MILLER CONSULTING

ASSET MANAGEMENT , AUDITING AND PROJECT DEVELOPMENT

SOME IMPACTS OF ROADING AND FLOOD DAMAGE ON SOUNDS ROADS

Part only –(this is a second report) –

1 French Pass and D'Urville Island area , Bulwer area , Titirangi and Anakoha roads
2 Moetapu Bay , Onahau and Torea roads
3 Port Underwood and Tumbledown Bay roads

Period 1985-2010

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Introduction :

This is a second report covering the balance of Sounds Roads not addressed in the first report delivered in 2015.

These two reports collectively address most of the significant damage to the 'Sounds' receiving waters; there are very few and minor other sites that have not been addressed; these are not considered of significance.

The report has 3 sections:

The first section (Section 1) covers the area D'Urville Island , French Pass , Bulwer , Anakoha and Titirangi plus.

Parts of these areas were subject to a 'weather bomb' in approx.1989 –unofficial records from D'Urville Island indicate a 48 hour rainfall of 25 inches!! (If correct this would be one of the heaviest rainfalls recorded in NZ)

I will report, specifically indicating whether damage recorded in the report in this area was attributed to that special event OR were separate storm and flood damage events in the areas.

I have also included some damage on private land which may be of interest and which I was aware of, I must record my thanks to Terry Savage of D'Urville Island, Tony Redwood of Okaha farm, John Webber of French Pass, Gerald, the old Sounds roadman (refer Te Towaka – Port Ligar Road section) and others for their input and assistance with some detail.

The D'Urville Island 'Blue' slip to the sea (and potentially an unstable area on Woodmans Road) is by far the largest single damage site in the 'Sounds'.

There were some other 'huge' slips on D'Urville Island especially as a result of the 'weather bomb' referred to; however, most of them did not reach the sea directly. In the bay below and south of Woodmans Road AND on the Greville Harbour property of DOC (previously F Leov.) there were literally hundreds of slips (not dissimilar to damage caused by Cyclone Bola in the Poverty Bay area some years ago) none of these directly entered the sea. However Mrs Sue Savage advised that a rock approx. 400 m offshore in Woodmans Bay marks the limit at which the whole bay is still full of sediment and discolours in certain wind conditions, she also advised that when diving the seafloor is covered in sediment (I would assume still there from the 1989 event)

I have included some observations by locals, some private property damage of which I am aware and some anecdotal observations.

The second section (Section 2) includes Moetapu Bay , Onahau and Torea roads

Moetapu Bay road has suffered many roadside and property slips through many years, I must say it appears following my inspection that a large part appears stable now.

I recall being advised by J. C-------- then Assessor for the EQC that he understood there were 147 properties in the area at one particular time and he had received 50 claims for damage.

There are a number of files specifically in regard to this road where Council was exposed to potential liability issues .

Nevertheless in spite of the number of events relating to the road many slips were arrested before they reached the coast by private tracks and roads below the Council roads, otherwise there would have been a lot more material reaching the sea.

The sites referred to in Onahau and Torea Bay were of a lesser degree (Torea was the major of the 2), however I included Onahau because of the large spoil sites within the Bay and the improvement to land in the area (my opinion) following that filling and levelling.

The third section (Section 3) includes Port Underwood and Tumbledown Bay Roads.

There have been many slips on these 2 routes, (see my section introduction and notes). Once again many slips were arrested by downhill drives and accessways. At some other sites there will have been huge quantities of water borne silts and lighter materials into the receiving waters.

I have also included a little history of some of the roads in the area for interest.

Each section includes a Summary at the end.

The sites , their location , quantity and other details are included .

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SOME IMPACTS OF ROADING AND FLOOD DAMAGE ON SOUNDS ROADS

(PART ONLY) SECOND REPORT

SECTION 1

FRENCH PASS AND D'URVILLE ISLAND AREA , BULWER AREA , TITIRANGI AND ANAKOHA ROADS.

Site 1

Croisilles French Pass Road R.P. 0.85km

Coordinates : 2565908 / 6010332

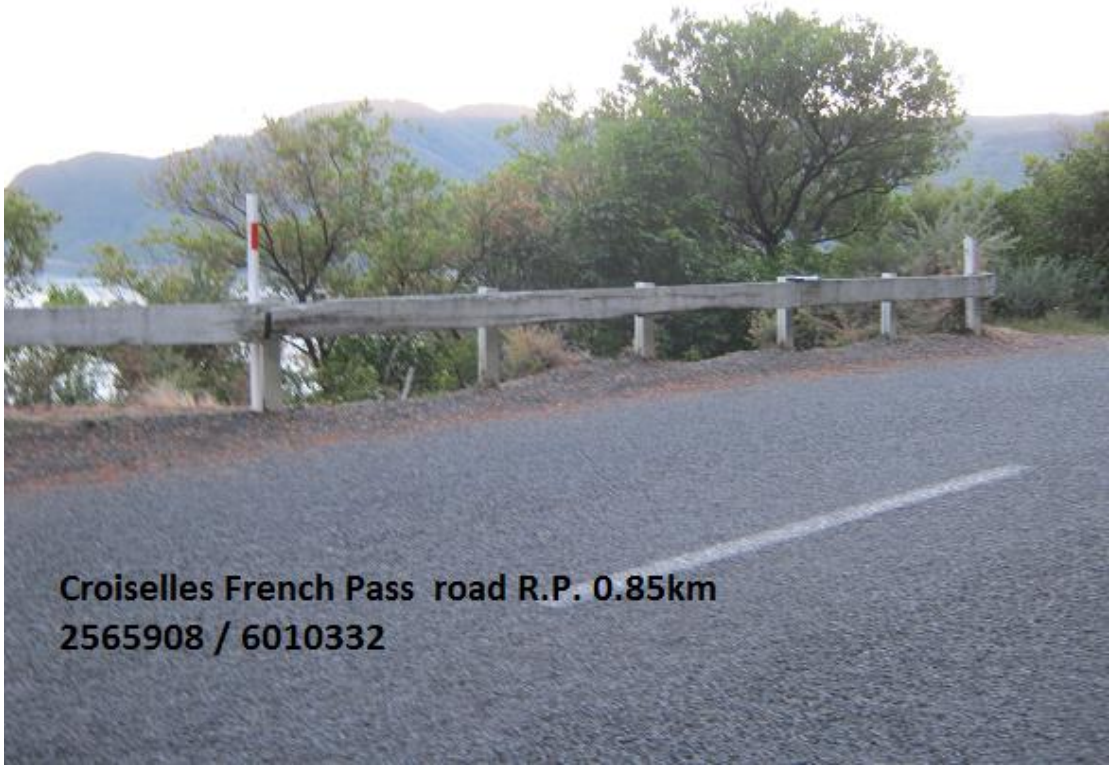
This site has a small barrier railing above a slip to the coast.

The damage has likely occurred as a result of early sidling fills which were not benched or compacted , although there is also some apparently unrelated but similar damage to the south of this site.

From the coast line looking up it is apparent there was an earlier event similar to this shorter section (this must have occurred prior to 1985 as I don't recall this damage) AND there is a later and significant event to the south which has occurred relatively recently (I think in about 2002 – THIS is NOT roading related)

The quantity involved was app. 800m3 and this event occurred app. 1990

I would estimate the earlier and later damage has probably deposited another 2000 m3 +- to the coast near this site .



Site 2

Croisilles – French Pass Road R.P. 36.95 km

Coordinates : 2580593 / 6030649

This is the site of the 'old' French Pass refuse tip.

The French Pass and environs residents maintained a rubbish tip at this location ; it consisted of a simple sidling fill of material above a gully and , I assume , some sort of rudimentary bench.

I am advised it was in operation from about 1970 (JW) until app. 1991 (unrelated to the 'weather bomb' event) heavy rainfall and perhaps just an instability of the site caused a dramatic collapse of the whole 'tip' down the gully and onto a lovely sandy beach below. Some light debris was strewn down the face but generally most material was on the beach or in the water.

I was the roading contractor in the area at that time and as I was taking plant to D'Urville Island I was asked by an officer of Council if I could uplift the worst of the material , transport it to D'Urville Island and find a strategic spot and dig a hole and bury it !!

Doing what I was instructed but with some reservations, I arranged for a barge to take us through the Pass, offload an Excavator and 2 trucks and we quickly loaded as much heavy and visible refuse as we could (also lots by hand), reloaded to the barge and went to D'Urville Island.

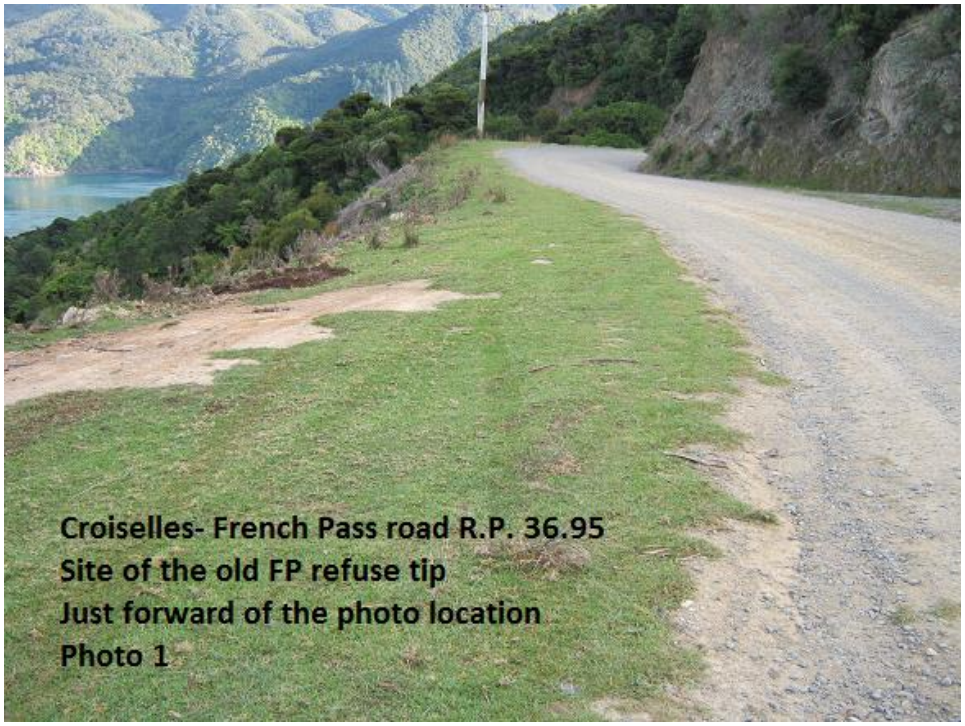
We proceeded to dig a hole on the side of the road and bury the 12-15 m3 of material we had loaded. I can say that one of the Islanders turned up and gave me my pedigree for bringing mainland rubbish onto their island ; I was able to refer him back to Council – one advantage of being the 'dumb' contractor !!

