banks.

3.2.4 Gravel extraction

The dam lying upstream of the application area interrupts the supply of gravel from the upper catchment, so that the bed material moving through the area downstream of the dam is therefore derived mostly from sediments eroded from the river banks. Although aggradation of the river bed through the urban section of the river is generally not a significant problem, erosion of river banks and deposition of eroded material downstream within the river channel in response to flood events can lead to reduction in the flood-carrying capacity of the river channel if not managed. The frequency and magnitude of the problem is largely determined by the frequency and magnitude of flood events.

GWRC does not currently use gravel extraction as a management tool in the Wainuiomata River and has no immediate plans to do so, but it is important to note that this activity may be required some time in future during the term of the new resource consent. In keeping with the 'long-term tool-box' approach that is being taken to the resource consent renewals GWRC therefore wishes to include the ability to extract gravel in its suite of available tools for channel management.

Possible future target areas for extraction are the exposed gravel beaches lying mostly downstream of the Black Stream confluence. GWRC currently estimates that up to 1500 ^{3} per annum might be extracted per year over the life of the consent on average. The actual amount of gravel extraction would be on an as-required basis in response to changes in the river channel arising from the effects of flood and erosion events. Only the minimum amount required to manage the existing flood risk would be undertaken, and additional limiting factors would be GWRC's annual budget constraints and the ability to minimise the costs of disposal of the extracted gravel.

Proposed methodology

Removal of gravel from the river bed would be undertaken via excavation from beaches above the active channel; this method has commonly been referred to as 'dry extraction'. Under this method all works are undertaken out of running water, except for any river crossings for access or for transport of extracted gravel that may be necessary.

Extraction would usually be carried out using either hydraulic excavators or front end loaders which load onto trucks (either road trucks or off road dumpers). Extraction would proceed in uniform

strips parallel to the river channel, to a depth no lower than 0.2 m above the normal level of the adjacent flow (Figure 6).

Figure 6: 'Dry' gravel extraction (example from Waikanae River)

Small stockpiles of the extracted gravel may be formed on a daily basis, but would not normally be left in the floodway for longer than the working day. The extracted gravel would be transported from the site using existing access tracks and/or public roads wherever possible. Trucks may need to cross the river in order to gain access to some beaches. Such crossings would be kept to a minimum, and restricted to a single point of entry and exit.

At the end of extraction, beaches will be left with an even surface to ensure that there are no major discontinuities that could divert future floodwaters. The next fresh or flood will then re-work the bed to a more natural form.

Timing of works

Generally extraction works would be undertaken in summer months when the river flows are low and exposed areas of beach are at their maximum.

3.3 Design of work programmes

GWRC undertakes a formal annual inspection of all infrastructural assets and assigns a condition rating of 1 to 5 to each asset (1 being highest). From this inspection, the annual work programme is derived; the work programme notes ongoing maintenance activities (mowing etc.) and the work required to improve those assets with low condition ratings.

The specific type of work chosen will depend on the nature of the problem at a site and river engineering design criteria such as channel width, flow velocities and channel alignment, the width

of berm to critical assets including stopbanks and services, cost versus benefit, available budget and environmental considerations.

Soft-edge works such as tree planting etc. are cheaper than hard-edge works but afford a lower level of protection and require time to establish before being effective. Construction of structural works at an early stage may avoid the necessity of more extensive works at a later stage, or reduce the requirement for repeat in-channel works with consequential reductions in overall cost and environmental impact.

Costs of permanent works can vary from $5/m² for willows, $7,000 to $11,000 for a typical debris fence[12] and from $1,500 to $3,000 for rip-rap lining[13]. New structural works will typically be constructed where existing willow protection is repeatedly failing, or where existing structural works have failed and repair is neither adequate nor appropriate.

A range of structural options is required to ensure the optimal option (based on consideration of the factors above) is used at each particular site.

[12] Based on 2013 GW rates of $366/m and a typical length of 20-30 m.
[13] Based on 2013 GW rates of $123/tonne and a volume of between 12 - 25t/m.

4 Consideration of Alternatives

4.1 General

Alternatives to the proposed activities can be considered at a number of levels. On a broad scale, the consequences and unacceptability of doing nothing, and the consideration of what type of flood protection works should be adopted in the Wainuiomata River have already been addressed through the flood hazard assessment work and GWRC capital works programme. It is not proposed to re-consider these issues further in this application.

In addressing the more specific issue of alternatives to the individual activities that are proposed, it is relevant to note that the types of activities undertaken in the river have changed, and will continue to change, over time in response to different management philosophies, available technology, experience of what does and does not work at a practical level, and increasing understanding of the river system and the effects of activities. The evolution of the flood protection system within the managed section of the river also influences the types and the relative amounts of works that are required on an on-going basis.

The works and activities proposed in this application form a suite, or 'tool-box' of techniques to address the identified flood risk in the Wainuiomata River, and are based on current good engineering and environmental practice. This has been formalised into an updated COP that is still under development. The COP provides specific details of the methods of undertaking each of the identified activities, together with agreed restrictions around their use.

The availability of a 'toolbox' of methods enables river managers to select the most suitable method or methods to address a particular issue, taking into account:

- the urgency of the work and consequences of not undertaking it
- the degree of digression of the channel from its design alignment and/or desired plan form
- the values associated with the specific site and the river as a whole
- the environmental effects of the work and available alternatives to achieving the desired outcomes

River managers undertake such assessment, and consideration of alternative methods, in the development of all work plans.

4.2 Willow planting

One matter that has been specifically questioned as to its need or otherwise is the use of willows for river protection work.

Willow planting forms an essential part of current river protection work nationwide. Willows are easy to establish, grow rapidly and form an intricate root system that is ideal for binding and strengthening river banks and structural measures such as permeable groynes and debris fences. Generally, the same results cannot be achieved using native species. GWRC established a trial at three sites on the Hutt River in 2001 to investigate the use of native planting for river edge protection. The results of this work are reported in (Phillips et al, 2009). In summary, the report concluded that while native plants could be used to stabilise smaller order streams, there were limitations to the use of native planting for edge protection in larger rivers. In particular, natives are:

- slower to establish
- have shallower root systems
- have higher maintenance costs

The native species with the most potential for river edge protection are toetoe (*Cortaderia fulvida*), flax (*Phormium tenax*) and some grasses (*Carex sp*.). However it was also noted that in flood events there is potential for erosion of these clump-type plants to cause channel blockages.

Native plantings cannot be regarded as a comprehensive or comparable alternative to willows; the most realistic alternative at this stage is likely to be structural work (e.g. rock lining), which involves higher costs and arguably increased environmental impact.

It should be noted that GWRC uses sterile cultivars in all willow planting so that the issue of wilding plants becoming established in the river bed is minimised (although willow debris is still able to re-establish vegetatively on exposed beaches if left unchecked).

Once established, the presence of willows along a river bank contributes to the available aquatic habitat, by the provision of sheltered habitat within the tangle of roots binding the banks, the provision of shade by overhanging branches and by the input of leaf matter into the water.

Willow plantings along the Wainuiomata River are now relatively well established, and work involving willows by GWRC into the future is expected to be largely focused on maintenance and renewal of these plantings.

5 Assessment of Environmental Effects

5.1 Positive effects

The principal positive effects of the proposed works as a whole include increased security from the risks of flooding and flood damage for the local community. This includes increased personal safety, lowered risk of property damage or loss, lowered risk of insurance claims and costs and lowered risk of disruption to lives and economic activity of the local area and wider region.

5.2 Other effects

Actual and potential adverse effects of the proposed works are generally associated with impacts (both positive and negative) on the established natural ecology within the modified and managed river environment. These are identified and summarised with reference to individual activities in Sections 5.3 to 5.22. Cumulative effects arising from interaction with other consented works in the river are addressed in Section 5.23.

5.3 Discharge of sediment

5.3.1 In-river works

Activities that involve the movement or excavation of river bed material within flowing water (including, but not limited to, bed recontouring and wet gravel extraction) will cause discharge of natural fine bed sediments into the water column. The sediments are the same or very similar to those that occur naturally in the water column during natural flood events. The main difference is that the discharge from works activities is likely to occur at times of low flow when the suspended solid load of the water is also low.

The nature of the sediment discharge will depend on whether the sediment is derived from recently reworked gravels (i.e. gravels that have been disturbed and re-deposited by flood events in the channel), or from disturbance of older alluvial bank materials comprising gravels with a silt/clay matrix.

Measurements of turbidity and suspended solids were taken recently in association with the 2012 Hutt River gravel extraction programme upstream of Kennedy-Good Bridge (which was undertaken from 26 November 2012 to 19 December 2012). Approximately 16,000m^3 of gravel was extracted from a river length of approximately 300m (XS 0720 – 0750), (not the 1400 m river length between XS 0720 and 0860 as originally planned). The activity was undertaken by two bulldozers which pushed the gravel up onto a beach for later removal by off road dumper or road truck. The truck crossed the river at several locations. The results are summarised in Table 14. They show that maximum turbidity and suspended solids values of 306 NTU and 207 mg/l respectively, were recorded in the river during bulldozer operation.

Table 14: Turbidity and suspended solids (SS) monitoring results for the Hutt River during gravel excavation by bulldozer in flowing water 500m upstream of Kennedy Good Bridge on 28 November 2012

Time*	Bulldozer activity	Upstream		100m Downstream		500m Downstream	
		Turbidity (NTU)	SS (mg/L)	Turbidity (NTU)	SS (mg/L)	Turbidity (NTU)	SS (mg/L)
16:10	Excavating gravel from river	6	1	175	90	47	29
16:35	Excavating gravel from river	5	2	306	207	102	51
17:00	No activity (work ceased at 17:00)	6	1	52	180	84	100
17:35	No activity	4	1	13	72	64	17
18:00	No activity	5	1	7	1	8	1

*Sampling commenced at the upstream site followed by 100m and 500m downstream over a 15 minute period.

Source data from Geotechnics Ltd

Table 15 summarises the results of turbidity and suspended solids monitoring undertaken during repeated truck crossings of the Hutt River at the same location. Truck crossing activity was shown to cause turbidity and suspended solids increases of up to 16 NTU and 2 mg/L respectively.

Table 15: Turbidity and suspended solids monitoring results for the Hutt River during truck crossings of the river 500m upstream of Kennedy Good Bridge on 28 November 2012

Time	Truck activity	Upstream		100m Downstream	
		Turbidity (NTU)	Suspended solids (mg/L)	Turbidity (NTU)	Suspended solids (mg/L)
15:40	Prior to crossing river	1	1	6	2
15:48	Truck crossing river (1)	-	-	17	4
15:52	Truck crossing river (2)	-	-	5	2
15:54	Truck crossing river (3)	-	-	8	3
15:56	Truck crossing river (4)	-	-	12	2
15:58	Truck crossing river (5)	-	-	4	2
16:00	Truck crossing river (6)	-	-	7	2
16:02	Post crossing river	1	1	7	3

Source: Geotechnics Ltd

The results confirm earlier observations that water clarity returns to near ambient levels rapidly, often within 1 hour of the activity ceasing. This is an important result because it indicates that even during an intense period of in-stream channel works the aquatic biota downstream would have the benefit of normal water quality for at least half of each 24 hour period.

