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WAIKANAE GRAVEL EXTRACTION

POTENTIAL ENVIRONMENTAL EFFECTS

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Waikanae Gravel Extraction : Potential Environmental Effects

Purpose

To identify the potential effects and possible mitigation measures for minimising the effects from extracting gravel from the Waikanae River.

Summary

There are both positive and adverse effects from undertaking the proposed extraction. The primary positive effect is providing the local community with a greater level of security from flooding. There will however be negative effects to the ecology and environmental quality of the Waikanae River, particularly in the short term. How long these effects will persist for is unknown.

The adverse effects are not comparable to an annual fresh, nor can they be compared with gravel extraction activities carried out in the past. Although there are some common effects, the type and extent of the adverse effects are influenced by the environmental conditions present in each reach.

It is proposed to mitigate these adverse effects in two ways:

- Using methods that are specifically designed to minimise the adverse effects in each reach and the river system as a whole.
- Undertaking remedial works by replanting exposed banks with plants that include native species, and restoring the bed as near as possible to the current profiles.

The ongoing consultation process with the Department of Conservation and Fish and Game will help provide a better understanding of the effects and may lead to further mitigation measures being developed and adopted.

The long-term effect of maintaining the river in its current alignment rather than allowing the river to migrate over the whole floodplain is not addressed in this report.

Proposed Works

The proposed works are likely to include:

- Gravel extraction, including from the wetted area
- diverting the active channel from one side of the river to the other
- crossing the active channel to cart gravel and gain access to beaches
- creating bunding to control the discharge of sediment
- reshaping the bed of the river, including cross-blading
- re-vegetation and other remedial works.

The works will be undertaken during normal working hours. Works will not take place during the weekends or public holidays.

A work methodology has been devised that divides the proposed works into three different reaches. Different river environments exist along each reach, influencing the nature of the proposed works undertaken in each area and the associated effects. Maps outlining the proposed works are attached.

Potential Effects of Undertaking the Activity

The following section briefly addresses the potential effects and possible mitigation measures of the proposed works. The potential effects have been identified by examining relevant literature, past resource consent applications and discussions with Flood Protection staff, Fish and Game and the Department of Conservation. Further work addressing the exact nature of the effects and species affected by the proposed works may be required. Consultation has begun with the Department of Conservation and Fish and Game to help determine the effects of the proposed activity on the ecological values of the Waikanae River and possible mitigation measures.

A brief discussion outlining the effects of sedimentation and bed disturbance on instream ecology follows. These effects are commonly raised by people and organisations concerned about river works in general and are not specific to the Waikanae River. The three reaches in which the works are proposed are then discussed. Potential effects and possible mitigation measures available to reduce adverse effects on the ecological values of the Waikanae are identified. Development of a work programme and mitigation measures will continue as the consultation process continues. Finally, effects common to all reaches are discussed. A table is provided below summarising the potential effects of the proposed works.

Table 1 : Potential Effects resulting from the Proposed Works

Effect	Extent of Potential Effect	Duration
Ecological values		
Reach 1	More than minor	Unknown
Reach 2	More than minor	Unknown
Reach 3	More than minor	Unknown
Landscape	Minor, localised	Temporary
Landuse	Minor, localised	Temporary
Recreation	Minor, localised	Temporary
Flood Defence System		
During works	None	
Long-term	Consistent with FMP	
Community		
During works	Minor, localised	Temporary
Long-term	Positive	
Tangata Whenua	Unknown – further consultation is required	
Ground Water	No effect likely	

Ecology and Environmental Quality

The following section identifies the potential effects most likely to occur in a river environment as a result of this type of work. In summary, changing the physical and, or, the chemical characteristics of a water body will change the species found in the area disturbed. Some species will vacate the area, while others will no longer be able to survive in the changed conditions. As the flora and fauna inhabiting the aquatic habitats are interdependent, often the effects will be experienced through several trophic levels. For instance, decreasing algae in the river system affects the food available for invertebrates, which decreases the food available for fish, which may in turn leave less prey for available for birds. Subsequent changes in the river environment may mean that different species re-colonise the area affected by the works. The discharge of sediment is generally seen as one of the largest adverse effects to occur as a result of instream works.

Ecology : Effects of discharging sediment into a river environment

High levels of sediment affect the physical and chemical characteristics of a water body, further affecting the biotic community of the river including algae, invertebrates, fish, birds and people. Turbidity and suspended solids are two of the more common methods for measuring the extent of this effect.

Turbidity measures the clarity of the water and is usually expressed as NTUs (Nephelometer Turbidity Units). Turbidity guidelines used in the past by the Regional Council have identified a level of 5 NTUs as a guideline for aquatic life.