Obviously we had only uplifted a small part of the more obvious refuse and we certainly weren't going to do more than 1 trip of this type ; I estimate the whole tip may have contained up to 400-500 m3 of refuse in total most of which had simply flowed into the sea.

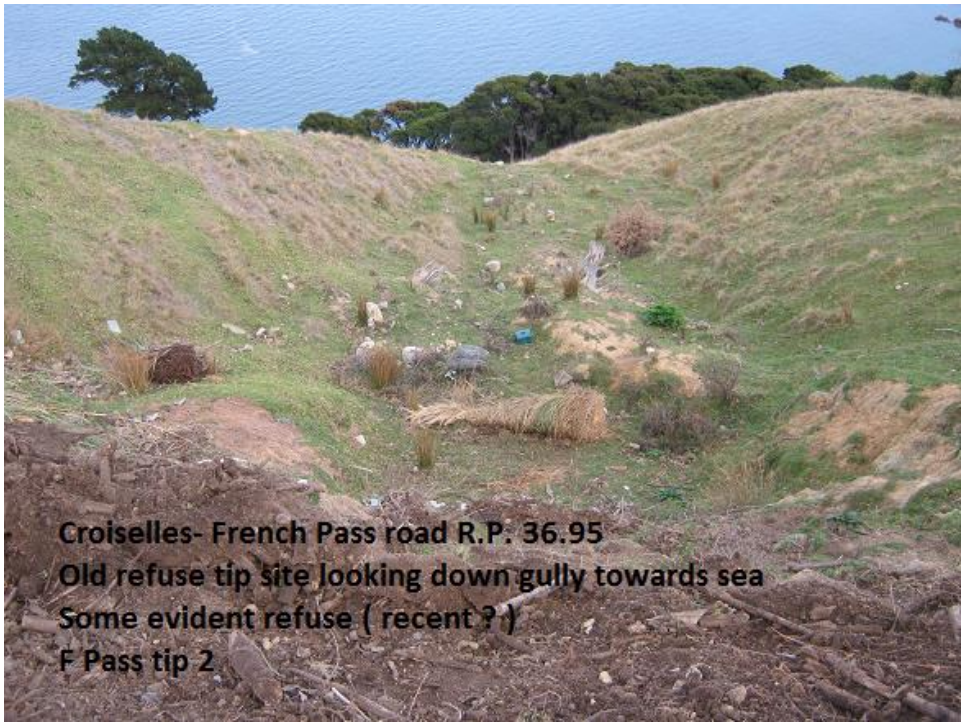
I would assume there must be some residual material in the ocean as there were old fridges, bits of cars , steel, etc. and the old roadman I was talking to (see Te Towaka –Port Ligar road photos) told me had tipped 2 concrete septic tanks over there from the old school before it, the tip , collapsed.

There are very strong currents extending from the 'Pass' back to this area so it will be most interesting to discover if there is any residue of the materials in the sea.

Needless to say the 'tip' was abandoned and other sites for refuse established (Rai Valley)



Croiselles- French Pass road R.P. 36.95
Site of the old FP refuse tip
Just forward of the photo location
Photo 1



Croiselles- French Pass road R.P. 36.95
Old refuse tip site looking down gully towards sea
Some evident refuse (recent ?)
F Pass tip 2

Site 3

Croisilles – French Pass Road R.P. 37.95 km

Coordinates : 2580581 / 6030992

This site is immediately obvious as one descends towards 'Collinet' Point and French Pass village and there have been several instances of slips and underslips at this location.

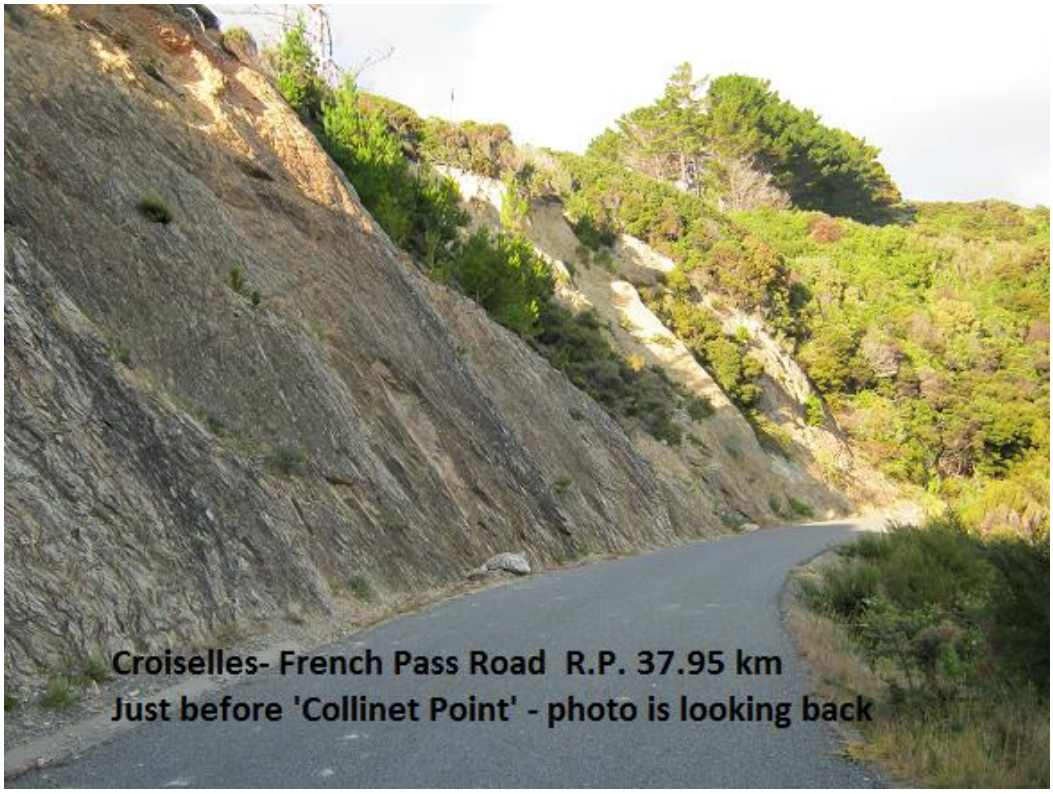
There are the evident downhill faces below the road with minimal vegetative cover and the bare schist faces above the road ; the slips from above the road terminate near the start of the RHS Concrete channel , a length of about 45 metres.

There is some evidence of the material , especially larger sections of rock along the coastline immediately below the site and there were 2 much smaller but similar underslip areas just forward.

The photo is looking back up the road .

The main event at this site occurred in app. 1998 when near 1200 m3 collapsed to the sea and some of the uphill material also crossed the road at this site.

At about the same time a 'chunk' of schist dropped off the end of Collinet Point ; this is obvious from a boat (pretty small probably only a few m3)



Site 4

Elaine Bay Road R.P. 2.1 – 2.25 km

Coordinates : 2574869 / 6016474 (near north end)

This site was the subject of survey and design, by me, following a dramatic collapse of the face above the road and the banks below the road.

The road was completely severed at the time and the event followed comparatively recently after pine trees were clear felled from the area above the road.

The survey identified that the new face reposed at an angle of near 45 degrees (almost exactly) ; this seems to equate to a number of other faces surveyed after slips of this type and in this type of material (including 'Day' site Kenepuru road – Ayson / 'Shagin' slip- Kenepuru road –THJ , Last site on Moetapu Bay road – DM)

I recall tales of an earlier County Engineer deliberately making 'cut' faces too steep so that after they fell down one could access Flood damage subsidy at a better rate than normal roading subsidy – I am sure another member of our profession would not entertain such thoughts !!!

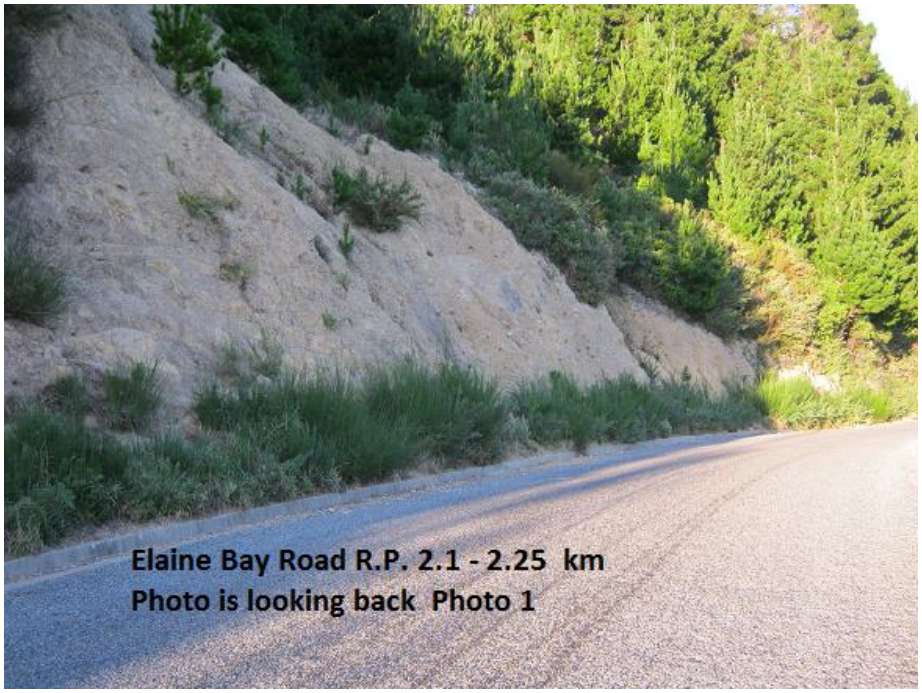
The remedial works included constructing an access bench so that plant could reach the top of the area with long reach 'booms' and a realignment of the road to the east and installing new drainage systems .