These latest results indicate lower values than those previously recorded by GWRC for the Hutt and Waikanae Rivers (see Table 16 which indicated that bulldozer channel shaping could generate suspended solids concentrations as high as 690 mg/l). By way of comparison, (Cameron, 2015) notes that suspended solids concentrations as high as 780 mg/l also occur during a one year return period flood in the Hutt River. For smaller more frequent flood events, i.e., those occurring three to four times each year, suspended solids concentrations typically fall in the range 100 to 400 mg/l.

Table 16: Suspended solids concentrations in Waikanae River below works

River	Activity	Suspended solids concentration in river (mg/L)		
		Background	Downstream (100m)	Downstream (300m)
Hutt	Channel shaping	2	480	-
	Bulldozer crossing river	2	130	-
	High river flow event (410m³/s @ Birchville on 19/11/96)	-	780	-
	High river flow event (160m³/s @ Birchville on 8/10/2007)	-	397	-
	High river flow event (80m³/s @ Birchville on 5/2/2013)		65	
Waikanae	Placement of rip-rap	<2	98	68
	Truck crossing	<2	<2	11
	Thalweg cutting by bulldozer	<2	690	160

Source: GWRC 1998 data.

In summary, the available data indicate that:

- River crossings by truck generate relatively low suspended solids concentrations, from 2 to 10 mg/l above background; this would apply to all machinery (other than bulldozers) required to do river crossings
- River crossings by bulldozer can increase river suspended solids concentrations by 130 mg/l
- Channel shaping by bulldozer can increase suspended solids concentrations by nearly 700 mg/l
- Suspended solids and turbidity levels return close to ambient levels rapidly, typically within 1 hour of the activity ceasing
- A moderate fresh (with no river works) can increase river suspended solids by over 700 mg/l

5.3.2 Earthworks outside the river bed

Earthworks undertaken on the banks and berms also have the potential to generate stormwater runoff containing suspended sediment. These will be controlled by adoption of appropriate sediment and erosion control methods (in accordance with GWRC guidelines and the COP).

5.4 Construction of impermeable erosion protection structures

5.4.1 Groynes

As outlined in Table 11, this activity is expected to be undertaken very infrequently on an as-required basis over the life of the new consent.

Short term effects

Construction requires excavation and disturbance of the bed material and creates a localised temporary increase in suspended solids concentrations, possibly by as much as 100 mg/l[14] immediately downstream of the works area (see Section 5.3.1). (Cameron, 2015) notes that an increase in suspended solids of this order would cause a sharp reduction in water clarity and would be clearly visible from the bank. Monitoring in the Hutt River (see Section 5.3.1) has confirmed that turbidity and suspended solids concentrations return rapidly to near ambient levels once the in-stream activity ceases, usually within 1 hour, and (Cameron, 2015) considered that even during intense and sustained periods of in-stream channel works the aquatic biota throughout the reach

[14] See Table 16 – placement of rip-rap in the Waikanae River generated 98 mg/l suspended solids. This activity is assumed to be similar to groyne construction.

would have the benefit of normal or near normal water quality for at least half of each 24 hour period. It considered that these conclusions are also applicable to the Wainuiomata River[15].

Mechanical disturbance of the bed would disrupt the macroinvertebrate community within the immediate works area and may cause some mortality of smaller fish which seek shelter within the substrate, but these effects are likely to be relatively minor. Trout and other large fish are more likely to move away from the disturbance and so are less likely to be harmed.

Other potential short term effects of groyne construction such as inconvenience to recreational users of the river or river banks and noise intrusion in the neighbouring community are anticipated to be less than minor, and can be adequately avoided or mitigated through adoption of appropriate practice and timing of works. Similarly, the risks of accidental spills of fuels and other chemicals associated with the operation of machinery in the river bed can be adequately managed through the adherence to appropriate practice.

Long term effects

(Cameron, 2015) notes that rock groynes may increase the morphological complexity of the river particularly if they are constructed against what was previously an eroding bank. This often results in deep pools associated with the toe of the structure, and water sheltered from the current downstream of the structure. The combination of fast water, sheltered water, deep pools and large crevices amongst the boulders can potentially provide a variety of habitat for both native fish and trout. Cameron has concluded from monitoring work in the Hutt River to date that rock groynes have the potential to enhance some forms of fish habitat and that the effect of such structures on native fish and trout populations in Wellington's western rivers is likely to range from neutral to positive. However, given that the level of use of these structures in the Wainuiomata River is very low, Cameron considers the scale of any such effects are likely to be negligible in this river.

The purpose of rock groynes is to alter the river flow pattern to protect the river banks at that location from erosion. To ensure that erosion problems are not generated downstream of the new structures in the long term, GWRC undertakes comprehensive engineering design prior to construction.

The overall significance of these effects needs to be considered in the context of the total area in which they will occur and the likely frequency, both of which are expected to be small.

5.4.2 Rock lining

As outlined in Table 11, there is currently only one 15 m length of rock rip-rap lining within the application area, and this activity is expected to be undertaken very infrequently on an as-required basis over the life of the new consent.

Short term effects

Construction of a trench and placement of rock would include disturbance of bed materials and a localised increase in suspended solids concentrations. (Cameron, 2015) notes that short term effects on water quality and habitat quality are likely to be similar to those described for the construction of rock groynes in the previous section.

Similarly, mechanical disturbance of the bed will disrupt invertebrate habitat and may cause some mortality of smaller fish which seek shelter within the substrate. The extent of this disturbance would depend on the quantum of rip-rap to be constructed and the type of habitat which is being

[15] This is based on both catchments having the same River Environment Classification (REC, NIWA 2004): a cool-wet climate, a geology based on hard-sedimentary rock in hill country relief, with an indigenous forest upper catchment (Cameron, 2015).

replaced. The overall significance of this effect needs to be considered in the context of the total area in which it occurs, which is relatively small.

Other potential short term effects of groyne construction such as inconvenience to recreational users of the river or river banks and noise intrusion in the neighbouring community are anticipated to be less than minor, and can be adequately avoided or mitigated through adherence to appropriate practice.

Long term effects

(Cameron, 2015) notes that the longer term effects of rock rip-rap lining are likely to be site specific. Bank battering could destroy valuable fish habitat beneath undercut banks or overhanging vegetation, and placement of boulders against the bank may reduce the availability of deep water habitat for larger fish. However, in other instances, where deep water is maintained against the toe of the rock rip-rap lining, protruding boulders and those which have worked free might potentially provide feeding lies for trout and shelter for other fish species. Crevices between boulders may provide shelter for small and in some cases larger fish. The establishment of vegetation amongst the rock lining has the potential to provide overhanging cover, which may improve fish habitat, although GWRC staff have advised it may also generate potential terrestrial weed management issues.

(Cameron, 2015) considers that overall this method would appear to have a neutral to negative impact on aquatic ecology at any specific location, depending on the extent of undercut banks and/or the net loss of overhanging vegetation. He notes in this context that there is evidence that the use of such structures in the Hutt River does not necessarily result in a reduction of habitat quality for native fish or trout. No specific data is available for the Wainuiomata River, but the extent of such structures in this river is much less than in the Hutt River.

Rock lining does alter the visual appearance of the river channel, but this is an accepted aspect of the river management regime. It can be mitigated to a reasonable extent by the choice of appropriate rock material compatible with the existing river bed material, and by establishment of appropriate vegetation behind the rocklines.

Given the small amount of new rock lining which is likely to be undertaken over the life of the new consent, the overall significance of these effects is expected to be minor.

5.4.3 Other structures

Construction of other impermeable erosion protection structures including **gabion baskets**, **reno mattresses and driven rail and mesh gabion walls construction** include the same basic components and similar types of effects as outlined above for rock rip-rap linings. Some excavation or disturbance of riverbed material is required in preparation for construction, and the finished structure will generally result in some loss of channel complexity. This may include some loss of fish habitat, particularly if the structure is replacing an undercut bank or dense overhanging vegetation. However, in other instances erosion protection structures may enhance channel complexity and create new habitat for fish. Given the relative infrequency with which these works are undertaken in comparison to rock lining, the overall impact of these works in terms of the total affected area is considered to be much less than those associated with rock lining.

Construction of rock or concrete grade control structures would also include minor, localised riverbed disturbance, and in the longer term could have the potential to impede fish passage and present an obstacle to recreational users. This could be avoided or mitigated by making suitable provision for these matters in the design of the structure.

5.5 Construction of permeable erosion protection structures

This category of structure includes debris fences, debris arresters and timber groynes. As noted in Table 11 these structures are used relatively infrequently in the Wainuiomata River.

Short term effects

Construction would involve localised diversion of the river and disturbance of the river bed by mechanical shaping and preparation of the site. The initial diversion of the river flow away from the works area would result in the discharge of suspended sediment into the flowing river, causing elevated turbidity and suspended solids levels, probably in the upper end of the range as discussed in Section 5.3.1. However the diversion would typically be completed quickly, usually within a matter of hours, after which the works are undertaken mostly in the dry, with minimal effects on river water quality.

Mechanical disturbance of riverbed materials would disrupt invertebrate habitat and may cause some mortality of smaller fish which seek shelter within the substrate. The extent of this disturbance would depend on the size of the structure and the type of habitat that is affected. Based on the total amount of river bed that would be affected the overall potential impact would generally be expected to be relatively minor.

Long term effects

Over time these structures work to trap flood-borne debris, which can provide sheltered habitat for juvenile and larger fish. However, as periodic clearance of debris is required to maintain the structure and prevent the accumulation of large obstacles in the flood channel, this may counter this positive effect to an extent. (Cameron, 2015) notes that on balance these structures would appear to have a positive to neutral effect on aquatic habitat and fish.

Other potential adverse effects on recreational users and the amenity values of the river arising from these structures are considered to be less than minor.

5.6 Construction of works outside the river bed

The construction of cycle ways, walkways, fences, drainage channels and other minor works outside of the river bed (on berms and stop banks within the river corridor) are unlikely to have any direct effect on water quality or the aquatic ecology of the rivers, provided that appropriate control of stormwater runoff from any areas of earthworks is undertaken. This would include undertaking works in accord with the Erosion and Sediment Control Guidelines for the Wellington Region (Greater Wellington Regional Council, 2006) and the COP. All other short-term effects associated with this type of construction work are expected to be less than minor. In the long-term, these works contribute to the development of the river corridor, which will have overall positive benefits for the local and wider community.

