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Dear Josh

TRAFFIC IMPACT ASSESSMENT – PAKOWHAI STOPBANK, HAWKES BAY

East Cape Consulting (ECC) has been engaged by Hawke's Bay Regional Council to prepare a Transportation Impact Assessment report (TIA) for a proposed stopbank to the west of Pakowhai in Hawke's Bay.

An Order in Council (OiC)[1] was established in 2024 to facilitate timely provision of works such as the proposed stopbank, which are part of the response to damage caused by Cyclone Gabrielle in 2023.

Schedule 3 identifies Matters Of Control. Access And Transport, Part (b), identifies "potential adverse effects on the safe and efficient operation of the transport network during flood protection works, and measures to avoid, remedy, or mitigate those effects". This TIA assesses potential traffic effects of the proposed stopbank and recommends mitigations.

By way of the summary, it is concluded that the project area has adequate opportunity to access the surrounding road network. The details of access routes and access points, and the management of construction effects more generally can be appropriately managed by a Construction Traffic Management Plan (CTMP).

1. SITE LOCATION

The location and proposed extent of the stopbank are shown as Figure 1 and Figure 2 below. The stopbank runs to the south of Links Road and the west of Pakowhai Road, generally following the alignment of the Tūtaekurī-Waimate Stream.

The road network context, including the District Plan road hierarchy (which used the One Network Road Classification (ONRC) system) is shown as Figure 3.

[1] The Severe Weather Emergency Recovery Legislation (Hawke's Bay Flood Protection Works) Order 2024.

Figure 1 – Location Plan (Source: Tonkin and Taylor[2])

[2] Hawke's Bay Regional Council, Pakowhai Secondary Stopbank, Preliminary Design (Tonkin and Taylor, 04/09/2025).

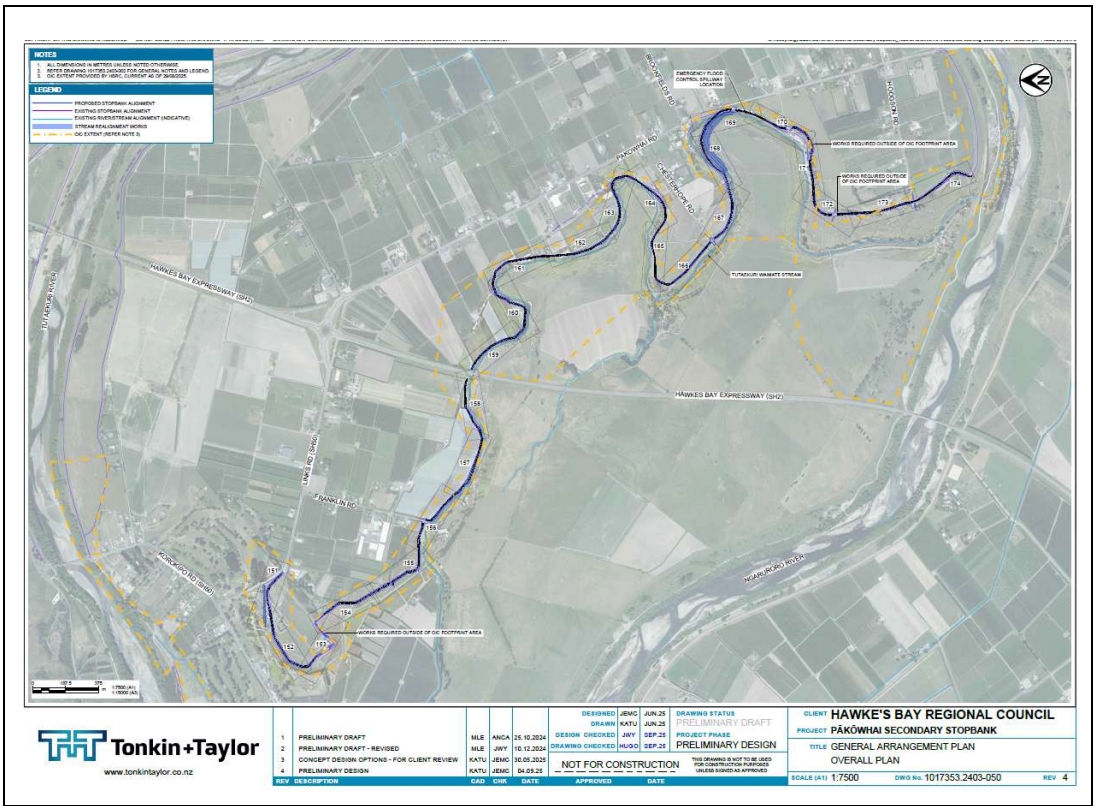


Figure 2 – General Arrangement Plan (Source: Tonkin and Taylor)

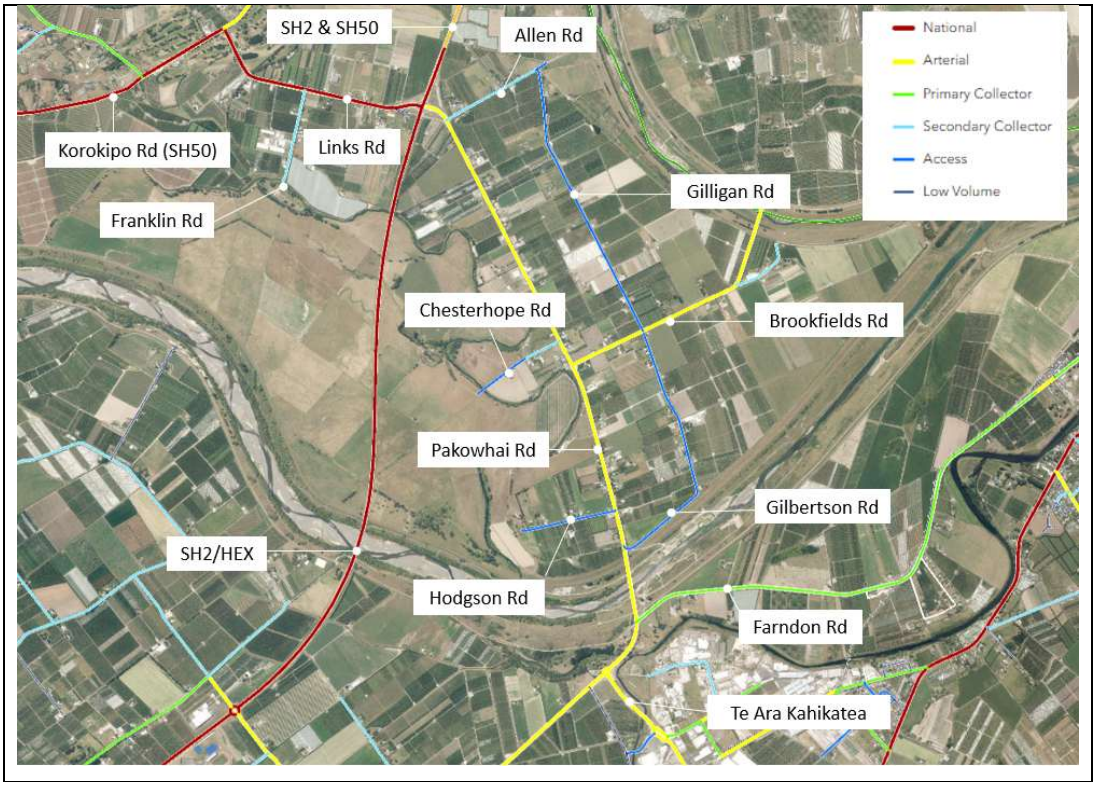


Figure 3 – District Plan Road Hierarchy (Base Map Source: HDC)

The project site and the surrounding area in in the Plains Production Zone (PPZ) of the Hastings District Council (HDC) District Plan.

2. ROAD NETWORK

2.1 Road Hierarchy

Figure 3 illustrates that the Hawke's Bay Expressway (HEX) forms the primary transport corridor in the area. It forms State Highway 2 (SH2) and runs generally north-south connecting to the boundary with Napier City in the north and to Central Hawke's Bay in the south.

