



NZ TRANSPORT AGENCY
WAKAKOTAHI

Peka Peka to North Ōtaki Expressway Project

Construction Methodology Report

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1 Introduction

1.1 The Project

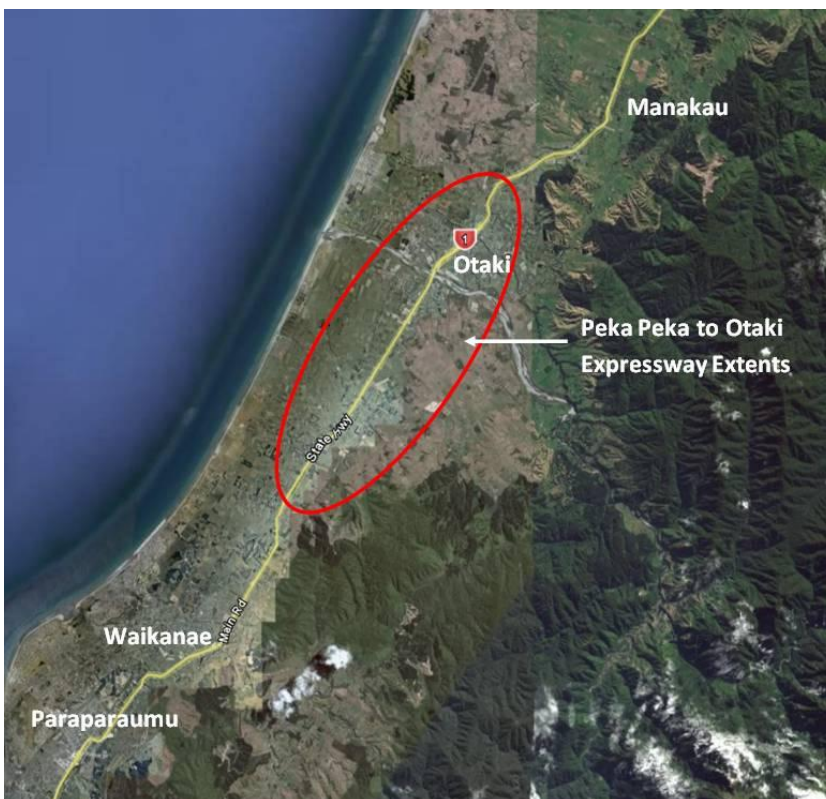
1.1.1 Main Alignment

The Wellington Northern Corridor RoNS runs from Wellington Airport to Levin and completing it will assist regional and national economic growth. The Peka Peka to North Ōtaki Expressway project (PP2O) is one of eight sections of the Wellington Northern Corridor RoNS. The location of the project in the overall scheme of this corridor is illustrated in **Figure 1-1** below.

The NZTA proposes to designate land and obtain the resource consents to construct, operate and maintain the Peka Peka to North Ōtaki section of the Kāpiti Expressway. This project extends from Te Kowhai Road in the south to Taylors Road just north of Ōtaki, an approximate distance of 13km.

The PP2O section of the Kāpiti expressway will provide an expressway with two lanes of traffic in each direction. Connections to local roads, new local roads and access points over the expressway to maintain safe connectivity between the western and eastern sides of the expressway are also proposed as part of the project. There is an additional crossing of the Ōtaki River proposed as part of the project, along with crossings of other watercourses throughout the project length.

On completion, it is proposed that the expressway becomes State Highway 1 (SH1) and that the



existing SH1 between Peka Peka and Ōtaki become a local road, allowing for the separation of local traffic. It is noted that the power to declare roads to be State Highways or revoke status resides with the Chief Executive of the Ministry of Transport, not with the NZTA.

Figure 1-1 : PP2O Project Extent

1.1.2 North Island Main Trunk

KiwiRail proposes to designate land in the Kāpiti Coast District Plan for the construction, operation and maintenance of a re-aligned section of the North Island Main Trunk (NIMT) through Ōtaki.



2 Project Scope

The purpose of this report is to describe an indicative philosophy for the staging and sequencing for the Peka Peka to North Ōtaki Expressway construction based upon general assumptions from the scheme estimate, risk report and the draft Construction Environmental Management Plan (CEMP).

The draft CEMP provides a methodology and framework of management plans and protocols to be used during the Project's construction phase, for implementing, managing and monitoring the environmental controls specified in relevant consent and designation conditions.

A "final" CEMP, which will be developed by the Contractor to suit its' specific methodologies, will outline all details required to enable the NZTA, KiwiRail and the Contractor to construct the Project with the least adverse environmental effects.

General overview:

- A construction period of 3.5 to 4 years is envisaged;
- The revocation of existing SH1 and the off-road pedestrian and cycle way (inclusive of the Ōtaki River Bridge clip-on) are not covered in this plan as this work will be carried out separately;
- The Peka Peka to North Ōtaki Expressway is assumed to tie into the new alignment from the MacKay's to Peka Peka Expressway project in the south, which will be constructed ahead of this project, and the existing state highway in the north;
- No allowance has been made for the proposed realignment of the North Island Main Trunk (NIMT) Line at Mary Crest. This is considered part of a separate Kiwi Rail project however, this project doesn't preclude any future realignment works in this location.
- Parts of the NIMT designation will be used as a shared storm-water system for the project.

A general overview of the proposed construction programme and methods which may be adopted during construction is provided however, at the time of reporting, the method of procurement for this project may be either:

- Traditional Measure and Value (M&V); or
- Design and Construction (D&C).

This indicative methodology provides options for construction of this project but requires some flexibility to be retained to allow innovation to be applied during detailed design and construction.

This report should be read in conjunction with the Draft CEMP and Erosion and Sediment Control Plan, which provides a detailed methodology for the environmental controls that this report outlines.

3 Construction Objectives

The objective of the construction phase is to deliver a high quality product, in the most cost-effective, timely and efficient manner, with zero harm to those involved, whilst complying with all conditions and minimising the effects on the surrounding environment, road and rail users and the local and wider community.

To achieve this objective, the construction methodology notes the following key features:

- The NIMT rail line runs between the Peka Peka to North Ōtaki Expressway alignment and the existing SH1 for 70% of the route. Therefore, access into the site is heavily reliant upon using existing level crossings off the existing SH1, until such time as access can be gained along sections of the Project.
- The earthworks sequencing for the Peka Peka to North Ōtaki Expressway is a critical element in the construction methodology as this is driven by locality and availability of suitable materials and disposal of unsuitable materials.
- Relocation of approximately 1.2Km of NIMT rail line through Ōtaki will allow access to approximately 250,000m³ earthworks cut materials which need to be relocated along the alignment north of Ōtaki River and to the south.
- Ground improvements generally in peat deposits at Ōtaki, Te Horo and at Mary Crest at the south end of the project need to be undertaken early.
- Progression of the Ōtaki River Bridge and major earthworks cutting, at the south approach to the bridge for relocation further south.
- Early use, where possible, of the proposed Peka Peka to North Ōtaki Expressway route and bridges to transport materials throughout the site, minimising construction traffic on SH1 and local roads and the associated impacts.
- Sequencing of construction to optimise cut/fill earthworks balance and the effective reuse of undercut material, in order to minimise cut to waste and the requirement for imported material from “borrow areas” and local quarries.
- Selection of aggregate sources to minimise disruption from construction traffic on local roads while maintaining cost-effectiveness.
- Traffic management and construction sequencing arrangements that are safe, timely and result in minimal disruption to all road and rail users, including pedestrians, cyclists, horse-riders and construction vehicles.
- Provide planning and temporary facilities for the rotation/realignment of the Ōtaki Rail Station and realignment of the NIMT to minimise disruption to rail users

4 Indicative Construction Philosophy

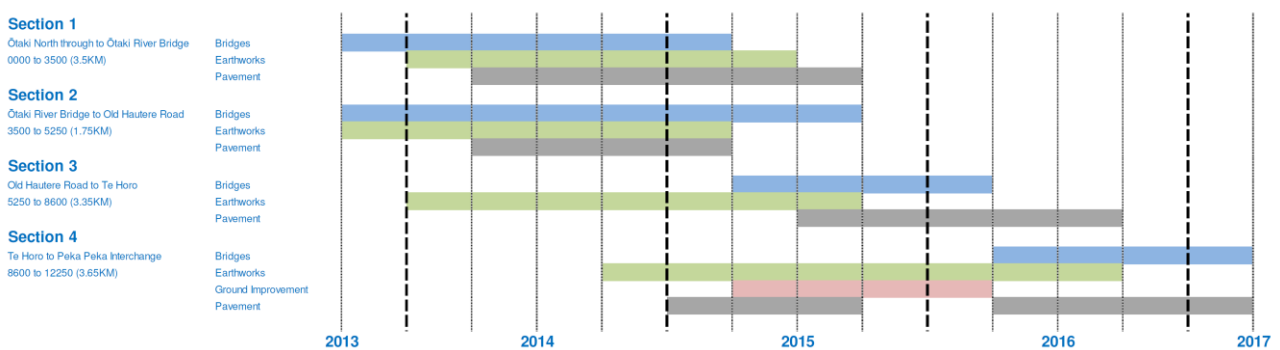
This indicative general methodology applies to the whole site and should be read on conjunction with the draft CEMP.

4.1 Project Establishment

This section describes how the Project will be established. It includes details on the likely location and purpose of the construction compounds that will be established to facilitate the works and also outlines how water and lighting are likely to be supplied to the construction operations.

4.2 Indicative Programme

The indicative programme below shows possible durations of bridges, earthworks and pavement construction in the various Construction Sections.



4.3 Site Access

Access into the site is formed from local roads. For much of the site, it is envisaged that the accesses will not be required from the existing SH1 but off side roads, and where required, will use existing level crossings over the NIMT. This methodology assumes that the project would be split into sections to enable the use of these existing level crossings and local roads. Site accesses off local roads would need to have suitable long term Traffic Management Plans and be provided with stabilized entranceways and pull off areas for construction traffic.

4.4 Site Security and fencing

Site fencing and security gates will be installed early at each access point and along the Peka Peka to North Ōtaki Expressway alignment. Construction compounds will be fully security fenced to provide for local offices, plant and materials storage during non-working hours as well as car parking for workers. The site will have stock-proof fencing installed as site clearance activities progress throughout each section, in advance of the main construction activities.

4.5 Construction Compounds

Due to the lineal extent of the project, a series of site construction compounds will be required along the alignment to accommodate and service works at various stages during the construction programme.

4.5.1 Main Contractor's Compound

The main Contractors compound and offices may be located between existing SH1 and the Peka Peka to North Ōtaki Expressway alignment between ch3200 and ch3400 in Section 1. The main Contractor's compound would typically be 1ha to 1.5ha in size. This is an ideal location as it is on the outskirts of Ōtaki, on the northern side of SH1, shielded from the residential properties by SH1 and the NIMT rail line. There is safe access and egress to and from both sides of existing SH1 beneath the rail and State Highway overbridges. These accesses are currently used by heavy haulage to and from the Winstone Quarry and the Stresscrete Ōtaki operations compound, hence are considered suitable for heavy vehicle operations.

The function of the Project Compound is to provide:

- Main administrative centre and welfare facility;
- Plant/equipment storage and workshop;
- Local access to alignment;
- Delivery point for materials into site; and
- Management and disposal of site and office waste.

Electricity will be provided to all facilities by connection to mains electricity. The facilities will also have a fixed telephone line for telephone and internet communication. Ablutions will connect directly into existing wastewater and sewer services where possible, otherwise septic tanks may be provided and these will be emptied via sucker-truck for offsite disposal. Water supply will be from a combination of mains water connection and water tanks located within the complex.