Alabaster and Lloyd (1982) state that there is no evidence to suggest that concentrations of suspended solids of less than 25 mg/l have harmful effects on fisheries. Further, they believe that it should be possible to maintain good or moderate fisheries in waters that contain 25-80 mg/l, but waters containing 80-400 mg/l are unlikely to support good fisheries. Only poor fisheries are likely to be found in waters containing greater than 400mg/l.[1]

Sediment discharges and the corresponding settling of sediment affect instream organisms by:

- **Reducing the amount of light in the water column**. This decreases the level of photosynthesis occurring in the river system, reducing food sources for invertebrates. Feeding also becomes more difficult for fauna that requires good visibility to locate food including invertebrates, fish and birds.
- **Reducing algae and periphyton in the river**. Depositing sediment may have an abrasive action across river gravels, further reducing the food available for other organisms.
- **Changing the chemical composition of the water column**. The release of sediment may affect the mobility of different invertebrate species and clog fish gills. The substrate below the upper bed surface may be different in character to the bed surface. For instance, underlying clay materials may be exposed, changing the minerals freely available in the system and the organisms that may (or may not) be tolerant to these chemical changes.

[1] Alabaster and Lloyd, 1982, *Water Quality Criteria for Freshwater Fish*, Wellington: Food and Agriculture Organisation of the United Nations, Butterworth Scientific (2nd Edition)

- **Releasing or re-suspending absorbed toxicants**. Instream life may be harmed by toxicants from, for instance, pesticide and or herbicide residues re-suspended from the bed. The writer is unaware of the presence of residues being identified as a problem in the Waikanae River.
- **Changing the substrate from a clean gravel bed to one smothered by silt**. Fine sediment may fill in the spaces between gravels and rocks, decreasing the habitat for invertebrate species like caddisflies. Silt covering bed gravels also blocks sunlight from reaching algae on the gravel bed. A change in the bed's substrate may affect its suitability as feeding and spawning areas, and hinder larval stages of some species.
- **Reducing food quality and availability**. All of the above effects may change an organism's ability to exist within the riverbed, leading to some species leaving the area and affecting higher trophic levels, such as birds, ability to survive in that area.

Ecology : Other Effects

The most immediate effect on the ecology of the river is likely to be the departure of species from the work area as they try to avoid the immediate effects of the proposed activity. For instance, fish and highly mobile invertebrate species will vacate the area around the work sites. For bird species this may mean disruption to feeding patterns, roosting or the availability of using the river as a corridor between the sea and inland areas.

The proposed works will mean changing the substrate structure. Effectively the 'landscape' of the riverbed is changed, adversely affecting the inhabitants and their ability to re-colonise. Losing the natural variability of the streambed makes the bed more uniform and decreases the variability in micro-flow regimes, such as eddies. Different sized gravels and rocks within a riverbed provide microhabitats for invertebrates and lies for fish. As a result, the number of the niches available for different species decreases. 'Pool', 'run' and 'riffle' associations for fish provide an excellent example of the importance of bed structure variability. The effects of changing the bed's structure are not limited to the aquatic environment. Birds reliant on instream flora and fauna for feeding, or for habitat such as beaches may also be affected by the proposed works. A loss in habitat may lead to a change in species composition and a decrease in biodiversity temporarily.

Favouring one part of the year for the works over another may adversely affect different species in different ways, and to different extents. The extent of the disruption on an organism's life cycle is dependent on the time of the year that works are undertaken. Spawning and nesting periods are generally considered to be critical ecological times. A table is provided at the end of the report identifying some of these times.

Temporary diversions may also change the habitat characteristics of the instream environment by:

- altering the rate and type of flow
- the width and depth of the active channel
- as a result of the above changes, the water temperature

This may affect the diversity and distribution of species found in an area. Diverting the active channel may affect fish passage or leave fish stranded in pools.

There may also be a positive effect in deepening the river channel. In the past, similar works have been observed by river engineers to increase the tidal exchange experienced in the area defined as Reach 1. This may allow for a greater dilution of the waters within the estuarine environment, allowing the elevated nutrient levels to decrease, thereby improving the environmental quality of this reach.

Extent and Nature of Effects

Cumulative effects can arise in all of the effects identified above. Cumulative effects can be experienced in two ways, over time and in combination with other effects. For the proposed activity, cumulative effects may result from undertaking the activity in conjunction with other activities authorised by the global consent; activities undertaken by other parties; and from repeating the works over a number of years.

The significance and magnitude of the above effects will be influenced by the following factors:

- the nature of the environment at the work site
- what other activities are occurring in the river at the same time
- where in the river works are undertaken, including in relation to other works*
- the time of year the works are undertaken*
- the duration of the works, hours per day, days per week, weeks per year, etc.*
- weather
- flow
- the health of the river i.e. the system's resilience to disturbance
- the vulnerability of any species i.e. if their status is rare or threatened
- the method used to achieve the works*
- remediation strategies*
- cumulative effects of the activity over time*
- cumulative effects of the activity and activities authorised by the global consent*

* Factors we can influence to mitigate any effects.

There are no guidelines available in New Zealand that identifies an appropriate duration for river works to protect aquatic life.[2] No literature was found in preparing this report that identifies the recovery rates, or the resilience of river systems, after works such as gravel extraction have been completed. This makes it difficult to determine the extent of effects through time and accordingly this has not been attempted.

Effects by Reach

The adverse effects on the ecology and environmental quality of the Waikanae River are similar over the length of the works, but the extent and the mitigation measures will be different along each reach. This reflects the different work practices used and the different environmental conditions in each reach.