There is an obvious deposition of material into the sea at this site and the extent of the works is still apparent.

The damage occurred over some years starting in 1995 (collapsing outer edge) and finally permanently repaired following significant collapse of the face in app. 2004

In total there has been app. 2000m3 to the coast and sea at this location.

See 2 photos that follow.


Elaine Bay Road R.P. 2.1 - 2.25 km
Photo is looking back Photo 1


Elaine Bay Photo 2 looking down to the sea and 'back'

Site 5

D'Urville Island

Main Road R.P. 0.65

Coordinates : 2580809 / 6033791

This was one of the sites where damage occurred as a result of the 'weather bomb' in Feb 1989 ; it is difficult to reconcile the benign environment now with the site immediately after the flood damage occurred.

The whole creek above the culvert was stripped of cover and vegetation as far up as one could see (almost to Kupe Road in fact) about 10-15 metres wide and the creek had incised probably near 2-3 metres deep.

The road at the site was 'sheared' right through about 4 metres deep and over a length of near 20 metres ; the existing 1.8m dia Reinforced concrete culvert was strewn down the stream completely smashed into small chunks about 100mm sq. , some held together with the remnants of the spiral reinforcing . I have seen damage to culvert pipes before but never anything as dramatic as this event – all 4 pipes were now just like pebbles in the creek bed and banks !!

The watercourse used to run parallel with, and below, the road exiting into the bay on the LHS from the coast line (South side) , following the storm the creek now exited on the other (north side) of the bay – this had previously just been a trickle !! . The area near the old homestead which was wrecked was covered in stones and debris as was the general area.

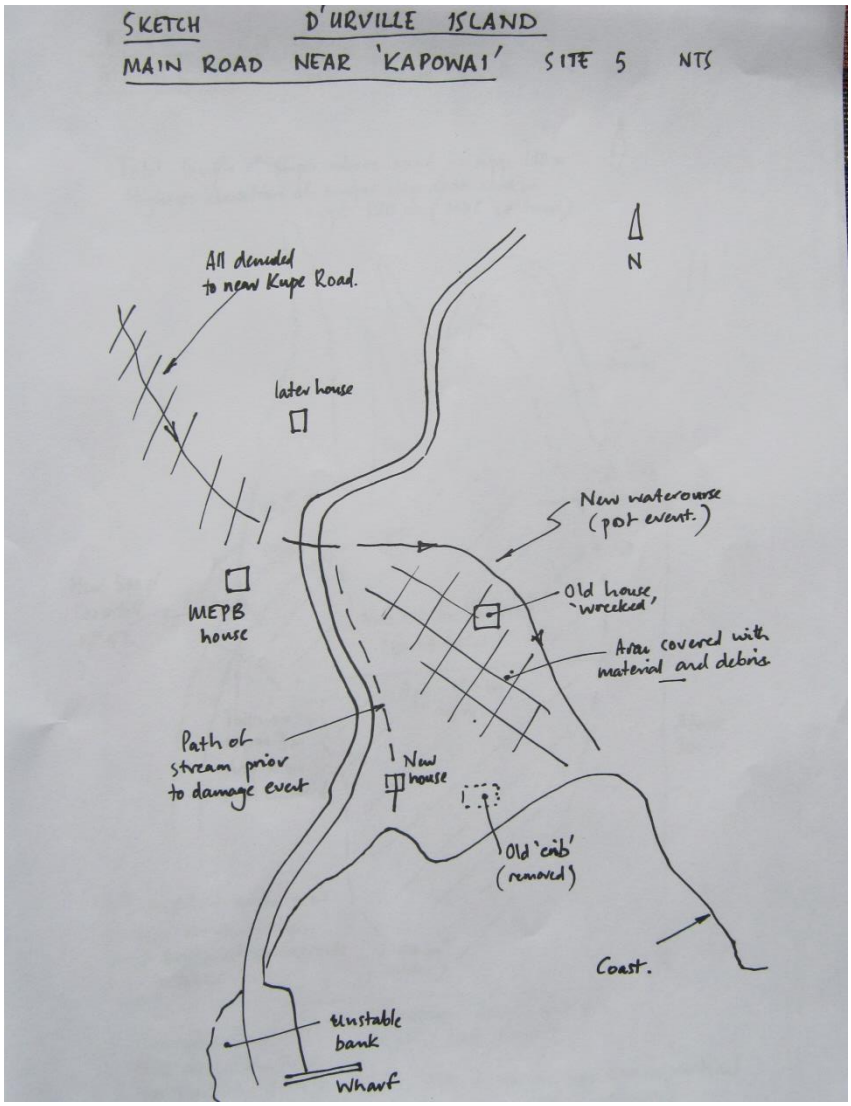
There is a fairly recent house above what was the old watercourse and the stream appears to have established in its newer location . The whole area looks pretty tidy now !!

The damage was completely unrelated to any of the roading activities , the culvert capacity was never going to be big enough for the intensity of rain (the culvert has been replaced with 2 / 2 m dia. RC Culverts effectively increasing the capacity by 2.5x – I suspect one will never know if this capacity would carry the discharge from a similar event)

I estimate in total over 10,000m3 of material was moved down the watercourse and into the sea with possibly another 3000m3 spread over the ground areas.

NOTE Material has been falling from the face above and south of the Wharf complex ; during my time we have uplifted this material and used it as a road surfacing – I do not know when the wharf was constructed , certainly before 1985 , and I do not know if some of this material was ever used as backfill for the significant retaining structure along the foreshore – looking at the configuration of the ground one would suspect it was ; and it was also used to elevate the parking areas.

This photo is looking back towards the Wharf (start of the road) – extremely bright sun , and to culvert number 6 – the replaced structure. There is a recent access at photo right


SKETCH D'URVILLE ISLAND
MAIN ROAD NEAR 'KAPOWAI' SITE 5 NTS
N
All deviated to new Kupe Road.
later house
New waterourse (pot event.)
Old house 'wrecked'
MEPB house
Area covered with material and debris
Path of stream prior to damage event
New house
Old 'crib' (removed)
Coast.
unstable bank
Wharf

SITE 6

D'Urville Island

Main Road R.P 10 km (approx. our Landrover tachometer broke !!)

Coordinates : 2583450 / 6038587 (near 2nd new Farmtuff pipe)

The 'Blue slip' site

There was a dramatic collapse of the 'Blue slip' area extending from near the summit of Attempt Hill (top of slip near 650 metres elevation) to the coastline and the sea.

The road was completely severed some metres deep as a result and has been reformed several times since due to the fact there is some continued subsidence as well as drainage problems in this area.

I was advised by the Engineer who effected the survey and alignment of the road when it was first constructed that this had been the most difficult section of the road – it had not been possible to go to the west of Attempt Hill as it was too steep and this section had always been unstable and poorly drained. Nevertheless I believe the collapse was simply the result of the huge amount, and intensity ,of rainfall.

After the event one could stand near the south end of the site and look down towards the East ; there was a completely bare , denuded swathe of slip extending for at least 300 metres below the road , nearly to the Trig station to the north and approx. 100-150 metres wide , the area above the road was similarly bare exposed blue material generally. I am advised that one could climb from the sea to the base of this visible area described above and that the slip extended to the sea about 30-40 wide with all the vegetation stripped in some places right down to underlying bedrock. (JW)

There was some damage to property and buildings at the coastline below and to my delight a large number of Deer escaped to increase the feral population.

I estimate there would have been in excess of 100,000 m3 of material which flowed to the coast (conservative) The event occurred in Feb. 1989 – the 'weather bomb' event.

This is one of , if not the most ,significant event in the sounds to my knowledge .

There has been some recent work installing new culverts and drainage systems , this is probably the 3rd or 4th instillation so far.

There were some other significant events especially on Greville Harbour road but material did not reach the coast directly – I suspect much sediment would have entered the Lake in Greville Harbour Bay and the extensive drainage systems which used to cover the flats in

this area. There was no significant damage on Main road beyond here or Port Hardy roads

There are 4 photos , 1 and 2 are looking back , and a sketch indicating some site details

This photo (1) is taken from near the Trig on the north side looking up towards Attempt Hill