The compound is typically constructed in the following sequence:

- Clear site, establish erosion and sediment controls including clearwater diversions;
- Locate, protect or divert any services;
- Install granular access track to the area;
- Grade topsoil into bunds around the compound area as clearwater diversion;
- Place imported crushed rock surfacing to the compound;
- Erect security fencing and gates;
- Construct stormwater works; and
- Install foundations and pre-fabricated offices and workshops and connect to services.

There are limited earthworks to be undertaken to prepare the site in this location.

The construction and operation of the compound will be carefully managed to avoid disruption to the existing commercial operations and to ensure the safety of all using the accesses.

4.5.2 Local Construction Compounds

A local construction office compound will be set up at some of the bridge sites. It is expected that there will be one construction compound in each of the 4 Construction Sections. The purpose of each of these

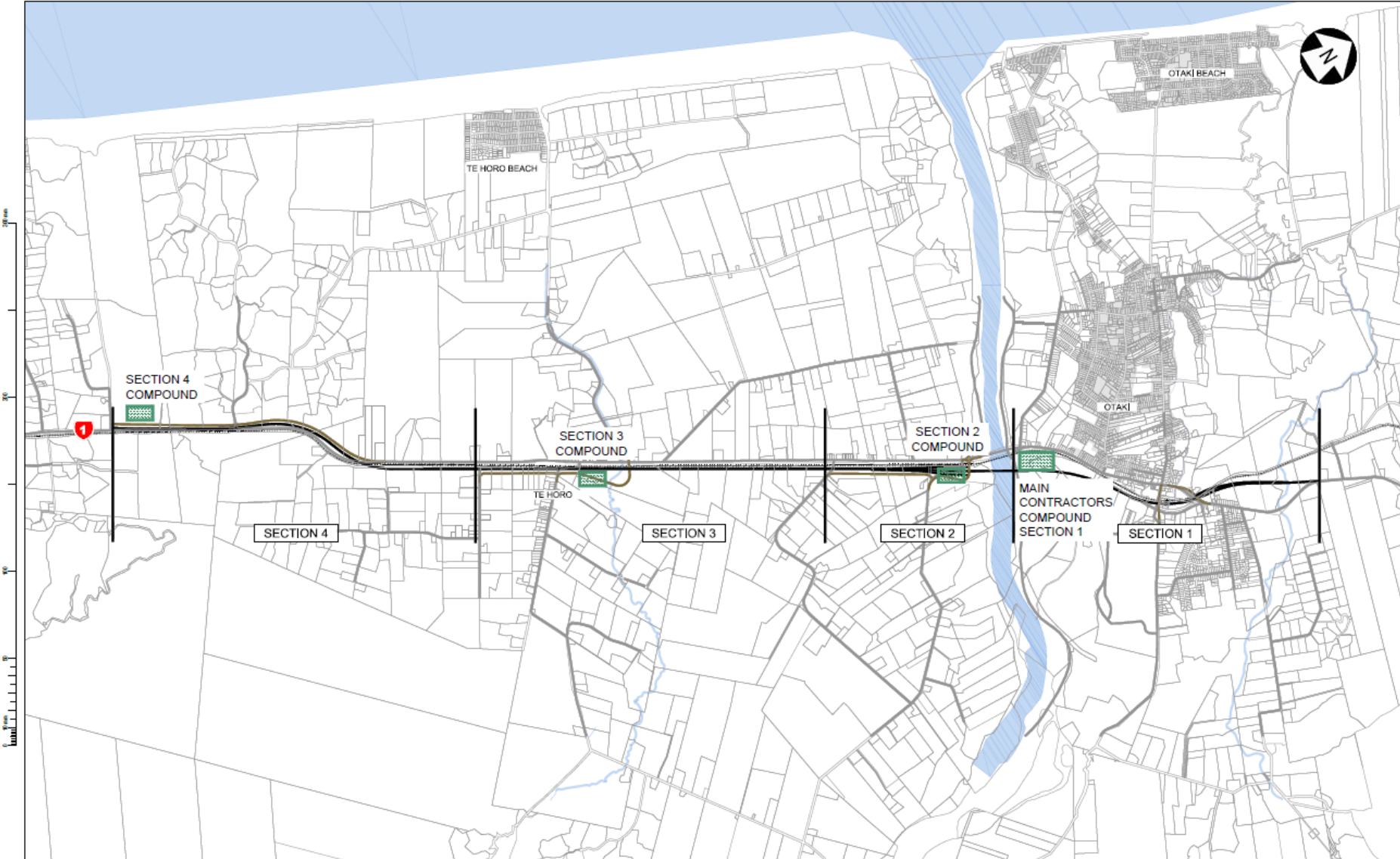
compounds will be to provide a construction office and welfare facility specifically for the duration of the bridge construction works. Services provided will be:



- Welfare/small office facility;
- Local plant/equipment storage;
- Local access to Alignment;
- Delivery point for construction materials; and
- Collection of site waste.

There are very limited opportunities to connect toilet blocks directly into existing waste services so portaloos will be provided and regularly maintained. Alternatively, waste storage tanks may be used and will be pumped out regularly to an approved disposal location. Water supply to site compounds will be from a mains water connection or tanks/bore if no connection is readily available.

Security lighting for the construction compounds will be designed and set up to minimise light pollution and ensure appropriate light shielding occurs.

The following plan shows possible locations for the construction compounds for each of the four Sections. The actual locations may be influenced by methodology and sequencing and will be confirmed once a contractor is selected.



				NZ TRANSPORT AGENCY PEKA PEKA TO NORTH OTAKI EXPRESSWAY CONSTRUCTION STAGING	
POSSIBLE CONTRACTOR OFFICE LOCATIONS		Date: 12/12/12		Drawn By: CS06	
Scale: 1:15000(A1), 1:30000(A3)		Project No: 5/2664/1/6504		Status: RA	

4.6 Water Supply

Where practicable and, to minimise the impact on water resources, the reuse of water from sediment retention devices will be used in construction operations. Swales can be formed early in the construction phase with decanting earth bunds (DEB's), primarily as erosion and sediment control devices but also to store water for re-use. However, to ensure adequate supply of water, an option to use deep water bores could be envisaged along the route of the Project. To minimise haulage, potential locations for water take could be as follows:

- Mary Crest area by the proposed attenuation pond;
- Te Horo Beach Road area near the local road;
- North of the Ōtaki River;
- South of the Waitohu Stream; and
- Peka Peka Interchange area (existing M2PP Project bore).

Where practicable, these bores could also provide water supply to the office/welfare facility in the construction compounds.

During drier months and at peak earthworks construction periods it is expected that up to a maximum 300cum per day will be required predominantly for construction purposes and a small amount for office use. This is based upon utilising up to 6 water tankers (5,000-6,000 litre capacity) during peak construction and water take would be spread between the water take locations.

Consents will be sought for the installation of water bores as required.

4.7 Construction Lighting

Lighting will be required in some construction areas to enable operations to proceed during the hours of darkness. Portable generator driven lighting towers will be brought to site as required and positioned to avoid the negative effects of light spill into local properties and onto local roads.

4.8 Night Work

In general, construction operations will occur during the day, unless operations are being carried out on or adjacent to an existing road or over live roads and rail that will require working during off-peak traffic hours at night. Elements that may require night time construction work are:

Bridges:

- Bridge 2 - crossing the existing NIMT rail line
- Bridge 4 - Rahui Road Underpass, span crossing the existing NIMT rail line
- Bridge 7 - South Ōtaki Interchange over the rail bridge
- Bridge 8 - Te Horo Underpass, span over NIMT
- Bridge 9 - Mary Crest Rail Bridge

Local road construction works that may have night time construction work are:

- Ch0000 to Ch0600 existing SH1 widening/Ōtaki northern gateway construction
- Ch1500 and Ch1800 - existing SH1 realignment tie in (each end) and County Road north tie in
- Ch2100 - Rahui Road/SH1, Rahui Road to County Road south tie in
- Ch3900 - Existing SH1/ Ōtaki Gorge Road Roundabout tie in
- Ch4300 - Ōtaki Gorge Road/Old Hautere Road tie in
- Ch5300 - Old Hautere Road tie in
- Ch7400 - Te Horo Beach Road tie in
- Ch7900 - School Road/Gear Road intersection
- Ch8600 - Gear Road tie in
- Ch9500 - new local road connection to ex-SH1
- Ch12250 - Peka Peka Interchange, Expressway and local connection

The northern tie in to existing SH1/Ōtaki northern gateway construction (Ch0000 to Ch0600) and the existing SH1/ Ōtaki Gorge Road Roundabout (Ch3900) will require permanent lighting. This will be provided as early as possible and supplemented where required with portable lighting towers.

At the southern end of the project, Peka Peka Interchange in its intermediate layout form constructed under the McKay's to Peka Peka project, will be fully lit and it is expected that tie in works at this location will require enhanced temporary lighting. Additional permanent lighting will be utilised where possible and supplemented with portable lighting towers where necessary.

4.9 Haul Roads

One of the principles of the Erosion and Sediment Control plan (ESCP) is to utilise the eventual stormwater devices, i.e. stormwater retention ponds and swales drains, as run-off carriers and retentions. Sediment controls will be installed within these stormwater devices until earthworks are complete and areas stabilised. In the period between earthworks completing and commissioning of the Project, for example while the proposed route is being used as a haul road, the stormwater devices will continue to be used to carry and collect run-off. Appropriate sediment control will remain in place in the constructed swale drains and retention areas to capture any potential sediment from the haul roads. Dust will be controlled by the use of watercarts where required.

4.10 Earthworks

The project involves approximately 800,000m³ of cut-to-fill and 45,000m³ imported fill across 4 construction Sections.

Figure 4-1 provides a graphical representation of the cut/fill comparison for the scheme design. It shows large cut volumes around chainages 1000, 4000 to 5000 and 10500 which provide a general balance of materials for the project. The estimate has assumed only a small amount of imported fill would be required.