[2] Berry A, 1998, *An investigation into the sources of faecal contamination and turbidity in the Waikanae River*, Wellington: Wellington Regional Council. Resource Investigations Department

Methods for each reach have been developed to mitigate the effects of the proposed activity and reflect the common localised environmental conditions existing in each reach. The methodology should be interpreted being as a tool for managing the effects in each reach, as well as the total effects from the proposed activity. Refining the methods identified below may further mitigate adverse effects following consultation.

In the following section, each reach is examined to determine the extent of any adverse effects from the proposed activity and identify possible mitigation measures. The following table shows the levels of sediment discharged into the Waikanae River as a result of works undertaken in the past. The work site was located immediately upstream of Greenaway Road. It is likely that the discharges of sediment would be similar to those of the proposed works, although the duration of the discharge is likely to be longer in the tidal reach.

Table 2 : Kauri Puriri Works – Suspended Solids (mg/l)[3]

Activity	Jim Cook Park	Greenaway Road	Otaihanga Domain
Baseline	<2	3	3
Trucks crossing	<2	<2	11
Extracting gravel behind bunds	<2	<2	7
Placing groyne	<2	98	68
Next day	<2		4
Next morning			9
Cutting thalweg		690	160
13 hours after thalweg cut			9

Similar works in the Hutt River during channel reshaping work have recorded a peak sediment discharge of 480mg/l, which dropped to 83mg/l an hour after the works had been completed.[4] Likely sediment loading for an annual fresh is not known, however, a large fresh (less than an annual event) on the Hutt River has been recorded as 780 mg/l.

Reach 1 : Coastal Marine Area

The proposed site to excavate material is within the Waikanae Scientific Reserve, which has been identified as having high conservation values. The low flow river channel will not be changed or disturbed in undertaking works in this reach of the river. The work is anticipated to take a month to complete and all work will be undertaken when the flats are exposed by the tide.

- The aim is to extract approximately 6,000m^3 of Sand/Gravel from the beach on the right bank.
- A large excavator and six wheeler road trucks would be used to take the material away.
- The material would be windrowed against the right bank during the low tide and load out onto trucks as the tide comes back in.

[3] Data from Flood Protection files

[4] Montgomery Watson, Resource Consent Applications for Operations and Maintenance Activities on the Hutt River, September 1997, p 69-70

- The beach would be trimmed to a similar profile each day, following the completion of the extraction work.
- All work would be done when the beaches are exposed, generally from mid tide to low tide.
- Work would take about one month.
- The extraction would be done within 6 to 12 months after the next mouth cut so that feeding birds would have had time to relocate to the estuary's south end as they normally do following a mouth cut.

Potential Effects and Proposed Mitigation Measures

Birdlife

To mitigate the effects of the extraction work on bird life, it is proposed that any work is undertaken approximately 6–12 months after the river mouth has been cut to allow a suitable habitat to be established for any birds south of the work site. In the past, birds have favoured this area when the mouth has been cut. In addition, the work will be undertaken outside the nesting and migratory times of sensitive species. The variable oystercatcher, banded dotterel, black fronted tern and caspian tern are all species identified in the Conservation Management Strategy as contributing to the indigenous values of the reserve. To avoid nesting and migration times it appears that the period September to October or December to January would be the best times to undertake the works.

Vegetation

The extraction site is located on the true right bank, no vegetation will be removed and the site will be accessed via existing tracks. The material would then be loaded onto trucks and carted away.

Decreasing the bed level will not affect the saltmarsh vegetation found on the opposite bank or any of the estuarine species found near the work site. The excavation depth is not significant when compared with the daily and monthly tidal fluctuations. In past works, the effect has been found to be small and the fact that this vegetation remains at the site, despite previous works and mouth openings, supports this analysis.

If required, estuarine species could be removed prior to the works commencing and be reinstated after the extraction. The adverse effects are on the vegetation are likely to be minor, localised and temporary in nature.

Positive effects may result from the works as a change in channel alignment may threaten the existing salt marsh on the left bank. Re-vegetation proposed as part of the remedial works will allow for the removal of existing introduced species and replacing them with native plants.

Instream Life

The works should not adversely affect instream biota as it is proposed that no instream work occur. However, biota found at the work site, such as shellfish, may be affected. Liaison with the Department of Conservation will help assess the impact of works and their potential effects in this environment. The proposed works will not affect fish passage. Some sediment would be released into the coastal area at the work site as the tide comes in and inundates the work area. However, this reach of the river has higher background turbidity than reaches further upstream. The flora and fauna associated with this area are likely to be less sensitive to increases in turbidity. As no instream work will occur, any instream species disturbed by the proposed works should be able to easily relocate from the work site.

Reach 2 : Tidal Reach

Two different operations are proposed in this area. Firstly, approximately 5,000m^3 of material located between cross sections W050-070 will be cross-bladed across the channel. This work will also entail establishing a new meander after the cross-blading has been completed. The proposed works should take one week to complete. The second operation proposes to extract approximately 5,000m^3 from between cross-sections W070-130. The material will be removed from four sites located upstream and downstream of the Otaihanga Domain and will result in the mean bed level being reinstated to levels similar to 1991. Material would be windrowed to the true left bank before being carted away. Extraction will occur from the wetted area. The works are estimated to take four weeks to complete.

