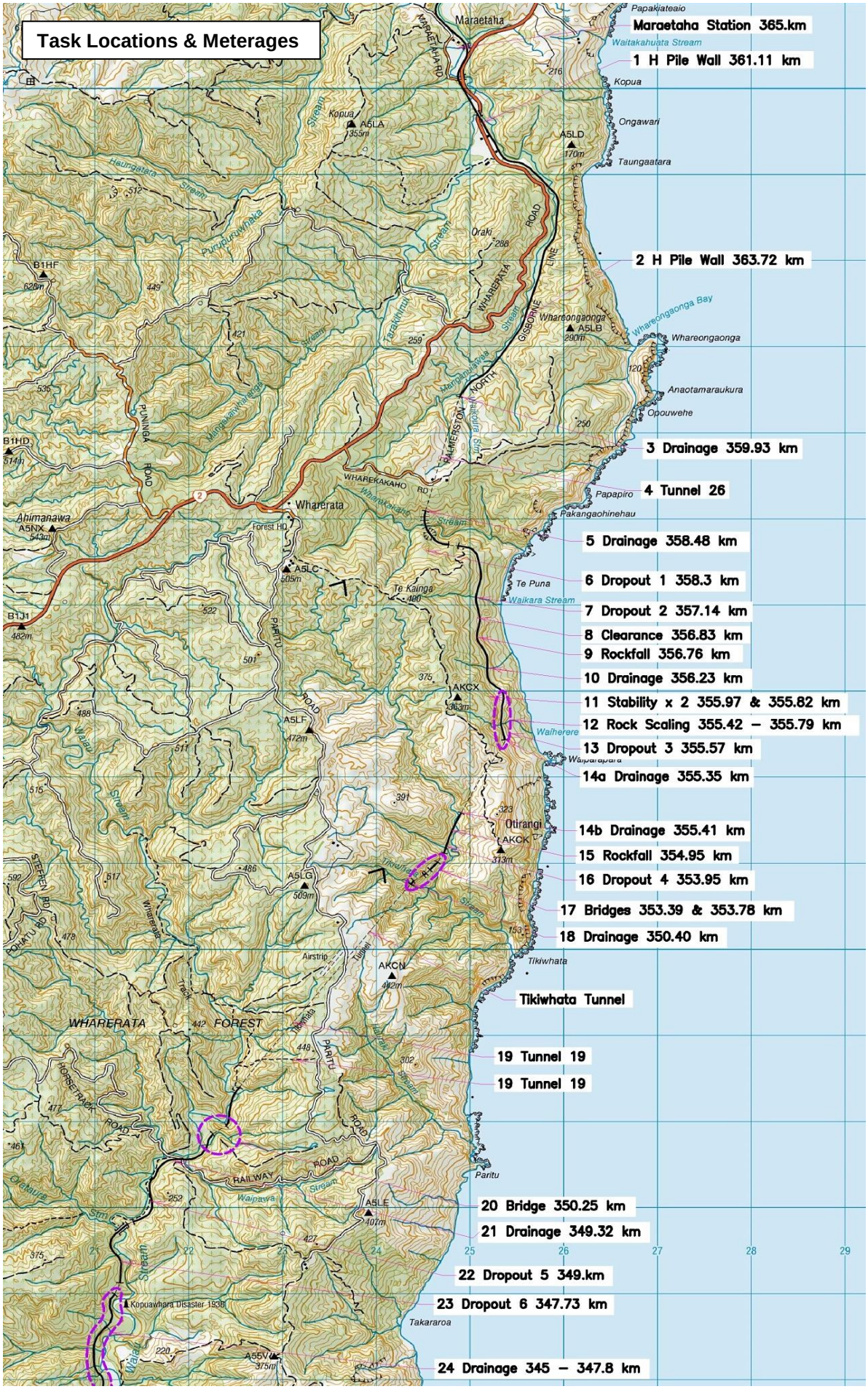
PNGL Wairoa – Gisborne 296.3 - 390.5km
Track Formation Repair Works
Civil Construction Work Packages
30%Design & Pricing – October 2019