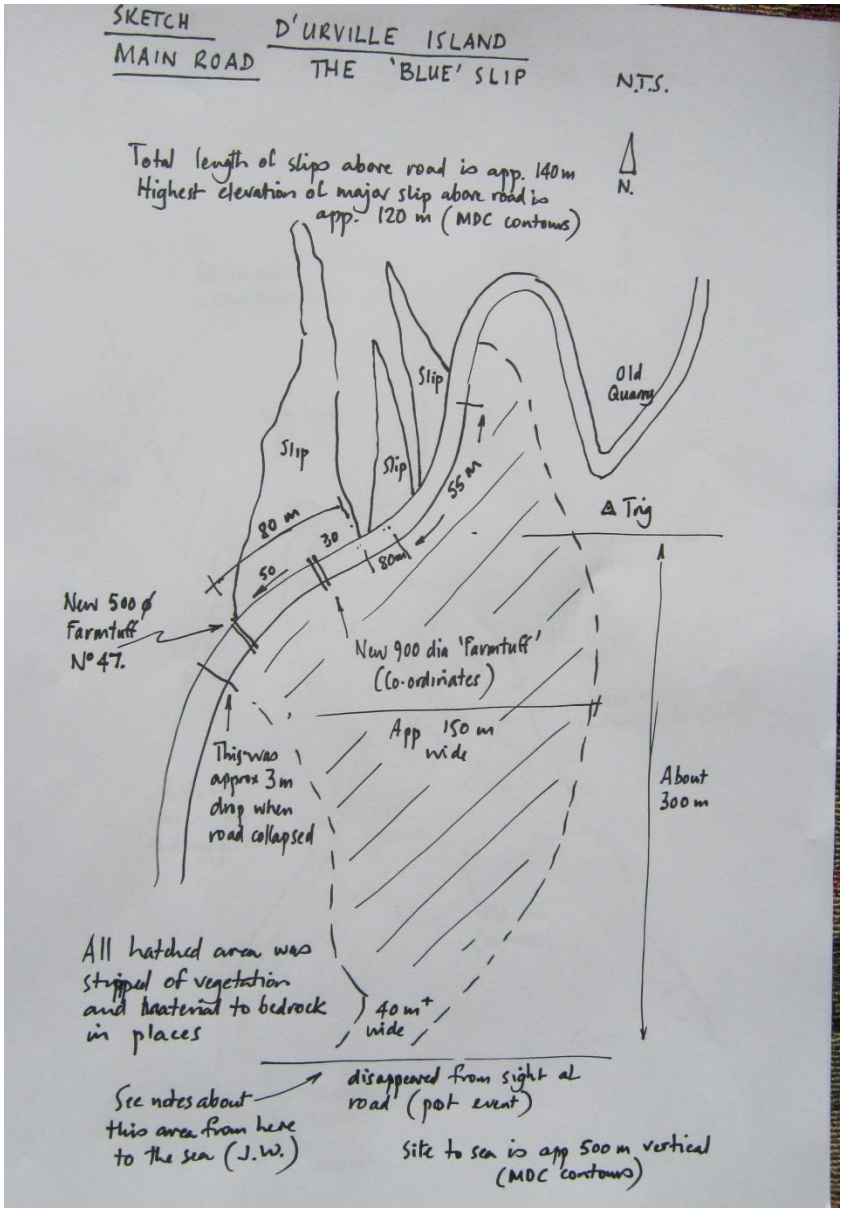
This photo (2) is taken from near the new Farmtuff culvert (one of two) recently installed. You can observe in the photo foreground some evidence of where the road was severed by the slip and has been ‘ramped ‘down. You can also see what, I assume, are the salvaged pipes from the previous culvert instillation near here (I am not aware as to why they have been replaced ?)

This photo is from near the large (2nd) Farmtuff looking to the outer edge and down off the road edge.

There are virtually no areas below the road that have not re-established vegetative cover.

Very difficult to visualise what the site looked like post the initial damage.

This photo is from near the large (2nd) Farmtuff looking towards the North showing part of the slip and the blue material.


SKETCH
MAIN ROAD
D'URVILLE ISLAND
THE 'BLUE' SLIP
N.T.S.
Total length of slips above road is app. 140m
Highest elevation of major slip above road is app. 120 m (MDC contours)
N.
Slip
Old Quarry
Slip
Slip
55m
Trig
80 m
30
80m
50
New 500ϕ Farmtuff No 47.
New 900 dia 'farmtuff' (Co-ordinates)
App 150 m wide
This was approx 3m drop when road collapsed
About 300 m
All hatched area was stripped of vegetation and material to bedrock in places
40m+ wide
disappeared from sight at road (pot event)
See notes about this area from here to the sea (J.W.)
Site to sea is app 500 m vertical (MDC contours)

Site 7

D'Urville Island Woodmans Road R.P. 10 km (approx..)

Coordinates : 2576497 / 6036230 (at South end)

NOTE THIS IS NOT A DAMAGE SITE, IT IS APPENDED FOR INFORMATION ONLY

This is included for interest only as although the road and hillside slumped it has NOT collapsed to the coast or sea.

This section of road slumped in about 2002 dropping about 2 metres vertically and moving about 4 metres towards the west (coast)

The movement can be observed by sighting along the line of poles and noting the sideway shift of the line , which is very obvious . I am advised by locals it still appears to be moving but it doesn't look very different to the initial movement to me.

I surveyed the site by stadia survey in 2002 app. And noted at that time there were cracks extending across the slip area below the road and down to a distinctive terrace on the ridge

I applied slip circle design to the area and estimated there is potentially 130,000 m3 of material at this location which may , or may not , slip to the sea one day !!

The road length affected is 120 metres app.

I have NOT included this in the summary .

The slip extends from here to the photo distance and above and below the road

Site 8

Te Towaka – Port Ligar Road R.P. 8.8 km

Coordinates : 2583323 / 6024678

This is 'Rocky Creek' the site of a major discharge of slip material to the sea in the 'weather bomb' of Feb. 1989.

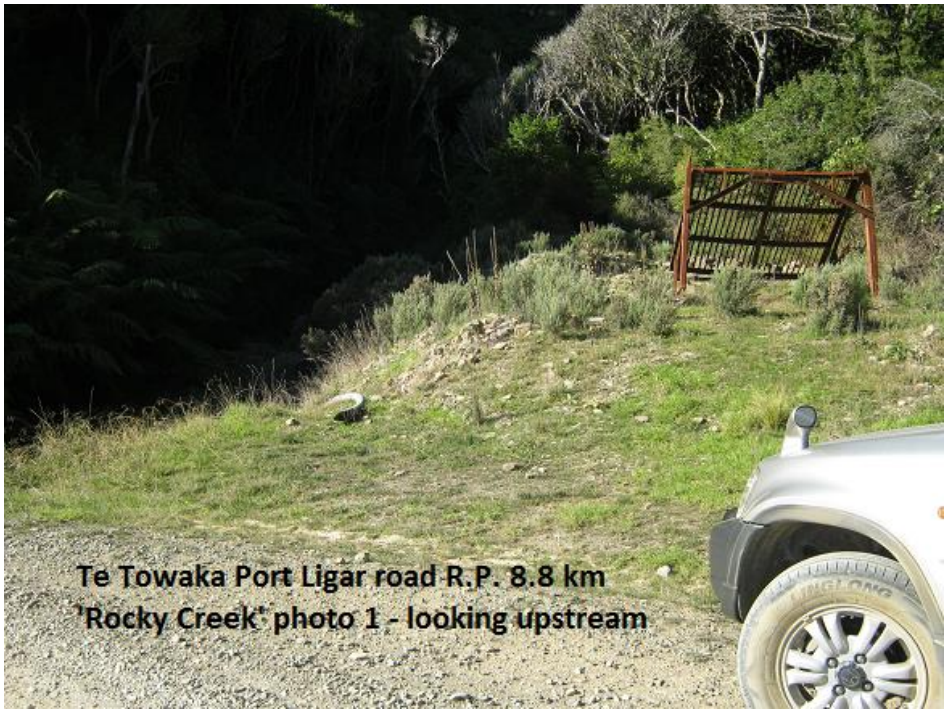
The slip emanated near the skyline , filled the creek near the culvert approx. 4 metres deep , completely buried the culvert and the road about 1-2 metres deep and over the flat below the road before pouring into the sea.

The material above the culvert was removed as was the material on the flats and it was subsequently processed as roading aggregates , in total in excess of 6000m3 was disposed of in this fashion. The material into the sea , possibly another 2-3000 m3, has been used to construct 'fingers' and some no doubt remains on the sea floor.

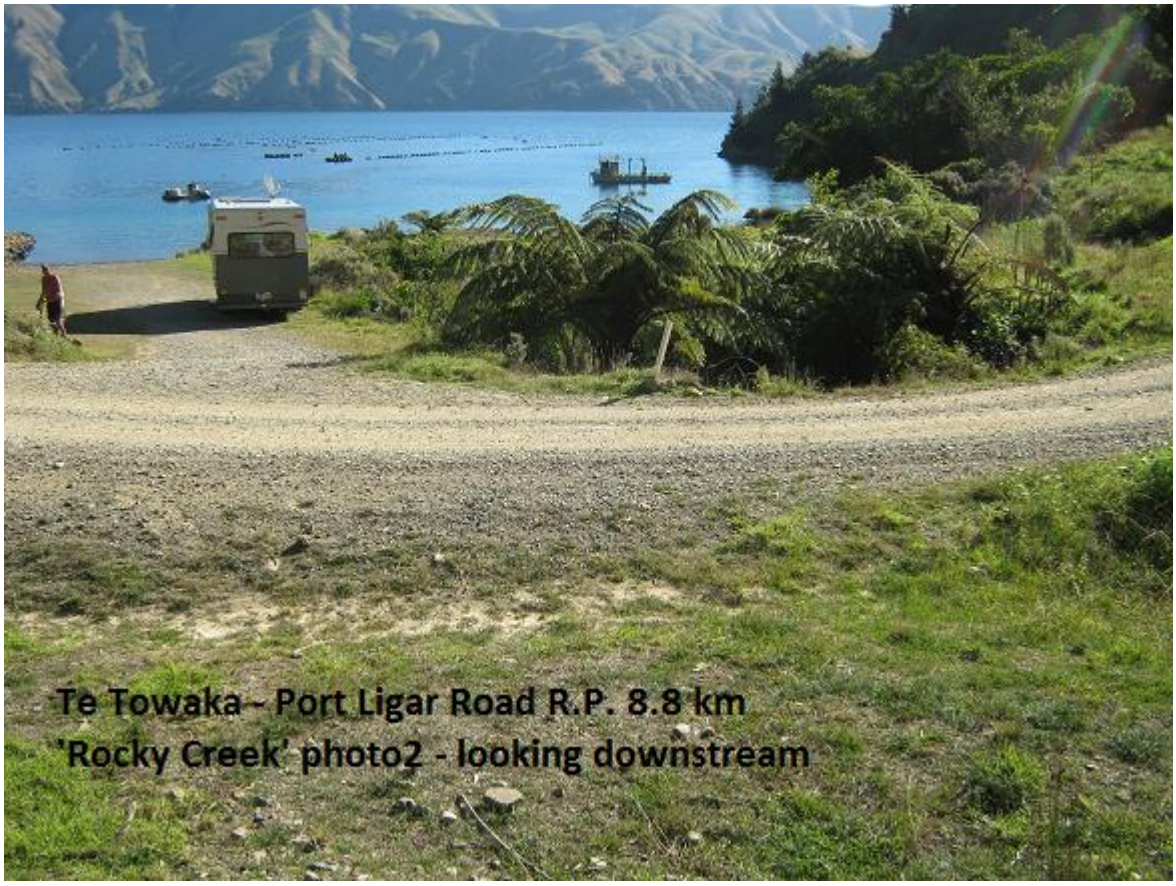
The 2 m RC culvert is the original although some pipes were uplifted and relaid after clearing of material.