State Highway 50 (SH50) provides an inland alternative to the west, named as Links Road and Korokipo Road. It then shares the HEX corridor to the north of Links Road. These roads are all classified as national routes and are managed by the New Zealand Transport Agency (NZTA).

In the supporting HDC network, Pakowhai Road is classified as an arterial road. It also runs generally north-south and connects from the HEX south to Whakatu and Hastings. Brookfields Road and Te Ara Kahikatea provide east-west arterial connections.

Farndon Road is classified as a primary collector road. Allen Road, Franklin Road and part of Chesterhope Road are secondary collector roads. Other roads are classified as access roads.

2.2 Road Layout and Daily Volumes

The characteristics of the road network around the site are summarised in Table 1 for the road links.

Table 1 – Road Link Characteristics[3]

Road	Status and RCA	Average Daily Traffic Volume (vpd)	Posted Speed Limit	Typical Formation
HEX (SH2 and SH50)[4]	National route and State Highway, NZTA	22,170	100km/h	Divided carriageway (wire rope) one lane each way with additional lanes around Pakowhai Road roundabout.
Korokipo Road (SH50) (south of Links Road)[5]	National route and State Highway, NZTA	5,469	70km/h	One lane each way, sealed width approximately 8.5m. Centreline and edge lines.
Links Road (SH50)[6]	National route and State Highway, NZTA	6,344	100km/h	One lane each way, sealed width approximately 10.5m Centreline and edge lines.
Pakowhai Road	Arterial Road, HDC	9,350 – 11,800	80km/h with some sections of 60km/h	One lane each way separated by painted flush median with edge lines. Sealed width approximately 12m.
Allen Road	Secondary collector, HDC	390	80km/h	Unmarked two-way carriageway. Sealed width approximately 5.3m.

[3] Traffic volumes and carriageway widths sourced from Mobileroad website (carriageways also inspected with site visit).
[4] Site ID: 00200659, South of Links Road.
[5] Site ID: 05000013, 300m East of Franklin Road.
[6] Site ID: 05000014, 200m South of Omarunui Road.

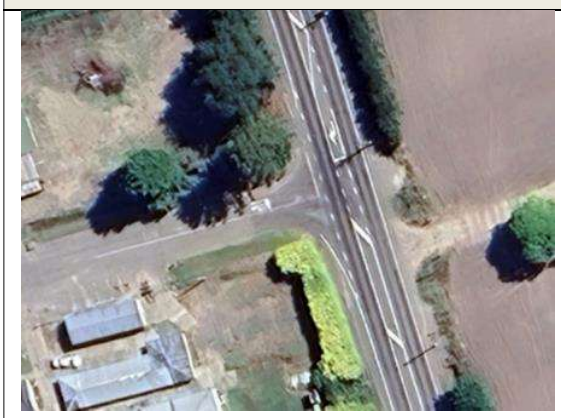
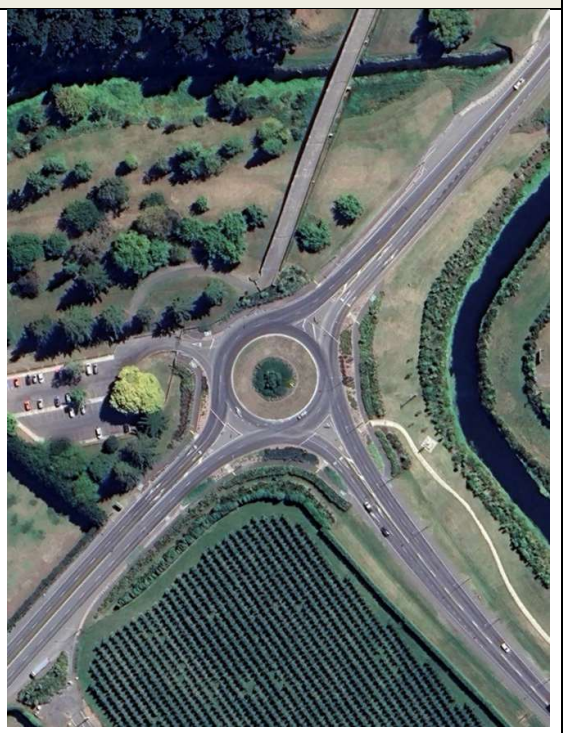
Road	Status and RCA	Average Daily Traffic Volume (vpd)	Posted Speed Limit	Typical Formation
Gilligan Road	Access, HDC	220	80km/h	Unmarked two-way carriageway. Sealed width approximately 5.4m.
Brookfields Road (Pakowhai Road to Gilbertson Road)	Arterial, HDC	3,625	80km/h	One lane each way, sealed width approximately 8m. Centreline and edge lines.
Chesterhope Road	Access (western end) and secondary collector (eastern end), HDC	230	60km/h	Unmarked two-way carriageway. Sealed width approximately 5.1m. Concrete footpath on southern side.
Hodgson Road	Access, HDC	80	80km/h	Unmarked two-way carriageway. Sealed width approximately 7m for the first 60m from Pakowhai Road reducing to approximately 5m.
Gilbertson Road	Access, HDC	320[7]	80km/h	Unmarked two-way carriageway. Sealed width approximately 7m. Currently closed from a point ~50m east of intersection with Pakowhai Road. River track can be accessed to/from Pakowhai Road. Properties with access to Gilbertson Road cannot access Pakowhai Road and travel via Brookfields Road.
Franklin Road	Secondary collector, HDC	380	80km/h	Unmarked two-way carriageway. Sealed width approximately 5.3m.
Farndon Road	Primary collector, HDC	3,475	80km/h	One lane each way, sealed width approximately 7.4m. Centreline and edge lines.
Te Ara Kahikatea	Arterial, HDC	10,700	80km/h	One lane each way, sealed width approximately 13m. Centreline and edge lines.

The characteristics of the road network around the site are summarised in Table 2 for intersections.

[7] Prior to closure.

Table 2 – Intersection Characteristics

Korokipo Road (SH50)/Links Road (SH50)	**Links Road (SH50)/Franklin Road**
	
Give way controlled T-intersection where Korokipo Road (SH50) has priority running south-west to north-east. Right turn bay and some left turn shoulder widening provided on north approach.	Stop controlled T-intersection. Links Road has priority east-west.
HEX (SH2 & SH50)/Pakowhai Road	**Pakowhai Road/Allen Road**
	
Dual lane at-grade roundabout with a diameter of 60m. Two approach lanes on all legs.	Give Way T -intersection. Pakowhai Road has priority (north-south). Right and left turn lanes on Pakowhai Road.
Pakowhai Road/Chesterhope Road	**Pakowhai Road/Brookfields Road**
	
Stop controlled T-intersection. Pakowhai Road has priority (north-south) Painted median on Pakowhai Road. Left turn lane provided on Pakowhai Road approach from south.	Give Way T-intersection. Pakowhai Road has priority. Painted median, right turn lane and left turn shoulder widening on Pakowhai Road.

Pakowhai Road/Hodgson Road	Pakowhai Road/Gilbertson Road
	
Stop controlled T-intersection. Pakowhai Road has priority. Painted central median on Pakowhai Road with right turn bay marked from north.	Give Way controlled T-intersection. Pakowhai Road has priority. Through movement not permitted along Gilbertson Road to the east of intersection. Turns to/from Pakowhai Road restricted to left in and left out only.
Pakowhai Road/Farndon Road	**Pakowhai Road/Te Ara Kahikatea**
	
Priority controlled T-intersection with continuous channelised left turn lanes to and from Farndon Road. Right turn bay on Pakowhai Road south approach. No right turn permitted from Farndon Road to Pakowhai Road.	Dual lane roundabout (~40m diameter central island). Two approach and departure lanes on three of the four legs.

2.3 Hourly Volumes (HEX Roundabout)

Classified turning movement data for the HEX/Pakowhai Road/Links Road roundabout was made available to the project team. This count was undertaken on Thursday 27 February 2025 and covered the time periods 6:30am-10:00am, 11:00am to 1:00pm, and 2:30pm to 6:00pm.