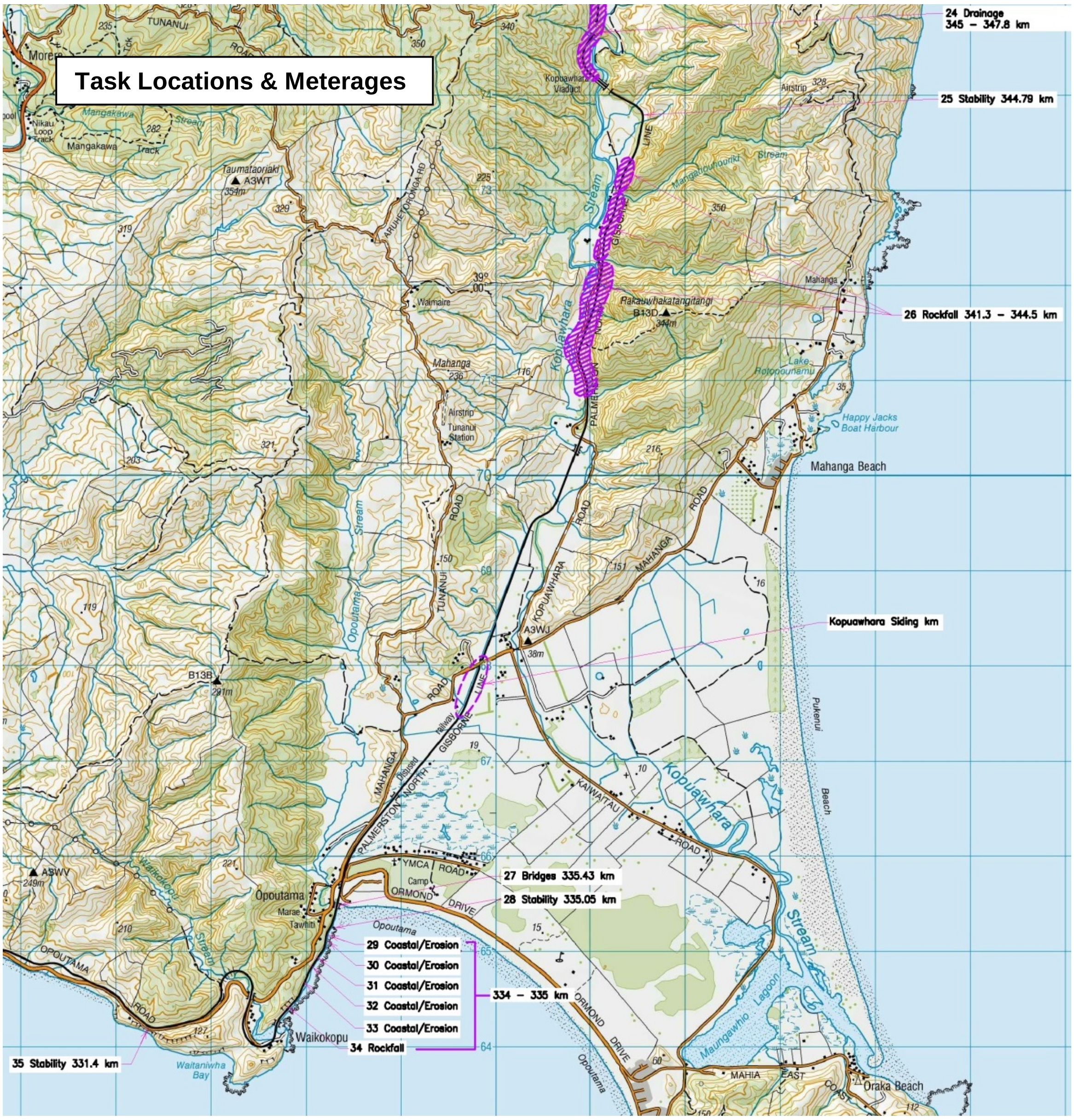
Date: 10th October 2019

Project: FGL 1331

Prepared by: Maurice Fraser - Fraser Geologics Ltd

Section Two – Tasks


Task Locations & Meterages
Maraetaha Station 365.km
1 H Pile Wall 361.11 km
2 H Pile Wall 363.72 km
3 Drainage 359.93 km
4 Tunnel 26
5 Drainage 358.48 km
6 Dropout 1 358.3 km
7 Dropout 2 357.14 km
8 Clearance 356.83 km
9 Rockfall 356.76 km
10 Drainage 356.23 km
11 Stability x 2 355.97 & 355.82 km
12 Rock Scaling 355.42 – 355.79 km
13 Dropout 3 355.57 km
14a Drainage 355.35 km
14b Drainage 355.41 km
15 Rockfall 354.95 km
16 Dropout 4 353.95 km
17 Bridges 353.39 & 353.78 km
18 Drainage 350.40 km
Tikiwhata Tunnel
19 Tunnel 19
19 Tunnel 19
20 Bridge 350.25 km
21 Drainage 349.32 km
22 Dropout 5 349.km
23 Dropout 6 347.73 km
24 Drainage 345 – 347.8 km
Maraetaha
Papakiateaio
Waitakahuata Stream
Kopua
Ongawari
Taungaatara
Oraki
Whareongaonga
Whareongaonga Bay
Anaotamaraukura
Opouwehe
Papapiro
Pakangaohinehau
Wharerata
Te Puna
Waikara Stream
Te Kainga
Otirangi
Tikiwhata
Paritu
WHARERATA FOREST
Kopuawhara Disaster 1938
Takararoa



Task Locations & Meterages
24 Drainage 345 – 347.8 km
25 Stability 344.79 km
26 Rockfall 341.3 – 344.5 km
Kopuawhara Siding km
27 Bridges 335.43 km
28 Stability 335.05 km
29 Coastal/Erosion
30 Coastal/Erosion
31 Coastal/Erosion
32 Coastal/Erosion
33 Coastal/Erosion
34 Rockfall
334 – 335 km
35 Stability 331.4 km

Site Location
SITE LOCATION

Repair Task:	**Task 1 – Embankment Slip 1**
Track Location:	Rail Chainage 363.72
Description:	Short washout on embankment edge approx. 150m south of Bridge 274 (over SH2)
Required Works	Driven H pile repair wall with timber lagging nominal 10m long.
Scale/ Scope/Volumes:	Driven H pile repair wall with timber lagging nominal 10m long. Allow driven 250UC73 @ 800 centres, 9m deep with 200*50 H5 timber lagging installed behind rear flange. Nominal trackside retained height 1.5m with sloping embankment toe.
Construction Comment:	Design TBC - steel section sizing to be confirmed. Driven pile design adopted on basis of driving into embankment filling and avoiding drilling works and concrete supply into corridor.
Designer Comment:	Alternative drill & concrete (600mm with temporary casing) as well as whalers & tiebacks if required. Timber lagging as required – retention is primarily from arching between steel uprights at close driven centres Steel sections not galvanised
Rail Operations:	Work trains past site, including deliveries for Beach Loop dropouts. Work trains can operate without slip being repaired.

SCOPE OF WORKS	
DRAWING PACKAGE:	Refer FGL drawing set 1331 -
SITE ACCESS:	Via rail access point Maraetaha station 365km
SITE PREPARATION:	Clear vegetation
SUBSOIL DRAINAGE:	Base of lagging
STORMWATER DRAINAGE:	none
EARTHWORKS:	Works as required to install piles and backfill
OTHER 1:	
OTHER 2:	

METHODOLOGY – SITE SPECIFIC:		
SITE SPECIFIC RISK ITEMS	**SPECIFIC ACTIVITIES**	**RESPONSIBILTY**
ITEM 1 **ITEM 2** **ITEM 3**	1.1	Site management Contractors
	1.2	Site management Contractors
	1.3	Site management Contractors
	1.4	Site management Contractors
	1.5	Site management Contractors
	1.6	Site management Contractors
	1.7	Site management Contractors
	1.8	Site management Contractors

	Task 2 – Embankment Slip 2
Track Location:	Rail Chainage 361.11km
Description:	Short washout on embankment edge approx. 300m south of logging road level crossing off SH2 @ 361.40
Required Works	Driven H pile repair wall nominal 15m long, with timber lagging
Scale/ Scope/Volumes:	Driven H pile repair wall nominal 15m long, with timber lagging Allow driven 250UC73 @ 800 centres, 9m deep with 200*50 H5 timber lagging installed behind rear flange. Nominal trackside retained height 2.5m with sloping embankment toe.
Construction Comment:	Design TBC - steel section sizing to be confirmed. Driven pile design adopted on basis of driving into embankment filling and avoiding drilling works and concrete supply into corridor. Note causes of slope failure to be assessed - considered to be due to combination of over topping surface runoff and toe erosion but TBC
Designer Comment:	Alternative drill & concrete (600mm with temporary casing) as well as whalers & tiebacks if required. Timber lagging as required – retention is primarily from arching between steel uprights at close driven centres however significant dropout volume will require backfilling with GAP65 Steel sections not galvanised
Rail Operations:	Work trains past site, including deliveries for Beach Loop dropouts. Work trains can operate without slip being repaired

Embankment Slip 2 - 2013 Photos

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
OTHER 2:	

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Repair Task:	**Task 3 – Wharekakaho Tunnel 26 North Portal**
Track Location:	Rail Chainage 359.93km
Description:	Northern Tunnel Portal Drainage Works
Required Works	Northern Tunnel Portal Drainage Works
Scale/ Scope/Volumes:	Excavate out and reinstate swales coming out from tunnel portal. Nominal 60m of swale deepening & widening required to accommodate existing culvert depth. Install larger secondary culvert where stream crosses under track - allow new 1350mm diameter culvert nominal 10 m long (TBC) Extend and deepen bypass and overflow swales down both sides of formation. Widen stream channel on eastern side and dig back into slope to provide more sediment catch area.
Construction Comment:	Inspect ground above tunnel - there is around 1.8km^2 of area to west of tunnel and not clear on site where the drainage for this runs - possibly over top of tunnel or approx. 50m to north of track alignment. May require access track to be constructed up onto western side of tunnel and clean out of areas. Existing culvert partially blocks with material coming down stream channel, larger / additional culvert required.
Designer Comment:	Existing culvert @360.03km logged as 1.2* 1.2 box - this is 50% blocked with sediment, swales require deepening. Max capacity 5.1m^3/s at track level surcharge flows.
Rail Operations:	Work trains past site, including deliveries for Beach Loop dropouts.

Temporary drainage works undertaken in week of 15 July 2019 – open up tunnel drainage, stockpile spoil against stream to confine sediment to channel and stop water flooding over track. Note significant groundwater drainage flowing out of exposed ballast.

Uncovered tunnel drainage on western side of formation, plus flow through culvert under track.

View looking north, existing culvert crossing in front of truck, new culvert immediately downstream of this

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
OTHER 2:	