5.7 Demolition and removal of existing structures

(Cameron, 2015) notes that the effects of demolition and removal of an existing structure on water quality and aquatic ecology will be site specific, depending on the type of structure and its location, and that the magnitude of these effects could be expected to fall within a range up to and including those described above for the construction of those structures. Generally structures are only removed if they have been damaged and/or have become redundant because of changes in the river channel. The removal of such structures may reduce the health and safety risk to river users, as well as reducing adverse visual impacts. Given the small number of structures in the Wainuiomata River, and the very infrequent need for removal, the overall impact of such work over the life of the consent is expected to be less than minor.

5.8 Maintenance of structures on the river bed

Any potential adverse effects associated with the repair, replacement, extension or alteration of existing structures on or in the river bed will depend on the type of structure, its location and the extent of the works required. The magnitude of these effects could be expected to fall within a range from less than minor, up to and including those described above for the construction of those structures. The principal routine maintenance work on structures in the Wainuiomata River is likely to be the regular cleaning of stormwater outlets through the main stopbanks, and the overall effects of this are expected to be less than minor.

5.9 Maintenance of works outside the river bed

Since these works occur outside the bed of the river there is little potential for them to have an adverse effect on the water quality or aquatic ecology of the rivers, provided that appropriate control of stormwater runoff from any areas of earthworks is undertaken.

Potential short-term adverse effects on recreational users and the neighbouring community of these activities are expected to be less than minor, and the long-term effect is to contribute to the development and maintenance of the river corridor, which will have overall positive benefits for the local and wider community.

5.10 Establishment of vegetative bank protection

5.10.1 Willow planting

Willow planting to be undertaken under the new consent is expected to be focused on the maintenance and renewal of existing willow stands, rather than any significant increase in the total areas or extent of willow plantings.

Short term effects

As willow planting works are undertaken in the dry, the effects of construction on water quality and aquatic habitat are expected to be negligible, as noted by (Cameron, 2015).

Other potential short term effects on any roosting birds, recreational users and the neighbouring community are also expected to be less than minor, and can be easily mitigated by the adoption of appropriate good practice (as outlined in the COP).

Long term effects

(Cameron, 2015) has reviewed recent literature and reports that planting and layering for edge protection can benefit the aquatic ecology of the river due to the creation of shade and shelter, control of water temperature and control of sediment and nutrient levels. He notes that on the other hand, it is also recognised that willow plantings and other bank protection methods may limit the natural tendency of the river to meander and could therefore restrict habitat diversity to some extent. The use of willows along river edges has also been found to reduce the natural biodiversity of the river ecosystem.

He concludes that willow management is complex and context dependent; however on balance the continued use of willows as front line river bank protection is likely to enhance some forms of fish habitat and the overall effect on native fish and trout populations is likely to be positive. Interplanting with natives in the river corridor offers further opportunity to mitigate the loss of biodiversity values.

5.11 Maintenance of vegetative works

As described in Table 13, maintenance of willow plantings include removal of old trees, replanting, or layering and tethering of existing trees. It also includes periodic trimming of willows to clear survey sight lines for channel maintenance or realignment work, and to maintain recreational access where appropriate. GWRC undertakes only a small amount (i.e. along sections of only a few metres) of this work per year, on average, in the Wainuiomata River.

Short term effects

The short term effects of maintenance work are expected to be negligible, however the removal of old trees may result in the immediate loss of fish habitat.

Long term effects

(Cameron, 2015) notes that willow layering for edge protection can benefit the aquatic ecology due to the creation of shade, cover and the supply of woody debris to the river. Willow trunks layered over the bank into the channel may provide many opportunities for cover for eels and other fish species.

On the other hand the removal of trees may result in the loss of good quality fish habitat. While re-planting would normally be undertaken following tree removal, there may be a delay of 10 to 15 years before the full benefits of riparian planting on aquatic ecology are realised. In practice however new willow lines are often established behind existing willows several years before front line willows are removed. This allows for newer willows to become established before removing old trees, thus reducing potential adverse effects.

Cameron also notes that a recent review by Wagenhoff & Young (2013) has identified risks to in-stream habitat from widespread willow removal, and on-going work by Dr Mike Joy of Massey University has also noted the potential negative effects of willow removal in small streams where the trees form a crucial habitat element.

It should be noted that widespread removal of willows is not contemplated in the Wainuiomata River under the new consent. Cameron concludes that the removal of one or two rows of a stand of willows, or of isolated unstable trees is unlikely have significant long term effects on river ecology.

In relation to other long term effects, maintenance and rejuvenation of willow plantings contributes to the overall stability of the river channel and enhancing and maintaining the visual amenity values of the river corridor.

5.12 Channel maintenance

5.12.1 Removal of vegetation

This activity covers the removal of excessive or unwanted willows or other tree species from the channel, so as to minimise potential for blockages during floods, or to prevent dislodged willows re-growing in the channel. Short and long term effects are as described for willow maintenance work (Section 5.11).

5.12.2 Removal of beach vegetation

(Cameron, 2015) notes that there is evidence that removing weeds from river beaches has considerable value for those birds which roost and breed on open river beds (i.e., Rebergen 2011 & 2012). However, as noted in Section 2.6 the Wainuiomata River does not currently support breeding populations of such birds.

Other potential adverse effects associated with the operation of machinery, such as the generation of noise and dust, or accidental spills of fuel or chemicals, can be managed by appropriate practice (as outlined further in the COP) and are expected to be less than minor.

5.12.3 Clearance of flood debris

Clearance of flood debris may involve operation of machinery on both gravel beaches and in the active channel. In the latter situation, there is likely to be localised short-term disturbance of the river bed and generation of elevated suspended sediments in the water column. The effects on water quality will depend on the machinery involved and the time spent in the channel. Overall, these effects are expected to be similar or less than those described for the maintenance of structures.

(Cameron, 2015) considers that overall, there is little doubt that flood debris can increase the range of water depth and velocities which in turn provide for a variety of habitat preferences for fish, although he notes that Jowett (1995) suggested that flood debris are not sufficiently abundant to influence fish distribution to any great extent. He concludes that a balanced approach, whereby flood debris is left in the river where it presents no immediate risk, would ensure that adverse effects on fish habitat are minimal.

5.13 Channel shaping and realignment

5.13.1 Beach ripping

(Cameron, 2015) considers that this activity unlikely to have any immediate downstream effects on water quality or aquatic habitat, since it is undertaken on the dry beaches rather than in the active channel. The effects are to loosen the beach gravels so that in the next flood, the bed material will be more readily mobilised, possibly causing additional siltation and gravel accumulation in the reach downstream. These processes already occur during floods and consequently river biota is well adapted to a dynamic, mobile bed environment. In this context the additional silt and gravel entrained from lengths of ripped beaches is unlikely to be important.

5.13.2 Beach recontouring

As noted in Table 13 this activity will be undertaken only very infrequently in the Wainuiomata River.

Short term effects

Beach recontouring work is undertaken in the dry bed away from the active channel, and consequently there is little risk of short term construction impacts on water quality or aquatic ecology.

Other potential adverse effects such as the generation of noise and dust, or accidental spills of fuel or chemicals, associated with the operation of machinery can be managed by appropriate practice (as outlined in the COP) and are expected to be less than minor.

Long term effects

(Cameron, 2015) considers the medium and long term effects of beach recontouring may be neutral to positive in terms of river bird habitat and probably neutral to marginally negative in respect of the aquatic ecology. The latter conclusion is based on the premise that the activity contributes to the straightening of the water course and thus may result in the loss of some channel complexity and potentially aquatic habitat. However, he concludes that this effect is likely to be negligible.

5.13.3 Channel diversion cut

Establishment of the diversion cut involves mechanical excavation of a new channel on the desired new alignment; generally this is through a beach area, away from the flowing channel. The excavated material may be placed between the side of the new channel and the flowing channel which is to be realigned or it may be removed to another location in the river bed.

The excavation cut is bunded at the upstream end and a flow restriction barrier placed at the downstream end while excavation work proceeds to minimise silt discharges. When the new channel is completed, the end bunds are removed to allow diversion of the active channel into the newly formed channel (this may either be done immediately by mechanical means or may be done naturally by the river over time). Some bed recontouring, to push excavated material across the old channel alignment (if it is not to be retained as a backwater habitat area) may also be required to achieve the finished profile.

As noted previously, channel diversion cuts would not be undertaken in the Wainuiomata River under normal circumstances, but might be used to remedy a major channel alignment distortin created by a flood event. Potential adverse effects of this activity during construction involve disturbance of dry river bed habitat (which has the potential to affect river birds) and disturbance or restriction of recreational use. Provided works are undertaken in accordance with the COP, these effects would be expected to be minor.

Once the diversion cut becomes operational, and water is diverted into the new channel, there is likely to be an initial release of suspended sediment to the river from the disturbed river gravels in the bed of the new channel. This may result in some deposition of sediment downstream. The effects of this would not be as significant as those associated with bed recontouring or gravel extraction, and are expected to be short-lived.

5.14 Bed recontouring

Short term effects

Bed recontouring involves working in the active channel and entails extensive disturbance of bed material and significant release of suspended sediment into the water column (see Section 5.3.1). The work is undertaken on an as-required basis (typically after flood events) to provide protection to small sections of actively eroding banks. The activity may not need to be undertaken every year, but when undertaken may involve working up to 300 m (approximately) of the river (either in one or a few locations) over a few days per year.

Previously it has been noted by Mitchell (1997), in a review of GWRC's Flood Protection practices in Wairarapa Rivers, that:

"*Channel realignment tends to resemble the impact of a flood and a resulting course change. Aquatic life in larger channels is dominated by insects adapted to such unstable conditions. The major biological impact will be the amount of loss of riffle sections, simply because riffles are the major sites of invertebrate production in rivers….Obviously realignment works that involved the loss of large areas of riffles could impact local fish production."*

(Cameron, 2015) notes there is, however, strong evidence that macroinvertebrate re-colonisation of shallow riffle areas disturbed by channel realignment is rapid and that any impacts are likely to be short lived. This conclusion is supported by work undertaken by GWRC in relation to macroinvertebrate re-colonisation in the Hutt River and reported in Perrie (2009) and (2013), and by Massey University in relation to macroinvertebrate re-colonisation on northern Wairarapa Rivers, reported in Death *et al* (2013). GWRC has used the results of this work to inform development of the COP and EMP.

Other potential adverse effects associated with the operation of machinery, such as the generation of noise and dust, or accidental spills of fuel or chemicals, can be managed by adherence to appropriate practice and are expected to be less than minor.