I consider the event was simply the result of the intense rainfall ; the slip emanated near the ridgeline at an elevation of near 500 m (MDC contours)

See photo below.



Note the material still above the creek at photo centre and right. (under screen)



This photo is looking towards the sea . Gerald the old County roadman (before my time – ie pre 1985) is standing near his hut which has been on this site for > 60 years.

Gerald stated that the material over the site would have been at about his waist height in depth at the time of the event and I know it was over the road in the photo foreground.

Site 9

Bulwer Road R.P. 4.7 km (at Bulwer sign and gate ; RAMM location of end of road is further forward)

Co ordinates : 2589797 / 6029097

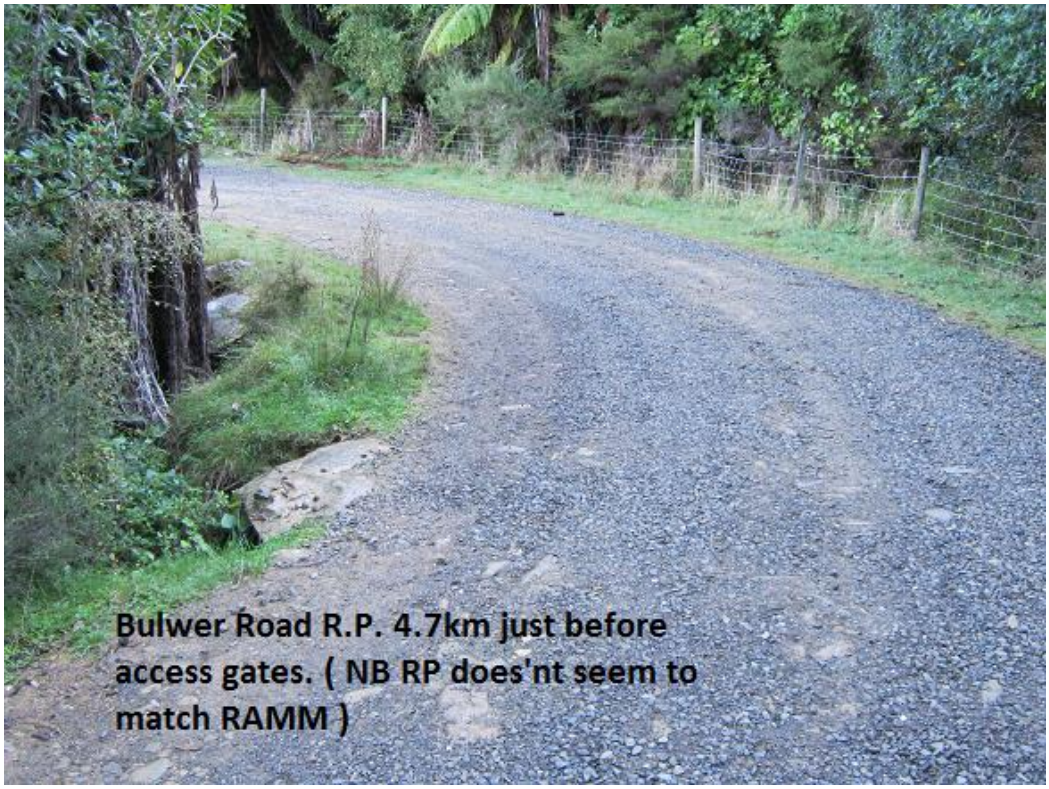
This site was damaged by the 'weather bomb' of Feb. 1989

A major slip , came down the watercourse, and had commenced at the ridgeline (app 500 metres elevation MDC contours) and flowed right to the sea.

The culvert was completely destroyed and has been replaced with 2/1.8m Dia R.C pipes and a house near the coast was damaged beyond repair as a result of material damage.

The road was impassable and equipment and new pipes were brought in by barge from Havelock (C P------ of Picton carried out the repair work)

I estimate in excess of 4800m3 came down in total of which app. 3000m3 entered the sea.



The Bulwer property sign and a gate are just forward of this photo , the culvert pipes are at photo left

Site 10

Titirangi Road R.P. 15.1 km

Coordinates : 2606675 / 6017664

Although there were some slips forward of this site and near the coast as a result of the Feb 1989 'weather bomb' none of them reached the sea in any significant quantity , however , this site in approx.. 1993 was a different matter.

The whole side of the road collapsed over a length of 40-50 metres and the road was 'retreated' to the west.

The slip extended from the road down to and across an access road into Port Gore (private road) flowed across the flats and thence to the sea. One could stand at the side of the residual road and look directly to the coast and the sea.

Unfortunately I couldn't identify now where it actually entered the sea , however there must be some evidence of it near the coast.

I estimate there was about 4000m3 of slip of which possibly 1500 m3 entered the sea and the event may have been exacerbated by the unstable outer edge of the road coupled with the heavy rainfall.

This photo is on the road – note second growth vegetation along edge.

See following photo.

This photo is looking to Port Gore . The material flowed across near the photo centre to the sea.(I can't identify or recall exactly where)

In the photo distance about 1/3rd from LHS is the beach where the famed Mikhail Lermontov grounded before drifting off and finally sinking around the headland on the LHS (next bay plus one). I was told that while the ship was grounded an offer was made to use a bulldozer and take a hauser from the ship and tie off to a plantation of Macrocarpa trees , however the offer was allegedly rejected because it would have assigned salvor rights to the vessel.

I don't know how true , or not, this is but it sounds about as reasonable as some of the actions which took place at the time and contributed to the sinking !!

I have seen the photos of the boat right by the shore and close to the house in the area when it was grounded !! And I have seen the stand of Macrocarpa trees .

Site 11

Anakoha Road R.P . 2.3 km

Coordinates : 2603796 / 6013557

This is the site of the Mount Stokes Stream and culvert.

Considerable amounts of material were carried down this watercourse from a very big slip in the headwaters (near where the Mount Stokes Track crosses a saddle) and completely blocked the road culvert and then sluiced over the road and thence to the flats and the river below.

Note there is still some residual material stockpiled on the side of the road below the stream (this was excavated to open the culvert – some was carted to waste)

This event occurred in Feb 1989 and I estimate in total some 2-3000 m3 travelled to the flats and river below.

I consider this event to be a natural erosion event caused by the intense rainfall.

This photo is taken on Anakoha Road at Mount Stokes Stream – note the material on photo left just past the culvert – this is the type of material which flowed to the river below.

Site 12

Anakoha Road R.P. 4.55 km

Coordinates : 2604103 / 6014748

Following heavy rain in Feb 1989 the side of the road collapsed near this bridge , below the road and the creek RHS looking downstream. (The erosion and deep scour below the bridge are obvious if looking over the edge at the bridge)

This material flowed across Masons road and the adjoining paddock which were covered in material (schist type gravels) and the main river was considerably aggraded ; significant material was carried down to the coast and subsequently into the sea.

There was app. 2000m3 washed into the watercourse and I suspect the damage was caused by blocked culverts above the site which diverted water across the road and over the bank near the downstream abutment of the bridge.

This event combined with the Site 11 material contributed to the aggradation of the stream AND the scour of the approaches to Kinders Bridge PLUS the discharge to the sea estimated at > 1000 m3 in total. The bridge on Kinders road had previously had a 'scour hole / swimming hole' on the downstream side about 3m deep ; the whole bed aggraded throughout the length of this stream and the bridge was left, bereft of approach fills and standing in the air, – post damage repairs including 'sheathing' the rail iron piles in R.C pipes together with new sheeting timbers and rock protection work at the abutments (still obvious)

Photo at the bridge site – the edge of the bank collapsed and the stream was severely scoured at the photo right area (quite apparent on the ground)

This photo is at Kinders Road Bridge looking upstream – note rock abutment protection work in photo foreground and aggraded riverbed . The approach fills on both sides of this bridge were completely washed away and the bridge stood about 3m in the ‘air ‘suspended on its rail iron piles

This photo is looking downstream from Kinders Road Bridge – the ‘shoal’ in photo foreground was the location of the 3 m+ deep swimming hole in this river and the whole creek has aggraded by 1-2 m + from its bed levels prior to the event.

The coordinates of Kinders Bridge are : 2603228 / 6016246 and it is at R.P. 0.3km on Kinders Road.

Site 13

Beyond Anakoha Road end on private access (Mr T. Redwood – Okaha farm)

Coordinates at the creek crossing access and near the coast : 2602910 / 6016533

This site is included as T. Redwood was supportive of this project and gave me the following information.

In 1993 there was a severe storm when both streams above the road and coast (see sketch) had new slips which sent large quantities of gravels down the main creek across the access road and to the coastline and sea – near and below the site of the coordinates.

The creeks themselves were also scoured out , in some places up to 3m deep approx. so that they became incised and too steep to cross in many areas.

There was a huge build up of gravels from about 400m above, and into, the coastal area and T Redwood advised that he removed 6000m3 from the watercourse , a further 6000m3 was salvaged from near the coast and an estimated additional 2000m3+ flowed into the intertidal area and beyond.