METHODOLOGY – SITE SPECIFIC:		
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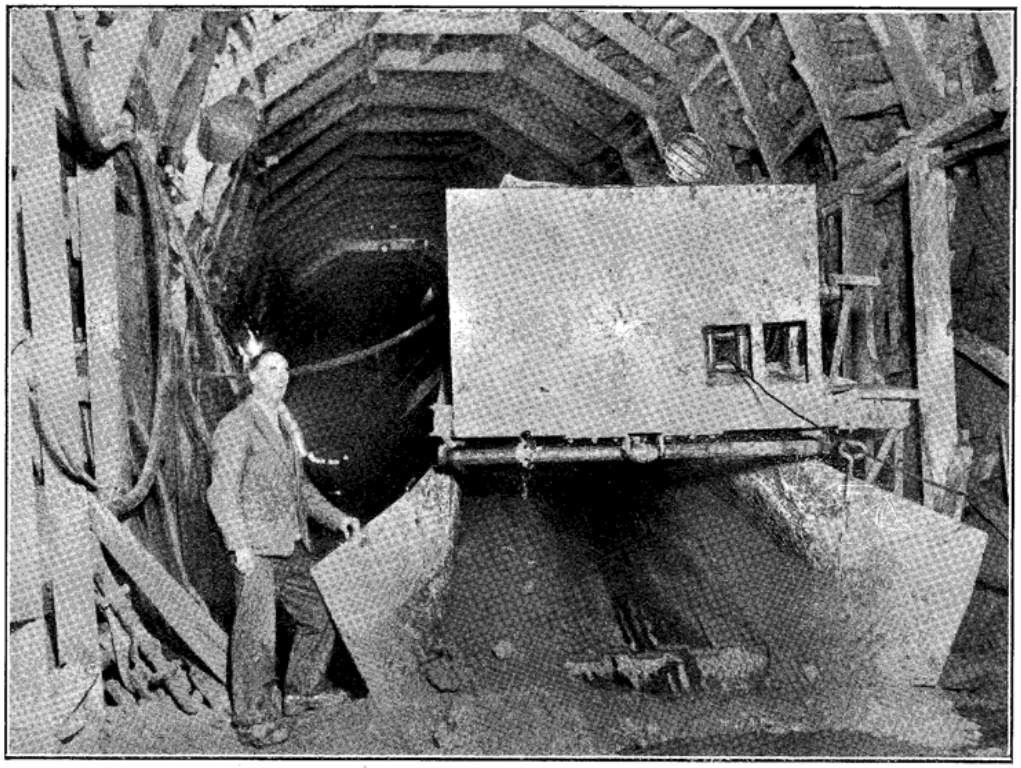
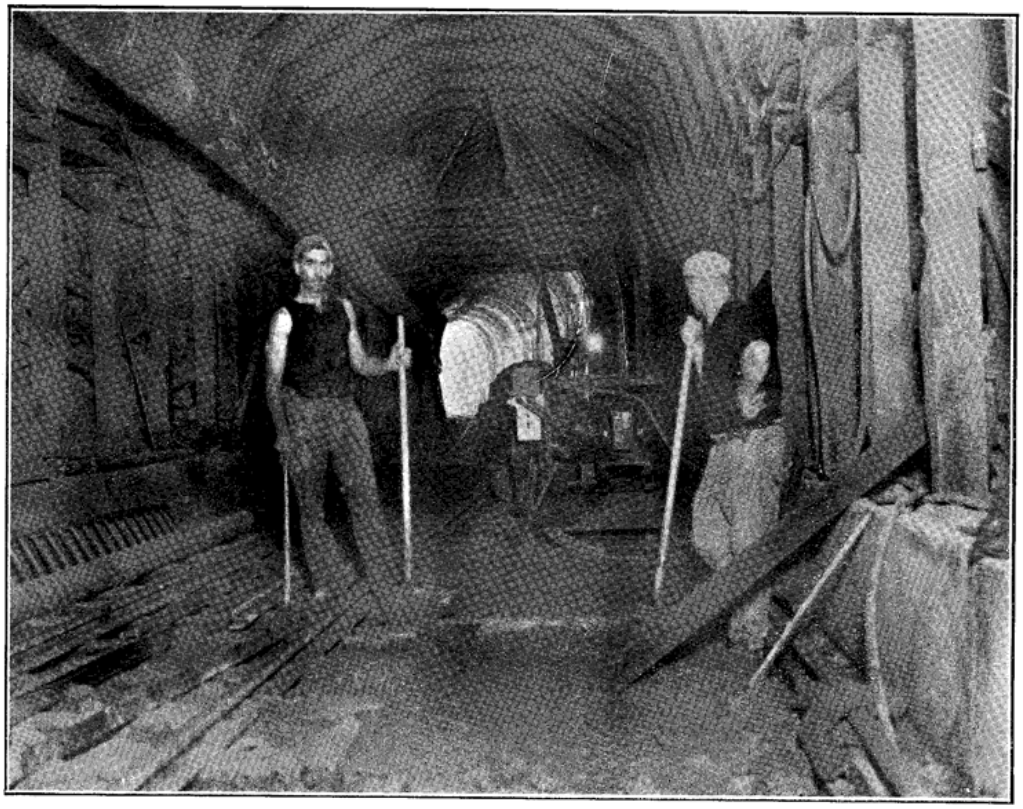
Repair Task:	**Task4 – Wharekakaho Tunnel 26 Lining**
Track Location:	Rail Chainage 359.29km (nominal)
Description:	Crackling in concrete tunnel lining
Required Works	Allow for baseline lazer scan survey through tunnel (Woods Consultants) as part of track reopening works.
Scale/ Scope/Volumes:	Assess concrete lining cracking - has been in place for nearly 80 years, in good condition for age. No physical works anticipated
Construction Comment:	Assess concrete lining cracking - has been in place for nearly 80 years, in good condition for age. No physical works anticipated
Designer Comment:	
Rail Operations:	Survey works early in program – no work trains expected during survey operations.

Following pages show historical images from tunnel construction – 1937 /38 (National Library Data).

Note concrete lining was directly poured / pumped around timber sets & lagging and tunnel supports shown in various photographs.



MUCK-SCRAPER SLIDE AND SHIELD USED FOR RAPID CONVEYANCE OF MATERIALS FROM THE WORKING-FACE.



VIEW OF CONSTRUCTION, SHOWING CONCRETE-PUMP IN CENTRE FOREGROUND. NOTE STEEL FORMWORK IN MIDDLE DISTANCE AND COMPLETED CONCRETE LINING IN BACKGROUND.

WAIKOURA TUNNEL, WHARERATA SECTION, NAPIER–GISBORNE RAILWAY.

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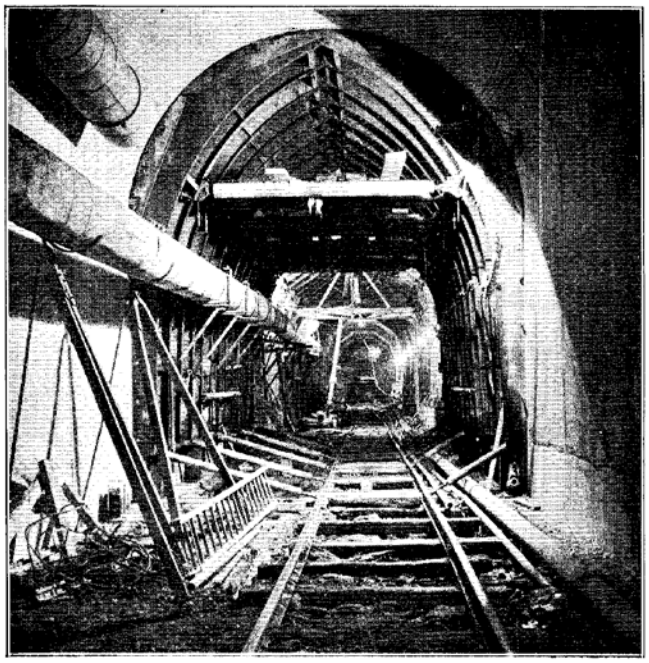
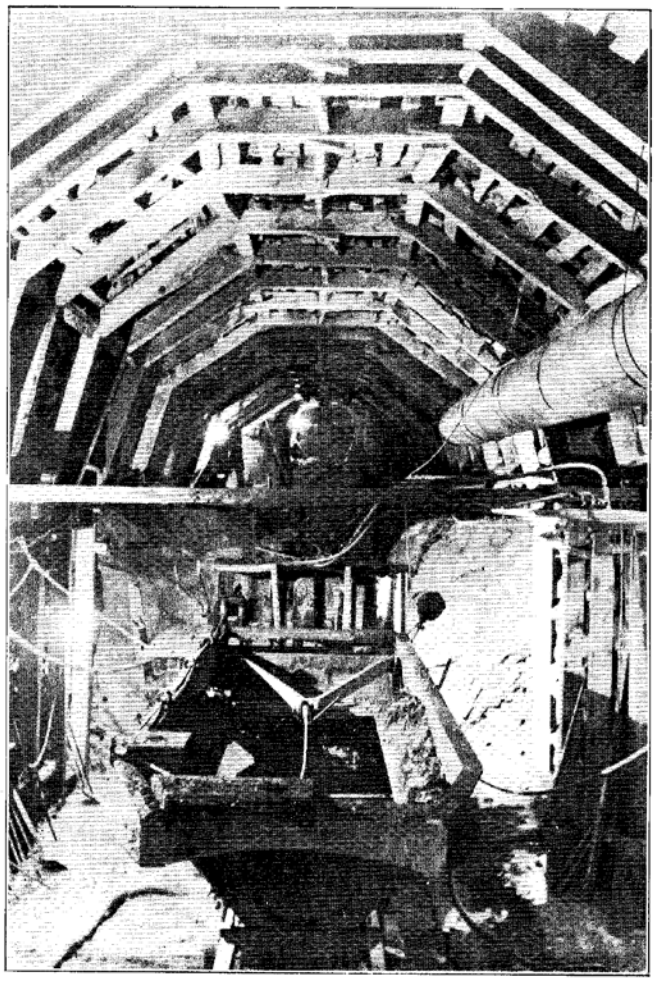


Waikoura Tunnel, North End. View showing Stages of Construction: Timbering in Background; Steel Formwork in Middle Distance, and Finished Lined Tunnel in Foreground.