Long term effects

(Cameron, 2015) considers that bed recontouring, where it is used to straighten the channel, is likely to result in loss of channel complexity and a consequent overall reduction in aquatic habitat diversity. Mitchell (1997) observed that major channel alignment involves the direct loss of habitat and offers few direct ecological benefits apart from greater channel stability. Mitchell concluded that channel realignment was the flood protection practice most likely to have significant impacts on the environment (but noted that, overall, the river management approaches used on Wairarapa Rivers should result in an enhancement of biological activity).

Perrie (2009) observed that channel realignment on the Waingawa River resulted in significant straightening of the river channel in the study reach and had a clear impact on the diversity of habitat types. In particular deep runs were reduced in overall extent and pools were completely removed, while the proportion of shallow run and riffle habitats increased. Perrie considered this to be a net reduction in the overall diversity of habitat in this reach because of the relative scarcity of deep water habitat and because of the higher complexity of that habitat type relative to shallow water habitats.

In summary, (Cameron, 2015) concludes that generally the medium to long term effects on the aquatic ecology of bed recontouring, where it is used to straighten the channel, are mostly negative, and the significance of those effects for the river ecology at the reach scale will depend on the quantum of bed recontouring undertaken over time. He notes, however, that it is possible that this activity could be undertaken at a rate that balances the destabilising effects of floods, without on-going loss of habitat complexity, provided measures are in place to ensure the number of pools and riffles within a specified reach are not reduced below an agreed optimum level.

The scale of bed recontouring in the Wainuiomata River is expected to be significantly less than in the Hutt, Waikanae and Otaki Rivers and thus the effects are also expected to be less in scale than in these rivers. There is also an opportunity to mitigate any adverse effects in the Wainuiomata River by applying the principles developed for the Hutt River gravel extraction programme, whereby the works are designed to form a well-defined low flow channel with a 'natural' slope to the beach and well-formed pools and riffles, which provide good quality habitat for invertebrates and fish. The addition of other design elements, such as the maintenance or creation of backwaters as part of these works, could also be considered to assist in the retention of habitat diversity.

5.14.1 Gravel extraction

As noted in Table 13, GWRC seeks the ability to extract approximately 1,500 m^3 of gravel per annum from the beaches in the river corridor, mostly downstream of Black Stream, if required for management of the river channel.

Short term effects

(Cameron, 2015) concludes that gravel extraction from the dry is likely to have minimal effects on water quality in Wellington rivers, although in those cases where trucks are required to cross the river there is potential for minor discharge of suspended sediment and disturbance of bed material. The latter can be managed by requiring vehicles to use designated crossing points.

Other potential adverse effects associated with the operation of machinery, such as the generation of noise and dust, or accidental spills of fuel or chemicals, can be managed by adherence to appropriate practice (as outlined in the COP) and are expected to be less than minor.

Long term effects

The potential for accumulation of fine sediment on the river bank arising from dry extraction has been noted by Death et al (2011) in the Pohangina River, but (Cameron, 2015) concludes that this is unlikely to occur in the Wainuiomata River, due to the different nature of the catchment geology. Mobilisation of fine sediment poses little risk to the Wainuiomata Estuary, located 16 km downstream of the application area.

Other long term effects of gravel extraction (including potential effects on birds) are expected to be minimal.

5.15 Water quality

Adverse effects on water quality can be generated by the deliberate movement of river bed material associated with activities such as the construction of structures, bed recontouring and gravel extraction. The release of suspended sediment into the water lasts for as long as the activities are occurring, and typically gravel extraction is likely to have the greatest effect in this regard. Investigations have found that at their most extreme the levels of suspended sediments generated are similar to those that occur naturally during floods. Typically the effects on water quality are short lived, with the river rapidly returning to ambient turbidity levels upon the cessation of the disturbance. These effects can be avoided as far as is practicable by the adoption of good practice as outlined in the COP, which involves design and planning of works prior to any on the ground activity, to ensure works are undertaken in the most effective and efficient manner.

Operation of machinery in the bed of the river has the potential for adverse effects on water quality arising from accidental fuel or oil spills. This can be avoided by the adoption of good practice that prohibits all re-fuelling and any other maintenance work involving oils, hydraulic fluid etc. from occurring on the river bed.

Finally, there is potential for earthworks undertaken on the banks and river berms to generate suspended sediments in stormwater runoff from such areas. This could affect water quality in the rivers. Such effects can be avoided by the adoption of good practice, such as adherence to GWRC's erosion and sediment control guidelines (Greater Wellington Regional Council, 2006) to ensure stormwater discharges from earthwork areas are appropriately managed.

5.16 Aquatic ecology

The ecological effects of each flood protection activity will be site specific, depending on interactions between river channel morphology and the composition and distribution of riparian and aquatic communities in the affected reach. Some practices such as the establishment of vegetative buffer zones, willow planting and layering, and construction of rock groynes, will have mostly positive effects on river ecology, while other activities such as channel realignment by bed recontouring will have mostly negative effects (at least in the short term). Vegetative bank protection is by far the most widespread activity in the Wainuiomata River, and its effect on riverine ecology is likely to be mostly positive. Other activities with higher potential for adverse effects are undertaken on a relatively smaller proportion of the river.

The EMP proposes baseline environmental monitoring of a number of ecological variables to build a database of information that will be applicable to the Wainuiomata and other rivers, and can be used to assess the effects of flood protection activities over time. Included are: riparian vegetation, native fish & trout surveys, inanga spawning habitat, pool and riffle counts, substrate size & cover, river bank undercutting & overhanging vegetation & NCI parameters. Event monitoring for works that involve significant disturbance of the river bed in the flowing channel, such as wet gravel extraction and bed recontouring, is also proposed. This would involve before and after monitoring of water quality, habitat quality, biological monitoring and NCI.

The methodology to be used in this monitoring work is still under development. This includes the identification of thresholds and 'triggers' which if exceeded, would result in further detailed investigation or a review of the flood protection activity being monitored. The findings of such a review would determine if any changes to the COP were required.

5.17 Birds

As noted above, adverse effects on river birds are likely to be relatively minor, largely due to the absence of threatened or vulnerable species in the Wainuiomata River. Monitoring surveys as proposed in the EMP will ensure that if any future change in bird populations occurs, this can be identified and appropriate mitigation developed.

5.18 Landscape and visual

The overall adverse effects of GWRC's flood protection activities on the visual amenity and landscape values of the Wainuiomata River are expected to be less than minor. Specific avoidance and mitigation can include adherence to good practice, such as:

- ensuring the use of construction materials that are compatible with the natural geology of the river environment, and
- avoidance of storage of materials or machinery in the river bed.

The effects of GWRC's management of existing willow plantings, mowing of river berms and other works undertaken outside the river bed, together with the removal of debris and vegetation from the river bed all contribute in a positive way to the visual appeal of the river corridor.

5.19 Recreation

Any adverse effects of GWRC's flood protection activities are most likely to be relatively minor, involving restriction of access to sections of the river or river berms. These could be avoided as far as is practicable by restrictions on the most disruptive activities (such as wet gravel extraction or bed recontouring) at times of peak recreational use at those locations. These provisions have been included in the COP.

5.20 Neighbouring community

Based on past experience, the overall adverse effects on the neighbouring community are anticipated to be less than minor overall.

Any effects are most likely to be associated with noise, and are most likely to occur in areas where residences are closest to the river corridor.

The potential for such effects can be adequately avoided by such things as:

- restriction of activities to reasonable working hours
- management of traffic movements
- good communication with affected residents

Ensuring that a readily accessible system for making complaints exists, so that any complaints can be conveyed to the appropriate staff and addressed promptly.

These provisions have been included in the COP.

5.21 Cultural

Reports on cultural values relevant to the application area, and an assessment of impacts of flood protection works on cultural values have been prepared for GWRC by Raukawa Consultants (on behalf of Port Nicholson Block Settlement Trust & Wellington Tenths Trust – PNBST/TT) and Te Runanga o Toa Rangatira Inc. These reports are included in Appendix J; note that the report by Raukawa Consultants is still in draft. Key points made in each report are summarised briefly below.

5.21.1 PNBST/TT

The Wainuiomata River was of significance to iwi Maori from the earliest times, with interest focussed mainly on the resources of the river mouth. Canoes travelled up the river from the coast and the application area would have been used for mahinga kai. Environmental changes, both natural (due to the 1855 earthquake and uplift of the area) and human induced, have significantly diminished the indigenous fish population of the river.

There are no known sites of special significance to the tangata whenua in the application area, although this reach would have been used for fishing.

Careful management is essential to minimise impacts and to ensure that works are not timed during critical periods around native fish migration upstream and downstream, and water quality and fish passage are maintained. Planting work adjacent to the river can benefit invertebrate production, providing food sources for eels and is therefore desirable.

Finally, the role of Te Atiawa/Taranaki Whanui as kaitiaki of the river should be included as part of the monitoring of the overall Wellington River systems. As kaitiaki, tangata whenua should have an active role in both the formulation of river management plans as well as with general river management.

5.21.2 Ngati Toa

Ngati Toa's relationship with the Hutt and Wainuiomata Rivers dates to the Amiowhenua expedition of 1819 and Te Rauparaha's initial invasion of the Hutt Valley. Later the catchments of both rivers became important resources for the iwi following their permanent migration and settlement in the Cook Strait region in the 1820's. Both rivers were valued for a diverse and plentiful supply of kaiawa (freshwater food), including the now scarce piharau (blind eel), as well a source of fresh water, and traditional medicines and materials for use in the arts and economy.

The application area was not favoured for Ngati Toa settlement and the iwi is not aware of any significant sites within it. Ngati Toa is principally concerned with one site of significance, namely Te Whanganui-a-Tara/Wellington Harbour, downstream of the application area. (GWRC notes that this area is unlikely to be affected by the proposed activities, due to the significant distance of the application area from the coast).

The role of kaitiaki with respect to customary rohe and the promotion of sustainable management is one that Ngati Toa considers to be of the utmost importance. Of paramount concern is to ensure that mauri (life force) of streams and rivers is protected and enhanced. This happens when environmental health and natural balances are sustained. When environmental degradation and destruction occurs in any form, mauri is weakened or extinguished. In the latter case, active efforts to restore mauri are essential.

Te Runanga employ a number of cultural indicators to assess mauri of rivers and streams and to inform assessment of effects to mauri of human activities. These include:

- Life supporting capacity and ecosystem health
- Clarity and quality of water

- Natural flow and processes
- Abundance and diversity of endemic species
- Productive capacity
- Suitability and accessibility for cultural use
- Status and accessibility of sites of cultural significance
- Existing and potential riparian vegetation
- Ratio of native plants to exotic plants
- Catchment land use

From consideration of these factors, Ngati Toa believes that the mauri of the Wainuiomata River, in respect of the area encompassed by the application, to be in a state of degradation, such that remedial and restorative efforts are needed. Further, the iwi is also of the view that activities such as those proposed in this application have the potential to affect water quality and ecosystem health, and thus to diminish mauri.