In the LH creek looking upstream from the road there is another slip , which is even larger than the slip that occurred during this event . I had occasion to visit this slip and I estimate it was about 200m high , 30 m wide and up to 4 m deep OR approx. 20,000 m3

T R has advised me this also occurred in 1993

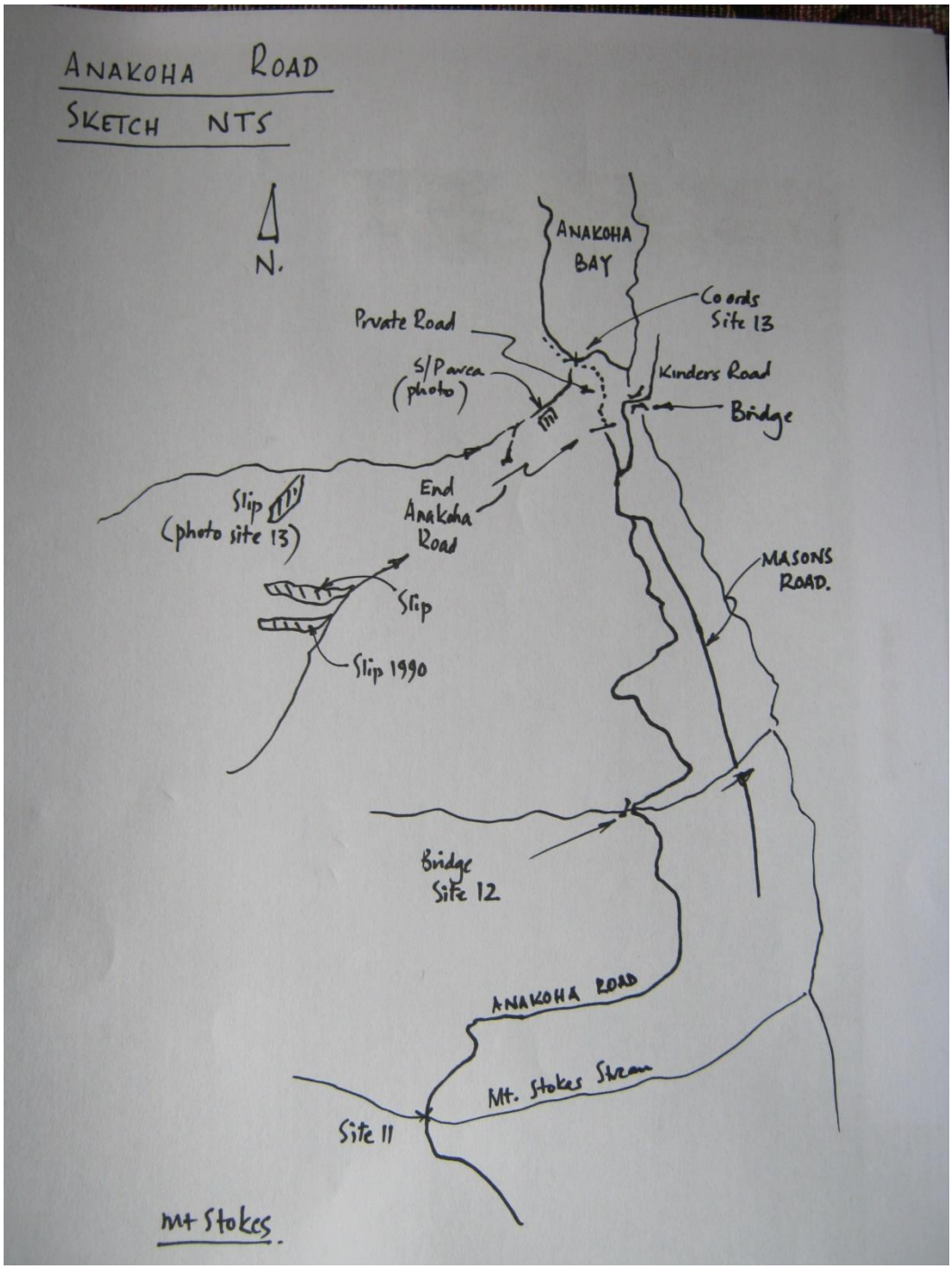
The bay appears to have large quantities of deposited material apparent right to near the Woolshed where there is a narrow channel for launching boats. Having regard to this there must have been a number of events that have deposited material into this bay and it will be interesting if this can now be identified.

This photo is from near the access road looking towards Mount Stokes (obscured in cloud) the creek in photo centre has 2 slips – both occurred in the 1993 event . The creek on the photo right has another 1993 slip (see following photo)

This is a poor photo off the RHS (western slip area)

This photo is looking north towards the access road and shows some of the remaining stockpiled 8000 m3 recovered from the creek on photo left.

See appended sketch.


ANAKOHA ROAD
SKETCH NTS
N.
ANAKOHA BAY
Coords Site 13
Private Road
S/P area (photo)
Kinders Road
Bridge
Slip (photo site 13)
End Anakoha Road
MASONS ROAD.
Slip
Slip 1990
Bridge Site 12
ANAKOHA ROAD
Mt. Stokes Stream
Site 11
Mt Stokes

SUMMARY

Croisilles – French Pass Road

Site	R.P.	Coordinate	Coordinate	Quantity	Date
1	0.85	2565908	6010332	800/2000	1990
2	36.95	2580593	6030649	400	1991
3	37.95	2580581	6030992	1200	1998

Elaine Bay Road

4	2.1+	2574869	6016474	2000	1995+

D'Urville Island

5	-	2580809	6033791	10,000	1989
6	-	2583450	6038587	100,000	1989
7	-	2576497	6036230	NA	NA

Te – Towaka Port Ligar Road

8	8.8	2583323	6024678	2000	1989

Bulwer Road

9	4.7	2589797	6029097	3000	1989

Titirangi Road

10	15.1	2606675	6017664	1500	1993

Anakoha Road and area

11	2.3	2603796	6013557	NA	1989
12	4.55	2604103	6014748	1000	1989
13	NA	2602910	6016533	2000	1993

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MARLBOROUGH SOUNDS – PART TWO

SECTION 2 :

MOETAPU BAY , ONAHAU AND TOREA BAY ROADS

Introduction :

These 3 roads complete the Kenepuru Sounds area as well as some discharges into Queen Charlotte Sound (Onahau and Torea) and are complementary to the information in the first report prepared for Council.

Moetapu Bay Road has suffered severe damage throughout the period under consideration (1985-2010) and I recall in discussions with J.C------- , the EQC investigator that following one of the significant storm events in about 1990 there had been 147 properties in the area and he had received 50 claims for damage.

While there have been some hugely significant slips many did not impact directly on the coastal environment , in many cases because the material was arrested by access roads and tracks constructed below and parallel to the road.

I also recall when proposals were lodged with Council for uphill development in one area vociferous objection from one resident (Mr B W-----) and an application for the total cost of damage in the area to Council as part of his defence in opposing the application. (The information was provided under the Freedom of Information Act)

I am also aware of another event not included in this report, as it was on private property, where approx.. 1000m3 ‘dropped off’ the peninsula end of one property into the sea . This event was visible for many years to every boat travelling Mahau Sound area and it may have been coincidental that the ground fracture commenced near the end of the sewage field disposal area.

Onahau Bay Road marked the end of the original formed Kenepuru Road into the area , the Onahau Road itself as well as Torea Road were the links between the Queen Charlotte and Kenepuru Sounds . The area beneath and across Onahau area was surveyed and proposals prepared for a possible tunnel linking the 2 sounds at about the same time , or perhaps later, as similar proposals were mooted for an open channel via Linkwater (hence this name) The Onahau area is the shortest distance between these 2 Sounds.

Beyond the Portage and around the Western side of Kenepuru Sound and in the Totaranui areas there were historic and formed bridle tracks , the area was administered by a Kenepuru Roads Board until ‘taken over’ by the

Marlborough County following which extensive development took place using highly subsidised development roading funds from Central Govt and local share contributions.

I am advised that the County Engineer of the time considered it good practice to make unstable batters so that when they subsequently collapsed Council could be advantaged by highly subsidised Flood Damage funding to allow general improvement in the area . I do not mean to imply that this rumour is the 'gospel truth' , however if it is, I can say it would not have been the first use of this technique in NZ at the time.

The Moetapu Bay Road was constructed generally by one significant property owner in the area who formed the road to a standard acceptable to Council who then accepted the vesting and maintenance of the road; this took place as a number of incremental steps over the years some of which occurred during my period with the Council.

The road was upgraded and progressively sealed over a number of years although there are still some areas deficient in width where the unstable surrounding ground has meant that they have been signposted and maintained as 'single lane'.

Council has faced and contributed to property damage on more than one occasion along this road where roading activities have been considered contributing factors to the 'downhill' damage. All of these area documented on Councils files.

Moetapu Bay Road Site 1

R.P. 0.65 km

Coordinates : 2582333 / 5994041

This site has a large Rail Iron wall some 47 m long x 3m – high

There were extensive slips from above the road , through the road and thence to the coast. There is some well established regrowth but evidence of the old slip above the road is still apparent.

This damage occurred in app. 1992 and would have been a combination of the unstable hill side and the road activities , ie. steep batters and unstable edges.

There was approx.. 900 m3which flowed to the coast .

The centre of the wall is adjacent to road culvert number 6 .

See culvert 6 marker in photo Left

Moetapu Bay Road Site 2

R.P. 0.95

Coordinates : 2582263 / 5994006

This site was an underslip as a result of the road edge collapse to the sea.

The site is at culvert number 8

This event occurred in app. 1992 and involved near 600 m3 to the sea.

Note the plant mix nib constructed to prevent further water flows over the road edge at this site.