The total roundabout volume, classified by light and heavy vehicles, is summarised on Figure 4 below. Figure 5 shows the heavy vehicle volumes only.

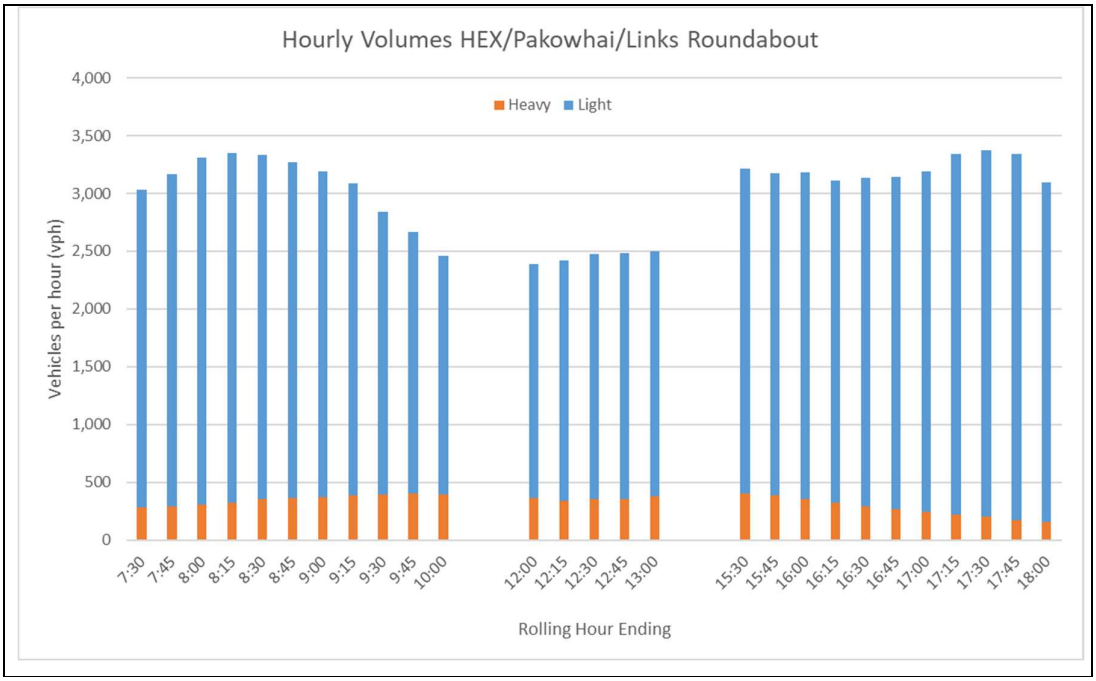


Figure 4 – Total Hourly Volume Summary (HEX Roundabout)

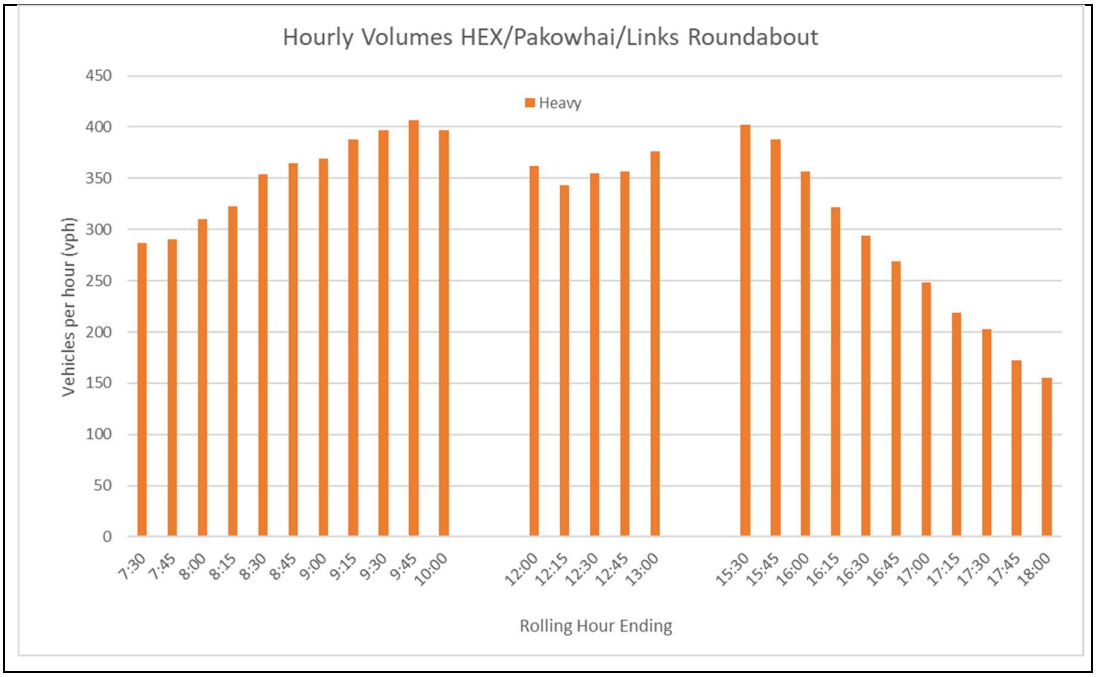


Figure 5 – Total Hourly Heavy Vehicle Volume Summary (HEX Roundabout)

The graph shows that the roundabout carries a combined light and heavy vehicle volume of approximately 3,400 vph during the morning and evening peak hours. These occur during the hour ending 8:15am and 5:30pm. Volumes during the middle of the day are lower, at just under 2,500 vph.

The roundabout carries between 150 and 410 heavy vehicles per hour. These volumes build through the morning, settle during the day at around 350 vph and decline from around 4pm.

3. ROAD SAFETY

The NZTA Crash Analysis System (CAS) was used to review the road safety history of the area. The search area included the roads[8] and intersections described in Table 1 and Table 2.

The five-year period 2020 to 2024 inclusive was reviewed, as well as any available records from 2025 to date. Injury crashes (fatal, serious or minor) were captured. The crash history is summarised in Table 3. This Table also notes if heavy vehicles were involved in any of these crashes and provides specific commentary on those incidents.

Table 3 – Injury Crash Summary

Location	Total Injury Crashes	Severity			Crash Types and Factors	Heavy Vehicles Involved
		Fatal	Serious	Minor		
Intersections						
HEX/Pakowhai Road Roundabout	4	-	-	4	Loss of control, merging, changing lanes, hit rear. Alcohol, inattention, inappropriate speed.	-
Links Road/Korokipo Road (SH50)	2	-	-	2	Failure to give way turning from side road.	-
Pakowhai Road/Allen Road	2	-	-	2	Loss of control turning or overtaking	-
Pakowhai Road/Chesterhope Road	1	-	-	1	Loss of control, driver inexperience.	-
Pakowhai Road/Gilbertson Road	2	-	1	1	Loss of control, driver inexperience, forbidden movement.	1[9]
Pakowhai Road/Brookfields Road	3	-	1	2	Loss of control, missed intersection or end of road. Slippery road surface, inappropriate speed.	-
Pakowhai Road/Farndon Road	2	-	-	2	Failure to give way, making right turn from left-only lane.	1[10]
Pakowhai Road/Te Ara Kahikatea	4	-	-	4	Loss of control (3) and failure to give way. Excessive speed, driver inexperience.	1[11]

[8] The review of the HEX was limited to the area around the Pakowhai Road roundabout and did not include any mainline sections beyond this.
[9] Southbound truck on Pakowhai struck by a tractor making a banned turn into Gilbertson Road.
[10] Southbound truck on Pakowhai Road was struck by car making right turn from left only lane out of Farndon Road.
[11] Car failed to give way to truck.