1. Cross-blading W050 to 070

- Approximately 5,000m^3 of material would be moved in the reach.
- A dozer would cut a channel on the right bank and then push the material over to the left bank. A large excavator would trim up the material to a 2:1 batter ready for the placing of rip-rap.
- The material is to be cross-bladed from a beach on the right bank to the left bank. The material would then have a rip rap lining placed in front of it. The rip-rap would be placed over a longer three to five year period.
- The cross-blading would be done in three hour time blocks around low tide with each portion worked in that day being trimmed before the tide covered the beaches again.
- A new meander would be established on the right bank, crossing to the left bank at the downstream end, at the completion of the cross-blading.

2. Extraction W070 to 130

- The aim is to extract approximately 5,000m^3 of fine gravel material from this section of the river. This is equivalent to a general lowering of the mean bed level by 300mm. The mean bed level in this reach has risen 300-400mm since 1991.
- The operation would need to work out of Otaihanga domain.
- The gravel material would be windrowed onto the left bank by an excavator during the outgoing tide. The excavator would then load out material onto trucks and carted away. The contractor may also choose to use self-loading motor scrapers to pick the material up and cart it away to a stockpile. This would depend on which contractor was undertaking the extraction.

- The extraction would take place in four blocks, two upstream and two downstream of the Domain with extraction starting at the upstream end.
- Each block would take about one week to complete, with the full extraction operation taking a minimum of four weeks and possibly longer, depending on whether the extraction was stopped between each block. A suitable long range forecast would be required before starting each block.
- A new thalweg, approximating the existing one, would be developed at the completion of work in this reach.

Potential Effects and Proposed Mitigation Measures

Birdlife

This reach is unlikely to be used for nesting, but may provide valuable habitat for roosting. The site will be examined with DOC to determine which species use the area, and what, if any, periods are critical to avoid. If required, any material along the banks or in the bed of the river will be reinstated to provide roosting material, so long as the material does not have the potential to impede flood flows or adversely affect the channel.

Vegetation

The site at which the cross-blading will occur is upstream of the area identified in the Conservation Management Strategy as being valuable saltmarsh vegetation. Access to this work site will be over an area that is dominated by introduced weed species and pasture grasses. Although some damage may occur to this vegetation, the nature of these species ensures that the area will recover quickly. Care will be taken to ensure any native or introduced species valuable for habitat are not damaged, or are replaced.

The extraction sites will be accessed at points without vegetation. Some trimming of willow species may be required but these species recover quickly. No native species will be damaged or removed as a result of undertaking the works.

Although accessing these extraction sites may result in some damage to vegetation in the area, the nature of the species ensures that any adverse effects will be less than minor, localised and temporary. Slumping of the banks may occur as a result of the works affecting inanga (whitebait) spawning areas. A site visit is required to determine if these areas are used as spawning grounds and the amount of area that would be disturbed. Determining these details will allow mitigation measures, if required, to be developed. For instance, if slumping occurs on one side of the river, the opposite bank could be left intact.

Instream Life

The works undertaken in this area are likely to result in significant disruption to instream life. Based on past works undertaken in the Waikanae River, large amounts of sediment will be discharged into the river as a result of undertaking the works. Fish are sensitive to changes in water quality. Increased turbidity will adversely affect the feeding efficiency of visual predators and fish distributions, with some species actively avoiding turbid waters.

The works programme proposes to begin excavation at the upstream sites and work to the downstream sites. This approach should minimise the sediment being deposited on the bed after the bed has been disturbed. In addition, the cross-blading will be undertaken in three hour blocks around low tide and trimmed to reduce the potential sediment load entering the river at high tide.

The extent of the adverse effect and the river ecology's ability to recover from works such as this is unknown. Indigenous species have adapted to a river environment than experiences relatively high sediment loadings during a fresh. Fish species and mobile invertebrates will vacate an area if the conditions are not suitable. In the Ashburton River, research has shown that invertebrates re-colonise an area between 6-12 weeks after a fresh has occurred.

The sediment loading that results from undertaking the works is likely to be similar to an annual fresh but will occur every day for a month. There is little research available to assess the scale and significance of this effect in relation to that experienced under flood conditions. Research suggests that the sediment within a river system is dependent on the amount of freely available sediment. Each subsequent fresh is therefore likely to have less sediment suspended within it as the amount of freely available sediment is exhausted. In contrast, the proposed works will be increasing the amount of freely available sediment by constantly disturbing the bed and re-suspending sediment that may otherwise have remained in situ.

Many fish species regularly move between freshwater and the sea and, for some species such as eels and inanga, their lifecycle is dependent upon their ability to migrate. Access through the lowland reaches is therefore vital, with water velocities and depths being particularly important in enabling such access.

The works will be undertaken in the wetted area but the material will be extracted by working along the bank rather than across the river. This allows limited passage to be maintained in the river channel, ensuring that fish and invertebrates are not stranded and can vacate the work site. In addition, the bed will be reinstated to a condition that allows for similar habitats to form. The bed will naturally begin to recover after freshes move the bed material into a more naturally occurring bed structure. The works will not significantly change the flow velocities experienced within this reach, and the increased depth in the channel is not significant when compared with the daily and monthly tidal fluctuations experienced in this reach.

The proposed works within this stretch will be undertaken outside the trout spawning season to mitigate adverse effects on this species. Indigenous fish spawning occurs throughout the year, dependent on the species examined (see table at the end of the report). Banded kokopu is identified in the Conservation Management Strategy as being present; this species spawns in June and so will benefit from works being avoided during this time.