Waiau–Tikitwhata Tunnel, South Face. View shows Timbering and Mechanical Muck-scraper.

GISBORNE–NAPIER RAILWAY.

Photo showing lining support at approx. track meterage 359.4km (TBC). Track has also been lowered to allow passage for high cube containers at this location.

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
OTHER 2:	

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Repair Task:	**Task 5 – Wharekakaho Tunnel 26 South Portal**
Track Location:	Rail Chainage 358.48km
Description:	Southern Tunnel Portal Drainage Works
Required Works	Upgrade tunnel cutting drainage works and swales leading out from tunnel portal
Scale/ Scope/Volumes:	Excavate out and reinstate swales coming out from tunnel portal. Nominal 60m of swale deepening & widening on both sides of formation towards Dropout 1.
Construction Comment:	
Designer Comment:	
Rail Operations:	Work trains past site, including deliveries for Beach Loop dropouts.


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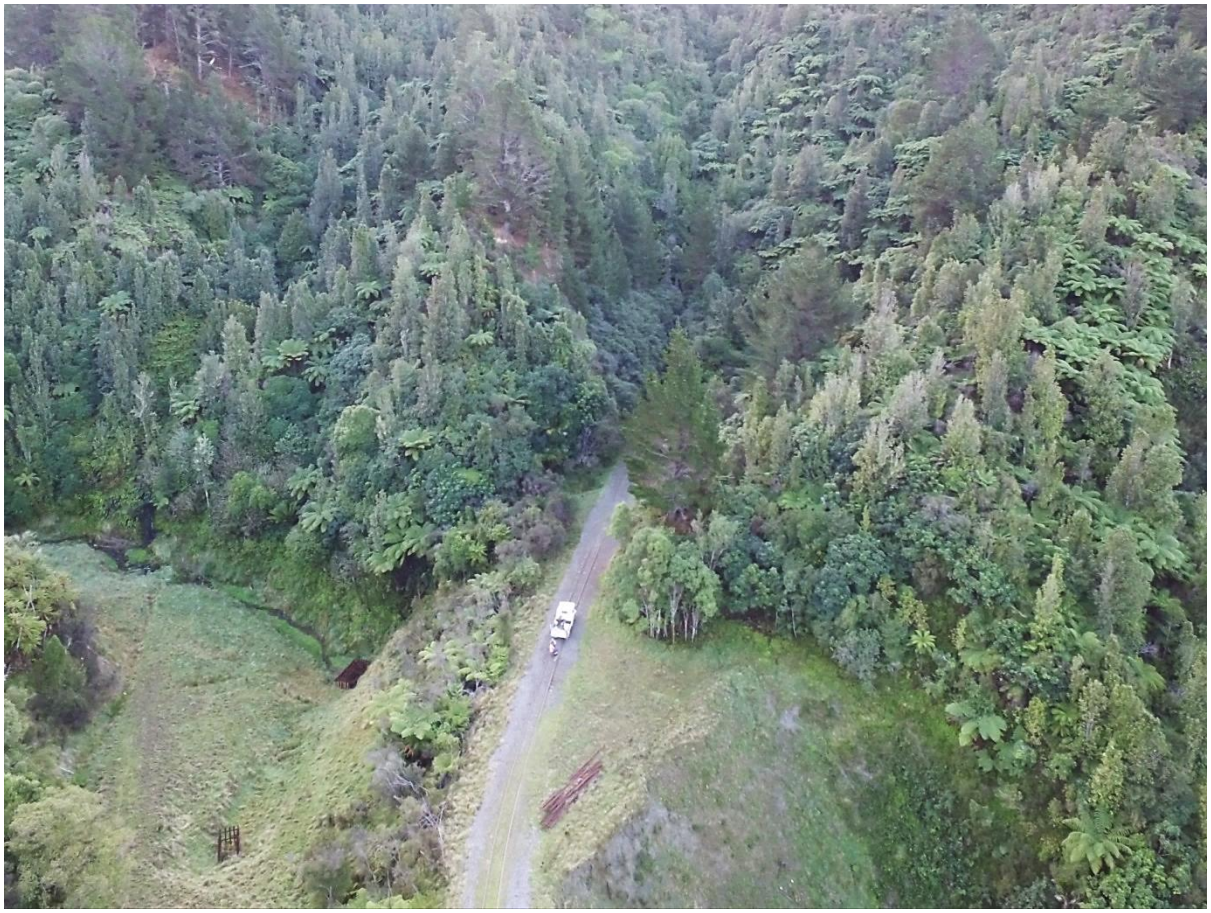