Location	Total Injury Crashes	Severity			Crash Types and Factors	Heavy Vehicles Involved
Midblock Sections						
Pakowhai Road	13	2	2	9	Loss of control (8), cut corner, u-turn, rear end, passenger fell from vehicle. Driver impairment, inexperience, fatigue, vehicle faults.	1[12]
Links Road	3	0	1	2	Rear end, loss of control when turning or overtaking.	-
Brookfield Road	1	0	0	1	Loss of control, inattention.	-
All Locations	**37**	**2**	**5**	**30**	**-**	**4**

In total, 37 injury crashes were reported in the search area, which comprises approximately 18km of roads. Two of these caused fatal injuries, five caused serious injuries and 23 caused minor injuries. The types of crashes, road user types and causative factors varied.

Review of the individual crash histories at these locations indicates that the following issues should be reviewed and considered in the Construction Traffic Management Plan (CTMP) that is discussed later in this report:

At Pakowhai Road/Brookfield Road:

- If construction traffic is to use Brookfield Road to approach Pakowhai Road, the conspicuity of the intersection for drivers approaching from the east.

At Pakowhai Road/Gilbertson Road:

- If the intersection is to be used for movements that are either currently permitted or temporarily permitted, measures to clearly indicated and enforce what turns are permitted and not permitted.

Four of the 37 reported crashes involved trucks. Two of these crashes involved drivers making a banned turn at either Gilbertson Road or Farndon Road. One involved failure to give way on the part of the other vehicle. Another involved a passenger falling from a moving truck. This was attributed to issues with safe work practices rather than the road environment itself. The reported road safety history does not point to any issues for heavy vehicles in this area.

More generally, increased construction traffic on the network does present generally elevated road safety risk for the duration of the project. The appropriate mechanism to mitigate and manage these is a CTMP, which is discussed in more detail later in this report.

[12] This incident involved a temporary traffic management worker collecting and standing up fallen road cones whilst standing on a slow-moving vehicle, driven by another worker. The driver was distracted and drove the vehicle off the road, causing the worker to fall.

4. PROPOSED STOPBANK PROJECT

4.1 Project Overview

An overview of the proposed stopbank was shown earlier as Figure 2. It is proposed to be split into five separable portions and delivered as two contracts. Contract 1 will include separable portions 1, 2 and 3. Contract 2 will include separable portions 4 and 5. The project areas are shown as Figure 6 below and included at a larger scale as Attachment 1.

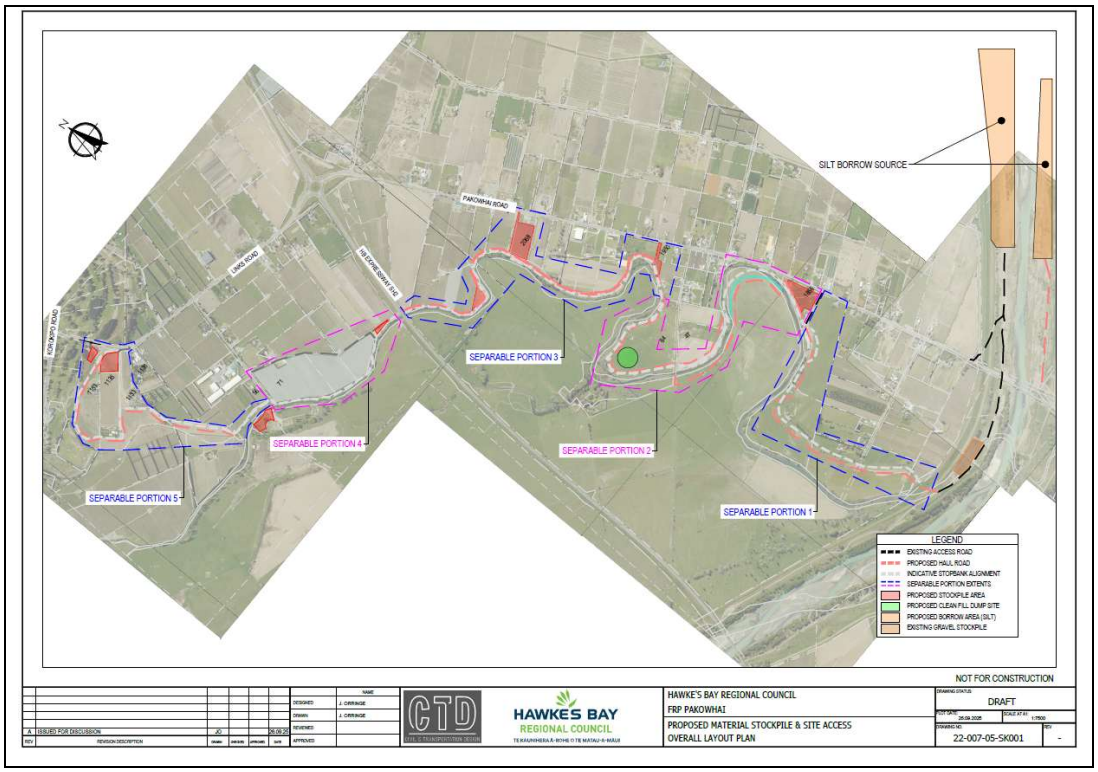


Figure 6 – Overall Layout Plan (Source: CTD)

It is understood that the project will require an estimated 230,000m^3 of imported material (compacted in place). The volumes by separable portion (SP) are expected to be:

- SP1 36,000m^3
- SP2 61,000m^3
- SP3 49,000m^3
- SP4 17,000m^3
- SP5 67,000m^3

The stockpiling phase is expected to take four to five months for each separable portion. Therefore, stockpiling for SP1, SP2 and SP3 is expected to take twelve to fourteen months. Stockpiling for SP4 and SP5 is expected to take eight to nine months. The two contracts will be delivered at roughly the same time so some stockpiling activities will occur simultaneously.

4.2 Construction Traffic Generation

Table 4 and Table 5 below presents estimates of construction movements during the enabling works phase, when material is stockpiled on site. This is expected to be the most intense phase of the project in terms of vehicle movements.

Low and high estimates are presented because the mix of vehicles used for haulage (trucks versus trucks with trailers) is not known at this stage of the project and will be determined by the successful contractor(s). Typically, transporting material with truck and trailer units is more efficient however trucks (alone) can be advantageous if manoeuvring space is constrained.

Each SP is expected to take approximately four to five months to complete. The two contract areas are expected to operate concurrently but the SPs within each are expected to operate sequentially.

Contract 1 (SP1, SP2 and SP2 on the southern side of the HEX) is expected to start in February 2026 and take eight to nine months in total.

Contract 2 (SP4 and SP5 on the northern side of the HEX) is expected to start in April 2026 and take 12 to 14 months in total.

Table 4 presents the low range (in terms of vehicle movements) estimate which is based on 80% trucks with trailers and 20% trucks. Table 5 presents the high range estimate which assumes 20% trucks with trailers and 80% trucks.

Table 4 – Estimate of Construction Traffic Movements (Stockpiling Phase, Low Estimate)

Parameter	Unit	Contract 1			Contract 2	
		SP1	SP2	SP3	SP4	SP5
Material required (compacted in place)	m^3	36,000	61,000	49,000	17,000	67,000
Material required after allowance for shrinkage and losses (20%)	m^3	43,200	73,200	58,800	20,400	80,400
Loads of Material[13]	Loads	2,400	4,067	3,267	1,134	4,467
Total Vehicle Movements (Two-Way)	Vehicle Movements	4,800	8,134	6,534	2,268	8,934
Days Available[14]	Days	90	90	90	90	90
Volume of Material Moved/day	m^3	480	813	653	227	893
Average Daily Vehicle Movements (Two-Way)	Vehicles per day (vpd)	53	90	73	25	99
Working Hours Per Day	Hours	10	10	10	10	10
Average Hourly Vehicle Movements (Two-Way)	Vehicles per hour (vph)	5	9	7	3	10

[13] Based on average capacity of $10m^3$ per truck and $20m^3$ per truck and trailer with assumed use of 20% trucks only and 80% trucks with trailers.
[14] Assumes 20 working days per month and a mid-range estimate of 4.5 months (90 days).