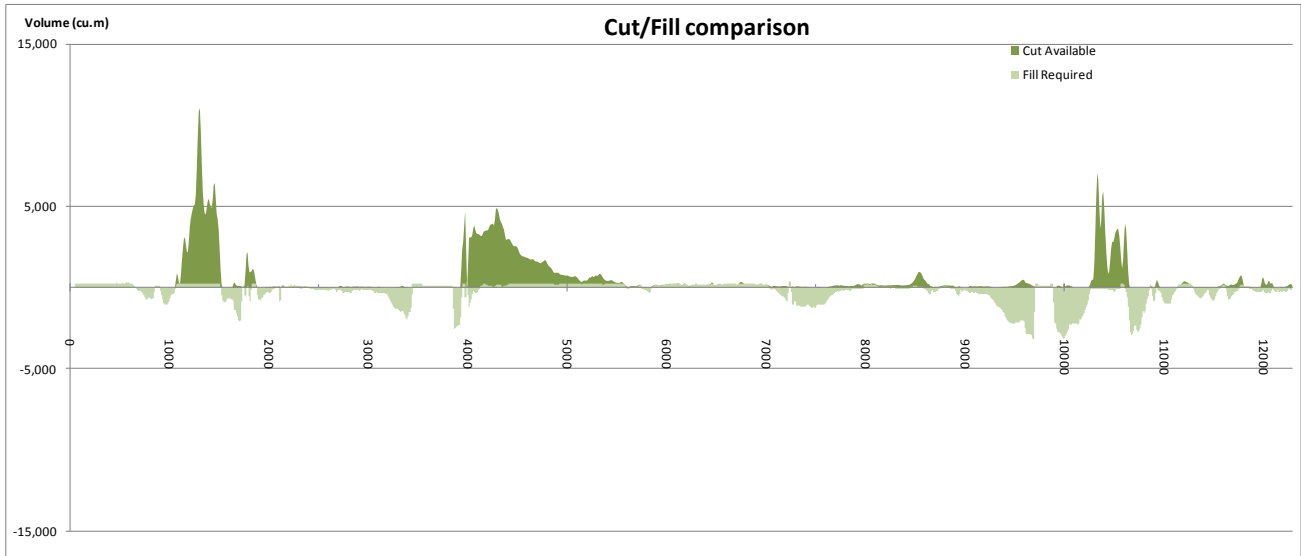


Figure 4-1: Cut/Fill Comparison

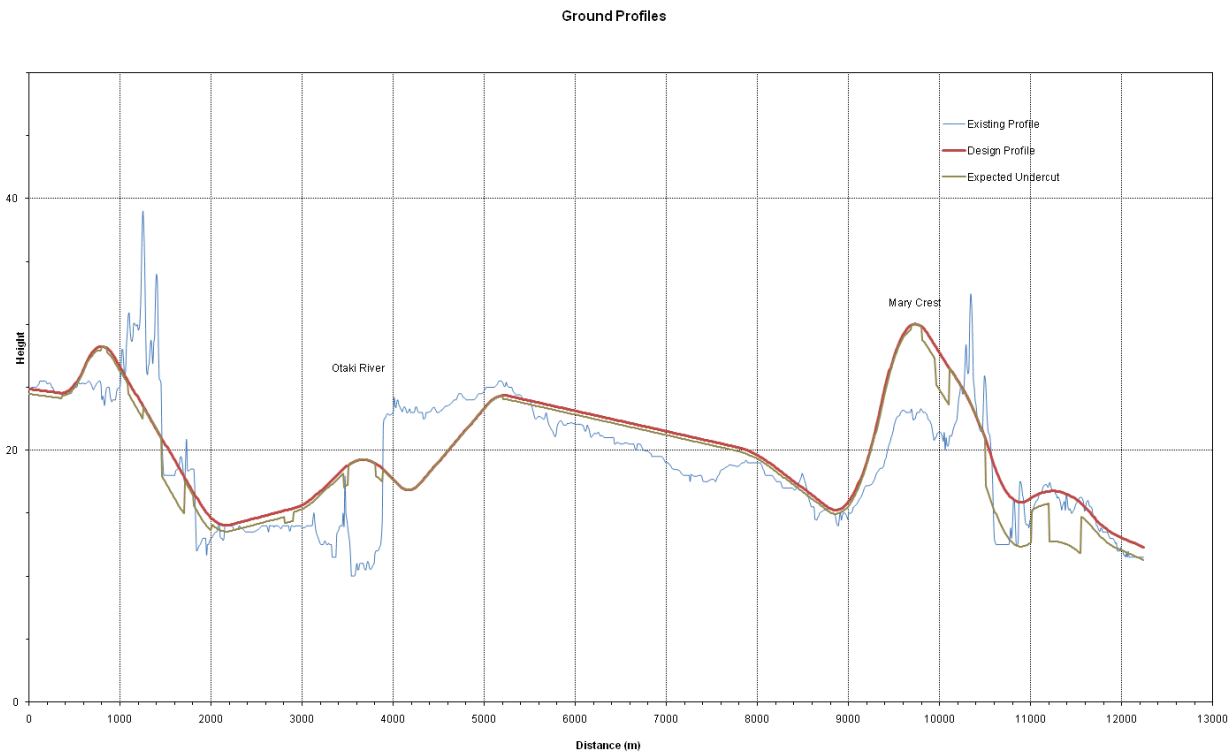


Figure 4-2: Earthworks Ground Profiles

For management purposes, each of the four construction sections will be progressed as an individual work package. Once the Construction Section site is set up plant and labour resources will establish and commence erosion and sediment control (ESC) works and site clearance to suit the earthworks phasing. Vegetation removed can be mulched and stockpiled for re-use around the site.

Topsoil stripping is typically undertaken by grading topsoil into bunds along the designation boundary fence for temporary storage and use as a clear water diversion. These will prohibit clear water entering the site and divert it along the alignment to existing watercourses. This method will rationalise the cartage of topsoil around the site.

Drainage elements, including wetland and flood offset storage areas, will be progressively completed and used as temporary ESC devices. The **permanent swales** at the sides of the expressway alignment can be excavated, from the outlet location, at the same time. As swale excavation proceeds, topsoil will be sequentially respread in the permanent swales. The respread topsoil and bunds can then be stabilised with grass seed and straw mulch for interim ESC purposes while the permanent grass swathe and landscape planting is established.

Decanting earth bunds (DEB's) can be installed at 100m - 200m intervals (3,000m² catchments) for ESC function and for construction water supply storage. Water carts can extract and re-use water collected in the DEB's for dust suppression where required.

Earthworks undercutting and cut-to-fill within the section can then commence, using dump trucks or motorscrapers, or can be carted to the required locations further along the alignment by road haulage (truck and trailer) via site accesses, local roads and SH1.

Undercut areas will generally be backfilled with sand so ground water will pose little problem for compaction purposes. The undercut material may also be re-used as buttress fill along the expressway embankments to limit the cartage off site, reduce the risk of batter failure and also to limit the need for imported material.

The **general principle for dealing with unsuitable ground**, mainly peat deposits, is to undercut to a maximum depth of 3m below existing ground or new subgrade level, whichever is lower. Replacement engineered fill is then imported to progressively backfill the excavation.

If unsuitable ground remains at a depth below 3m, a surcharge load (additional earthworks fill) will be utilised and may be left in place for up to 12 months for consolidation to occur. There is a potential shortage of suitable earthworks fill material on the project therefore any suitable materials in preload areas will be re-used once the settlement periods are completed.

Where possible, preload embankments will be constructed using cut material generated from the construction of the proposed Expressway Alignment. However, depending upon final detailed design and construction programme requirements by the successful tenderer, there may be a requirement for imported fill to be used in the embankments due to:

- 1 The bottom layer of the embankment may require an imported granular fill to facilitate drainage of groundwater generated by surcharge loads; and/or
- 2 In some locations, imported fill may be required to enable early completion and preload of the embankments to allow settlement periods to be achieved within the overall Project timeframe.

Table 9, extracted from the Geotechnical Interpretive Report, outlines areas where preloading may be required. Based on the thickness of compressible materials and the proposed road form, it is estimated that preloading would be required for a period of about 6 to 9 months.

Other ground improvement methods such as soil mixing using lime or other cement materials, vibro-compaction/replacement, and stone columns may be suitable options if unforeseen ground conditions such

as substantially thick unsuitable materials are encountered after further site investigations or during construction.

Table 9: Embankments in Inter-dunal Areas

Location	Approximate Station	Embankment Height	Indicative Thickness of Inter-dunal Deposits	Preparation of Embankment Foundation
North of Country Road	1450 – 1700 m	Up to 3 m	Up to 3 m	<ul style="list-style-type: none"> ▪ Option 1: Complete removal of soft deposits. ▪ Option 2: Preloading of soft materials and formation of shoulder buttresses or pressure berms.
Mary Crest Inter-dunes	9350 – 9750 m	Up to 8 m	1 m to 3 m	<ul style="list-style-type: none"> ▪ Complete removal of 1 m to 3 m thick soft deposits and replacement with competent fill.
South of Mary Crest	10500 – 11550 m*	Up to 5 m	Up to 3 m to 4.5 m	<ul style="list-style-type: none"> ▪ Option 1: Complete removal of soft deposits. ▪ Option 2: Removal of soft deposits up to 3 m depth and replacement with competent fill. Preloading the remaining soft materials. ▪ Option 3: Preloading of soft materials and formation of shoulder buttresses or pressure berms.
South of Mary Crest	11550 – 12200 m	Up to 1 m	1 m to 2 m	<ul style="list-style-type: none"> ▪ Complete removal of 1 m to 2 m thick soft deposits and replacement with competent fill

Note: * Localised inter-dunal deposits exist in between dune sand and alluvial deposits, refer to Figure 2 for

Expressway cut materials will be **“conditioned”** in cut or in fill as required to achieve suitable moisture content for placement and compaction as engineered fill. The bulk material from Section 1 and Section 4 is expected to primarily be dune sand while the material from Section 2 is generally expected to be silt/gravel alluvium material.

Dust will be controlled, as required, by watercarts extracting water from pre-consented bores/locations or ESC extraction points along the alignment.

The **earthworks production rate** is generally dependent upon access, haulage distance, resources and weather but for the purposes of this report we have assumed an average production rate of 4000m³ per week per Construction Section during the earthworks season, typically September to May. This gives an average area of open earthworks in fill of 1.5ha per Section. In reality this figure could double with conditioning of the alluvium from Section 2.

Potential sources of imported fill for the preload embankments include:

- Kāpiti Quarry;
- Ōtaki Quarry; and
- Waitohu Quarry.

The successful tenderer will contract the supply of materials on a commercial basis. The rate of consumption of specialised materials, e.g. NTZA M4 basecourse may not be manageable from one source and multiple supply sources may be required.

The sourcing of material will be managed by the successful tenderer. However, a degree of flexibility must be maintained for competitive tendering. During construction, it is foreseen that this will be efficiently managed by the successful tenderer to minimise haul distances, truck movements and cost.

4.11 Stormwater Drainage during Construction

Stormwater management during the construction phase is a separate and unique stage in the water management of the proposed Project. It occurs after earthworks activities have ceased in an area, and initial erosion and sediment controls may no longer be appropriate, but before long term operational stormwater controls are fully operational. Stormwater management measures are proposed for impervious construction areas and the pavement of the constructed Expressway.

4.12 Stormwater Drainage

The primary drainage conveyance system will be grassed swales, with ponds in some locations. Culverts are designed for crossing all waterways with the exception of the Ōtaki River and the Waitohu Stream. Culverts are provided for the smaller streams that are either permanent or intermittent. Culverts are also incorporated into the expressway embankment where natural flow paths would be interrupted.

Fish passage is to be provided for all culverts where fish are present. Culverts that are installed for stormwater drainage are not required to provide fish passage as these are not in watercourses or environments where fish species are anticipated to be present.

The installation of culverts will either require temporary watercourse diversion (around the local site) or will be constructed slightly off line and the watercourse will be realigned. In some instances temporary over-pumping may be used during installation. Site specific environmental management plans (SSEMP's) will be developed for geographical areas within the Project which will, amongst other things, cover the installation of each culvert.

Given the topography of the site, it is not expected that major diversions of waterways will be needed.

4.13 Bridge Construction

There are 9 bridges to be constructed, two of which are within the existing watercourses of Waitohu Stream and Ōtaki River. The construction methodology for each of the 9 bridges will be covered by the relevant SSEMP for their geographical area. The bridges are:

- Bridge 1, Waitohu Stream Bridge;
- Bridge 2 (note: this is the local road over expressway bridge);

- Bridge 3 (note: this is the local road over rail bridge);
- Bridge 4, Rahui Road Underpass;
- Bridge 5, Ōtaki River Bridge (two bridges that run parallel with each other);
- Bridge 6, (note: this is the South Ōtaki Interchange over expressway bridge);
- Bridge 7, (note: this is the South Ōtaki Interchange over rail bridge);
- Bridge 8, Te Horo Underpass; and
- Bridge 9, Mary Crest Rail Bridge.

Once the site access, fencing and ESC is prepared each bridge, whether a road crossing or stream/river crossing, will generally be constructed in the following sequence:

- 1 Preparation for ground improvements;
 - Cut existing ground to the base of the abutment, where required. Temporary retaining may be used to support adjacent land or infrastructure if required.
 - Replace peat with sand fill, where required. Temporary retaining and dewatering may be required to facilitate this operation.
- 2 Install stone columns, using vibro-replacement techniques, if required;
- 3 The current bridge design indicates the use of standard rotary bored piles potentially using driven (vibro-hammer) steel casings. This method is assumed for the purposes of this construction methodology. However, once detailed design is completed piles could be installed using other methods including:
 - Standard rotary bored piles, with driven temporary casings;
 - Driven steel 'H' piles;
 - Bottom driven steel casing with reinforced concrete; and
 - Continuous flight auger (CFA).