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
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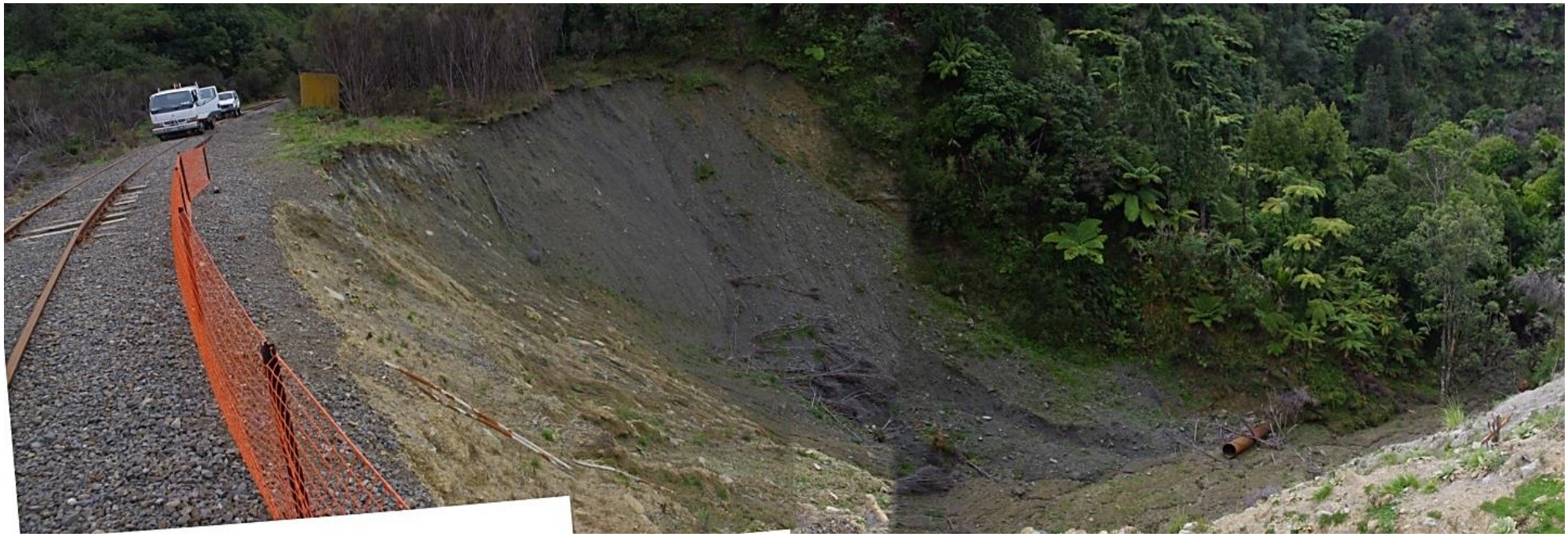
Repair Task:	**Task 6 - Dropout 1**
Track Location:	Rail Chainage 358.300km
Description:	Dropout 1 is located just south of Wharekakaho Tunnel (26) at rail chainage 358.300km +/-. Access for plant and equipment by Rail Plant and materials can be stored on site as required – stockpile area available on upstream site of rail embankment.
Required Works	Downstream embankment - reinstate buttress support using 1:1 sloping Paragrid reinforced MSE slopes 15m & 10m high from toe, reinstate emergency overflow drainage and install new 1.75m arch culvert as additional Q_{100} flood flow capacity.. Excavate cutting faces south of embankment to allow for minor rail slew and provide for buttress & MSE fill material. Incorporate new high level arch culvert outlet, potentially allow fusible backfill over culvert for extreme storm events.
Scale/ Scope/Volumes:	Dropout dimensions are in the order of 40m wide by 60m long and nominally 20 to 30 metres deep. Upstream catchment is some 1.83km^2 with a base concrete arch culvert of nominal 1.2*1.8m dimensions and a 900mm diameter, high level emergency overflow steel pipe culvert. Top of rail level (TOR) is nominally RL 130m with the base culvert invert at nominal RL 110m and emergency overflow set at nominally RL 119m. Base of the dropout is around RL100m +/-, some 60 to 70m downstream of rail centreline. Indicative MSE fill volumes are in the order of 23,000m^3
Construction Comment:	Rebuild buttress fill against pinnacle embankment using Paragrid reinforced MSE slopes. Setup area as spoil dump site for surplus materials from Beach Loop and material excavated from northern end of Wharekakaho tunnel - use DBM side tip wagons Allow to slew track westward (1-3m) to ease tight radius curve on top of current embankment. Allow to excavate cutting slopes on southern end of site to allow for track slew and supply buttress fill material. Allow for new high level secondary inlet on existing 1.2*1.8 tunnel drainage under ridge line (1500/1800Ø vertical manhole drilled down onto tunnel or similar). Allow for repair of emergency 900 Ø overflow works -recover pipes in downstream washout and reinstate with additional rip rap outlet protection. Allow for additional high level 1750Ø arch culvert for balance of Q_{100} flood capacity as well as additional flow capacity in event of partial base flow blockage.
Designer Comment:	KR completed significant inlet works in 2014 / 2015 including construction of rail protection inlet screens on 1.2*1.8 arch culvert under embankment– these are in very good condition and require minor cleanout works only. Detailed MSE design likely to require rockfill toe and spare material buttress. Subsoil drainage under buttress fill - mix of aggregate, geotextile protection and megaflo Ultra 300 high strength pipe. Keying depth at base of buttress toe key - will need undercut down into / through fill materials present in base of fill. Drainage design – consider emergency inlet detailing for base arch drain, detailing around new 1750Ø arch box culvert including riprap discharge on downslope side. Upstream catchment 1.83km^2, Q100 flood design 33m^3/s: • 1200*1800 Arch, 60m long 20m deep, Q =23m^3/s @ 9m flood surcharge • 900Ø steel culvert, Q = 3.5m^3/s @ 3m head Culverting required to pass 1:100 flood flows - minimum additional 8m^3/s. Prudent to also allow say 30% blockage on main culvert in extreme event – require nominal 14m^3/s e/o Use 1.75Ø Arch box set 5-8m below TOR – nominal 18.5m3/s capacity
Rail Operations:	Work trains past site, including deliveries for dropout 2, 3& 4. Approx. 50% of backfill material expected to be work train side tipped wagons from past dropout 2 and elsewhere.

Drone view looking into current embankment from east. Note emergency 900Ø pipe overflow approx. 10m from track level on embankment LHS (shown as *). Note also waterfall on RHS of image – this is discharge from arch culvert under the ridgeline

Drone view looking down on formation. Note Railway grid around upstream inlet as well as emergency bypass. Note also additional lengths of overflow pipe in base of washed out gully – these need to be recovered and reinstated.

Drone view looking north down onto formation and into Tunnel 26 Portal. Note swales areas requiring clearance under Task 5

Drone view looking into cutting area immediately south of Dropout 1 embankment. Allow to excavate on both sides to obtain adequate fill materials for dropout backfilling and allow for minor rail slewing as required.



2013 photos stitched together looking into northern side face. Note washed out 900Ø pipe sections in base washout, substantial volumes of spoil washed away in 2012 event and evidence that multiple overtopping events have occurred based on vegetation growth on ridge facing

View into base of gully / dropout. Note excavation up to 5m deep may be required at toe to key into competent founding ground for MSE fill slope.

View in cutting looking back to Dropout 1 embankment / north. Allow to widen 2 – 4m on LHS for track slew and take out RHS side of cutting for additional bulk filling as required.

1936 historical photo during Wharekakaho Tunnel 26 construction – tunnel spoil was railed out over gully and then either bottom or side tipped to form unconsolidated embankment. Note photo is also good indication of typical excavated rockmass materials in other embankments and fills in Beach Loop and Kopuawhara Valley areas.

1986 NZR aerial photograph showing dropout 1 prior to failure - note significant material within downslope gully as well as cleared areas around and behind the cutting to the south.

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
OTHER 2:	

METHODOLOGY – SITE SPECIFIC:		
SITE SPECIFIC RISK ITEMS	**SPECIFIC ACTIVITIES**	**RESPONSIBILTY**
ITEM 1 **ITEM 2** **ITEM 3**	1.1	Site management Contractors
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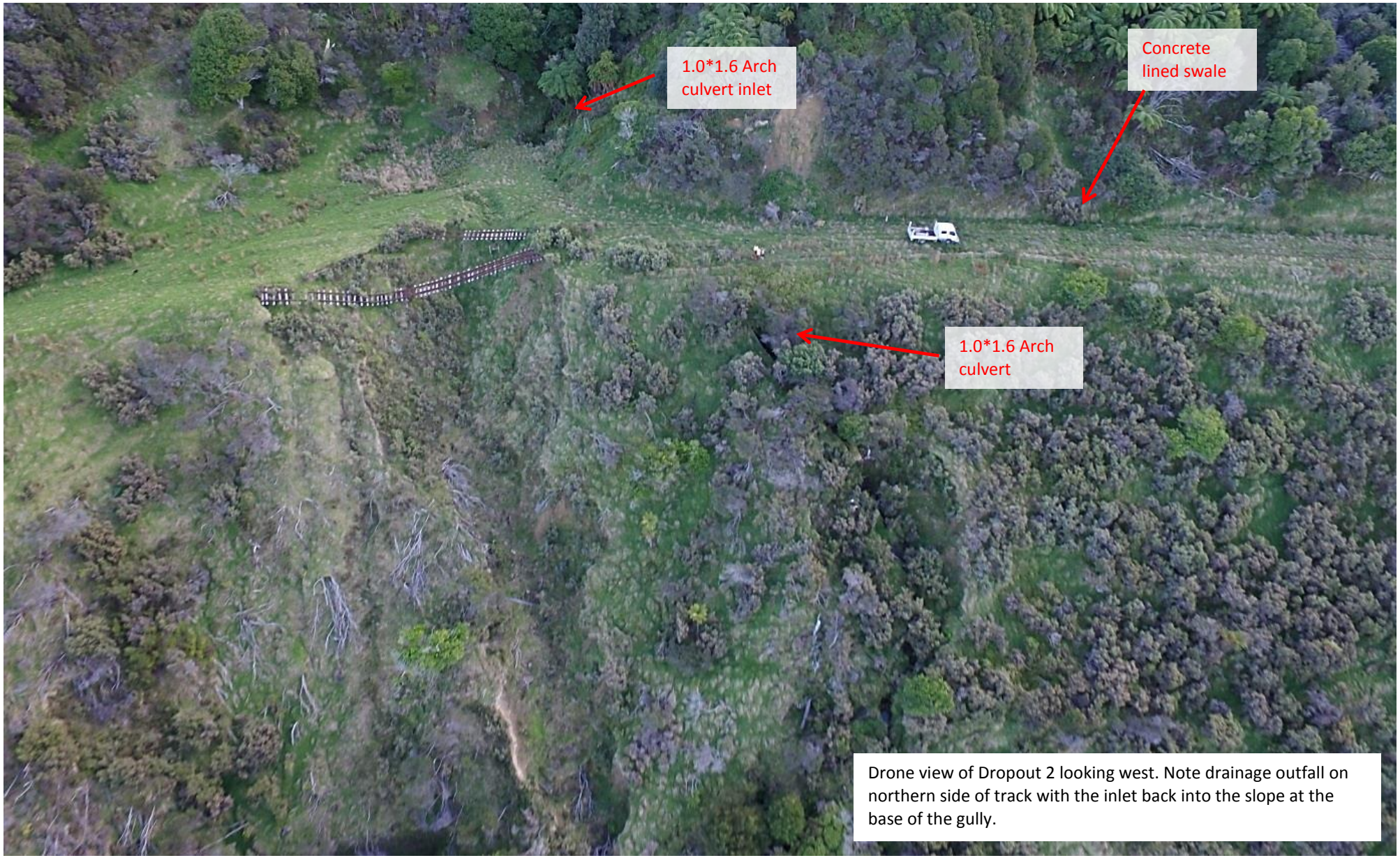
Repair Task:	**Task 7 - Dropout 2 Beach Loop**
Track Location:	Rail Chainage 357.14km
Description:	Reshape and bench out the washout area prior to installing either a 2V:1H (63 degree) sloping Paragrid reinforced MSE slope faced off with hybrid 0.5m high gabion baskets filled with local site soils or a vertically faced retaining wall structure backfilled with Paraweb reinforced GAP 80/ 100 greywacke derived hardfill.
Required Works	As per description above
Scale/ Scope/Volumes:	Indicative MSE fill volumes are in the order of 5600m^3 for the retaining wall option and nominally 16000m^3 for the site fill option. (main difference is engineered fill performance under seismic shaking) Installation of a high level culvert inlet (nominal 1500/1800mm manhole riser with a scruffy dome top) set several metres downstream to provide a high level inlet into the base culvert Excavation of a pondage area to provide for some future spoil volume from periodic culvert maintenance and cleanout , improved entrance into the swale drain including cutting back of the ridgeline and some short culverting.
Construction Comment:	Consider design with nominal Ru value for wet soils, compaction performance Consider subsoil drainage design, drainage aggregate, geotextile protection, megaflo Ultra 300 high strength pipe, benching works into underlying SST/ZST - rock breaker required?
Designer Comment:	Upstream catchment 0.3km^2, Q_{100} flood design 5.4m^3/s Base culvert: • 1000*1600 Arch, 30m long 5m deep, Q =8.5m^3/s @ 3m flood surcharge
Rail Operations:	Work trains to and eventually past site, including deliveries for Dropout 2, 3 & 4. Approx. 50% of site sourced backfill material option expected to be from material recovered south of Dropout 2.