Table 5 – Estimate of Construction Traffic Movements (Stockpiling Phase, High Estimate)

Parameter	Unit	Contract 1			Contract 2	
		SP1	SP2	SP3	SP4	SP5
Material required (compacted in place)	m^3	36,000	61,000	49,000	17,000	67,000
Material required after allowance for shrinkage and losses (20%)	m^3	36,000	61,000	49,000	17,000	67,000
Loads of Material[15]	Loads	3,600	6,100	4,900	1,700	6,700
Total Vehicle Movements (Two-Way)	Vehicle Movements	7,200	12,200	9,800	3,400	13,400
Days Available[16]	Days	90	90	90	90	90
Volume of Material Moved/day	m^3	480	813	653	227	893
Average Daily Vehicle Movements (Two-Way)	Vehicles per day (vpd)	80	**136**	109	38	**149**
Working Hours Per Day	Hours	10	10	10	10	10
Average Hourly Vehicle Movements (Two-Way)	Vehicles per hour (vph)	8	**14**	11	4	**15**

The worst-case traffic generation scenario has been taken from Table 5 and would occur if SP2 and SP5 were active at the same time. This would result in daily traffic generation of 285 vpd and peak hour generation of 29 vph.

Although other deliveries (earthmoving machinery and materials such as sheet piles) will occur throughout the project, higher numbers of deliveries will occur in those SP's with lower silt volumes rather than add to the larger volume SP's.

4.3 Access

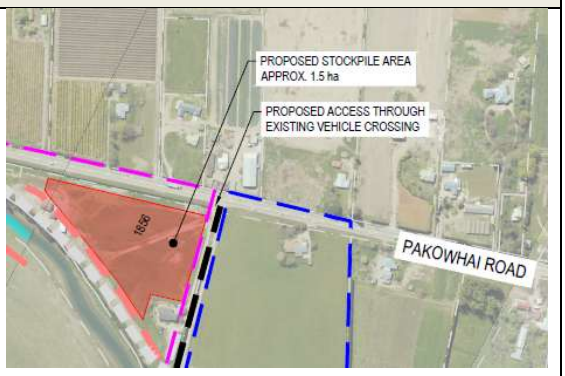
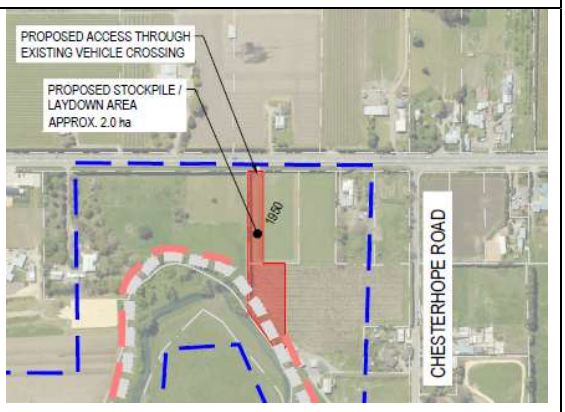
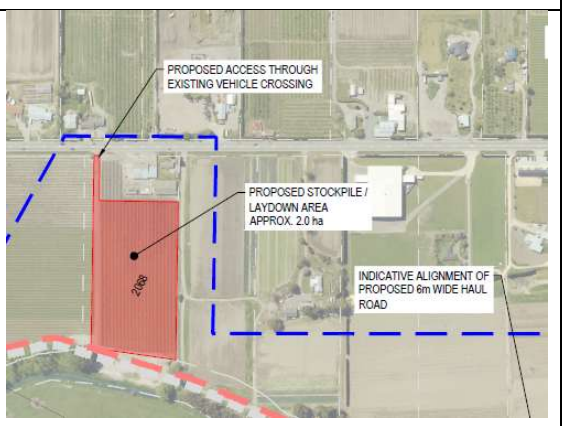
Proposed access arrangements to each SP are shown in detail on the CTD drawings in Attachment 1. A 6m haul road is proposed, generally following the alignment of the stopbank. Eight stockpile areas have been identified and will attract the most significant volume of heavy vehicle movements during construction. These are also shown on the CTD drawings. The external access points to be used during stockpiling can be summarised as:

- SP1 and SP2 will use the access at 1856 Pakowhai Road;
- SP3 will use the accesses at 2068 Pakowhai Road (80%) and 1950 Pakowhai Road (20%);
- SP4 will use Franklin Road for access;
- SP5 will use the Silky Oak access (1131 Links Road).

[15] Based on average capacity of $10m^3$ per truck and $20m^3$ per truck and trailer with assumed use of 20% trucks only and 80% trucks with trailers.
[16] Assumes 20 working days per month and a mid-range estimate of 4.5 months (90 days).

The proposed access points are summarised below in Table 6 and labelled indicatively in blue on Figure 7.

Table 6 – Access Points Overview

Access (ECC Reference)	Description	Images (see Appendix 1 for larger versions)
1	Existing vehicle crossing to 1856 Pakowhai Road	
2	Existing vehicle crossing to 1950 Pakowhai Road	
3	Existing vehicle crossing to 2068 Pakowhai Road	

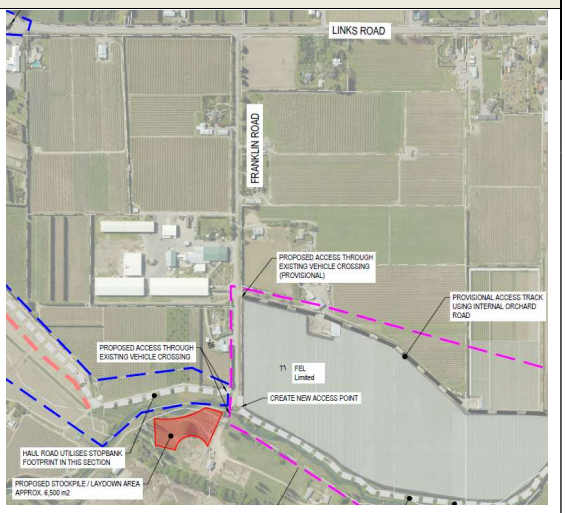
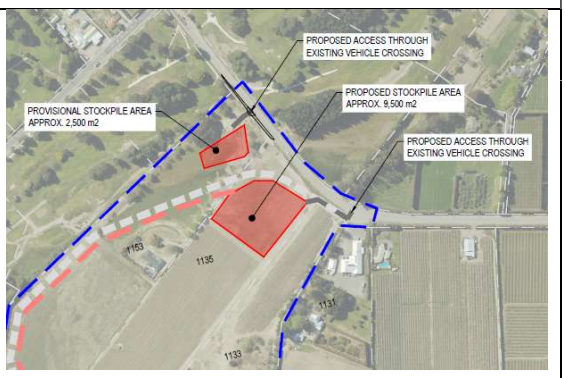
Access (ECC Reference)	Description	Images (see Appendix 1 for larger versions)
4	Existing vehicle crossing to 71 Franklin Road	
5	Proposed new access to eastern side of Franklin Road (southern end).	
6	Existing vehicle crossing to 56 Franklin Road	
7	Existing vehicle crossing to 1153 Links Road	
8	Existing vehicle crossing to 1131 Links Road	

Figure 7 – Site Access Points

4.4 Material Sources

The majority of fill material (if not all of it) is expected to come from the river berms on the Ngaruroro River.

This could be supplemented with some material from the HEX works (up 50,000m^3 or around 20% of the total requirement) and material available from a quarry on Taihape Road. These sites and their indicative haulage directions are shown in yellow on Figure 8 are listed as follows:

- Ngaruroro River berms (A);
- HEX site north (B); and
- Taihape Road quarry accessed via Korokipo Road south (C).