Reach 3 : Pukekawa

A total of 24,000m^3 of gravel will be extracted from this reach using conventional methods of gravel extraction. This entails removing gravel from beaches and using bunds to reduce the amount of sediment entering the river. Gravel may have to be removed to a depth of .5 to .75 metres below the beach surface to obtain the required amount. Trucks may have to cross the active channel to access gravel beaches and cart the material away. Excavation will not be carried out in the active channel but to achieve this the active channel will be diverted to access the gravel material. This reach could be excavated over a three to five year period, if required. The extraction sites would be accessed using existing roads and river access points.

- The aim is to extract 24,000m^3 of gravel from this reach. A total of 36,000m^3 has accumulated in the reach since 1991 but approximately 11,000m^3 was extracted during the construction of the Kauri Puriri Stopbank in 1996.
- A large excavator and road trucks would be used for the extraction.
- Access would be via Greenaway Road and down the river bed or an existing haul road on the left bank.
- Traditional extraction techniques would be used in this reach, whereby gravel would be extracted off beaches and behind bunds.
- For more detail on the methodology refer to the long-term consent.
- Gravel would be extracted off adjacent left and right bank beaches with the existing thalweg redeveloped at the completion of the extraction on the two beaches.
- The extraction could be undertaken over a three to five year period.

This reach of the river is relatively easy to access and it is anticipated that the potential effects of removing material from this area are less than the other two reaches. For this reason, it is proposed to maintain this reach as a deposition and extraction area to avoid having to undertake similar activities in the tidal and coastal areas in the future.

Potential Effects and Proposed Mitigation Measures

Birdlife

Birds that use gravel beds for nesting are unlikely to be found in this reach, as it is readily accessible to people, domestic animals and pest species. Disturbance and predation would effectively make this reach unlikely to be a viable nesting area. Birds, such as shags and kingfishers may however use this reach as roosting and feeding grounds. Roosting areas will not damaged by the proposed extraction but fish and invertebrates are likely to leave the area while the works are being undertaken. This is likely to render an area unsuitable as a feeding ground for birds for the duration of the works. However, this reach is a relatively small reach in comparison to the amount of similar habitat available to these species in the Waikanae River catchment. Birds are generally highly mobile and would be able to easily and quickly relocate further upstream. For this reason, adverse effects on bird species in this reach are likely to be minor and temporary. Ongoing consultation with the Department of Conservation will help understand the extent of the effect and the required mitigation measures that could be adopted.

Vegetation

Vegetation in this reach is predominately willows. The work sites will be accessed via existing tracks and no vegetation will be removed from the riparian margin. No adverse effect is anticipated on the riparian vegetation of the river in this reach as a result of the works.

Instream Life

The methods used to extract gravel from this area have been developed by the Flood Protection Group to minimise adverse effects on the environment. Gravel will not be extracted from the active channel and bunds will be used to minimise the discharge of sediment to the river. In addition, to limit the disturbance to the fisheries, the works would be timed to avoid critical ecological times, similar to the tidal reach.

Care will be taken to ensure pools are not created when the river flow is diverted, trapping fish. Any stranded fish will be immediately relocated upstream and fish passage will be maintained at all times.

To minimise the discharge of silt into the river, bunds will be used as a filter. In addition, the active channel will be diverted from the work sites. Major disturbance to the river will only occur when diverting the river to move the water away from the working areas. This will involve temporary increases in suspended silts while the bunds are established. Completing the diversion work in the shortest practical time will help mitigate these effects. The diversion work will involve the loss of macroinvertebrate communities over the length of the diversion. However, many invertebrates will be reintroduced naturally from upstream areas by drift and fish species should move back into the area once the works have been completed.

Potential Effects Common to the River

Landscape

During the excavation phase, heavy machinery will become an additional feature in the river landscape, particularly to local residents and users of the river and its banks. However, these effects will be localised to the work sites and only a relatively small part of the river length will be affected at any one time. Any effects will be temporary and limited to the duration of the works. The works will not result in a marked change to the landscape. Although the bed will be lowered in some places, this is unlikely to change the quality of the landscape, or the nature of the landscape's visual elements experienced by the public.

Surrounding Land Uses

The purpose of the works is to decrease the incidence of flooding on land surrounding the lower reaches of the river. The long-term effects of the works on land use will be positive with a reduction in flood frequency but the works will not eliminate the flood risk. No long-term adverse effect will be experienced on land use in the area as a result of the works.

In the short-term, land around the extraction sites may be used for temporarily storing gravel and equipment. Boundary changes or land acquisition are not necessary to undertake the works. Access to work sites could be confined to publicly owned land and the river bed, although there are areas where access through private land would be more expedient or have less impact. Access over private land would only be used if a suitable agreement could be reached with the landowner. Landowners will be approached and local residents will be part of the consultation process for preparing a resource consent application.

Recreation

There will be short-term disruption to public access for fishing and swimming along the river banks, and to the river itself, while the works are undertaken. For safety reasons, access across the affected sites is likely to be controlled while material is being excavated. Alternative access around the site will be provided as necessary. Works will be restricted in their duration to allow the river to clear at night and work will not be undertaken during weekends or public holidays. The short-term effects will be minor, localised and temporary.