Where concrete is required to be placed by tremmie, the water within the pile bore will be pumped, as displaced by concrete, into a purpose made settlement pond, where it will remain until any cement residue has dried sufficiently to allow disposal to a suitable offsite tip.

- 4 Construct pile cap where required. Where high water table is experienced, sheet piles may be installed around the pile cap construction area and the area dewatered into a local decanting earth bund or sediment control pond;
- 5 Construct concrete column and crossheads and construct Mechanically Stabilised Earth (MSE) wall abutments;
- 6 Where prefabricated deck units (segmental, beam or hollow-core) are to be used, these will be placed by crane. Where the bridge crosses a live road or the NIMT, placement will be carried out within a night-time road closure or rail Block-of-Line. Bridge deck units will be prefabricated offsite and transported by road to each bridge site;

- 7 Complete top deck and side barriers; and
- 8 Concrete supply is likely to be from a supplier local to the Project. Concrete deliveries to all sites will be accessed via SH1 and local roads. Placement of concrete will be via concrete skips or pumps, depending upon access and delivery distances from the concrete truck to the pour section.

Environmental controls for the various bridges will be designed dependent on the risks and location. Road bridges will have differing environmental controls to stream/river crossings which will be covered in the SSEMP for their geographical area.

The Construction Traffic Management Plan details the proposals to control vehicular, pedestrian, cyclist and equestrian traffic during bridge construction and will be developed for each access.

4.14 Pavement Construction

Progressively, on completion of the earthworks subgrade and drainage in each Section, pavement construction will be undertaken, along with traffic services. It likely that in the construction sections one carriageway of the proposed Expressway may be completed and sealed to enable immediate protection of the subgrade and pavement layers while the opposite carriageway construction is progressed.

A typical pavement cross-section for the expressway, excluding surfacing, could be as shown below:

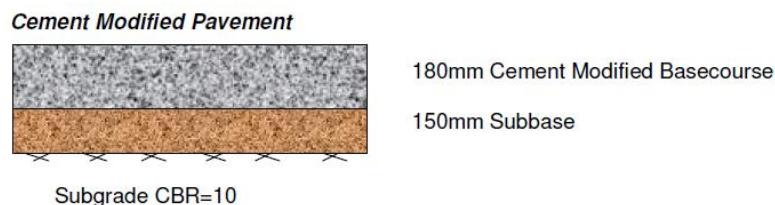


Figure 4-3 Typical Pavement Cross-Section

The local roads may have a similar typical cross-section but the basecourse layer is unmodified.

Pavement materials will be imported to site via SH1 and local roads, while early use of completed sections of the Expressway alignment will reduce traffic on the roading network.

Granular pavement courses will be constructed using traditional spread, grade and compact methods. Cement stabilization of the expressway alignment basecourse layer will be achieved with cement spreaders, water carts for hydration, mixing hoes, grader trimming and compaction plant. Care will be taken to avoid cement contamination into watercourses and wind conditions will be monitored to avoid air borne contamination. Cement product, if utilised, will be imported to site in tankers as daily use demands.

A risk allowance for this typical pavement option is provided in the table in Section 5.1 below, to cover the potential for a subgrade CBR value as low as 5%. This results in a potential increase in subbase depth from 150mm to 160mm overall, which increases the imported subbase quantities.

The final surfacing will be a two-coat chip seal with potential for Open Graded Porous Asphalt (OGPA) surfacing in selected locations if required for acoustic purposes.

While works are completed on each carriageway section, traffic services, roadside furniture and landscaping will progress.

5 Programme and Methodology

5.1 Construction Sections

This indicative construction methodology has considered the Expressway being managed as 4 separate construction sections, as shown below:

- Section 1 - Ōtaki North through to Ōtaki River Bridge Ch0000 to Ch3500 including NIMT;
- Section 2 - Ōtaki River Bridge to Old Hautere Road Ch3500 to Ch5250;
- Section 3 - Old Hautere Road to Te Horo Ch5250 to Ch8600; and
- Section 4 - Te Horo to Peka Peka Interchange Ch8600 to Ch12250.

It is noted that this is indicative only, and a final construction methodology will developed with Contractor input. These sections, along with key elements, are described in the table overleaf:

	Section 1	Section 2	Section 3	Section 4
Start and finish chainages	Ōtaki North through to Ōtaki River Bridge 0000 to 3500 (3.5KM)	Ōtaki River Bridge to Old Hautere Road 3500 to 5250 (1.75KM)	Old Hautere Road to Te Horo 5250 to 8600 (3.35KM)	Te Horo to Peka Peka Interchange 8600 to 12250 (3.65KM)
Bridges	Bridge 1 Waitohu Stream Bridge Bridge 2 (note: this is the local road over expressway bridge) Bridge 3 (note: this is the local road over rail bridge) Bridge 4 SH1 Rahui Road Underpass	Bridge 5 Ōtaki River Bridge Bridge 6 (note: this is the South Ōtaki Interchange over expressway bridge) Bridge 7 (note: this is the South Ōtaki Interchange over rail bridge)	Bridge 8 Te Horo SH1 Underpass	Bridge 9, Mary Crest Rail Bridge
Earthworks				
Cut available m ³	270,000	290,000	80,000	190,000
Undercut m ³	54,000	3,000	27,000	130,000
Fill needed m ³	-210,000	-35,000	-137,000	-470,000
Surplus to Section m ³	60,000	255,000	-57,000	-280,000
E/works duration wks				
In Section	68	73	20	48
To other Sections	15	64		
Truck movements				
In Section	10,500	1,800	6,900	23,500
Export or Import	3,000	12,800	-2,800	-15,100
*Truck & Trailer on SH1 or Dump truck on site	Surplus to Section 4 via SH1	Surplus to Section 3 via haul road, to Section 4 via SH1	Import from Section 2	Import from Sections 1 & 2 and offsite fill source
Local offline connections	Upgrade ex-SH1 Ōtaki Northern Gateway Realigned ex-SH1 (new local arterial road) over bridges 2 & 3, including North facing onramp County Road intersection Extended Rahui Road over bridge 4 Realigned NIMT (1.8KM) and move Ōtaki rail station	Ōtaki Gorge Road Interchange with south facing ramps Realigned Ōtaki Gorge Road over bridges 6 & 7 New Roundabout on ex-SH1 (new local arterial road) Extended Old Hautere Road (2KM) and connect to Ōtaki Gorge Road	Extended School Road (2.5KM) over bridge 8 and connect to Te Horo Beach Road Extended Gear Road (1.5KM) and connect to School Road	New local arterial road (5.5KM) from Te Kowhai Road, north to Te Hapua Road and then connect to ex-SH1 Local property accesses along ex-SH1 to Bridge 9
Drainage	8 culverts, swales (5.5KM), relocate railway wetland	3 culverts, swales (3KM)	7 culverts, swales (5.5KM)	12 culverts, swales (6.5KM)
Pavement Area				
Expressway m ²	90,000	49,000	84,000	91,500
Local m ²	9,500	11,200	14,000	19,250
Material vol m ³	33,000	20,000	33,000	37,000
Subbase risk m ³	16,000	10,000	16,000	18,000
Pavement duration (wks)	50	30	49	55
Truck movements imported materials incl. Subbase risk	2,000 3,000	1,200 1,800	2,000 3,000	2,200 3,300
Construction offices	Main Contractors compound between ex-SH1 and Expressway ch3200 to ch3400 access from Stresscrete Local bridge construction offices at Bridge 1, Bridge 2, Bridge 4	Local construction office at Bridge 6	Local construction office at Bridge 8	Local construction office at Bridge 9

5.2 Section 1 - Ōtaki North through to Ōtaki River Bridge Ch0000 to Ch3500

The key to construction in Section 1 through Ōtaki is the early realignment of existing SH1 and Rahui Road to provide the corridor for relocation of the NIMT, as early as possible. A critical task to be considered is the work to the historic Ōtaki Rail Station, which is to be relocated within the programme for Section 1, as part of the NIMT relocation.

Relocation of the NIMT then allows access to 270,000m³ of earthworks cut materials for expressway construction. To facilitate this and, to minimise the construction traffic impact on existing SH1 and through Ōtaki, the indicative sequence of construction through Section 1 (ch0000 to ch3500) is as follows:

(a) Existing SH1 Realignment including Bridges No 2 & 3

The realigned section of SH1 through Ōtaki will be constructed offline while the existing rail bridge and SH1 continues to operate.

Form site accesses from SH1, to the north and south of Bridges 2 and 3. Approved and compliant traffic management control on existing SH1 will provide safe and efficient site access and egress.

Install a culvert extension at Mangapouri Stream. The installation method will be covered in the SSEMP for the relevant geographical area.

Commence construction of the two bridges and earthworks embankments. Embankment fill will come from locally sourced earthworks cut (ch1500 to ch1700) and will be predominantly dune sand. As Bridge 3 is entirely within a cut area it is likely to be constructed from “top down”.

Bridge 2 will involve working adjacent to and above the NIMT and will require specific management planning with KiwiRail approvals, during construction.

(b) Bridge 4 Rahui Road Underpass Construction

Once piling works are completed on Bridges 2&3, Bridge 4 (Rahui Road) construction can be commenced. In order to minimise traffic impact, the bridge construction can commence with only localised lane restrictions on Rahui Road, at the west abutment. This can be undertaken by installation of long term traffic control but two-way traffic can be maintained until late in the construction phase when final approach ramp construction and roading tie-in can be undertaken using temporary traffic signals to control bi-directional traffic to one lane from County Road to the roundabout at existing SH1.

Bridge 4 construction can commence from the west abutment. This is a constraint to the sequencing of construction as the existing NIMT is at the eastern-most span of the bridge and cannot be relocated until bridges 2 & 3 are complete and existing SH1 traffic is relocated on to the new aligned section. The bridge construction must be sufficiently advanced, at this stage, to clear the NIMT rail span. County Road is realigned locally over the existing rail alignment at the eastern abutment.

(c) Localised earthworks for the NIMT realignment

NIMT earthworks can commence between ch1500m and ch2200m as soon as access is available. The options for construction plant access from one side to existing SH1 to the other are:

- Provide temporary support to the existing SH1 bridge south abutment and form a haulage route beneath the existing SH1 structure, or
- Provide a haulage route across existing SH1. However, installation of a plant crossing over existing SH1 has some difficulties with traffic delays and safety as well as a need for substantial temporary filling in Pare-o-Matangi Reserve.

The first option is preferred, subject to detailed design of support for the south abutment to create space for a haul road. Earthworks and pavement construction for the realigned existing State highway, either side of bridges 2 & 3, can also commence as the bridge construction progresses.

As these earthworks progress, it will be necessary to maintain vehicle and pedestrian access to current locations, including the rail station, until the bridge is completed and opened.

(d) Demolish the Old Rail Bridge

Once existing SH1 traffic is permanently moved to bridges 2 & 3 the existing SH1 and rail bridge can be demolished allowing unimpeded earthworks haulage and roading construction beneath. The bridge is a reinforced concrete structure which will be demolished with excavator-mounted hydraulic breakers and crushers. Water may be used to suppress dust during the demolition operation.

Demolition materials are likely to be disposed of offsite to an approved tip. Existing roading aggregate (approx. 1000m³) is likely to be re-used on site for haul roads, subgrade improvement and general fill.

(e) Prepare NIMT formation

At this stage Bridge 4 (Rahui Road) should be nearing completion. The rail corridor earthworks including an undercut of up to 3m in the railway wetland area (ch1500m to ch1800m approx.) can be completed up to the tie-in sections on the existing railway alignment.