Drone view of Dropout 2 looking south. Note significantly incised erosion into underlying side tipped soils from adjacent 1940s track benching and cutting operations and underlying residual soils



Drone view of Dropout 2 looking west. Note drainage outfall on northern side of track with the inlet back into the slope at the base of the gully.

Drone view of Dropout 2 looking north back along Beach Loop

2013 photographs – extent of washout and track formation damage. Base of dropout is still in spoil - no hard rock visible in photographs or during inspections.

Stitched photo view looking north - note extensive spoil depths on far facing, no intact rockmass visible.

1986 NZR aerial photograph showing Dropout 2 prior to failure - note significant fill material on slope below turnout and clear view of track drainage works on northern side. Note access track above loop area.

View of Beach loop prior to failure on left.

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
OTHER 2:	

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Repair Task:	**Task 8 – Cutting Excavation & Reinstatement**
Track Location:	Rail Chainage 356.83km
Description:	Excavate out slip material blocking track and reinstate stream drainage, install new culvert capacity under formation.
Required Works	Excavate out slip material blocking track and reinstate stream drainage, install new culvert under formation
Scale/ Scope/Volumes:	Estimated 2800m^3 excavation volume from cutting area Excavated material to go to dropout 2 as MSE fill (estimated 4300m3 incl. Task 9 volumes) Install new drainage outlet from stream - deepen swale next to track - install additional culverts under track to take stream overflows.
Construction Comment:	Establish where slope debris has come from and consider any uphill works required - install new access track up slope and undertake benching or drainage redirection works above site. Existing culvert(s) may be buried under fill, current culvert and deep swale drainage leading north looks impractical - additional concrete wall required under track formation to better direct water to north?
Designer Comment:	Upstream catchment 0.2km^2, Q100 flood design 3.6m^3/s Two culverts available • 356.773km, 650*1150 box, 7m long 1.8m deep, Q =2.23m^3/s • 356.847km, .76*.76 box, 20m long, 2m deep, Q = 1.5m^3/s Additional culverting required due to stream location – use 1.75Ø Arch Box to allow for significant sedimentation potential, direct flows across track, location TBC on site
Rail Operations:	Work trains past site, including deliveries for Dropout 3 & 4.

Drone view of cutting looking west - rock fall (Task 9) is on right. Note significant catchment area uphill, current culvert drainage is just off edge of picture on right.

Drone view of cutting looking west. Note potential for new Beach Loop access track from upper right on photo

2013 photographs showing washed out spoil across formation

2019 Photos showing temporary access track across top of spoil (note large spoil volume)

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
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Repair Task:	**Task 9 – Rock Fall Batter Slope**
Track Location:	Rail Chainage 356.76km
Description:	Regrade slope, reinstate excavated benches
Required Works	Regrade slope, reinstate excavated benches
Scale/ Scope/Volumes:	Excavate out failing material and large boulders - use boulders as rock toe for dropout 1 and 2 with backup fill material for dropout 3 – estimated 1500m^3 volume, tbc Reinstate existing benches and tidy up internal slope drainage. Excavate out swale at bottom of slope adjacent rail, improve rock catching ability, rework culvert inlets and outlets
Construction Comment:	Rock slope looks unstable but has generally performed reasonably well since 2013. Some material failing into swale at southern end, will require additional assessment. Significant failure 2010 – 2011. Has been ongoing issue since construction in 1940s.
Designer Comment:	Site of large landslide in mid 2000s. Consider loss of ground on downstream side of site - any precautionary H piles needed for track support? Drilled or driven pile design? (Currently not allowed for in pricing schedule)
Rail Operations:	Work trains past site, including deliveries for Dropout 3 & 4.


Rockfall slope
Area

Drone view of rock fall area on left and looking back into cutting area in middle part of photograph. Note eroded mid slope benching on rock fall face

2013 photographs rock fall area – note large rocks on batter slope.

Exposed rockmass on southern side of landslide area acting as side release zone.

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
OTHER 2:	

METHODOLOGY – SITE SPECIFIC:		
SITE SPECIFIC RISK ITEMS	**SPECIFIC ACTIVITIES**	**RESPONSIBILTY**
ITEM 1 **ITEM 2** **ITEM 3**	1.1	Site management Contractors
	1.2	Site management Contractors
	1.3	Site management Contractors
	1.4	Site management Contractors
	1.5	Site management Contractors
	1.6	Site management Contractors
	1.7	Site management Contractors
	1.8	Site management Contractors

Repair Task:	**Task 10 – Stream Works @ 356.23**
Track Location:	Rail Chainage 356.23km
Description:	Reinstate swale drainage, clean out entrance area, create additional sediment catch area.
Required Works	Excavate out slip material blocking swale drainage - clean out concrete headwall swale back to splash wall
Scale/ Scope/Volumes:	Slip partially excavated out by DBM in week of 15 June as emergency works Additional excavation works and removal of spoil to dropout 1 required.
Construction Comment:	
Designer Comment:	Additional slope protection where stream enters top of debris fan down to swale drain should be considered. Additional excavation and removal of fan drainage to be assessed further.
Rail Operations:	Work trains past site, including deliveries for dropout 3 & 4.

Swale clearance works July 2019 to prevent water flooding across track and destabilising slope on outside edge of track formation.