Works will not be undertaken during whitebaiting season in the coastal area and are unlikely to significantly affect other fishers.

There will be no long-term negative impacts from the works on recreation in the area. The riverbed will be left in a state that is consistent with the Waikanae River's current bed, leading to little change in the river environment utilised by the public. In the long-term, boat and canoe access would be improved and this is considered a benefit.

Flood Defence System

The river bed will be reinstated to a similar condition prior to undertaking the excavation. No holes would be left in the riverbed and the active channel will not be left in a position where erosion or scouring would undermine the flood defence system. Any material left on the floodplain will be aligned in a way that doesn't impede flood flows.

The proposed excavation is to increase the flood carrying capacity of the river and is consistent with the design standard contained in the Waikanae Floodplain Management Plan. Wellington Regional Council engineers and works personnel will oversee the works and ensure that the integrity of the flood defence system is not compromised during excavation.

Community

The principal reason for the works is to decrease the incidence of flooding during small flood events and to ensure that the active channel remains within the preferred channel alignment. This will provide benefits that include greater 'peace of mind', improved personal and property safety, and a reduced frequency of other psychological and social effects of flooding such as stress.

Adverse effects on the community may be experienced during the excavation of material from the bed of the river. Residents in the immediate vicinity of the works may be affected by localised truck movements, dust and noise. The works are also likely to result in discharges of sediment into the river. Turbidity guidelines used in the past by the Regional Council have identified a level of 2 NTUs for aesthetic values, compared with 5 NTUs for aquatic life.[5] This will be exceeded and a discussion on methods to mitigate this effect is provided in the 'Ecology and Environmental quality' section of this report.

Tangata Whenua

Kapakapanui, the environmental arm of Te Ati Awa ki Whakarongotai, have been approached and notified of the proposed works. A consultation process is currently being undertaken. Three historic pa sites were identified in the phase one of the Floodplain Management Plan investigations as existing along the river[6]. Maintaining a close relationship with the tangata whenua is envisaged and will ensure traditional cultural and historical values are protected.

Groundwater Resources

Altering the hydraulic regime, removing bed material and changing the substrate of a water body has the potential to change the characteristics of the river / groundwater system interface. For instance, removing material that acts as a confining layer may mean more water from the river system is lost to the groundwater system. Changing where the active channel flows may also affect aquifer recharge areas. In turn, these actions may alter wetlands and riparian vegetation by reducing or increasing the water available to these habitats. The works affecting the surface water / groundwater interface may have the potential to affect domestic wells that are hydraulically connected to the river.

It is unlikely that these works will result in any of the above effects. The proposed excavation will reinstate the bed levels to those existing in 1991 and since 1991 no significant changes have been observed in the proposed works areas. Changes to recharge systems have been observed in areas upstream as a result of works and these areas will be avoided in undertaking the above works. There will be no effect on water velocities within the river.

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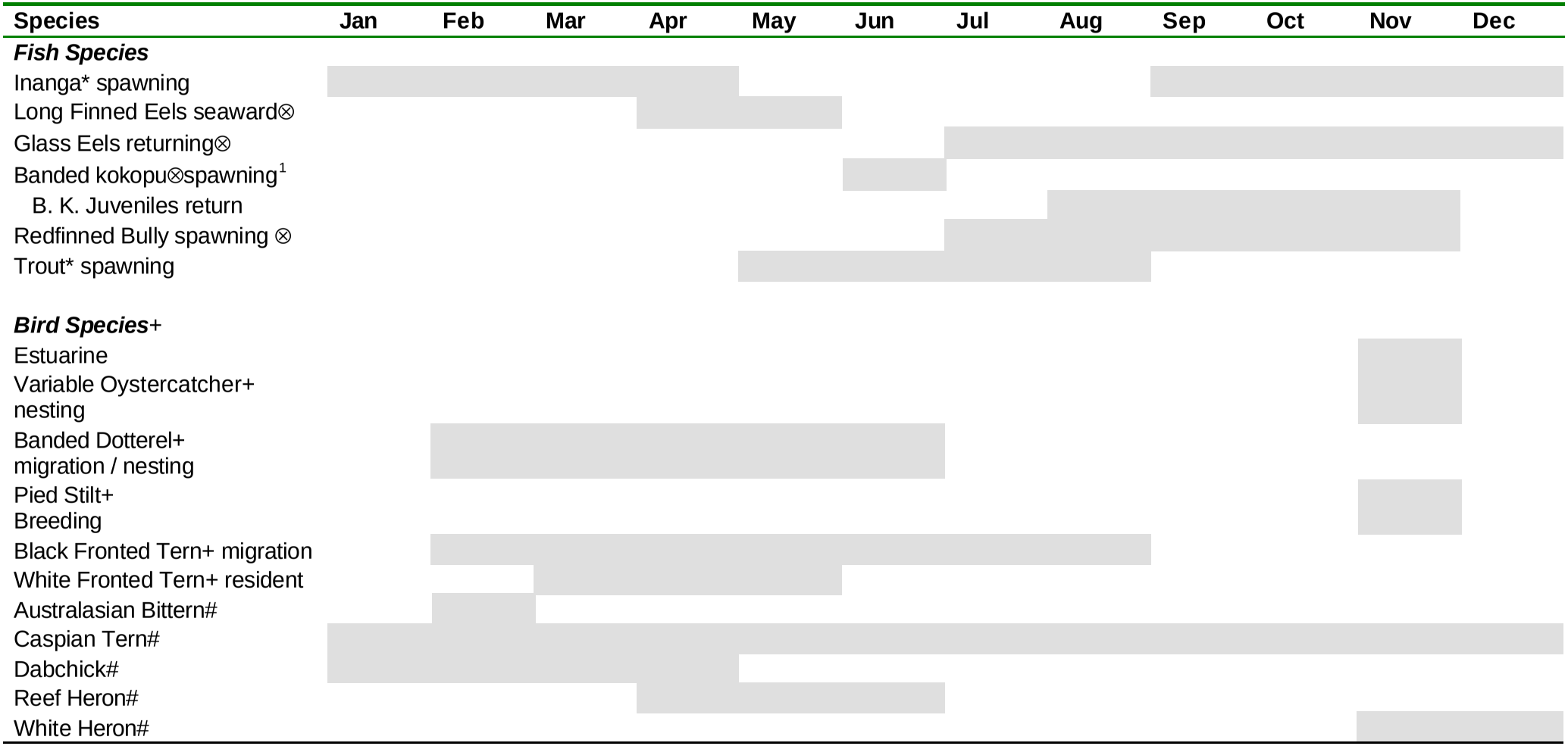
5 Berry A, 1998, *An investigation into the sources of faecal contamination and turbidity in the Waikanae River*, Wellington: Wellington Regional Council. Resource Investigations Department