(f) Relocate NIMT and Ōtaki Rail Station

The NIMT can then be moved to its new location. It is noted that the NIMT relocation tie-in work may need to be phased with the KiwiRail NIMT Block-of-Line programme. The historic Ōtaki Rail Station deconstruction and realignment works can also be undertaken at this time under the guidance of the Historic Places Trust. The work involves realigning the rail station building and platform by several metres, to suit the new track alignment. There is adequate land to the south of the existing platform and station to provide a temporary mass-bloc platform and commuter shelters while the station and platform deconstruction is undertaken and the new platform and station reconstruction works are being carried out.

The track lateral shift and tie-in will need to be programmed to suit KiwiRail track laying operations, however, once planning and programming is agreed, this is a relatively straight-forward operation.

Once the NIMT is moved, the eastern span of Bridge 4 (Rahui Road) and the County Road realignment can be constructed.

(g) Expressway Earthworks

At this stage there is unimpeded access from the northern earthworks cut area from ch1000m through the proposed route to Ōtaki River at ch3500m. Bulk earthworks can be undertaken with fill being transported along the alignment from the north while staying clear of existing SH1. An approximate 210,000m³ of fill is likely to be relocated within the Section 1 area. Water carts are likely to be used for dust suppression as required. A further 60,000m³ will be exported into Section 4 via existing SH1, to be used in undercut and preload areas.

The earthworks methodology will be undertaken primarily as described in the General Construction Philosophy.

(h) Drainage

There are approximately 5.5km of swales along with a number of culverts to be constructed within this section. These culverts will be installed prior to commencement of bulk earthworks and will be detailed in the relevant SSEMP that will be developed for their geographical area

The railway wetland relocation is also within this section and will also be covered in the relevant SSEMP with staging considerations to suit the constrained construction sequence.

(i) Pavement Construction

Section 1 pavement construction will commence as soon as subgrade levels have been achieved, with imported subbase materials placed early to protect the subgrade. Approximately 100,000m² of pavement is to be constructed and will require importation of approximately 33,000m³ of crushed aggregates into Section 1. This will generate around 2,000 - 3,000 Truck and Trailer trips into this section over an 18 month period.

(j) Complete Bridge 4 (Rahui Road)

Over a short period of approximately one month, the remaining earthworks embankments, drainage and pavement construction over County Road and at the western end of Rahui Road can be completed and the new Rahui Road can then be opened to traffic permanently. This will be undertaken using temporary traffic signals to control bi-directional traffic to one lane from County Road to the roundabout at the existing SH1. Single lane traffic will then be switched to the bridge once construction is sufficiently advanced.

(k) Waitohu Stream Bridge Construction

Piling works at Waitohu Stream Bridge can commence once the Bridge 4 foundations are completed. The work within the stream will be covered by the relevant geographical SSEMP which will detail suitable construction methodology. The Bridge requires foundations to be constructed within the streambed and consequently the method of construction is critical.

It is considered that construction of a causeway within the watercourse using locally sourced river aggregate may be appropriate for the foundation work. An appropriate consent will be required for this work. The method may be as follows:

- Construct a causeway from the riverbank, for piling rig access. The height of the causeway will be set at a level to permit inundation in high flow situations, or can be easily “breached” if required.
- All plant required to enter the watercourse via the causeway will be steam cleaned prior to arriving on site and will be checked daily for oil/hydraulic leaks. Any leaks will be repaired immediately and access into the watercourse will be delayed until inspection and clearance has been approved by the Construction Engineer.
- Fuelling will only occur in a securely bunded area well clear of the watercourse.
- All plant including the piling rig will be removed (walked) from the watercourse at the end of each working day or if inclement weather is forecast.
- After setout is undertaken, a sheet pile cofferdam can be installed and excavated to allow steel pile casing up to 30m in length to be installed using appropriate vibro-hammer equipment.
- Pile excavation will commence with pile arising’s being “spun-off” into a suitable steel skip to avoid material being deposited into the watercourse. The skip will be replaced as required by access along the causeway. It is expected that 30m³ - 40m³ could be excavated from each pile.
- Prefabricated reinforcement cages will be delivered via the causeway and placed into the pile once the founding depth has been reached and the pile toe is cleaned out.
- Concrete will be delivered to the pile/pier foundations via a line or boom pump situated clear of the watercourse and accessible by concrete delivery trucks via a haul road.
- It is expected that pile concrete will be placed under water within the pile casing using tremmie techniques therefore the cement laden water within the pile casing will be pumped to shore into a purpose-made storage pond well clear of the watercourse. Once this has dried sufficiently, the cement laitance will be loaded out and carted to a suitable offsite tip.
- Once pile concrete has cured, traditional pile break-down and pile cap construction methods will be undertaken, with reinforcement, formwork and concrete placement following. Alternatively precast pile caps piers and pier heads may be an option for minimising timeframes for working in the watercourse.
- Precast deck elements and barriers can then be installed.

(I) Northern Gateway Tie in to SH1

The tie-in to SH1 from Ch0000 to Ch0500 will require relocation of services, installation of culvert extensions and pavement widening on both sides of the highway, an upgrade to Taylors Road Intersection and extension of local property accesses, as shown on the project lay-out drawings. This will all be completed under appropriately approved traffic management plans and staged to minimise impact on local and regional traffic.

It is expected that drainage, earthworks and pavement construction will be undertaken on one side of the highway, traffic shifted onto new pavement with temporary lane markings, while the other side is constructed. For safety and efficiency reasons, completion of the gateway construction works into Ōtaki may be completed after the SH1 traffic is on the new expressway.

(m) Landscaping Pare-o-Matangi Reserve

As noted on a commemorative plaque within the reserve, Pare-o-Matangi Reserve was developed as a late 1990s Millennium project as a community amenity reserve by the Keep Ōtaki Beautiful group, with input from KCDC. Much of the existing reserve, as well as all of the undeveloped open space towards County Road will be removed as a result of the construction of the expressway and realigned railway.

As stated in c) above, the railway embankment earthworks can commence as soon as security fencing, ESC, site clearance and access beneath the existing SH1 bridge can be made.

There has been considerable consultation over the development and planting in Pare-o-Matangi Reserve, and the timing of that planting. Although this hasn't been fully confirmed yet, there will be a need to consider early landscape planting during the detailed programming phase of the work.

5.3 Section 2 - Ōtaki River Bridge to Old Hautere Road Ch3500 to Ch5250

The key tasks in Section 2 are the extension of Old Hautere Road to Ōtaki Gorge Road, Ōtaki South Interchange construction and Ōtaki River Bridge. Early construction of Ōtaki South Interchange will enable removal of the level crossing to the NIMT, separation of construction traffic from local traffic and full access to cut earthworks material and Ōtaki River Bridge construction.

Within this section is the availability of 290,000m³ of fill material between Ch3900 to Ch5250, primarily alluvial fan soils (silts and gravels) for transport south to Sections 3 & 4.

(a) Old Hautere Road Extension to Ōtaki Gorge Road

Construction of Old Hautere Road Extension to Ōtaki Gorge Road can commence early in the programme with the tie in to the existing local roads occurring as the final stage of the extension construction, once the site (including fencing, erosion and sediment control, etc.) has been set up as per the general construction philosophy outlined above. This local roading extension is generally construction of new pavement with subgrade improvement as required and swale drainage either side.

(b) Ōtaki South Interchange Construction

The interchange construction can commence early and will generally follow the sequence below:

- Disconnection of services and demolition of the buildings at the interchange needs to be undertaken first, with a Demolition Management Plan developed prior to construction.
- Install access to each bridge abutment for Bridge 7 (Rail Bridge) from Ōtaki Gorge Road. Code of Practice for Temporary Traffic Management (CoPTTM) level traffic control will be installed on SH1 and Ōtaki Gorge Road, for the site accesses. Provide site access gates, fencing, ESC, etc. as per the construction philosophy.

Construct **Bridge 7** MSE footings on West then East sides of the NIMT under KiwiRail stand-over, where required and commence MSE wall and approach ramp construction, clear of SH1. Piling for each abutment can be undertaken once the MSE walls are fully constructed.

Bridge 7 will involve working adjacent and above the NIMT and will require specific management planning with KiwiRail approvals, during construction.

Due to the close proximity, **Bridge 6** West abutment needs to follow soon after, however piling for Bridge 6 abutments can commence early, with minor filling to existing ground levels. The centre pier can either be constructed “top-down” or via local excavation to Expressway level, for piling.

Sequentially construct all 4 RC abutments for both bridges, followed by installation of the precast bridge elements which will be transported to site from SH1. Bridge 7 deck elements will be installed during the night.

While the bridge construction is underway, approach ramp fill, drainage, pavement work and traffic services can progress from Ōtaki Gorge Road to the east abutment of Bridge 6.

The roundabout construction on SH1 can commence simultaneously under appropriate CoPTTM traffic control.

Once pavement, traffic services and finishing’s are complete, the connection to Ōtaki Gorge Road and SH1 can be undertaken and the Interchange opened to traffic.

This frees up access to the remainder of the earthworks and expressway construction beneath Bridge 6 through to **Bridge 5 Ōtaki River Bridge** south abutment area.

(c) Ōtaki River Bridge

The construction period for the dual Ōtaki River Bridges is expected to commence as early as possible into the construction phase. Early completion of one of the bridges will allow construction traffic movement along the expressway alignment for earthworks haulage, drainage and pavement construction.

The work within the river needs to have significant mitigation efforts applied. The Bridge requires foundations to be constructed within the riverbed and consequently the method of construction is critical.

It is considered that construction of a causeway within the watercourse using locally sourced river aggregate may be appropriate for the foundation work. An appropriate consent will be required for this work. The method may be as follows:

- Construct a causeway from the riverbank, for piling rig access. The height of the causeway will be set at a level to permit inundation in high flow situations, or can be easily “breached” if required.
- All plant required to enter the watercourse via the causeway will be steam cleaned prior to arriving on site and will be checked daily for oil/hydraulic leaks. Any leaks will be repaired immediately and access into the watercourse will be delayed until inspection and clearance has been approved by the Construction Engineer.

- Fuelling will only occur in a securely bunded area well clear of the watercourse.
- All plant including the piling rig will be removed (walked) from the watercourse at the end of each working day or if inclement weather is forecast.
- After setout is undertaken, a sheet pile cofferdam can be installed and excavated to allow steel pile casing up to 30m in length to be installed using appropriate vibro-hammer equipment.
- Pile excavation will commence with pile arising's being "spun-off" into a suitable steel skip to avoid material being placed into the watercourse. The skip will be replaced as required by access along the causeway. It is expected that 30 - 40m³ could be excavated from each pile.
- Prefabricated reinforcement cages will be delivered via the causeway and placed into the pile once the founding depth has been reached and the pile toe is cleaned out.
- Concrete will be delivered to the pile/pier foundations via a line or boom pump situated clear of the watercourse and accessible by concrete delivery trucks via a haul road.
- It is expected that pile concrete will be placed under water within the pile casing using tremmie techniques therefore the cement laden water within the pile casing will be pumped to shore into a purpose-made storage pond well clear of the watercourse. Once this has dried sufficiently, the cement laitance will be loaded out and carted to a suitable offsite tip.
- Once pile concrete has cured, traditional pile break-down and pile cap construction methods will be undertaken, with reinforcement, formwork and concrete placement following. Alternatively precast pile caps piers and pier heads may be an option for minimising timeframes for working in the watercourse.
- Precast deck elements and barriers can then be installed.

(d) Expressway Earthworks

Within this section is the availability of 290,000m³ of fill material between Ch3900 to Ch5250, primarily alluvial fan soils (silts and gravels) for transport south to Sections 3 & 4. Cut from Section 2 to Section 3 can commence once the Section 2 and Section 3 site set up has occurred. This will be staged so cut will commence from south of the existing Ōtaki Gorge Road, carted via the Expressway alignment to Section 3 fill areas commencing at Ch5500 and proceeding south throughout Section 3. Approximately 57,000m³ will be cut to fill from Section 2 to Section 3, with the remainder of cut from Section 2 being transported, via SH1, to Section 4.