SCOPE OF WORKS	
DRAWING PACKAGE:	
SITE ACCESS:	
SITE PREPARATION:	
SUBSOIL DRAINAGE:	
STORMWATER DRAINAGE:	
EARTHWORKS:	
OTHER 1:	
OTHER 2:	

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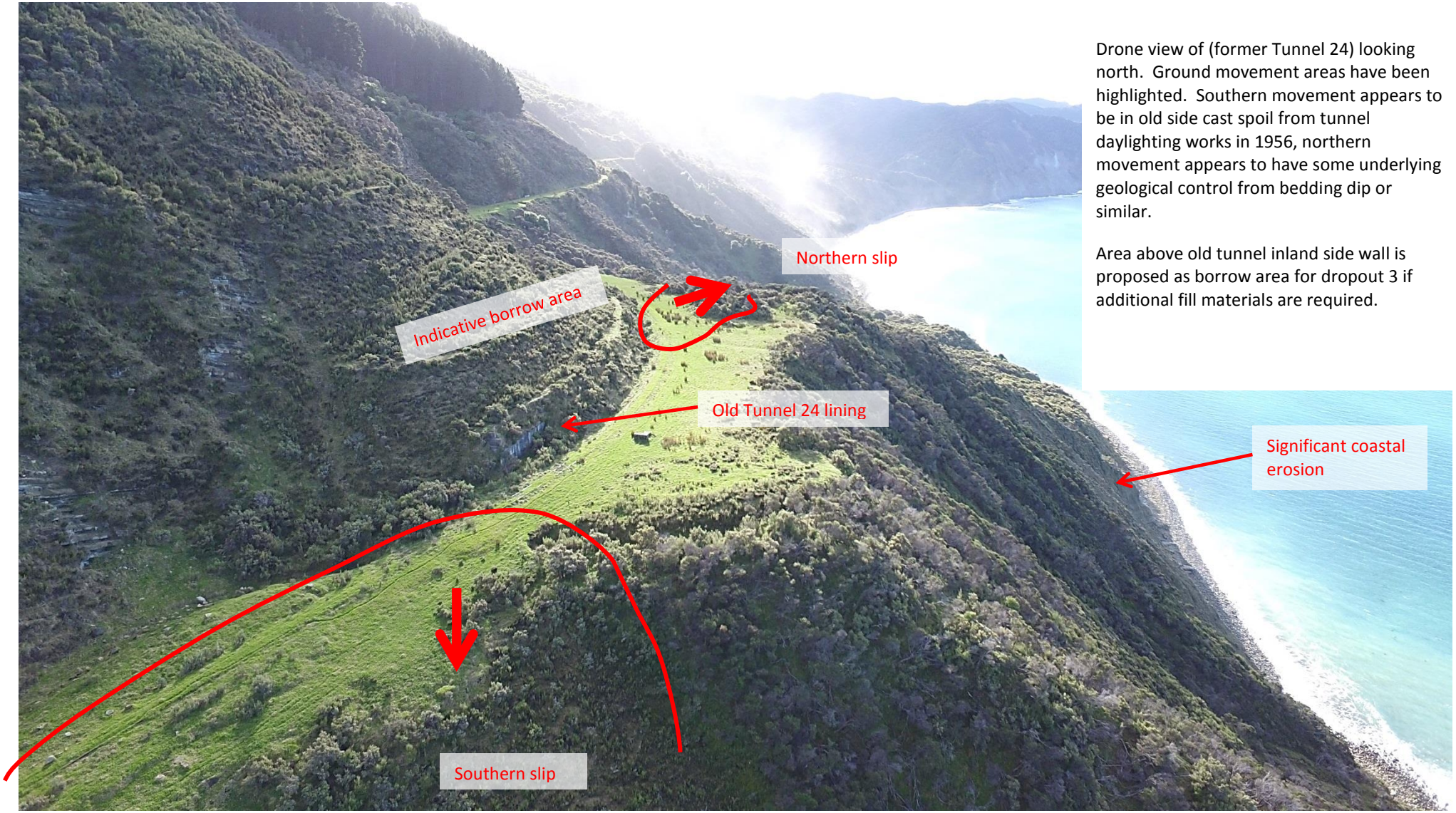
Repair Task:	**Task 11 – Old Tunnel 24 Site**
Track Location:	Rail Chainage 355.9km & 355.825km
Description:	Slow moving ground movement - ongoing KR maintenance and track reinstatement issue for multiple decades
Required Works	Geotechnical investigations to determine depth & extent of movement
Scale/ Scope/Volumes:	Allow to undercut and repack track over both areas as interim measure Allow for geotechnical investigations and machine holes on both slip areas - establish depth of movement as well as ground models for future risk assessment
Construction Comment:	Area uphill of old tunnel 24 lining proposed as fill source for Dropout 3 - see report section 4.5
Designer Comment:	Northern slip appears to be material failing down dip - possibly bedding plane controlled movement. Southern slip appears to be old fill movement, likely in material placed from removal of tunnel 24 in mid 1950s.
Rail Operations:	Work trains past site, including deliveries for dropout 3 & 4.



Drone view of (former Tunnel 24) looking north. Ground movement areas have been highlighted. Southern movement appears to be in old side cast spoil from tunnel daylighting works in 1956, northern movement appears to have some underlying geological control from bedding dip or similar.

Area above old tunnel inland side wall is proposed as borrow area for dropout 3 if additional fill materials are required.

Drone view looking west. Note height of coastal erosion reaching up from beach – over 100m high.

Long term erosion will require track to be benched further back into hill, hence proposed borrow area.

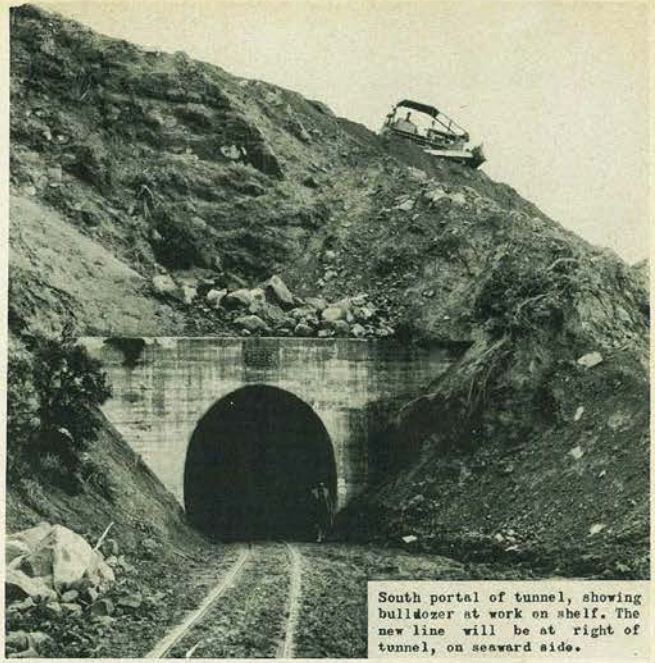
Historical photographs from 1956 tunnel daylighting operations – note benching and fill placement from this area back to Dropout 4

4 GISBORNE PHOTO NEWS, APR.5, 1956

EAST COAST RAILWAY DEVIATION

About a mile south of Beach Loop, on the East Coast railway, three bulldozers and a team of men are working night and day on a big contract. Their job: to shovel 150,000 cubic yards of hillside into the Pacific Ocean to make a new railway deviation. The plan will eliminate a short tunnel which is threatened by earth movement.

High above the sea, men working machines enjoy one of the most beautiful seascapes. But they have little time to admire the scenery, for the job demands unceasing concentration. One false move would be enough to bring disaster, as the picture at left indicates. View looking north to Gisborne shows Whareongaonga and Young Nick's Head in far distance.