6 Wellington Regional Council, 1993, *Phase 1 Tikanga Maori*, Wellington: Wellington Regional Council

Waikanae River Species : Migration / Breeding & Spawning Timetable



* Boffa Miskell's Environmental Investigations on the Waikanae River 1992

\+ Wodzicki. K. & Kennedy P Waikanae River Estuary: changes to the habitat and bird fauna evident from surveys thirty years apart, *New Zealand Journal of Zoology*, 978, Vol. 5, 551-579

⊗ McDowall RM Seasonal pulses in migrations of New Zealand Diadromous fish and the potential impacts of river mouth closure, *New Zealand Journal of Marine and Freshwater Research*, 1995, Vol. 29:517-526

\# Identified by DOC in the Region's CMS

[1] Banded kokopu and Redfinned bully species are identified as freshwater indicator species in the MfE Indicators programme

Reach 1 Coastal Marine Area

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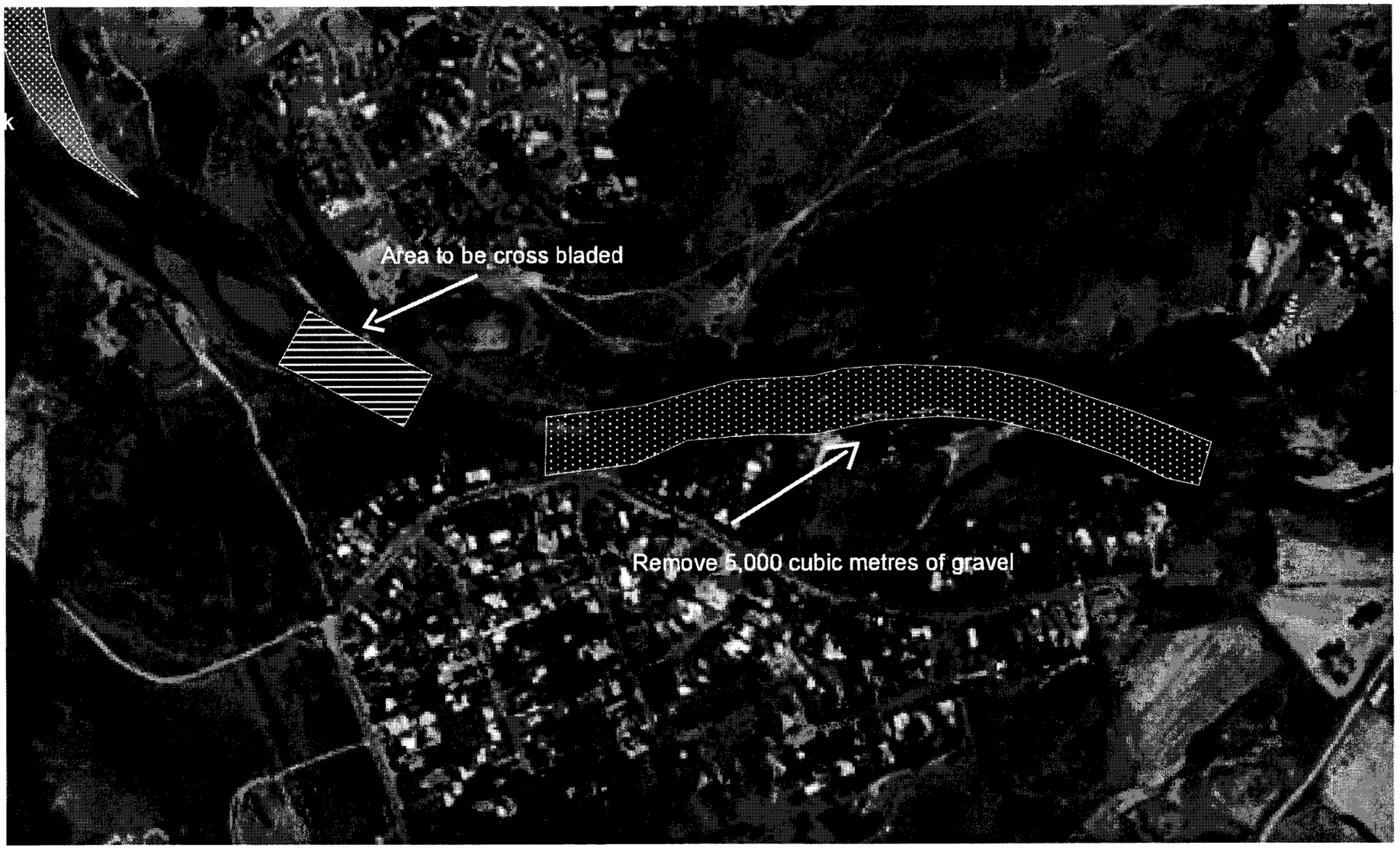
Scale
1:5000