It is acknowledged that GWRC have initiated efforts to mitigate adverse effects, and these will be instrumental in minimising negative impacts to mauri. Key issues of concern are as follows:

- Future management of precious freshwater resources must seek to achieve more than merely maintaining the existing and often compromised standards of ecological health in rivers and streams. Enhancement of waterways should be a primary objective.
- A heavy reliance is placed on river flow to disperse sediments generated during heavy works in the river bed. The effects of sedimentation (including input to Te Whanganui-a-Tara/Wellington Harbour) are of concern.
- The proposal to include flood protection activities not previously undertaken in the catchment is perceived by Ngati Toa as a 'major shift in management approaches to flood protection at the river'.
- The general depletion of fish stocks as a result of pressures placed on the river area subject to the application. This includes fish mortality and temporary or permanent loss of habitat arising from flood protection activities. Active steps must be taken to mitigate or remedy this. A programme to monitor fish abundance and diversity should be included in the monitoring plan, and an optimum level of pools and riffles maintained.
- Any structures constructed across the waterway must provide for fish passage (it is noted that the sewer crossing at Silverstream currently obstructs the upstream passage of inanga and smelt). Mechanical disturbance of the river bed and use of any vehicles in the river should be prohibited during the primary fish passage season from 1 September to 9 November.
- The use of vegetative protection is preferred by Ngati Toa, however the use of willows is of significant concern, and the iwi believes that there is a need to develop a more diverse approach to management of vegetation protection and the use of native species. This includes the need for more robust trials of the use of native species as an alternative or integrated bank protection method. Native revegetation in the river corridor should also be undertaken.
- Although some families continue to fish in parts of the river, the application area as a whole cannot be considered to function as a viable mahinga kai. Other resources traditionally harvested in this area are similarly depleted due to major loss of habitat and ecosystem support. Mitigation of these effects can only be achieved through restoration of native plants and trees on the river edge, enhancement of taonga species ecosystem support and re-establishment of sustainable species populations.

- Te Runanga disagrees with Cameron's assessment of the severity of environmental effects, and considers the scope of the assessment should have been wider, to include consideration of the effects of past activities on the river's state.
- A lack of ability to participate in management of the river at a high level has contributed to the severity of cultural impacts of flood protection activities. Ngati Toa seeks a joint management arrangement between the Regional Council and Mana Whenua to better reflect the customary interests of tangata whenua.

5.21.3 GWRC response

Progress on development of the COP has been significant since the two iwi reports were prepared. Many of the measures to avoid or mitigate adverse effects of the environment, and particularly those affecting fish and aquatic habitat, which GWRC has now included in the COP, will also achieve positive outcomes in terms of one or more cultural values. However, GWRC also acknowledges that there are some cultural and spiritual values and goals that are more problematic to make provision for within the current river management paradigm.

As explained further in Section 0, GWRC is continuing to work with iwi to ensure that knowledge is shared and understanding of cultural issues of importance and appropriate responses to them continue to be developed, and are incorporated into the Code and EMP. This is an iterative process that will be on-going.

5.22 Urgent works

Works undertaken under urgency in response to the mitigation of immediate risks to the safety of people, property or the community's existing investment in flood protection works may include any one or more of the activities and their associated effects described above; however, the urgent nature of the works may require them to be undertaken in a manner outside the usual methodologies and practices described in this application. The COP will include a protocol for undertaking urgent works.

Follow up work or additional works to effect a more permanent solution may be required following urgent works. The timing of any such follow-up work would be determined by the perceived level of on-going flood risk and operational constraints.

5.23 Cumulative effects

Within the application area there are five other granted resource consents of relevance:

- one held by GWRC for construction and maintenance of rock rip-rap in the bed of the Wainuiomata River to protect the abutments of the Reservoir Rd truss bridge
- three held by HCC: one for construction and operation of a stormwater overflow diversion from a stream on Hair St to the Wainuiomata River, one for construction and use of the sewer line beneath the bed of the Wainuiomata River downstream of the Main Rd bridge , and one for a grade control structure across the river bed immediately downstream of the Main Rd bridge
- one held by a private landowner for erosion protection works on the right bank opposite Faulke Avenue

Relevant consents for works upstream of the application area include:

- four held by GWRC for erosion protection and other works associated with the Wainuiomata Water Treatment Plant
- one held by a private landowner for placement of erosion protection in Black Stream

- one held by HCC for stormwater discharges from disturbance of the land associated with widening of Black Stream and two drains

Downstream of the application area there are the following existing consents:

- two held by private landowners to place rip-rap and undertake gravel extraction in the Wainuiomata River bed
- three consents held by eight landowners (further downstream than those noted above) to place rock riprap and concrete blocks and undertake associated diversion of water, disturbance and reclamation of the bed
- five held by HCC: one for channel re-shaping works associated with development of the golf course; one for placement of rip-rap and bed recontouring associated with the Wainuiomata Landfill; one discharge consent for stormwater associated with works near the Wastewater Treatment Plant, and one for river realignment and construction of debris fences immediately downstream of the Wastewater Treatment Plant and one for discharge of treated sewage from the Wastewater Treatment Plant to the river in extreme wet weather events. (Note this last consent has expired but has been afforded continuance under RMA provisions while an application that has been made to replace it is considered).
- other consents for gravel extraction behind a dam in Scholes Creek, and two consents for placement of rip-rap and construction of rock groynes in Catchpool Stream (both these tributaries lie downstream of the application area)

The cumulative effects of the proposed works on the existing works are expected to be less than minor, principally because the limited overall scale of the works, and the distance between GWRC's works and the majority of the other in stream works.

Consultation

5.24 Iwi

Meetings were held in late 2012 with the Teri Puketapu, from Te Runanganui o Taranaki Whanui ki te Upoko o te Ika a Maui, and Liz Mellish from Port Nicolson Block Settlement Trust.

An outcome of these meetings was the commissioning by GWRC of the Cultural Values report for the Hutt and Wainuiomata Rivers, which is discussed in Section 5.21.1. This report (still in draft) was prepared by Raukura Consultants for the Port Nicolson Block Settlement Trust and the Wellington Tenths Trust and is included in Appendix J.

GWRC also met with the representatives of Te Runanga o Toa Rangatira Inc. and subsequently corresponded further with them via email. They have subsequently provided a Cultural Impact Assessment, which relates to both the Hutt and Wainuiomata Rivers. This is discussed in Section 5.21.2 and included in Appendix J.

5.25 Science Group

As outlined in Section **Error! Reference source not found.**, one of the key consultation components has been the establishment by GWRC of a 'Science Group' to provide advice to assist the consent application process and in particular the environmental monitoring that has been undertaken as part of preparing this application and the wider consenting process. This group has met routinely since June 2012, and their involvement is anticipated to continue throughout the processing of this application and beyond. The group includes a cross section of scientists from within GWRC and external parties including Fish & Game NZ, DOC and Massey University, together with a consultant river management engineer.

The group has been instrumental in guiding the design of environmental monitoring in the Wainuiomata River and rivers in the Wellington Region. This has included recognition of the potential value of the Natural Character Index that is under development in the New Zealand context by researchers from Massey University (namely Amanda Death, Dr Russell Death and Dr Ian Fuller). The Group's input has also contributed significantly to development of the COP.

The Science Group meeting in March 2013 discussed the draft Hutt River application (which was subsequently lodged in early April) specifically, including the proposed approach, conditions and the new COP.

Subsequent to this, the Science Group has given further consideration to the specific matters and effects arising from the proposed works in the Hutt River as part of the ongoing drafting of the COP. This is an iterative process which is on-going and is extremely valuable to the project. It should be noted that the statements in this report do not necessarily reflect the opinions of individual members of the Science Group.

6 Mitigation & monitoring

A discussion of mitigation needs to be undertaken in the context of the assessment of the significance of overall effects and the absolute need for flood protection to occur. It is important that any constraints imposed on flood protection activities do not negate the positive benefits to the community of the flood protection system or impose unrealistic costs on the community.

Existing mitigation

Mitigation that GWRC currently undertakes in conjunction with management of rivers in the Wellington Region includes:

- Funding of the annual drift dive surveys in the Hutt and Waikanae Rivers undertaken by Fish & Game NZ. This has been undertaken since 1999, and has built up a valuable database of fish numbers and trends since that time. This provides a basis for assessment of environmental effects in these rivers which can also be useful for assessment in other Wellington Rivers (such as the Wainuiomata River) where less information is available.
- Native plantings in the river corridors (principally the Hutt, Waikanae and Otaki Rivers)
- Assistance to community groups and funding of the Hutt River ranger.

GWRC intends to continue all of this mitigation in relation to its wider river management programme.

6.1 Proposed additional mitigation

The proposed update of the COP will include additional measures of mitigation, including where appropriate, those raised by (Cameron, 2015) and (TRC Tourism, 2013). Examples may include provision of fish refuges in rip-rap and off-setting.

The proposed Environmental Monitoring Plan and its five-yearly iterations (see Section 7) will also provide mitigation. Over time it is expected that the COP will be amended and updated and the specifics of the Monitoring Plan will change; this approach will ensure that the mitigation undertaken to address adverse effects remains relevant and up to date on an on-going basis.

6.2 Monitoring

It is explained in Section 1 that GWRC is undertaking environmental monitoring to support the wider rivers consent project. Much of this monitoring is proposed to be focused on the Hutt, Waikanae and Otaki Rivers since the scale of works and therefore effects are expected to be larger in these rivers than in the Wainuiomata River. It is expected, however, that the results of the monitoring work in these rivers will produce information of relevance that be applied generally to the assessment of effects of works in the Wainuiomata River. The working draft of the Environmental Code of Practice and Monitoring Plan is included in Annex 1.

7 Proposed conditions of consent

A proposed set of conditions of consent are appended to this application which seek to manage the potential adverse effects on the environment (Appendix K). River management activities have the potential for short term adverse effects, and cumulative effects as the river changes over time. The proposed conditions enable site specific management procedures for significant activities or activities in identified sensitive locations and seasons, and comprehensive monitoring and reporting methods to identify changes in the river system if it occurs.

Additionally, GWRC does not intend that any conditions of consent will impose quantum limits, as it needs to be able to undertake its operation and maintenance activities using its 'toolbox' as required, guided as necessary by limits established in the COP via the consideration of the outcomes of the environmental monitoring, rather than through the imposition of arbitrary limits.

The proposed conditions require that all river management works and maintenance activities are undertaken in accordance with good practice guidelines in the COP, which incorporate the extensive technical learnings on river management practices.