The earthworks methodology will be undertaken primarily as described in the General Construction Philosophy.

(e) Pavement Construction

Pavement construction will commence as soon as subgrade levels have been achieved, with imported subbase materials placed to protect the subgrade. In Section 2, approximately 60,000m² of pavement is to be constructed and will require importation of approximately 20,000m³ of crushed aggregates. This will generate around 1,200 - 1,800 Truck and Trailer trips into this Zone over a 6 month period.

5.4 Section 3 - Old Hautere Road to Te Horo Ch5250 to Ch8600

The key tasks in Section 3 are the extension of Gear Road to School Road and the extension of School Road across Bridge 8 Te Horo SH1 Underpass connecting to Te Horo Beach Road. The early completion of Bridge 8 would provide a safe left-in, left-out option for construction traffic. In addition, the alignment requires three crossings of the Mangaone Stream. Expressway construction can proceed while these local road extensions and Bridge 8 construction is underway.

Within Section 3 there is a shortfall of earthworks fill material requiring approximately 57,000m³ of imported material for the Bridge 8 embankments and Expressway alignment between Ch5500 and Ch7900.

The construction of Old Hautere Road extension to Ōtaki Gorge Road can commence early in the programme with the tie in to the existing local roads occurring as the final stage of construction.

(a) Construction of Gear Road Extension to School Road

Construction of Gear Road Extension to School Road can commence early in the programme, to enable removal of local traffic from the Expressway alignment for site preparation and commencement of construction.

Disconnection of services and demolition and relocation of the buildings along the extension needs to be undertaken first, with a Demolition and Relocation Management Plan, developed prior to construction.

The tie in at each end to the existing local roads can occur as the final stage of the local road extension construction, once the site (including fencing, ESC, etc.) has been set up as per the general construction philosophy outlined above.

This local roading extension is generally construction of new pavement at grade, with subgrade improvement as required and swale drainage either side.

(b) Bridge 8 Te Horo Underpass and School Road Extension Construction

Te Horo Underpass construction can commence early and is likely to generally follow the sequence below.

Set up site access and security as per the general construction philosophy. Disconnection or relocation of services will be undertaken prior to construction.

Mangaone Stream crossings, including culvert extensions and installations, will be detailed in the relevant SSEMP for the geographical area. These crossings will be installed early in the earthworks construction.

Commence construction of the earthworks approach embankments from School Road and Te Horo Beach Road, with fill imported from Section 2.

Construct Bridge 8 MSE footings at each abutment and commence MSE wall and approach ramp construction. Piling for each pier location and abutments can commence once the MSE walls are sufficiently advanced to enable continuity of the piling operation throughout.

One of the spans for Bridge 8 will involve working adjacent to and above the NIMT and will require specific management planning with KiwiRail approvals, during construction to cover piling, pier, headstock and superstructure construction.

While the bridge construction is underway approach ramp fill, drainage, pavement and traffic services work will progress to completion.

Once pavement, traffic services and finishing's are complete, the connection to School Road and Te Horo Beach Road can be undertaken and the local traffic diverted clear of the main expressway alignment.

(c) Expressway Earthworks

Within this section is a shortfall of approximately 57,000m³ of fill material. Cut from Section 2 to Section 3 can commence once the Section 2 and Section 3 site set up has occurred.

Undercuts will be undertaken where required and backfilled with sand from Section 4. The existing NIMT level crossing will be retained to late in the construction programme to facilitate safe site access and egress i.e. left-in left-out movements.

Based upon current design, the earthworks programme within this section could be completed within one earthworks season.

(d) Drainage

There are approximately 5.5km of swales along with a number of culverts to be constructed within this section and these will be installed prior to commencement of bulk earthworks and will require SSEMP's to be developed.

(e) Pavement Construction

Pavement construction will commence as soon as subgrade levels have been achieved, with imported subbase materials placed to protect the subgrade. In Section 3, approximately 85,000m² of expressway pavement and 14,000m² local road pavement is to be constructed and will require importation of approximately 33,000m³ of crushed aggregates generating around 2000 Truck and Trailer trips into this section over an 18 month period.

5.5 Section 4 - Te Horo to Peka Peka Interchange Ch8600 to Ch12250

The key tasks in Section 4 are the construction of the new arterial road to the west of the Expressway alignment. This new arterial road provides for the temporary diversion of SH1, during construction, from Peka Peka Interchange through to the existing SH1, north of Mary Crest and the Expressway crossing of the NIMT.

Within Section 4 there is a shortfall of earthworks fill material requiring approximately 280,000m³ of imported earthworks material from Section 1 and 2 and potentially 45,000m³ of imported fill. There will also be extensive excavation and backfill of undercuts and construction of preload fill embankments for ground improvements.

Bridge 9 Mary Crest Rail Bridge across the NIMT will be constructed and will also provide local property access.

(a) Ground Improvements

Section 4 has approximately 130,000m³ of undercut for ground improvements to be carried out. The extent is widespread and up to 3m deep and is generally in peat materials. It is envisaged that the peat may be reused along the alignment for buttress fill (sub topsoil) within the Section but also in Sections 2 and 3. As excavation proceeds, peat will be stockpiled along the alignment in bunds to dry out prior to final placement.

The programme will require undercut and preload to be undertaken as soon as cut material (dune sand) from within Section 4 is available and as soon as imported fill from Sections 1 and 3 is available. It is envisaged that haulage and placement of 60,000m³ of surplus sand dune cut from Section 1 will take place as the Section 1 material becomes available. This may be used in undercut replacement fill to minimise ground water impact on fill progress. In addition, return trucking movements can back-load peat into Sections 2 and 3.

This Section also requires preload placement for the embankments at Mary Crest, along with improvement by stone columns at Bridge 9 Mary Crest Rail Bridge.

Section 4 has approximately 190,000m³ of cut material available for use within the Section.

(b) Drainage

There are approximately 6.5km of swales along with a number of culverts to be constructed within this section. The culverts will be installed prior to commencement of bulk earthworks and will be covered by the relevant SSEMP's to be developed for the geographical area. Consideration will be given for drainage in preload and settlement areas and how best to mitigate the impact of settlement. For example, an option could be the use of over-sized culverts where settlement is predicted after installation.

(c) Expressway Earthworks

The current design shows earthworks fill shortfall, within this Section, of approximately 280,000m³. It is envisaged that the majority of this earthworks shortfall would be imported from Sections 1 and 2, along SH1, with any residual balance made up from imported fill.

Undercuts will be undertaken where required and backfilled with sand from Section 4.

The earthworks programme within this section is expected to be approximately 24 months allowing for embankment preload which will be in place for up to 12 months prior to bridge construction. A conservative programme of 70 working days per earthworks season would require 3,500m³ earthworks fill production per day.

Sequencing of the earthworks in this construction section will be based on the early construction of the new arterial road to the west of the Expressway alignment as this needs to occur as soon as possible for diversion of SH1 traffic.

(d) New arterial road

The new arterial road to the west of the Expressway will also form the temporary diversion of SH1 from Peka Peka Interchange to the existing SH1 north of Mary Crest, removing traffic from the existing SH1 over that length.

(e) Bridge 9, SH1 Mary Rail Bridge

Bridge 9 is a highly skewed structure requiring ground improvements, sub-surface tie beams, working adjacent to, beneath and above the NIMT and will require specific management planning with KiwiRail approvals, and stand-over protection during construction. Precast concrete elements placed above the rail will be installed during night time rail operations shut down. The design and specific construction methodology will be agreed with KiwiRail.

A possible sequence for construction for the current bridge design, once site set-up has occurred, may be:

- Carry out ground improvements with vibro-replacement stone columns.
- Install piles using temporary casings and standard rotary bored techniques.
- Construct pile caps, excavate slot trenches and place precast tie-beams. An alternative may be to horizontally drill ties from one pile cap to the other however this would be done prior to the pile cap being cast.
- Install precast wall panels and provide temporary props until precast beams and infill concrete abutments and deck are poured. Once this is completed engineered fill to the abutments can be placed and compacted, along with settlement slabs and barriers, etc.

(f) Pavement Construction

The construction of the new arterial road to the west of the Expressway alignment, for the temporary diversion of SH1 from Peka Peka Interchange to the existing SH1 north of Mary Crest, is required as early as possible, once drainage, undercutting and earthworks fill has taken place.

Pavement construction will commence as soon as subgrade levels have been achieved, with imported subbase materials placed to protect the subgrade as early as possible. In Section 4, approximately 90,000m² of expressway pavement and 20,000m² local road pavement is to be constructed and will require importation of approximately 36,000m³ of crushed aggregates to be imported, generating around 2,200 Truck and Trailer trips into this section over an 18 month period.

(g) Southern tie in to SH1 Peka Peka Interchange

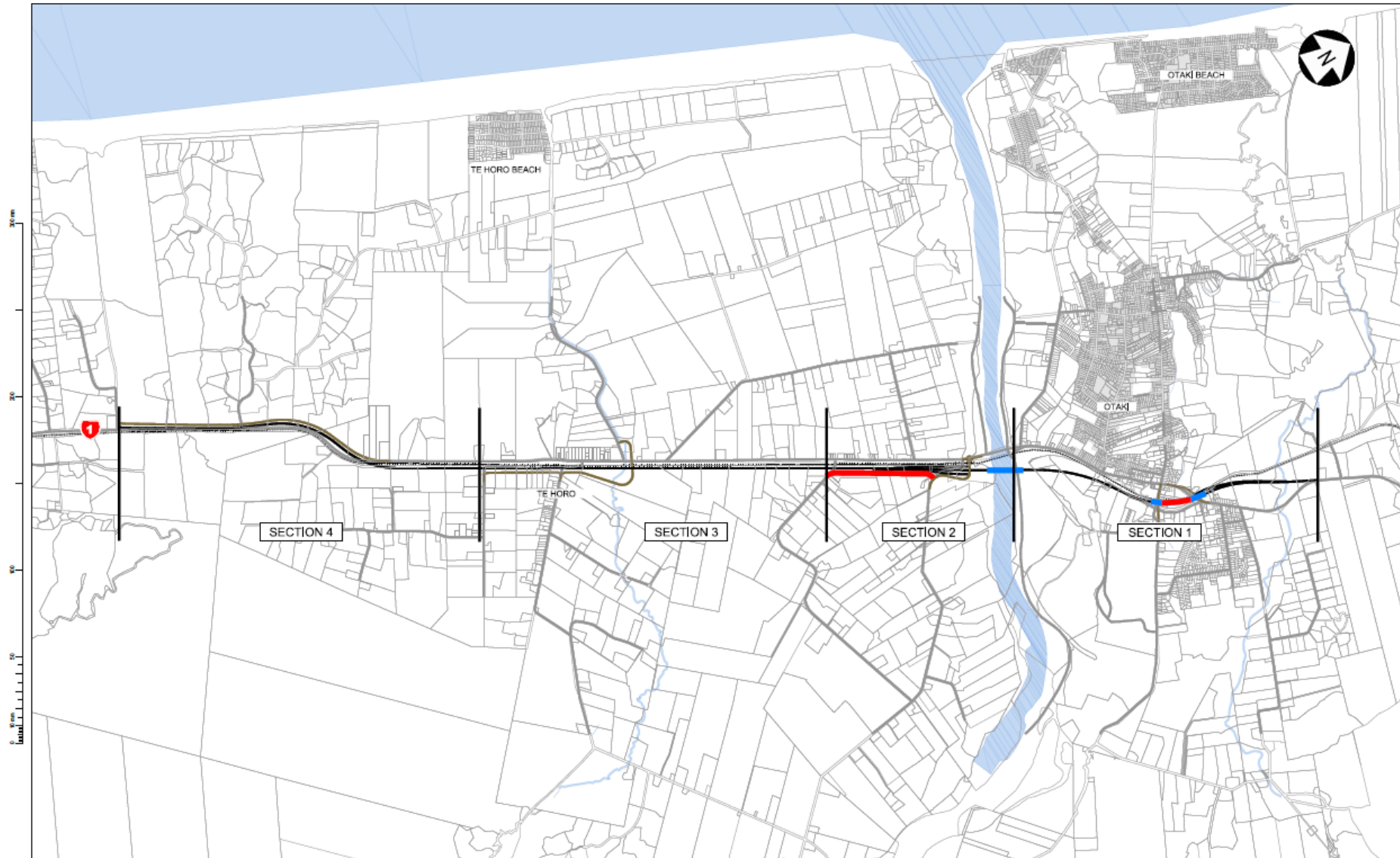
The tie in construction works will be undertaken towards the end of the construction phase under appropriately approved CoPTTM traffic management layouts. The Interchange tie-in works include upgrading the interim McKay's to Peka Peka Project layout, to the final Expressway configuration.