N



Reach 2 Tidal Area

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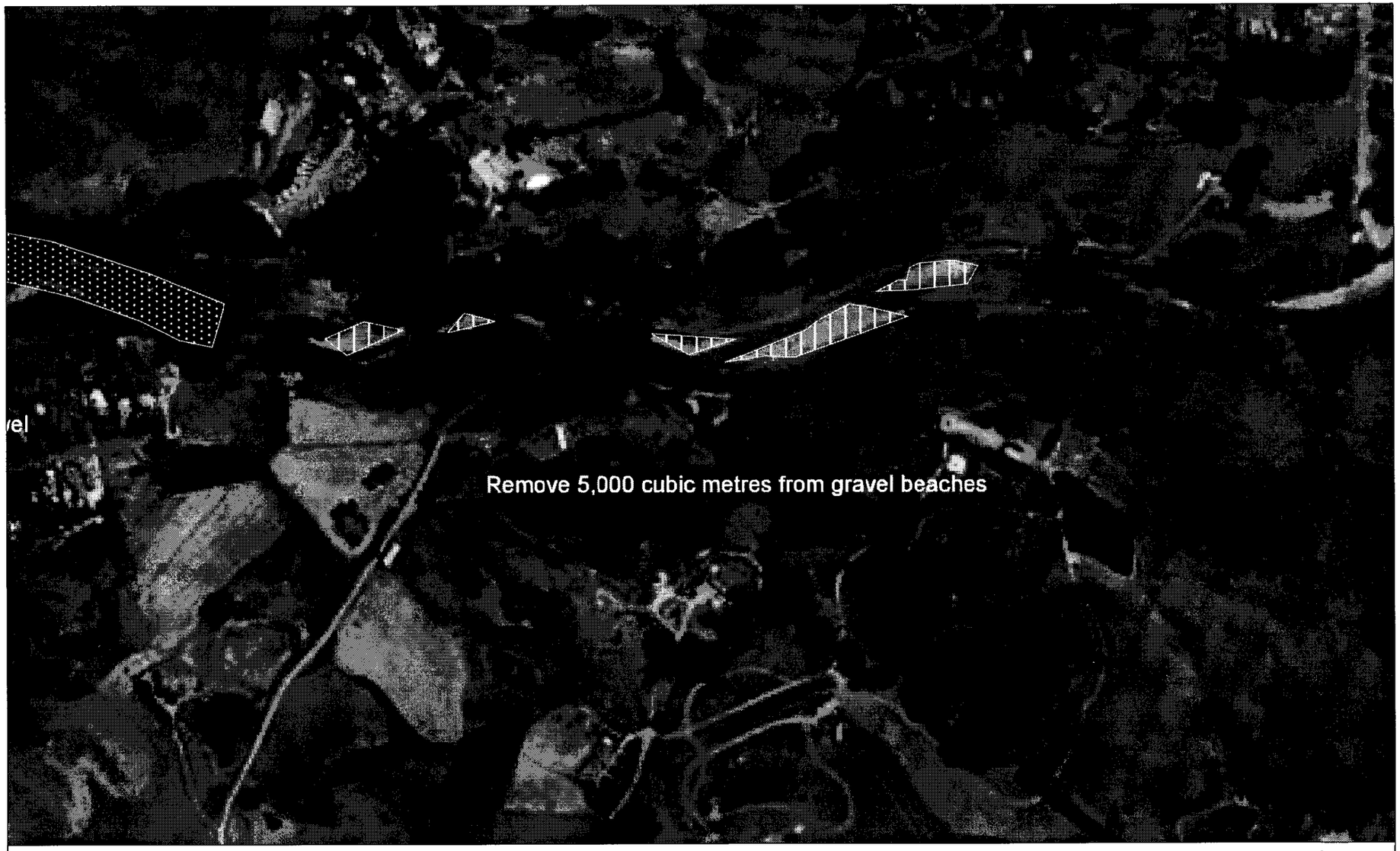

Reach 3 Pukekawa

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