8 Statutory assessment

8.1 RMA Assessment

Section 104 of the RMA sets out the matters to which a consent authority must have regard to, subject to Part 2 of the RMA, when considering an application for resource consent. These are:

- Any actual and potential effects on the environment of allowing the activity (refer to Section 5 above)
- Any relevant provisions of:
  - A national environmental standard
  - Other regulations
  - A national policy statement
  - A New Zealand coastal policy statement
  - A regional policy statement or proposed regional policy statement
  - A plan or proposed plan; and
- Any other matter the consent authority considers relevant and reasonably necessary to determine the application.

8.1.1 Part 2 of the RMA

Part 2 of the RMA sets out the purpose and principles of the Act. The purpose of the RMA is to promote the sustainable management of natural and physical resources.

The operations and maintenance activities undertaken by GWRC on the Wainuiomata River are imperative to protecting the social and economic wellbeing and health and safety of the people and assets of the surrounding area.

The COP approach, along with any necessary ongoing monitoring and the ability to review the Code where desirable, will ensure that the life-supporting capacity of the rivers and their ecosystems are safeguarded and adverse effects are avoided, remedied or mitigated.

Additionally the works are proposed to be undertaken in a manner that preserves the natural character of the waterways and their margins in the long term and maintains public access to and along the waterways. Amenity values will also be maintained and enhanced, and the habitat of trout will also be protected over time.

GWRC seeks to ensure that the relationship of Maori and their culture and traditions with the river are provided for.

In summary, the rivers will be managed in a way which enables people and communities to provide for their social, economic and cultural wellbeing and their health and safety, while ensuring that the life-supporting capacity of the rivers themselves are safeguarded and adverse effects upon them avoided and mitigated. The proposed works are therefore in keeping with the purpose of the Act.

8.1.2 National Environmental Standards

There are currently five national environmental standards in effect as regulations under the RMA, for:

- Air quality
- Sources of human drinking water
- Telecommunications facilities

- Electricity transmission
- Assessing and managing contaminants in soil to protect human health.

None of the provisions of these standards are relevant to this application.

8.1.3 National Policy Statements

Currently there are four national policy statements in force under the RMA:

- the New Zealand Coastal Policy Statement 2010
- the National Policy Statement on Electricity Transmission 2008
- the National Policy Statement for Renewable Electricity Generation 2011
- the National Policy Statement for Freshwater Management 2014.

Of these, the National Policy Statement on Freshwater Management is of potential relevance to this application.

National Policy Statement for Freshwater Management 2014

This national policy statement sets out objectives and policies that direct local government to manage water in an integrated and sustainable way, while providing for economic growth within set water quantity and quality limits. Setting enforceable quality and quantity limits is a key purpose of the policy statement. The NPS states that overall freshwater quality within a region must be maintained or improved, with timeframes for improvement (where freshwater 'management units' are below national bottom lines) to be determined by iwi and communities.

The objectives and policies relating to water quality (Objectives A1 – A2, Policies A1 –A4), integrated management (Objective C1, Policies C1 – C2), a 'national objectives framework' (Objective CA1, Policies CA1 – CA4) and tangata whenua roles and interests (Objective D1, Policy D1) have relevance to this application.

The policies relating to water quality consist of directives to regional councils to make or change regional plans to establish freshwater objectives in accordance with the national objectives framework policies (CA1 – CA4) of the NPS, and to set freshwater quality limits and targets for improvement (where required) for all 'freshwater management units' in their regions. Policy A3 (b) directs regional councils to make rules requiring the adoption of the best practicable option to prevent or minimise any actual or likely adverse effect of any discharge of a contaminant into fresh water. Policy A4 requires regional councils to make immediate changes to apply the following policies until any changes are made via the Schedule 1 RMA process:

"1. When considering any application for a discharge the consent authority must have regard to the following matters:

a. the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and

b. the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.

2. When considering any application for a discharge the consent authority must have regard to the following matters:

a. the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their secondary contact with fresh water; and

b. the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their secondary contact with fresh water resulting from the discharge would be avoided.

The discharges of natural silts and sediments arising from disturbance of the river bed in association with flood protection operations and maintenance works are the only discharges for which consent is sought in this application. This is not a 'new' discharge in the sense that this application is for a continuation of the same works that are already undertaken on these waterways. In any event, the assessment of effects in this report illustrates the manner in which the works will be undertaken to avoid adverse effects on the life-supporting capacity of the waterways reflects current good practice.

Policy C1 requires every regional council to manage freshwater and land use and development in an integrated and sustainable way so as to avoid, remedy or mitigate adverse effects, including cumulative effects. In relation to this application, the potential for cumulative effects of the proposed activities to have more than minor overall environmental effect has been assessed as being unlikely.

Policy CA1 requires councils to assign all freshwater bodies in their regions into identifiable 'freshwater management units', and Policy CA2 requires the development of objectives for these management units, taking into account the values for each. Appendix 1 of the NPS includes compulsory and additional national values to be considered in this process, and Appendix 2 includes attribute tables for the compulsory values that need to be determined for each freshwater body, including environmental 'bottom line' criteria.

With reference to the current application, it is relevant to note that the new COP has been developed with this approach in mind, i.e. utilising knowledge of the values pertaining to specific rivers and parts of rivers to assist in the determination of the most appropriate practices and river management methods for those areas.

Policy D1 requires local authorities to take reasonable steps to involve iwi and hapu in the management of freshwater and freshwater ecosystems in the region, work with them to identify tangata whenua values and interests and to reflect those in management and decision-making regarding freshwater and freshwater ecosystems.

As explained in Sections 5.21 and 0, GWRC has been actively engaging with iwi to give effect to these policies.

8.1.4 Regulations

The following regulations are of relevance to the application:

Freshwater Fisheries Regulations 1983

Clause 70 of these regulations states:

> *"(1) No person shall in any water intentionally kill or destroy indigenous fish.*
> *(2) No person, having taken indigenous fish from any water, shall leave the fish upon the bank or shore of any stream or lake, except where such indigenous fish is used in accordance with any provisions of a District Anglers Notice relating to lures".*

The proposed works are in accordance with these requirements. No indigenous fish are or will be killed intentionally as the result of any of GWRC's works and maintenance activities, although there may be some inadvertent mortality of small fish or larvae living in the crevices of the river bed as a result of river bed disturbance associated with construction works or bed re-contouring. Overall, the significance of this effect is expected to be less than minor due to the limited extent of any such effects. No large fish are expected to be affected as they are generally able to swim away from the affected areas.

8.1.5 Regional Policy Statement

The second generation RPS became operative on 24 April 2013. The proposed works are in keeping with this RPS. The relevant objectives and policies that GWRC is required to have regard to in the consideration of this application are identified in Appendix L.

An analysis of the proposal against the relevant objectives and policies is outlined below.

Fresh water

Objectives 8 and 13 and Policies 43, 53 and 64.

Although the Wainuiomata River is a modified waterway, evidence shows that it supports a relatively healthy aquatic ecosystem that includes a diverse range of native fish, as well as a significant brown trout fishery. The proposal provides for the protection and possible enhancement of these values through the adoption of good practice at all times.

Indigenous ecosystems

Objective 16 and Policies 47 and 64.

The approach proposed by GWRC is that the ecosystems and habitats within the application area will be maintained and in some cases enhanced. No habitats with significant biodiversity values that may potentially be adversely affected by the proposed works have been identified within the application area.

Natural hazards

Objectives 19 and 20, and Policies 51 and 52.

The proposed works and activities have an overall key objective of addressing the risks and consequences of the effects of the flood hazard within the urban Wainuiomata area. They thus give effect to these objectives and policies. Adoption of good engineering and environmental practice, together with on-going monitoring will provide certainty that proposed works and activities are appropriate and will not increase hazard risks.

Tangata whenua

Objectives 23 to 28 and Policies 48, 49 and 66.

GWRC recognises the kaitiaki roles of iwi in relation to the Wainuiomata River and seeks an outcome that is agreeable to them which is in keeping with these objectives and policies. Initial engagement with tangata whenua is underway and will continue through the period of processing and consideration of the consent and the on-going development of the COP. Engagement will then continue through the life of the consent as the COP and monitoring are kept up to date.

8.1.6 Regional Freshwater Plan

The proposal is in accordance with the requirements of the Regional Freshwater Plan for the Wellington Region (RFP). The relevant objectives and policies that GWRC is required to have regard to in consideration of this application are identified in Appendix L.

An analysis of the proposal against the relevant objectives and policies is provided below.

For ease of reference, the following list identifies which appendices of the RFP include (or do not include) the water bodies which are the subject of this application.

RFP Appendix	Appendix Title	Are the water bodies the subject of this application included in the Appendix?	Relevant RFP policies
Appendix 2	Wetlands, lakes and rivers and their margins, with a high degree of natural character	No – only areas upstream of the former Morton Dam site and within the Catchpool Stream catchment are included.	
Appendix 3	Water bodies with nationally threatened indigenous fish recorded in the catchment (Part A) and nationally threatened indigenous aquatic plants (Part B)	Part A – no Part B – yes. The pygmy clubrush *Isolepsis basilaris* has been recorded in coastal locations in the Wainuiomata catchment, but not within the application area.	4.2.13
Appendix 4	Water bodies with important trout habitat (including spawning areas) – water quality to be managed for fishery and fish spawning purposes	Yes – The section of the Wainuiomata River between the lower dam and the golf course (which includes the whole application area) is included.	4.2.14, 5.2.3
Appendix 5	Water bodies with regionally important amenity and recreational values – water	Yes - the section of the Wainuiomata River downstream of the Coast Road (Main Rd) bridge is identified in Appendix 5, specifically for 'angling'.	4.2.15, 5.2.4 5.2.10

	quality to be managed for contact recreation purposes		
Appendix 6	Water bodies with water quality to be managed for water supply purposes	No- Appendix 6 includes the Wainuiomata River above the Morton Dam site only.	
Appendix 7	Water bodies with water quality identified as needing enhancement	Yes – the section of the Wainuiomata River from the coast upstream to Black Stream confluence, and Black Stream to the northern end of the urban area are included as needing enhancement for aquatic ecosystems purposes[16].	5.2.9

The relationship of tangata whenua with fresh water

(Objectives 4.1.1 – 4.1.3 and Policies 4.2.1 – 4.2.8)

GWRC seeks an outcome that is agreeable to iwi and is in keeping with these objectives and policies. It seeks to ensure that the relationship of tangata whenua with the Wainuiomata River is recognised and provided for. Consultation with tangata whenua is underway and will continue through the period of processing and consideration of the consent and the development of the COP.

Natural values

(Objectives 4.1.4 – 4.1.6 and Policies 4.2.9 – 4.2.14)

The application area is not included in Appendix 2 of the RFP, being those waterbodies that have a high degree of natural character.

One threatened plant, *Isolepsis basilaris,* found in coastal locations near the Wainuiomata River mouth, is included in Part B of Appendix 3 of the RFP. This plant has not been recorded within the application area.