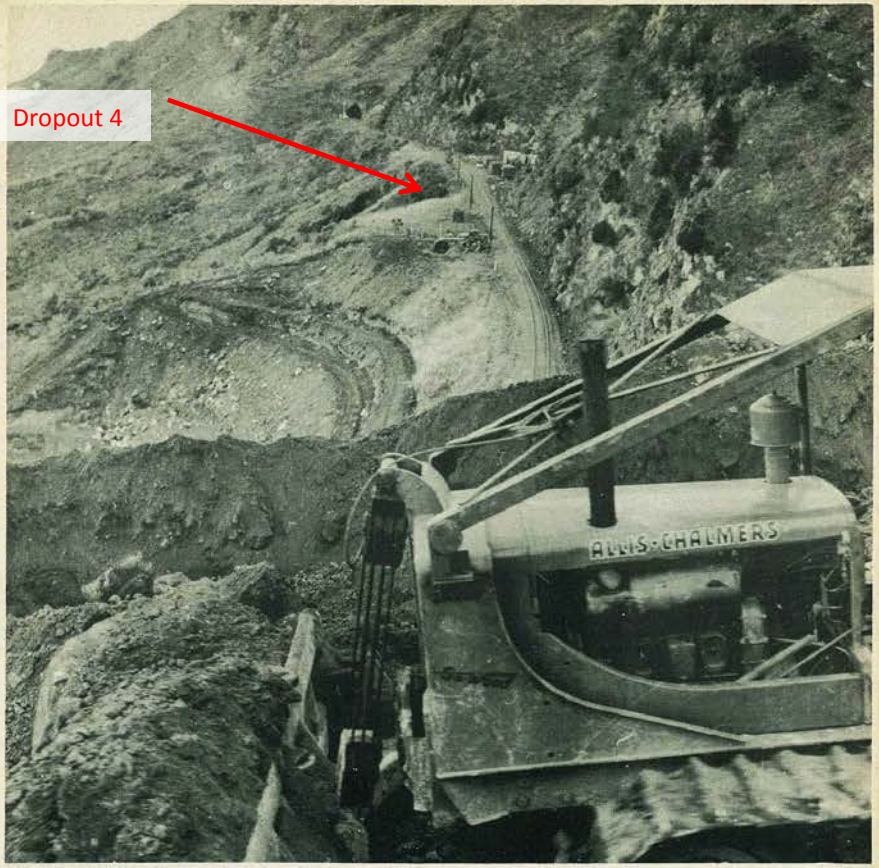


South portal of tunnel, showing bulldozer at work on shelf. The new line will be at right of tunnel, on seaward side.

Looking south from the job, showing two of the bulldozers at work.

GISBORNE PHOTO NEWS, APR.5, 1956 5

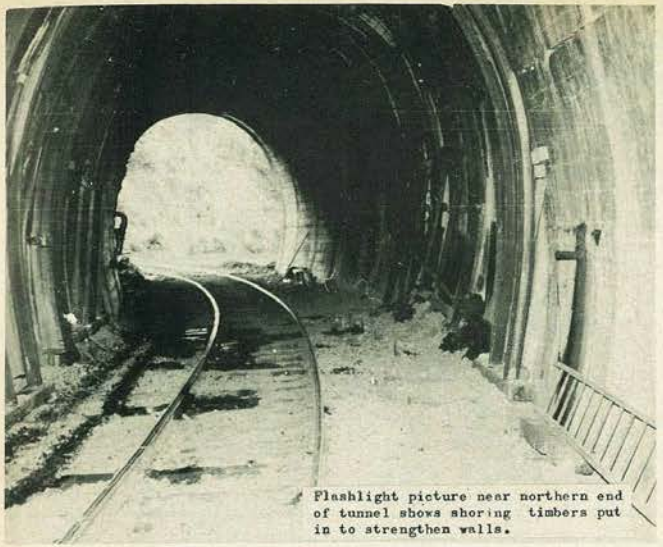
Dropout 4



Above: View from shelf looking over bulldozer at work shows line snaking towards longer tunnel to south of job and workers' camp to right of line. Bulldozer is right over tunnel. Hillside below line has been terraced to take embankment where new line will be laid.

Left: Doug Herbison, of Wharerata, on whose property work is being done, and who drove "Photo News" cameraman over rugged hills to job, chats with one of the bulldozer drivers.

Contractors for job are Brooks and Tollison Ltd., Napier. They have only three months in which to complete the work.

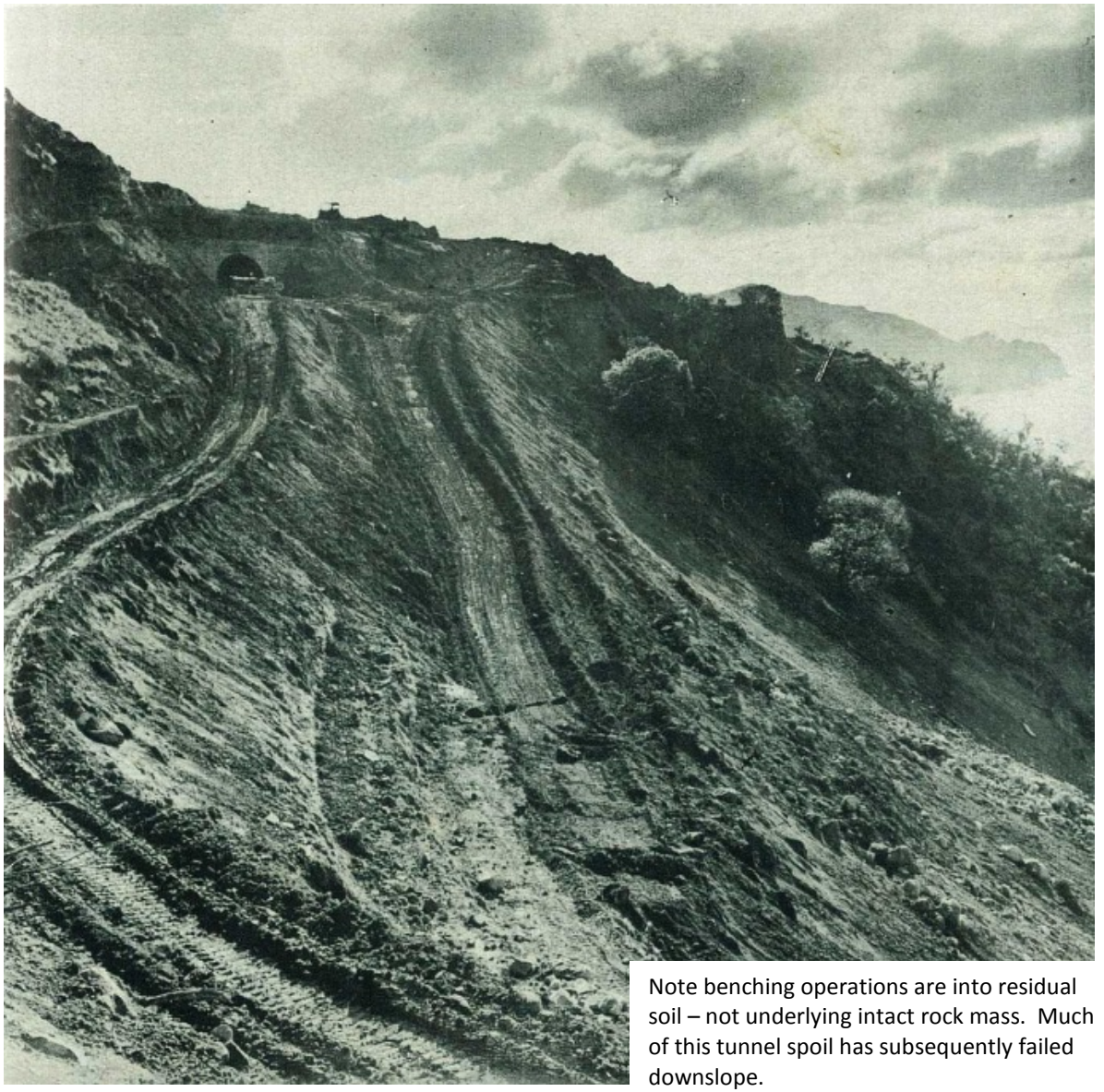


Flashlight picture near northern end of tunnel shows shoring timbers put in to strengthen walls.

Above: Mrs Lissette, wife of one of the workmen, who is living on the job with her five small children. She has eight men to cook for. Camp is 22 miles south of Gisborne.

Puzzle: Find the train. Near-vertical downward view from 500ft above Beach Loop gives only one small clue that a goods train is passing through. Small white mark half an inch from right-hand side of picture is steam from train about to enter doomed tunnel.

Historical photographs from 1956 tunnel daylighting operations – note benching and fill placement looking back to north



Note benching operations are into residual soil – not underlying intact rock mass. Much of this tunnel spoil has subsequently failed downslope.

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