Moetapu Bay Road Site 3

R.P. 1.2 km

Coordinates : 2582177 / 5993766

A major slip occurred emanating from above , and distant from, the road

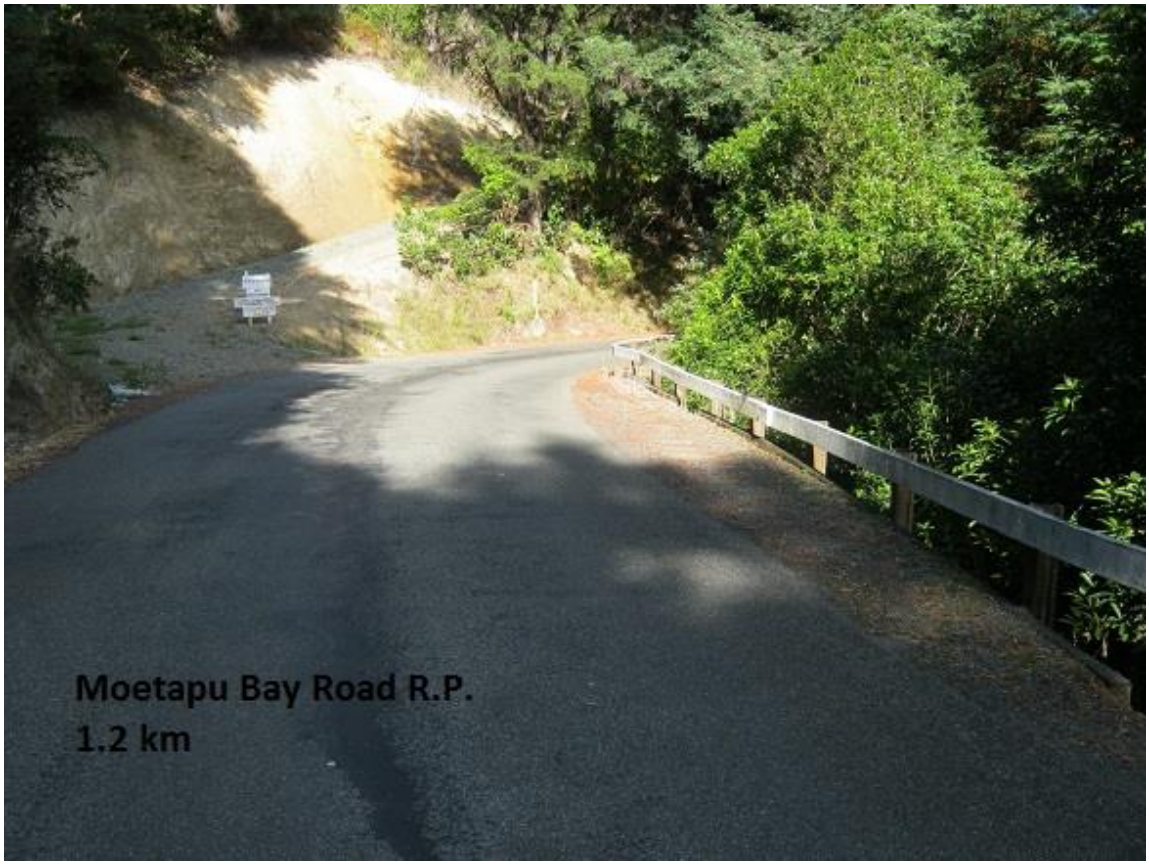
The lower part of the slip is obvious from the road.

The material discharged into the watercourse and flowed to the sea and app. 600 m3 was involved .

Note the comparatively recent access to the LHS (uphill of the road)

There is a retaining wall at the site 18 m long x 3 m high

The event occurred app. 1996



Moetapu Bay Road Site 4

R.P. 1.3 km

Coordinates : 2582102 / 5993741

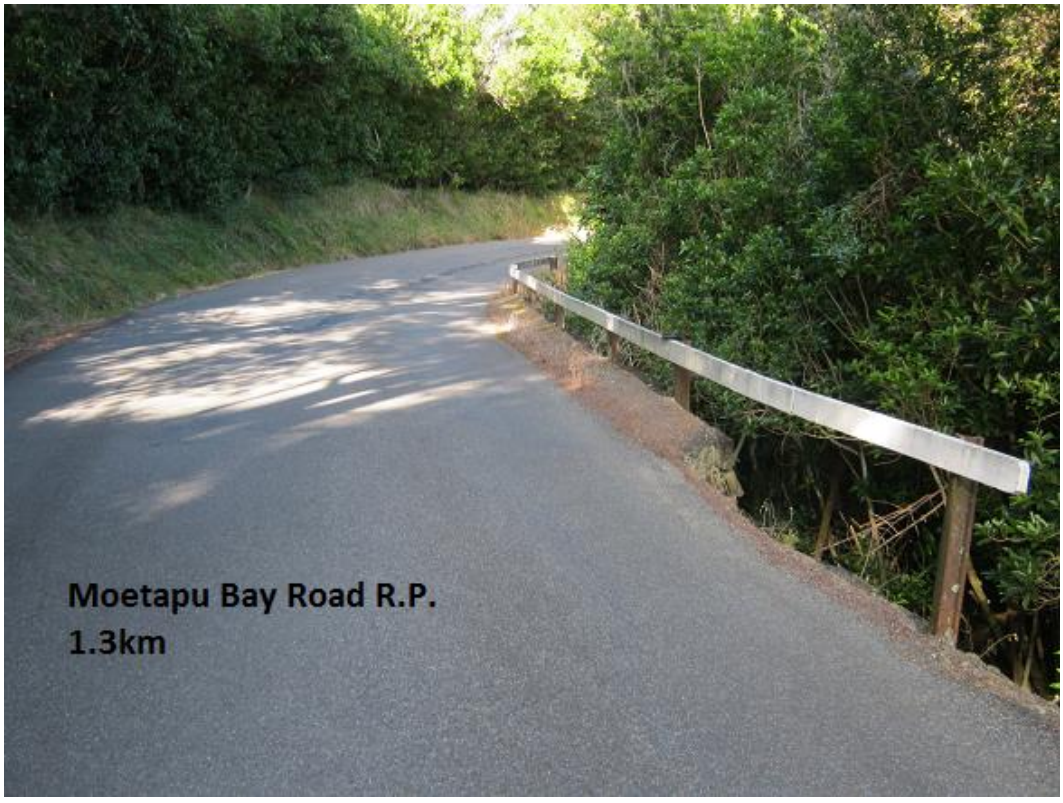
There is a large slip area still obvious sited above the road at this location.

There was an accompanying collapse of the road and a slip occurred down the face to the sea.

There was near 1400m3 and the event occurred app.1992

This is just below Culvert number 11

This was a significant event in this area.



Moetapu Bay Road Site 5

R.P. 1.5 km

Coordinates : 2581953 / 5993712

Another significant site where material emanating from a slip above the road crossed the road damaging the outer edge .

There have been 2 events at this site with similar effects.

A Rail Iron retaining wall 15m long x 3m+ high was constructed at the time of the first event in about 1988 and a subsequent Gabion extension another 2 m high was constructed post the second event in app. 1990

The site is near culvert number 14 and it was this watercourse which carried the material to the sea.

There was app. 900 m3 at the first event and app. 600 m3 at the second event.

The watercourse is deeply incised in common with many Sounds watercourses and I am aware of many where property owners have installed various types of velocity drops and arresters to try and reduce the effects of this scouring on creeks beds , there will be many records and field notes of mine on property files and potential liability sites. At this site a large ‘ sock’ has been placed to control and direct flows ; in some sites these instillations now reach almost ,or to , the coast line.(see photo 2)

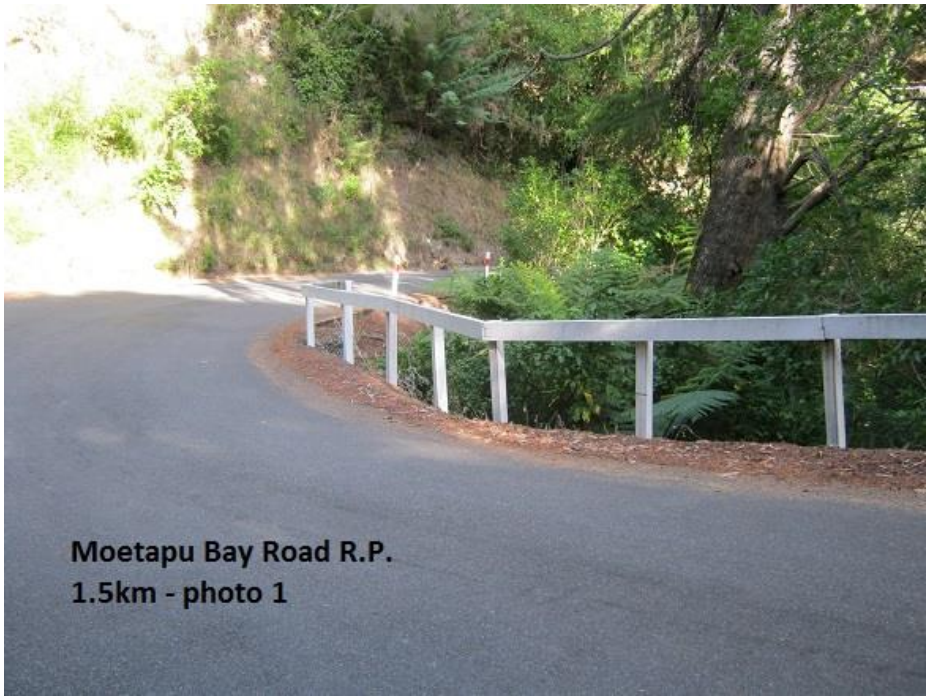


Photo 1 showing general view of site – watercourse is just near large Pine in photo Right.

This photo is looking below wall and shows the control ‘sock’ from the culvert outlet and the ‘incised’ watercourse. The conduit through the pipe carrying a water supply pipe is possibly an ‘illegal’ instillation (these commonly begin to trap debris and subsequently compromise the culvert capacity)

Moetapu Bay Road Site 6

R.P. 1.7km

Coordinates : 2581800 / 5993707

A significant event in 1990 where a large quantity of material from above the road collapsed onto the road , blocked the culvert and streamed down to the sea.

The culvert has the ominous number 13 and it was damaged as was the access drive and property towards the sea.

Mr T. Smit of T.H. Jenkins was engaged by the property owner (still resident here) and I liaised with him and the owner to resolve a solution to both the damage that had occurred and to minimise the likelihood of a future event.