A full commissioning plan will be developed with NZTA, KCDC, the contractor and the management consultant to ensure all pre-opening approvals and the opening day planning is in place.

The traffic can then be switched to the new alignment with tie-ins at both Ōtaki North and Peka Peka Interchange.

5.6 Indicative Construction Staging

The following plans (5) show an indicative construction staging based upon the Programme and Methodology outlined above.



- LEGEND**
- BRIDGE WORKS
 - PRELOADED SETTLEMENT (INACTIVE SITE)
 - CONSTRUCTION
 - COMPLETE

Item	Description	Quantity	Unit



NZ TRANSPORT AGENCY
PEKA PEKA TO NORTH OTAKI EXPRESSWAY
CONSTRUCTION STAGING

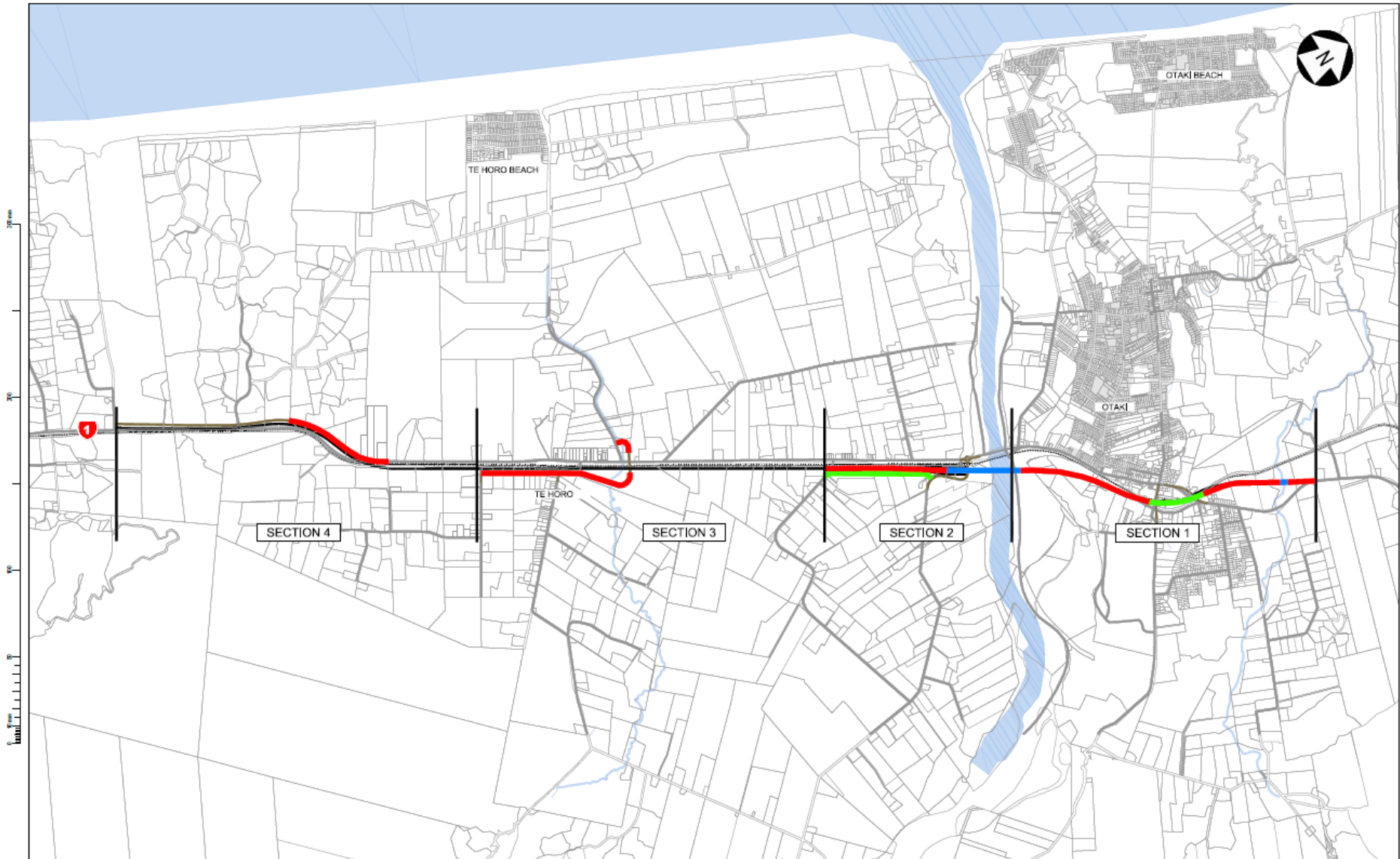
Item	Design	Quantity	Unit
102			

STAGE 1

Project No: 5/2664/1/6504

Scale: 1:15000(A1), 1:30000(A3)

CS01 RA



- LEGEND**
- █ BRIDGE WORKS
 - █ PRELOADED SETTLEMENT (INACTIVE SITE)
 - █ CONSTRUCTION
 - █ COMPLETE

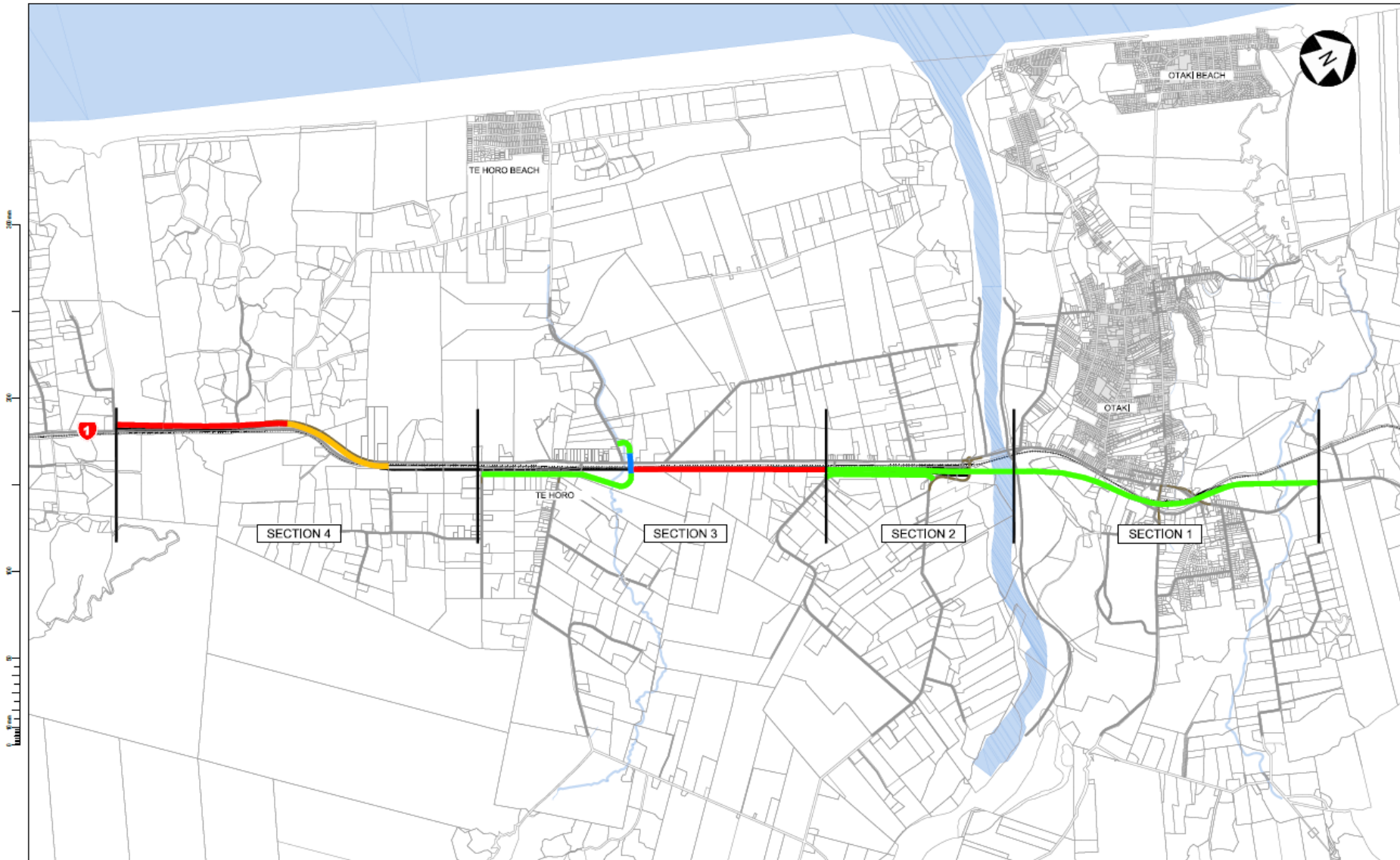
Section	Start	End	Start	End



NZ TRANSPORT AGENCY
PEKA PEKA TO NORTH OTAKI EXPRESSWAY
CONSTRUCTION STAGING

STAGE 2

Drawn	Checked	Approved	Issue Date
			10/12
Scale			
SC1614.00	1:15000(A1), 1:30000(A3)	5/2664/1/6504	CS02 RA



LEGEND

█	BRIDGE WORKS
█	PRELOADED SETTLEMENT (INACTIVE SITE)
█	CONSTRUCTION
█	COMPLETE

Section	Start	End	Length	Status
SECTION 4				
SECTION 3				
SECTION 2				
SECTION 1				