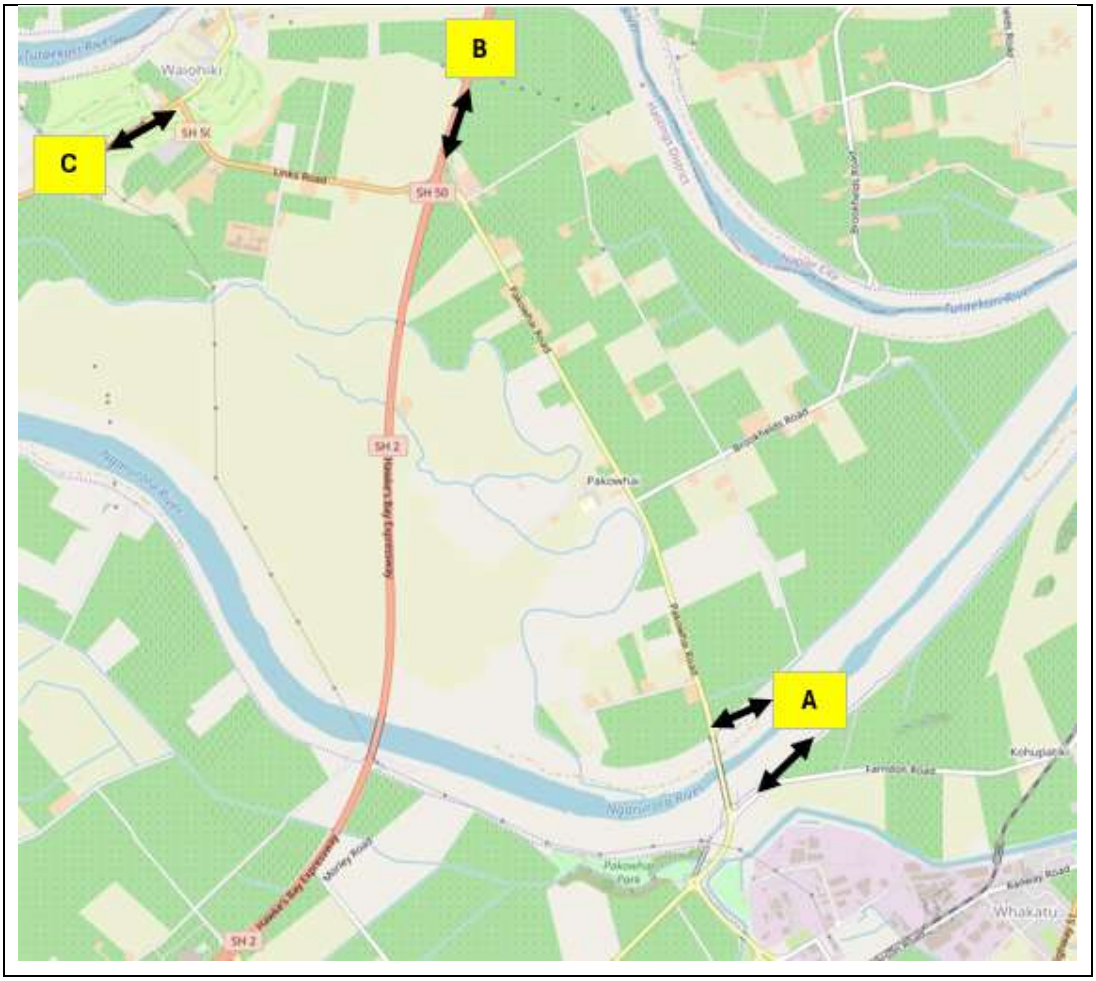


Figure 8 –Material Sources

Two supply scenarios have been assessed in the following sections of this report:

- Scenario 1 (S1) – 100% of the material comes from source A (70% north bank and 30% south bank).
- Scenario 2 (S2) – 70% comes from source A (with 70/30 split), 20% from source B and 10% from source C.

4.5 Haulage Routes

The road links that are likely to be used as transport routes between these various sources and access points were shown earlier on Figure 3.

For material source A (Ngaruroro River) trucks would use either Gilbertson Road (north bank material) or Farndon Road (south bank material) to approach Pakowhai Road. Because right turns onto Pakowhai Road are not permitted at both intersections[17], vehicles would need to turn left and travel south to the roundabout at Pakowhai Road/Te Ara Kahikatea to turn around. This roundabout is approximately 500m south of Farndon Road and 1km south of Gilbertson Road.

[17] Temporary right turns could be permitted by the road controlling authority as part of the CTMP process. However, for the purposes of this assessment the more onerous route has been reviewed as a worst case scenario.

They would then travel along (some or all of) Pakowhai Road, Links Road and Franklin Road to reach the relevant site access point. They would return via the same route in reverse (but with the left turn being available directly into Gilbertson Road or Farndon Road on the return journey).

For material sources B and C trucks would approach from either the HEX or SH50 and again use some or all of Links Road, Franklin Road and Pakowhai Road to approach the relevant site access point. They would then return via the same route in reverse.

5. EFFECTS ASSESSMENT

5.1 Daily Volume Changes

Table 7 presents a summary of potential daily traffic increases (heavy vehicles) on roads around the project area using the 'high' scenario from Section 4.2 above.

The analysis considers the two distribution scenarios listed above. Other assumptions are noted as footnotes. State Highways are coloured orange and HDC arterials are coloured blue.

Table 7 – Daily HCV Volume Changes (HIGH SCENARIO, SP2 and SP5 Concurrent)

Road Section	Existing Daily Volumes (vpd)			Additional HCV/day		% Increase in HCV	
	AADT	% HCV	HCV	S1	S2	S1	S2
HEX north of RAB[18]	26,604	7.4%	1,969	0	57	0%	3%
HEX south of RAB[19]	22,170	7.4%	1,641	0	0	0%	0%
Links Road (SH50 to site accesses)[20]	6,344	8.8%	558	0	29	0%	5%
Links Road (site accesses to HEX)	6,344	8.8%	558	149	148	27%	26%
Franklin Road[21]	380	12.9%	49	38	38	78%	78%
Pakowhai Road (HEX to #2068)	10,600	12.9%	1,367	149	145	11%	11%
Pakowhai Road (#2068 to #1950)	10,600	12.9%	1,367	149	145	11%	11%
Pakowhai Road (#1950 to Chesterhope)	10,600	12.9%	1,367	149	145	11%	11%
Pakowhai Road (Chesterhope to Brookfield)	10,600	12.9%	1,367	149	145	11%	11%
Pakowhai Road (Brookfield to #1856)	10,600	12.9%	1,367	149	145	11%	11%
Pakowhai Road (#1856 to Gilbertson Road)	10,600	12.9%	1,367	285	200	21%	15%
Korokipo Road (SH50), south of Links Road[22]	5,469	7.4%	405	0	29	0%	7%

[18] Estimated as 1.2 times the count at the site south of Links Road (based on intersection count data).
[19] Based on data from count site ID 00200659, on HEX south of Links Road.
[20] Both Links Road sites are based on data from count site 05000013.
[21] Franklin Road is not expected to be used in the worst case scenario since it provides access to SP4. It has been included in this table, with the loading expected when SP4 is active to capture the potential scale of effects on Franklin Road, when it is being used.
[22] Based on data from count site 05000014.

Road Section	Existing Daily Volumes (vpd)			Additional HCV/day		% Increase in HCV	
	AADT	% HCV	HCV	S1	S2	S1	S2
Gilbertson Road, east of Pakowhai Road	320	29.5%	94	200	140	211%	148%
Farndon Road, east of Pakowhai Road	3475	10.5%	365	86	60	23%	16%

The Table shows that the State Highway network (the HEX, Links Road and Korokipo Road) is already carrying a significant volume of heavy vehicles, in the order of 1,600-1,970 HCV/per day. On these roads, the increases in HCV volumes represent a small change of up to 3-7% for a short period of time (relative to the life of the road).

The HDC arterial network (Pakowhai Road) is also carrying a significant volume of heavy vehicles (1,370 HCV/per day). On this road, the increases in HCV volumes generally represent a change of up to 21%, again for a short period of time relative to the life of the road.