The proposed works are not expected to have any adverse effect on this threatened (or any other) plants.

The whole of the application area lies within the reach identified in Appendix 4 of the RFP as a water body with important trout habitat. GWRC's methods of operation, the monitoring undertaken to date and their commitment to ongoing monitoring that might be necessary to further understand and avoid or mitigate any effect of its activities on trout reflect its commitment to avoiding, remedying and mitigating any adverse effects on important trout habitat.

The practices proposed by GWRC are to be undertaken in a manner that preserves the natural character of the Wainuiomata River and its margins as far as practicable. Similarly the approach seeks to safeguard the life-supporting capacity of the river and its ecosystems over the long term.

Amenity value and access

(Objectives 4.1.7 – 4.1.8 and Policies 4.2.15 – 4.2.17)

The Wainuiomata River downstream of the Main Rd bridge is identified in Appendix 5 of the RFP as having regionally important amenity and recreational values for angling. (This applies to the part of the application area downstream of the Main Rd bridge).

[16]The RFP attributes this need in response to 'consistently poor water quality according to the regional council's water quality monitoring programmes'. This was in response to effects arising from sewage discharges, which have long since been removed. As such, it is unlikely that this particular classification is still relevant, according to advice received from GWRC Environmental Science staff.

GWRC's operations will be undertaken in a manner to avoid adverse effects on recreation, amenity and access. GWRC has historically avoided working in periods of peak recreational use and times works so that adverse effects on amenity and recreational use are minimised.

Public access is only restricted by GWRC within defined areas for the duration of particular works where necessary for public health and safety reasons.

Flood Mitigation

(Objectives 4.1.9 – 4.1.10 and Policies 4.2.18 – 4.2.22)

The operations and maintenance works that GWRC undertakes and seeks to continue undertaking are essential to meeting the outcomes sought by these objectives and policies.

The activities proposed to be consented by this proposal are undertaken to contain the risk of flooding to human life, health and property to an acceptable level, in accordance with the flood hazard assessment work done to date by GWRC.

In addition to the objectives and policies, the methods (other than rules) described in Section 8.3 of the RFP require that GWRC maintains and enhances flood mitigation in river beds of the region.

Water Quality and Discharges to Fresh Water

(Objectives 5.1.1 – 5.1.3 and Policies 5.2.1, 5.2.3 – 5.2.16)

These objectives and policies require that the part of the Wainuiomata River that is the subject of this application be managed to safeguard existing aquatic ecosystems; in addition, the whole area is to be managed for trout fishery and trout spawning. The lower part of the application area (i.e. as far upstream as the Black Stream confluence) is identified in Appendix 7 as needing enhancement for aquatic ecosystem purposes and Appendix 5 requires this area to be managed for angling as well. The area covered by the application is not listed in Appendix 2 of the RFP as requiring water quality to be managed in its natural state, nor in Appendix 6, for water supply purposes.

The discharges associated with the proposed works are of natural silts and sediments only. The works will be undertaken in a manner that manages the water body for its intended purpose. The COP will ensure that methodologies and times of works are developed so as to achieve this.

Water Quantity and the Taking, Use, Damming or Diversion of Fresh Water

(Objectives 6.1.1 and 6.1.4 and Policies 6.2.14 – 6.2.15)

Some of the works proposed require the temporary or permanent minor diversion of the watercourse for the purposes of undertaking the works. Any diversions required will be undertaken in a manner to avoid adverse effects.

Use of the Beds of Rivers and Lakes and Development of the Floodplain

(Objectives 7.1.1 – 7.1.4 and Polices 7.2.1 – 7.2.15)

These objectives and policies stress and illustrate the importance of GWRC's flood protection activities; the ability of GWRC to continue to undertake them and to maintain existing flood protection infrastructure. The application is entirely consistent with, and gives effect to, them.

Conclusion on RFP objectives and policies

GWRC's proposal is in keeping with the objectives and policies of the RFP and will achieve the environmental results anticipated.

The works proposed are essential to the wellbeing of the people of the Wainuiomata area as they protect them to an identified level of flood protection. The objectives, policies and methods require that this occurs in a manner that provides for the avoidance or mitigation of adverse effects on the recreational and natural values of the water bodies. GWRC is committed to doing this and has proposed specific measures (outlined in this application) to be undertaken in conjunction with the proposed works to ensure this is achieved.

8.1.7 Regional Soil Plan

The proposal is in accordance with the requirements of the Regional Soil Plan for the Wellington Region (RSP).

The majority of the land in the river corridor, including the stopbanks and berms, falls outside the scope of the RSP.

The key objectives of the RSP of relevance to the proposal are:

- General - to ensure that land use practices reflect the inherent susceptibility of some landforms to erosion,
- Vegetation Cover - that vegetation cover is used wherever practical as a method of avoiding, remedying or mitigating erosion ,and
- Soil Disturbance - that sediment runoff is effectively managed.

The need to address the inherent susceptibility of river banks to erosion is an integral part of all the flood protection works that GWRC undertakes, and the reason that many of the works are undertaken. Protection of the banks from erosion is primarily effected by the use of rock protection structures, riparian planting in conjunction with bed recontouring and other channel management practices. The use of vegetative cover to manage river bank erosion has been extensively employed in the Wainuiomata River, in conjunction with other methods where this is not practicable.

Generally the amount of soil disturbance associated with works out of the river bed will be limited. GWRC is committed to adopting good practice in such situations to ensure sediment runoff into the waterways is avoided as far as is possible. Adopted practice will be in accord with GWRC Erosion and Sediment Control Guidelines and the COP.

8.1.8 Proposed Natural Resources Plan

The PNRP is the new generation combined regional plan for Wellington. The PNRP was publicly notified on 31 July 2015 and Council hearings will commence in April 2017. Until the conclusion of the necessary Hearings and any subsequent appeals, there is significant uncertainty as to the final rule provisions and objectives and policies that may be included in a Natural Resources Plan.

Therefore out of an abundance of caution, this application seeks resource consent under the Rules set out in Table 10.2 below. An assessment of the application under the themes of relevant objectives and policies is provided in Table 10.1 below. We note that confirmation of the relevance and applicability of these rules as the PNRP progresses will be discussed in conjunction with GWRC's regulatory team.

Table 10.1: PNRP Objectives and Policies Assessment

Objectives and policies theme	Objective/Policy	Comment
Mana whenua and relationships with air, land and water	Objectives 14 - 16	GWRC has established working relationships with mana whenua which recognises their connection to the air, land and water. Consultation with mana whenua has also been focussed on how the principals of kaitiakitanga can be realised through ongoing input into river management activities and cultural health monitoring.
Risk from natural hazards	Objective O20	GWRC's application relating to river management activities is focused on the Council's ability to manage risk from natural hazards and climate change in the form of flooding. This will

Objectives and policies theme	Objective/Policy	Comment
		mitigate the potential adverse effects of flooding on people, communities and infrastructure.
	Policy P29	GWRC's river management activities directly give regard to climate change and its ability to cause or exacerbate river flooding and erosion.
Riparian margins	Objective O27	GWRC's activities in relation to river management will involve establishing riparian vegetation. Other activities focused on improving flood resilience will maintain existing riparian vegetation.
Earthworks and vegetation clearance	Objective O44	GWRC may be required to carry out land use activities such as earthworks as part of its river management activities. GWRC will implement appropriate measures to minimise adverse effects on soil and water from these activities in accordance with the Good Practice guidelines set out in the COP (Annex 1).
	Policy P97	Earthworks and other land use activities will be managed to minimise discharges of sediments.
Minimising adverse effects	Policy P4	In this application, GWRC is proposing the use of good management practices during its river management activities, including timing activities appropriately and, where possible, locating the activities away from Scheduled sites.
Flood protection activities	Policy P15, P16	GWRC's river management activities are expressly provided for in policies P15 and P16. Both existing and new flood activities are recognised as being beneficial and generally appropriate.
	Policy P7	The proposed gravel extraction for flood protection and control purposes, are recognised as a form of beneficial use and development.
Managing gravel extraction	Policy P103	Gravel extraction activities will be carried out for the purpose of managing flooding and erosion and risk, and taking into account natural processes (including coastal processes).

Rules identified as relevant to the activities proposed have been identified as including (but not limited to) the following.

8.2 Additional rules in the Proposed NRP affecting flood protection activities

Table 10.2: PNRP Rules

Rule	Rule wording	Activity Status
Rule R67	Discharges inside sites of significance	Non-complying
Rule R101	Earthworks and vegetation clearance	Discretionary
Rule R108	Activities in natural wetlands and significant natural wetlands	Non-complying
Rule R127	Reclamation of the beds of rivers or lakes	Non-complying
Rule R129	All other activities in river and lake beds	Discretionary
Rule R153	Removal or demolition of a structure or part of a structure	Restricted discretionary

Rule	Rule wording	Activity Status
Rule R195	Disturbance or damage inside sites of significance	Non-complying
Rule R201	Dredging for flood protection purposes or erosion mitigation inside sites of significance	Discretionary
Rule R205	Destruction, damage or disturbance inside sites of significance	non-complying

8.3 Other matters

8.3.1 GWRC Long Term Plan

GWRC's Long Term Plan is a requirement of the Local Government Act 2002, and contains information about the range of activities and services the council intends to provide to meet the region's needs, along with an explanation of expenditure and funding associated with them. The LTP for 2012 -2022 was adopted by Council on 27 June 2012.

Flood protection and control works to be undertaken over the next 10 years in the Wellington Region are outlined in Part 3 of the LTP. This shows that GWRC plans to spend approximately $80M over this time on investigations and capital works (such as structural improvements and stopbanks). Although no further capital works are programmed for the Wainuiomata River, $229,000 has been allocated for development of the new COP over the next two financial years, and this will have direct relevance and application to the works programme in the Wainuiomata River.

Currently, annual expenditure on flood protection operations and maintenance works (approximately $12M) accounts for around 6% of GWRC's total annual operational expenditure. On average, over $15M is programmed to be spent annually in the next ten years on maintenance and operational activities in Wellington rivers.

8.3.2 GWRC Asset Management Plan

The GWRC Asset Management Plan (AMP) contains further detail of the level of maintenance and anticipated expenditure relating to the assets (including flood protection infrastructure) managed by GWRC on behalf of the community. The requirements of the AMP are an important input to the development of GWRC's annual maintenance works programme.

8.4 Notification

The persons or parties considered to be affected by the proposal are landowners whose land lies within the application area or adjacent to it, iwi, HCC, Department of Conservation, Fish & Game NZ and recreational users of the Wainuiomata River corridor. In accordance with s95A (2) (b) of the RMA, GWRC requests that the application be publicly notified so as ensure that any other persons who may be interested in the proposal can become involved and have their comments and opinions considered.