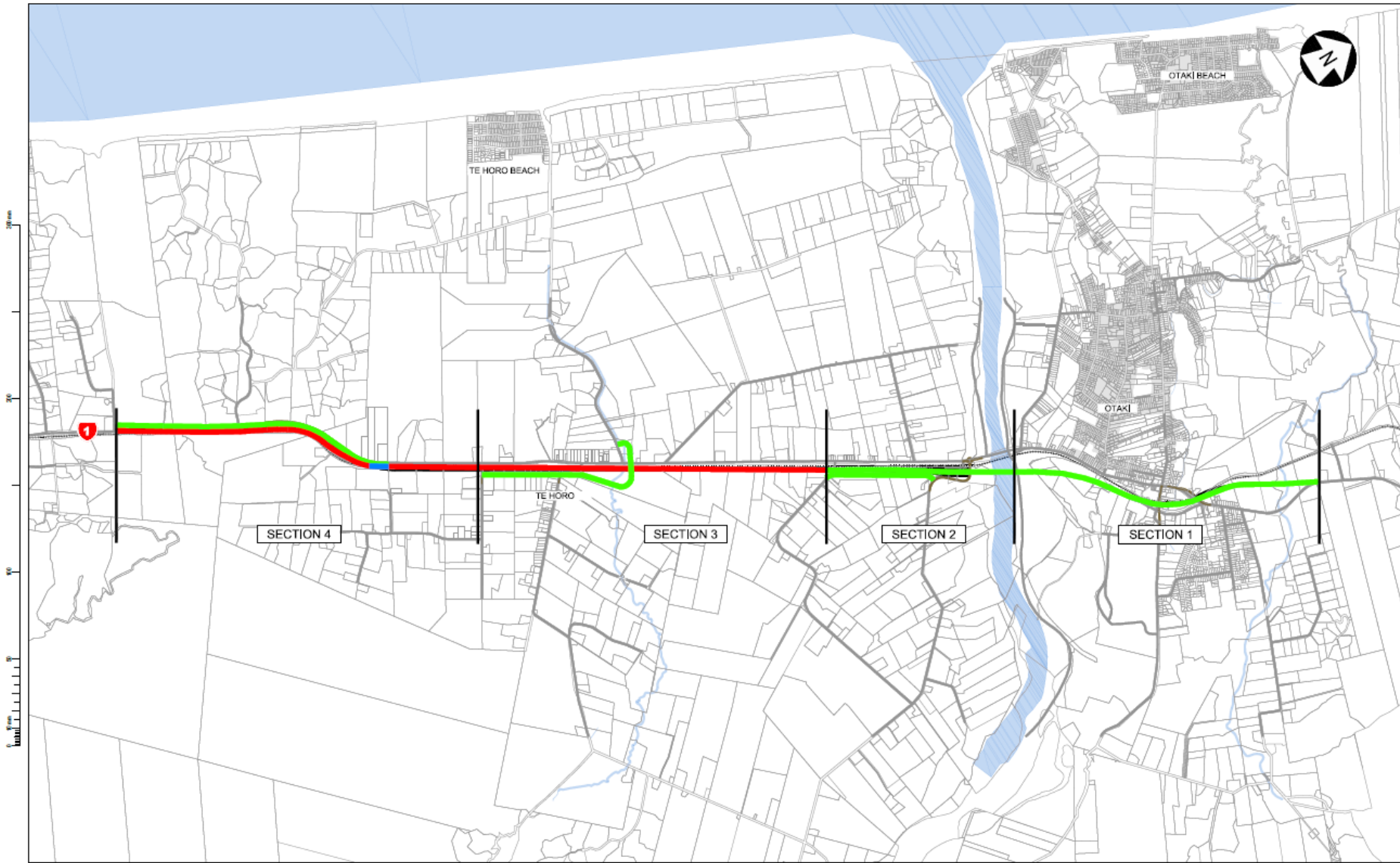


Scale	1:15000(A1), 1:30000(A3)
Sheet No.	5/2664/1/6504

NZ TRANSPORT AGENCY
PEKA PEKA TO NORTH OTAKI EXPRESSWAY
CONSTRUCTION STAGING

STAGE 3

Sheet No. CS03
Revision RA



- LEGEND**
- █ BRIDGE WORKS
 - █ PRELOADED SETTLEMENT (INACTIVE SITE)
 - █ CONSTRUCTION
 - █ COMPLETE

Section	Start	End	Start Date	End Date

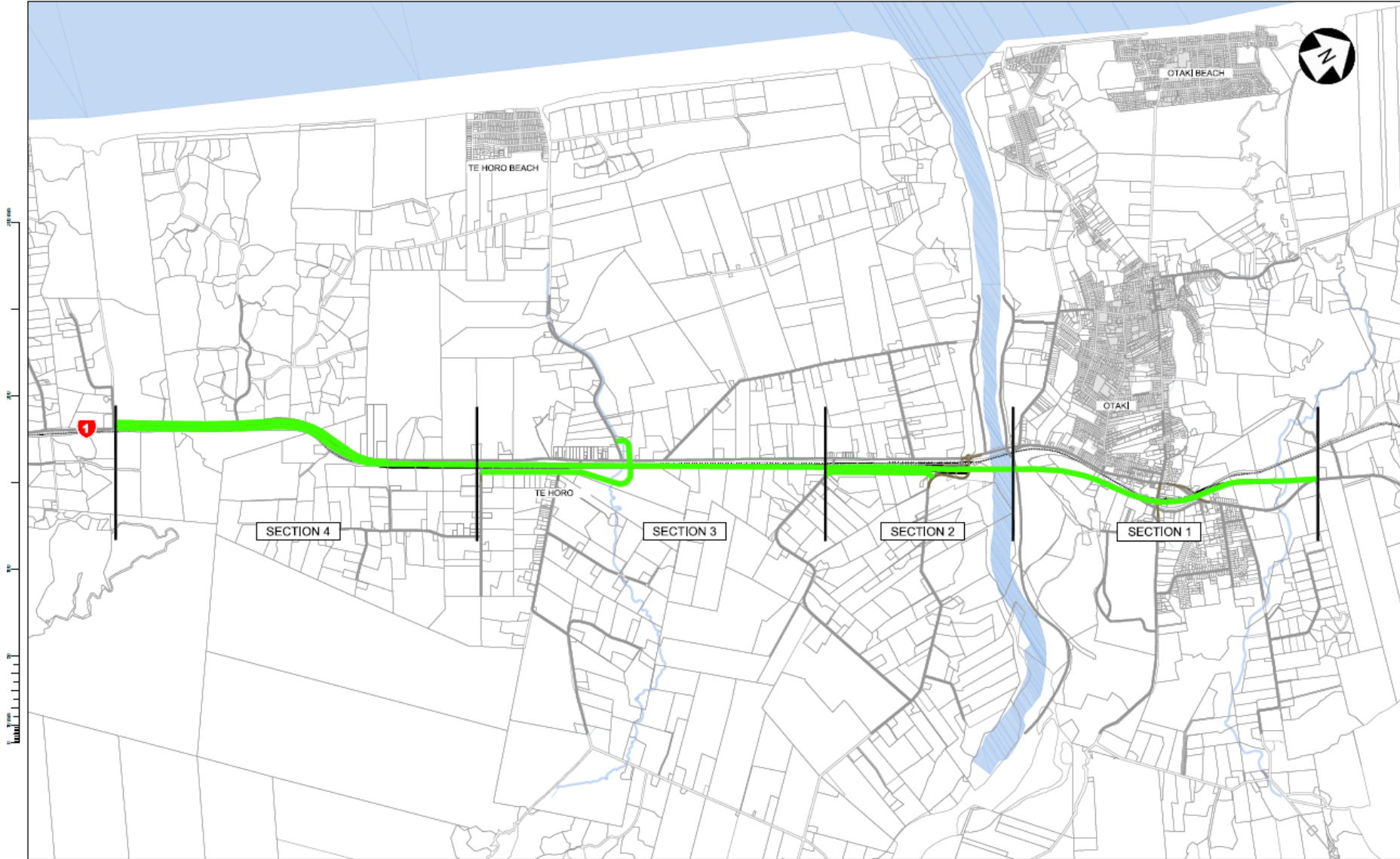


Client	Project	Section	Drawn Date
NB	SH	SH12	
Project No.	Scale	Drawing No.	Sheet No.
5C1814.00	1:15000(A1), 1:30000(A3)	5/2664/1/6504	CS04

NZ TRANSPORT AGENCY
PEKA PEKA TO NORTH OTAKI EXPRESSWAY
CONSTRUCTION STAGING

STAGE 4

Sheet No. CS04
Revision RA



LEGEND

	BRIDGE WORKS
	PRELOADED SETTLEMENT (INACTIVE SITE)
	CONSTRUCTION
	COMPLETE

Section	Start	End	Start Date	End Date



NZ TRANSPORT AGENCY
PEKA PEKA TO NORTH OTAKI EXPRESSWAY
CONSTRUCTION STAGING

STAGE 5

Scale	1:15000(A1), 1:30000(A3)
Sheet No.	CS05
Revision	RA

5.7 Summary of Environmental Effects

The table below provides a summary of the environmental effects that construction of the proposed Expressway will present and details the relevant Management Plans that describe the mitigation measures.

Actual & Potential Effects	Cause of Effect	Management Plan Name/Technical Report
Discharge of sediment to waterways	<ul style="list-style-type: none"> • Earthworks, bridge construction and drainage works 	Erosion & Sediment Control Plan (refer to Appendix C of the CEMP, Volume 4)
Dewatering of excavations	<ul style="list-style-type: none"> • Excavation and replacement of peat with sand • Excavation of sand below wetland/flood storage areas and replacement with peat 	Erosion & Sediment Control Plan (refer to Appendix C of the CEMP, Volume 4)
Disruption to groundwater	<ul style="list-style-type: none"> • Preload embankment settlement into peat. • Excavation & replacement of peat with sand. • Excavation below wetland/flood storage areas. 	Geotechnical Engineering and Geology Report (Technical Report 4, Volume 3)
Dust	<ul style="list-style-type: none"> • Cut faces • Haul routes • Fill embankments 	Erosion & Sediment Control Plan (refer to Appendix C of the CEMP, Volume 4) Construction Air Quality Management Plan (refer to Appendix B of the CEMP, Volume 4)
Oil and chemical spills	<ul style="list-style-type: none"> • Construction plant, vehicles and equipment • Construction materials 	
Noise and vibration	<ul style="list-style-type: none"> • Construction plant, vehicles and equipment 	Construction Noise and Vibration Management Plan (refer to Appendix A of the CEMP, Volume 4)
Light Spill	<ul style="list-style-type: none"> • Construction compounds and night works. 	Construction Methodology Report (Technical Report 5, Volume 3)
Working adjacent watercourses	<ul style="list-style-type: none"> • Bridge 1, Waitohu Stream Bridge • Bridge 5, Ōtaki River Bridge • Bridge 8, Te Horo Underpass • Culverts to existing watercourses 	Erosion & Sediment Control Plan (refer to Appendix C of the CEMP, Volume 4)

Actual & Potential Effects	Cause of Effect	Management Plan Name/Technical Report
Diversion of waterways Disruption to fish movements	<ul style="list-style-type: none"> • Permanent realignment of streams and drains • Temporary diversion for drainage installation 	Erosion & Sediment Control Plan (refer to Appendix C of the CEMP, Volume 4) Ecological Management Plan (refer to Appendix E of the CEMP, Volume 4)
Abstraction of water for construction	<ul style="list-style-type: none"> • Dust suppression • Compaction of granular materials • Ground improvement and structural work 	Erosion & Sediment Control Plan (refer to Appendix C of the CEMP, Volume 4) Geotechnical Engineering and Geology Report (Technical Report 4, Volume 3)
Settlement	<ul style="list-style-type: none"> • Ground improvement, earthworks construction & structural work. 	Geotechnical Engineering and Geology Report (Technical Report 4, Volume 3)
Construction traffic	<ul style="list-style-type: none"> • Ōtaki Project Office • Site Access points and local site compounds • Material deliveries • Removal of demolition materials various locations • Earthworks haulage from Sections 1 & 2 to 4 • Relocation of peat between Construction Sections • Administration 	Construction Traffic Management Plan (refer to Appendix G of the CEMP, Volume 4)
Waste	<ul style="list-style-type: none"> • Peat disposal • General waste management • Resource utilization 	
Contaminated land	<ul style="list-style-type: none"> • Various sites actual and proposed 	Contaminated Soils Management Plan (refer to Appendix D of the CEMP, Volume 4)
Archaeology	<ul style="list-style-type: none"> • Relocation of buildings, earthworks 	Accidental Discovery Protocol (refer to Appendix J of the CEMP, Volume 4)

Actual & Potential Effects	Cause of Effect	Management Plan Name/Technical Report
Built heritage	<ul style="list-style-type: none"> • Relocation of buildings, earthworks 	Accidental Discovery Protocol (refer to Appendix J of the CEMP, Volume 4)
Culturally sensitive areas	<ul style="list-style-type: none"> • Earthworks 	Accidental Discovery Protocol (refer to Appendix J of the CEMP, Volume 4)