The arterial network (and to a lesser extent the primary collector network including Farndon Road) are expected to carry significant volumes of heavy vehicles and to support freight movement and economic activity around the region. It is reasonable to conclude that they have been designed for this purpose, in terms of their width and their pavements.

Franklin Road and Gilbertson Road, which do not have high existing HCV volumes, may not have been designed with the width and pavement strength suitable to sustain the expected level of HCV activity.

Road pavement design is carried out on the basis of an average number of heavy vehicle axles spread across a number of (typically 25-30) years. Therefore, any activity that results in a higher number of axles (than anticipated) travelling along a road in a relatively short period of time will accelerate pavement failure by consuming its capacity more quickly (irrespective of whether that is three or six months).

The usual approach to managing this risk is to carry out pre-construction and post-construction Pavement Condition Surveys (PCSs) to identify pavement damage and/or failure that occurs during the construction period. Pavement repairs are then carried out in a timely fashion which avoids more substantial work resulting from delayed repairs. Costs can be borne by the project or pro-rata based upon typical heavy vehicle volume versus project specific traffic. It is generally accepted that the state highway network is constructed to accommodate heavy vehicles and therefore it is expected that any PCSs will be limited to the HDC road network.

Recommended measures are outlined in Section 7, taking into account the above analysis and the findings of the next section.

5.2 Peak Hour Capacity Assessment

Table 8 below presents an assessment of existing volume to capacity ratios for the various roads that could potentially be used as transport routes.

This table uses existing traffic volume data from the Mobileroad website, NZTA open data portal and intersection survey described earlier. The capacity of each road has been estimated based on characteristics including the sealed width, road markings, and degree of access control. Other assumptions are noted as footnotes.

Table 8 – Volume to Capacity Assessment (Existing)

Road Section	Daily Volumes			Peak Hour (Two-Way)[23]		Capacity Assessment		
	AADT	% HCV	HCV	All Vehicles	HCV	One-Way Volume (PCU)[24] [25]	Capacity (PCU / lane)	Ratio (V/C)
HEX north of RAB[26]	26,604	7.4%	1,969	2,706	200	1,523	1,600[27]	95%
HEX south of RAB[28]	22,170	7.4%	1,641	2,174	161	1,303	1600	81%
Links Rd (SH50 to site accesses) [29]	6,344	8.8%	558	672	59	411	1,000	41%
Links Road (site accesses to HEX)	6,344	8.8%	558	672	59	411	1,000	41%
Franklin Road	380	12.9%	49	38	5	26	300	9%
Pakowhai Road (HEX to #2068)	10,600	12.9%	1,367	1,060	137	718	1,000	72%
Pakowhai Road (#2068 to #1950)	10,600	12.9%	1,367	1,060	137	718	1,000	72%
Pakowhai Road (#1950 to Chesterhope)	10,600	12.9%	1,367	1,060	137	718	1,000	72%
Pakowhai Road (Chesterhope to Brookfield)	10,600	12.9%	1,367	1,060	137	718	1,000	72%
Pakowhai Road (Brookfield to #1856)	10,600	12.9%	1,367	1,060	137	718	1,000	72%
Pakowhai Road (#1856 to Gilbertson Road)	10,600	12.9%	1,367	1,060	137	718	1,000	72%
Korokipo Road (SH50), south of Links Road[30]	5,469	7.4%	405	634	47	424	1,000	42%
Gilbertson Road, east of Pakowhai Road	320	29.5%	94	32	9	25	300	8%
Farndon Road, east of Pakowhai Road	3,475	10.5%	365	348	36	230	1,000	23%

Table 8 shows that the most critical parts of the network is the HEX, which is operating at 95% of its theoretical capacity, and Pakowhai Road which is operating at 72% of its theoretical capacity.

Table 9 repeats this assessment with the addition of the peak hour heavy vehicle movements expected during construction. These are again taken from the high scenario with SP2 and SP5 active.

[23] Peak hour volumes estimated from recent hourly count data for State Highways (11.6% and 10.1% on Korokipo Road and Links Road respectively) and 10% for other roads except Chesterhope Road which is estimated as 25% because of the presence of the school.

[24] One way volume estimated from recent directional counts for State Highways (62% and 56% of the two-way total on Korokipo Road and Links Road respectively) and as 60% of the two-way total for other sites.

[25] A conversion factor of 2.0 applied to convert all existing and proposed HCV into passenger car equivalent units PCUs) for capacity calculations.

[26] Taken directly from intersection count data.

[27] HEX capacity assessment assumes the two-lane cross-section (one each way) that exists beyond the immediate vicinity of the roundabout.

[28] Taken directly from intersection count data.

[29] Both Links Road sites based on on data from count site 05000013.

[30] Based on data from count site 05000014.

Table 9 – Volume to Capacity Assessment (During Stockpiling)

Road Section	Daily HCV Volumes (Two-Way)			Peak Hour HCV Volumes (Two-Way)			Volume to Capacity Ratio	
	Existing	During Project (Max of S1 or S2)	Total	Existing	Worst Case During Project	Total	Existing	Worst Case During Project
HEX north of RAB	1,969	57	2,026	200	6	206	95%	96%
HEX south of RAB	1,641	0	1,641	161	0	161	81%	81%
Links Road (SH50 to site accesses)	558	29	587	59	3	62	41%	41%
Links Road (site accesses to HEX)	558	149	707	59	15	74	41%	43%
Franklin Road[31]	49	38	87	5	4	9	9%	10%
Pakowhai Road (HEX to #2068)	1,367	149	1,516	137	15	152	72%	73%
Pakowhai Road (#2068 to #1950)	1,367	149	1,516	137	15	152	72%	73%
Pakowhai Road (#1950 to Chesterhope)	1,367	149	1,516	137	15	152	72%	73%
Pakowhai Road (Chesterhope to Brookfield)	1,367	149	1,516	137	15	152	72%	73%
Pakowhai Road (Brookfield to #1856)	1,367	149	1,516	137	15	152	72%	73%
Pakowhai Road (#1856 to Gilbertson Road)	1,367	285	1,652	137	29	165	72%	75%
Korokipo Road (SH50), south of Links Road[32]	405	29	433	47	3	50	42%	43%
Gilbertson Road, east of Pakowhai Road	94	200	294	9	20	29	8%	15%
Farndon Road, east of Pakowhai Road	365	86	450	36	9	45	23%	24%

Table 9 shows that the expected changes in volume to capacity ratios are small on all the assessed links. All links continue to operate within their respective estimated capacities.

More generally, the addition of 29 HCV/hour represents a small-scale change compared to existing flows on the network.

As described at Section 2.3 above, the HEX roundabout carries approximately 3,400 vph during the peak hours of the day and 2,500 vph during the middle part of the day. The project's peak hour generation represents a change of no more than 1% at this location.

Along Pakowhai Road, peak hour volumes are around 1,000 vph. The addition of 29 vph represents a change of no more than 3% along this corridor.

[31] Franklin Road is not expected to be used in the worst-case scenario since it provides access to SP4. It has been included in this table, with the loading expected when SP4 is active to capture the potential scale of effects on Franklin Road, when it is in use.
[32] Based on data from count site 05000014.

The peak hour volume at the Pakowhai Road/Te Ara Kahikatea roundabout is estimated[33] as being some 2,200 vph. At this location the project represents a 1.3% change in peak hour volume.

Changes of this scale are unlikely to materially affect operation and are not assessed as requiring any additional network capacity.