9 Summary and Conclusions

GWRC is seeking resource consents to enable the continuance of the suite of flood protection works and maintenance activities that it undertakes in the Wainuiomata River. This work is undertaken to fulfil GWRC's statutory obligations in respect of flood protection and management of flood hazard, and also give effect to the requirements of the community of the Wainuiomata area, in accordance with the local government watercourses agreement that exists between GWRC and the territorial authorities within the Wellington Region.

The Wainuiomata River flows through significant areas of urban development and pastoral activity downstream of Richard Prouse Park. Despite this, the river has fair water quality and supports a relatively diverse fish population. It provides a trout fishery resource for the region (mostly downstream of the application area).

The range of activities that GWRC wishes to have the ability to undertake in the Wainuiomata River is comprehensive, covering the construction and maintenance of structures, establishment and maintenance of vegetative plantings and river bank protection, a variety of channel management and maintenance activities including bed recontouring and gravel extraction. Activities will be undertaken both in the river bed and on land within the river corridor. However the scale of the proposed works over the life of the new consent is low, particularly compared with the works that GWRC proposes to undertake in other rivers that it manages (including the Hutt, Waikanae and Otaki Rivers). All activities will be undertaken in response to a determined need, with the most appropriate method being selected from the range of available tools. Most of the activities will be undertaken on a relatively infrequent basis, but all of the activities identified are deemed to be appropriate to include in the 'toolbox', even if they have not been undertaken frequently in recent years. The ability to undertake new activities, once they are incorporated into the COP through an agreed process, is also sought as part of the new consent.

The most extensive flood protection works currently in the Wainuiomata River are willow protection plantings, which line approximately 59% of the banks within the application area. Under the new consent GWRC proposes to principally maintain and renew these established plantings, rather than significantly increase the planted areas. Rock lining currently affects only 15 m of the 9.6 km river bank length; GWRC does not expect to construct significant new areas of rock lining over the term of the new consent. The activity having the most potential for environmental impact that is currently undertaken is bed recontouring. This is undertaken in limited areas of the river on an intermittent, short term basis. The frequency and amount of bed recontouring that is required to protect eroding banks from further damage is determined principally by the frequency and magnitude of flood events and the damage to banks that arises from them. It is proposed to continue to undertake bed recontouring on the same basis under the new consent. GWRC also seeks the ability to extract up to 1500 m^3 per annum of gravel from exposed beaches under the new consent in order to manage flood risk when required. This work will not involve work in the active channel (other than minor vehicle crossing for access).

The main potential adverse effects of the proposed activities can be grouped into six categories, described below.

Water quality

Adverse effects on water quality can be generated by the deliberate movement of river bed material associated with activities such as the construction of structures and bed recontouring. Gravel extraction in the active channel can also release large amounts of sediment to the water column, but this activity is not proposed in the Wainuiomata River (only extraction from beaches above the active channel).

Operation of machinery in the bed of the river has the potential for adverse effects on water quality arising from accidental fuel or oil spills. This can be avoided by the adoption of good practice that prohibits all re-fuelling and any other maintenance work involving oils, hydraulic fluid etc from occurring on the river bed.

There is also potential for earthworks undertaken on the banks and river berms to generate suspended sediments in stormwater runoff from such areas. This could affect water quality in the river. Such effects can be avoided by the adoption of good practice, such as adherence to GWRC's erosion and sediment control guidelines (Greater Wellington Regional Council, 2006) to ensure stormwater discharges from earthwork areas are appropriately managed.

Aquatic ecology

The ecological effects of each activity will be site specific, depending on interactions between river channel morphology and the composition and distribution of riparian and aquatic communities in the affected reach. Some practices such as the establishment of vegetative buffer zones, willow planting and layering, and construction of rock groynes, will have mostly positive effects on river ecology, while other activities such as channel realignment by bed recontouring will have mostly negative effects (at least in the short term). (Cameron, 2015) notes that vegetative bank protection is by far the most widespread activity in the Wainuiomata River, and its effect on riverine ecology is likely to be mostly positive. Other activities with higher potential for adverse effects are undertaken on a relatively smaller proportion of the river. He concludes that when viewed as an overall package, it seems likely that net effect of all these activities on native fish and trout populations is likely to be close to neutral and that existing values will be maintained.

GWRC mitigation of bed recontouring is currently focused on incorporating final shaping of affected reaches to provide for more complexity of habitat to assist recovery. GWRC is also committed to continued investigations into the impacts of in-river works on aquatic ecology which will ultimately help to improve practice and enhance mitigation. (Note that these studies may not be undertaken on the Wainuiomata River but will provide information that will be of relevance to it).

Over time, it is expected that the COP will be amended and updated and the specifics of the monitoring plan will change; this approach will ensure that the mitigation undertaken to address adverse effects remains relevant and up to date on an on-going basis.

Recreation

In the short term any adverse effects of GWRC's flood protection activities are most likely to be minor, involving restriction of access to small sections of the river or river berms.

Neighbouring community

Based on past experience and the absence of complaints received over the past fifteen years in relation to GWRC's river works and maintenance activities, the overall adverse effects on the neighbouring community are anticipated to be less than minor overall.

Any effects are most likely to be associated with noise, and are most likely to occur in areas where residences are closest to the river corridor.

The potential for such effects can be adequately avoided by:

- Good communication
- Restriction of activities to reasonable working hours
- Ensuring that a readily accessible system for making complaints exists, so that any complaints can be conveyed to the appropriate staff and addressed promptly

These and other procedures have been included in the COP.

Cultural

Reports on cultural values relevant to the application area, and an assessment of impacts of flood protection works on cultural values have been prepared for GWRC by Raukawa Consultants (in drat) (on behalf of Port Nicholson Block Settlement Trust & Wellington Tenths Trust – PNBST/TT) and Te Runanga o Toa Rangatira Inc.

Many of the provisions that have been incorporated in the COP to protect ecological values, such as works exclusion periods, requirements to include provision for fish passage, measures to avoid accidental fish mortality, and mitigation of adverse effects on aquatic habitat will also achieve positive outcomes in terms of cultural values.

However, GWRC also acknowledges that there are some cultural and spiritual values that are more problematic to make provision for within the current river management paradigm. GWRC is working with the iwi to ensure that understanding of cultural issues of importance and appropriate responses to them continue to be developed, and are incorporated into the COP and EMP.

Other effects

Adverse effects on river birds are expected to be relatively minor, largely due to the absence of threatened or vulnerable species in the Wainuiomata River and the lack of suitable habitat for riverbed nesting birds. Nevertheless, GWRC is committed to the adoption of good practice, such as provision for the possibility that threatened species may become established in future. Monitoring surveys as proposed in the EMP will ensure that if any future change in bird populations occurs, this can be identified and appropriate mitigation developed.

Other potential adverse effects of the works on the landscape and visual amenity values of the river corridor are considered to be less than minor.

Overall, the long term positive effects of the suite of proposed works when viewed as a whole are significant: the direct reduction of the flood hazard and risks to life, property and the economy of the Wainuiomata community. They are a key component of the continued economic and social well-being of the wider Hutt City area and the Wellington Region.

GWRC is seeking a 35 year term for the new consents, and is proposing to have much of the specific detail relating to works, including work quantums, excluded from the consent conditions.

Central to this proposal is the idea that a comprehensive COP will sit alongside GWRC's flood hazard assessment work and annual works programmes (and associated detailed work plans) to guide and direct GWRC's works and maintenance activities. The COP, rather than consent conditions, will provide specific detail and direction on the methodology to be adopted for individual activities. It will be a living document that reflects current good practice.

GWRC also proposes a wider on-going programme of research and monitoring of the key environmental effects of activities, and as outlined in the EMP. The outcomes of this monitoring will be subject to evaluation and review which in turn will lead to adjustments to the COP, through an agreed process. Iwi and stakeholders will be engaged in this process.

This approach allows for informed environmental decision making through-out the life of the consent, on the best information available. The approach avoids the need to seek changes to the consent conditions at unnecessary cost to the ratepayer but provides a robust system of ensuring that the activities and methodologies used are environmentally appropriate over the 35 year life sought for the consent.

A working draft of the Environmental Code of Practice and Monitoring Plan is included with this application as Annex 1. Development of this document will be on-going through the application process, and beyond.

Consultation with affected parties and interested groups has been commenced in the preparation of this application and will continue throughout the application processing.

The proposed suite of activities has overall status as a Discretionary Activity (based on the principle of bundling activities to the highest activity status). GWRC has requested that the application be notified to ensure any other affected or interested parties have the opportunity to have input to the consideration of the application.

This application has illustrated that the proposal is in keeping with the purposes of the RMA and the objectives and policies of the regional policy statement and plans and will deliver the anticipated environmental results that the policies of the regional plans are expected to achieve. For this reason we consider that the consents should be granted.

10 References

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11 Applicability

This report has been prepared for the exclusive use of our client Greater Wellington Regional Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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Appendix A: Consent Application Forms

Appendix B: Application Area

- **Maps 1-7**

Appendix C: Land Ownership Details

- **Maps 1 - 7**
- **Land Owner Schedule**
- **Certificates of Title**

Appendix D: Williams (2007)

Wainuiomata River - River Corridor: assessment of design channel & edge buffer zones based on river character. Prepared for Greater Wellington Regional Council

Appendix E: Flood Hazard Maps

- **Sheet 8 *from* Flood and Erosion Hazard Wainuiomata River: Information Sheet 8a (September 2012)**
- **Sheet 9 *from* Flood and Erosion Hazard Wainuiomata River: Information Sheet 9a (September 2012)**
- **Sheet 10 *from* Flood and Erosion Hazard Wainuiomata River: Information Sheet 10b (September 2012)**
- **Sheet 11 *from* Flood and Erosion Hazard Wainuiomata River: Information Sheet 11b (September 2012)**

Appendix F: Cameron (2015)

Effects of Flood Protection Activities on Aquatic and Riparian Ecology in the Wainuiomata River. Prepared for Greater Wellington Regional Council (Flood Protection)

Appendix G: TRC Tourism (2013)

Wellington Rivers Recreational and Tourism Assessment. Report prepared for Greater Wellington Regional Council.

Appendix H: Activity Photographs

Appendix I: GWRC works and maintenance records

- **Willow planting (2002 – 2011)**
- **Tethered willows**
- **Construction of rock lining (tonnage and location)**
- **Bed recontouring ('cross-blading') – location and length**

Appendix J: Cultural Impact Reports

- **(Raukura Consultants, undated) – draft report**
- **(Te Runanga o Toa Rangitira Inc, 2013)**

Appendix K: Proposed Conditions of Consent

Appendix L: Relevant Regional Objectives & Policies

- **Regional Policy Statement**
- **Regional Freshwater Plan**

Annex 1: Environmental Code of Practice and Monitoring Plan (working draft)

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