6. NETWORK CONSTRAINTS ASSESSMENT

Site inspections and supporting and desktop assessments were undertaken of the roads and intersections that could potentially be used as transport routes. The key constraints that emerge from this analysis are:

Table 10 – Network Constraints

Location	Comments	Consequence
Pakowhai Road/Gilbertson Road Intersection	The left-in and left-out (LILO) layout of the intersection means that trucks intending to travel north need to make a left turn, then U-turn at the roundabout approximately 1km to the south and return to the north.	Travelling south to use the roundabout has been assessed from a capacity point of view and can be appropriately accommodated. There is potential for a right turn to be temporarily made available at this intersection, subject to temporary traffic management controls managing layout and potentially the timing of trips to avoid peak hours. This would offer some travel time savings and cost benefits. The successful contractor could pursue this approach and seek approval for road layout changes. It has not been relied upon here.
Pakowhai Road/Farndon Road Intersection	The LILO layout of the intersection means that trucks intending to travel north need to make a left turn, U-turn at the roundabout approximately 500m to the south and return to the north.	Travelling south to use the roundabout has been assessed from a capacity point of view and can be appropriately accommodated.
Existing vehicle crossing to 1856 Pakowhai Road (1)	Driveway intersection, about 10m wide with power poles along both sides, adjacent to dwelling driveway, opposite commercial driveway. Painted flush median on Pakowhai Road.	If this access is to be used for two-way operation it will require vehicle swept path analysis and temporary traffic management (TTM).
Existing vehicle crossing to 1950 Pakowhai Road (2)	Driveway intersection, about 6m wide with telephone pole along one side. Painted flush median on Pakowhai Road.	If this access is to be used for two-way operation it will require vehicle swept path analysis and temporary traffic management (TTM).
Existing vehicle crossing to 2068 Pakowhai Road (3)	Driveway intersection, about 5m wide with fruit trees along both sides. Painted flush median.	If this access is to be used for two-way operation it will require vehicle swept path analysis and temporary traffic management (TTM).

[33] Based on approach volumes of 20,100 vpd (Pakowhai Road north), 13,400 vpd (Pakowhai Road south) and 10,700 vpd (Te Ara Kahikatea), peak hour being 10% of daily and an even directional distribution.

Location	Comments	Consequence
Links Road/Franklin Road intersection	Stop controlled T-intersection. Franklin Road seal width less than 5.5m which might impact tracking, power poles along east side. A right turn treatment is warranted on Links Road (at current speed limit) if trucks approach from the west.	This intersection will require vehicle swept path analysis and temporary traffic management (TTM).
Franklin Road midblock	Franklin Road seal width less than 5.5m which might impact tracking, power poles along east side.	If used for two-way operation vehicle swept path analysis and temporary traffic management (TTM) is required. Consider shoulder widening (could be unsealed).
Existing vehicle crossing to 1153 Links Road (7)	Sight distance constraint for right turn entry from the west, a lower speed limit is required. A right turn treatment is warranted on Links Road (at current speed limit) if trucks approach from the west.	If this access is to be used for two-way operation it will require vehicle swept path analysis and temporary traffic management (TTM).
Existing vehicle crossing to 1131 Links Road (8)	Sight distance constraint for right turn entry from the west, a lower speed limit is required. Driveway width could be too narrow for two-way use. A right turn treatment is warranted on Links Road (at current speed limit) if trucks approach from the west.	If this access is to be used for two-way operation it will require vehicle swept path analysis and temporary traffic management (TTM).

Sight distances were observed at each access/intersection and corroborated by desktop analysis as shown by Appendix 1. Due to the number of trucks using each intersection Safe Intersection Sight Distance (SISD[34]) was adopted for consistency, to suit the relevant speed limit.

SISD is achieved from the minimum position (5m setback) at all locations, and it is typically achieved from the preferred position (7m setback) as long is vegetation, such as hedging, is trimmed back to the road boundary. The only accesses where adequate sight lines are not achieved, at the existing speed limit, is Links Road (7 and 8) as noted by Table 10[35].

No specific constraints were identified at:

- The river track/Gilbertson Road intersection;
- Pakowhai Road/Brookfields Road intersection;
- Pakowhai Road/Hodgsons Road intersection;
- Pakowhai Road midblock
- HEX/Links Road/Pakowhai Road roundabout;
- Korokipo Road/Links Road intersection;
- Pakowhai Road/Allen Road intersection; and
- Links Road midblock.

[34] Defined by Table 3.2 in Austroads – Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections.
[35] A temporary speed restriction would address this deficiency (notwithstanding right turn bay requirements).

7. MITIGATION OF EFFECTS

The construction of the stopbank will vary the normal operating conditions of the road network in the area around the site, potentially affecting both State Highways and roads managed by HDC.

A number of construction-related matters including sources of materials, staging and the relative use of various site access points will be determined by the delivery team/contractor(s) in upcoming project phases.

The appropriate tool for managing and mitigating the potential construction related traffic effects identified above is a Construction Traffic Management Plan (CTMP). This should be prepared in consultation with HDC and NTZA and should reflect the various phases of the project and their different potential effects.

A PCS may also be appropriate, for Franklin Road and Gilbertson Road, to help identify remedial work arising from the project and allocate repair resources/costs.

The overall purpose of the CTMP is to provide a framework for the safe and efficient movement of construction traffic such that potential impacts on the surrounding road network are minimised and appropriately managed. It is also a framework for communication and coordination between the project delivery team, NZTA and HDC.

A CTMP would typically include (but not be limited to) the following:

- **Construction traffic volumes and timing:** Confirmation of expected daily and peak traffic generation, and identification of periods of highest construction activity.
- **Communication protocols:** Contact details of key personnel and processes for managing stakeholders and public engagement.
- **Haul routes and access arrangements:** Confirmation of intended material sources and haul routes to and from the site, including vehicle entry and exit points, and any restrictions on the use of local roads.
- **Parking and access arrangements for staff fand visitors:** Including expected workforce numbers, management of access and on-site parking areas.
- **Proposed changes to the public road network:** identification of changes required on public roads including (by way of example) localised seal widening at intersections or driveways or widening of local roads two enable passing/two-way movement.
    - The CTMP should specifically address the constraints identified in Table 10 and confirm that all access routes and access points have appropriate sight distance for the existing or TMP-managed speed environment and can accommodate the nominated design vehicle.
- **Traffic management measures:** Specification of temporary traffic management (TTM) controls such as signage, speed limit changes where necessary to maintain safe and efficient traffic flow.
- **Travel demand management and/or disruption management measures**: specification of measures to manage, spread or stagger demand, steps to minimise disruption to other road users e.g. warning signs and communication through other channels.
- **Road safety management measures:** These can include driver protocols and any monitoring and reporting requirements.
- **Oversize and overweight movements:** Arrangements and route planning for any oversize or overweight vehicles.

- **Pedestrian and cyclist safety:** Identification of existing pedestrian and cycle facilities and provision for their safe operation during construction, including any required detours or protection measures.
- **Construction staging and scheduling:** Outline of how traffic management will evolve over different construction stages, and strategies to minimise disruption during peak commuter periods or special events, particularly on the HEX.
- **Environmental controls:** Measures to manage dust, debris, and mud tracking onto public roads, and protocols for immediate clean-up if required.
- **Emergency access:** Assurance that emergency vehicle access to and through the construction site and adjacent properties is maintained at all times.

The CTMP should be developed in consultation with, and be subject to certification by, HDC and NZTA prior to the commencement of the relevant phase of construction works.

The CTMP should be prepared by a suitably qualified and experienced traffic management practitioner in accordance with the Code of Practice for Temporary Traffic Management (CoPTTM); and/or the New Zealand Guide to Temporary Traffic Management (NZGTTM).

With the CTMP process recommended above, the temporary effects associated with the construction of the stopbank can be appropriately mitigated.

8. CONCLUSIONS

Sufficient capacity is expected to be available within the road network to accommodate traffic associated with construction of the stopbank.

There are physical constraints on some local roads and capacity limitations at some intersections however, these can be managed with careful planning via a CTMP.

On Franklin Road and Gilbertson Road the relatively large number of heavy vehicle movements associated with the construction process may accelerate pavement aging (and subsequent failure). It is recommended that this risk be managed by a pavement condition survey (PCS) condition.

We trust this report provides the advice sought regarding the potential effects related to construction of the proposed stopbank. Please do not hesitate to contact us if you require anything further.

Yours sincerely,

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Attach:
Attachment 1 – CTD Overall Layout Plan (four pages)
Attachment 2 – Sight line drawing (number 25-0181-02A sheet 1 of 1)