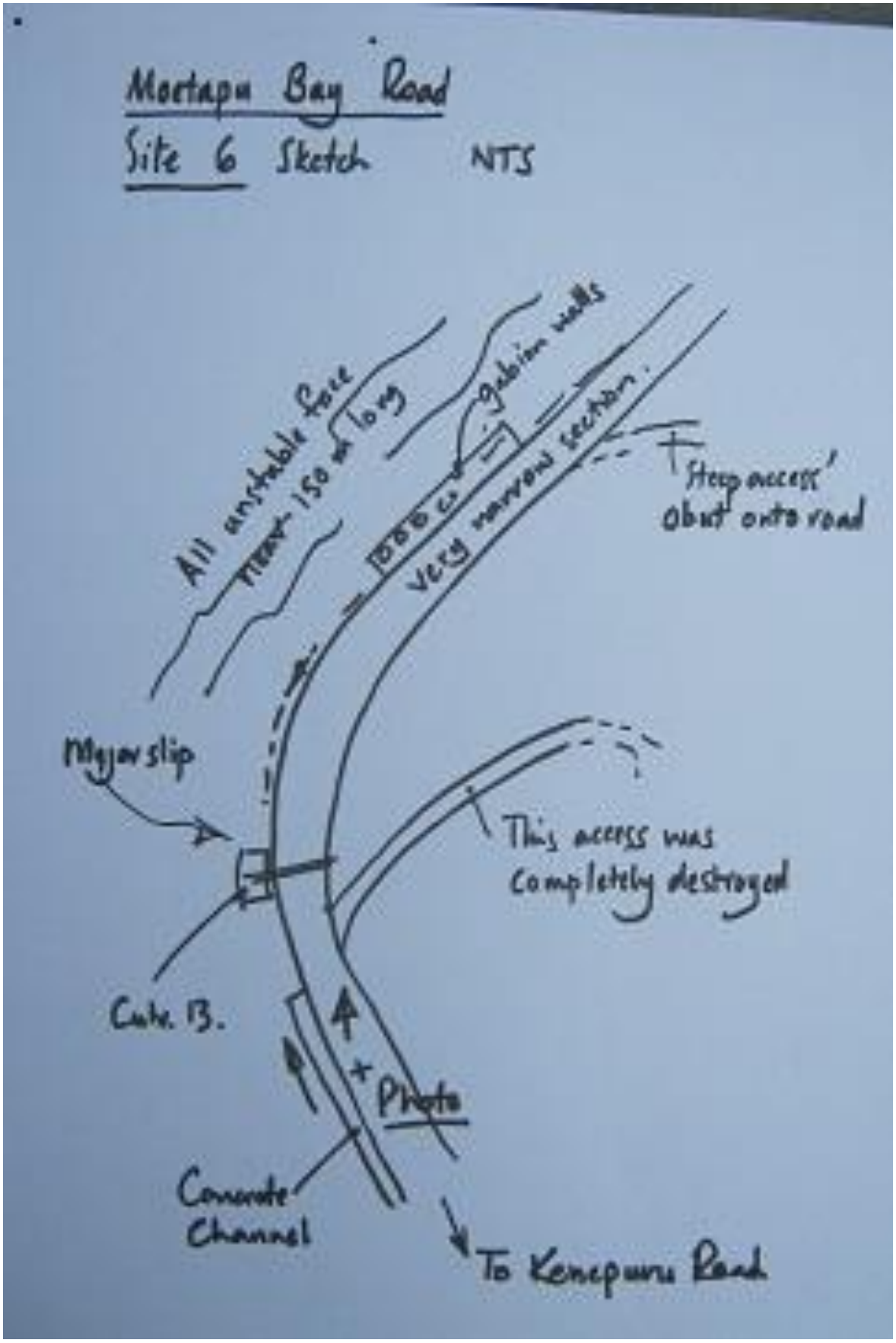
At that time all of the LHS concrete channel was installed from before the culvert down the LHS ; the significant culvert inlet structure was constructed , some protection work was carried out beyond the site along the LHS in attempt to arrest the continually collapsing bank , migrating towards the road and the property drive was completely rebuilt together with extensive remedial works on the property itself.

A great example of a solution reconciled by all the parties working together cooperatively for a common good.

The LHS forward of the site has continued to be a problem , further works were carried out subsequent to 1990 and continued to near 2008 ; the road is ‘single lane; and is likely to stay this way in the foreseeable future with the unstable bank above and a steep bank to the RHS compromised by some steep accessways off the road.

There was app. 600 m3+ that flowed to the sea , I suspect the road construction may have contributed to the collapsing LHS exacerbated by quantities of underground water that discharge along the LHS , note there was an extensive ‘cutoff’ subsoil drainage system installed along this LHS – I think it has been removed or compromised.

You can just observe in this photo the driveway to the RHS that was completely scoured out and has been rebuilt , as has virtually all of the road formation reconstructed post the event . See sketch following.


Mortapu Bay Road
Site 6 Sketch NTS
All unstable face
Near 150 m long
Gabion walls
Steep access
about onto road
Very narrow section
Major slip
This access was
Completely destroyed
Culv. 13.
4
Photo
Concrete
Channel
To Kenepuru Road

Moetapu Bay Road Site 7

R.P. 1.9 km

Coordinates : 2581611 / 5993688

This site is at 'Elephant Point'

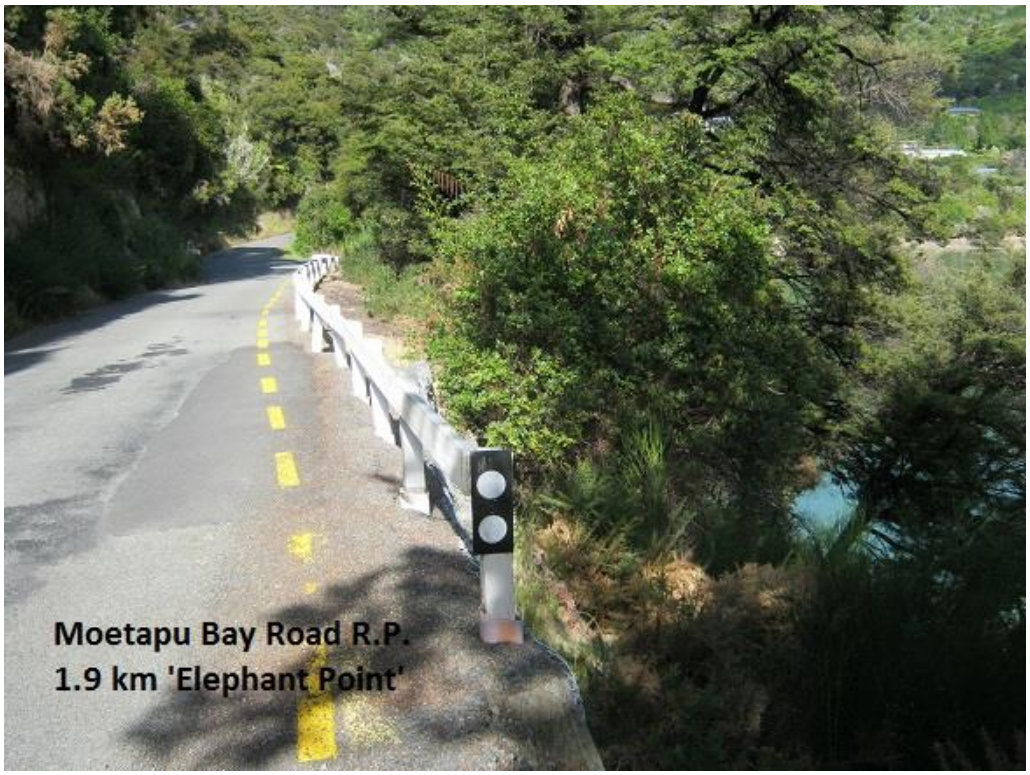
There was an obvious collapse of the road straight to the sea , still apparent with material and vegetation at the coast line.

The road was retreated to the LHS and a 'railing' purely to define the safe road edge was installed.

There have been some sections protected with gabion walls , bags etc.

There have been several events at this site but the major event occurred in app. 1998 continuing until about 2004

There was > 1500 m3 of material to the coast , the event is most likely roading related.



Note events from 2.7 forward to 4.0 were all arrested by accesses to private property.

Moetapu Bay Road Site 8

R.P. 4.1 km

Coordinates : 2580167 / 5993671

A large slip emanating above the road , and below the road.

Note significant Gabion walls each side of culvert ‘tied’ across the road and the rocked invert below the culvert to act as a velocity drop and scour arrest.

This is culvert number 35 and it is near 4 m deep .

Material flowed down this watercourse to the sea

The quantity was app. 600m3 and the event occurred about 1998

Moetapu Bay Road Site 9

R.P. 6.0 km

Coordinates : 2578707 / 5993511

There is a 30 m long rail iron wall at this site.

A large slip from above the road crossed the road , the outer edge collapsed and further material was picked up down the slope to the sea.

This was a major event and Council accepted some liability and funded part of some protection works on the access below the road . I recall there were another 3 rail iron walls built on the access . Full details will be on Councils liability files (his first name was T------) and the total cost excluding the road reinstatement works was near $140,000 a significant cost for 1 property.

The site is just beyond culvert number 52 .

I consider natural erosion may have caused the initial slip as it came from well above the road.

Near 1500 m3 went to the sea and the date was app. 1990.

Moetapu Bay Road Site 10

R.P. 6.5 km

Coordinates : 2578453 / 5993150

This was another major event

A slip emanated from above the road , completely blocked the road and large quantities of material flowed down an adjacent watercourse to the sea.

A large amount of material was stockpiled on a bench near the middle of the site evident as a 'turn area' on the RHS (this is all filled material)

After the initial work to open the road this site was surveyed and contract drawings prepared to complete the final restoration . The Contractor was P----- - Contractors and most material was carted back to Linkwater . I recall the contract quantity was about 5500 m3 in total.

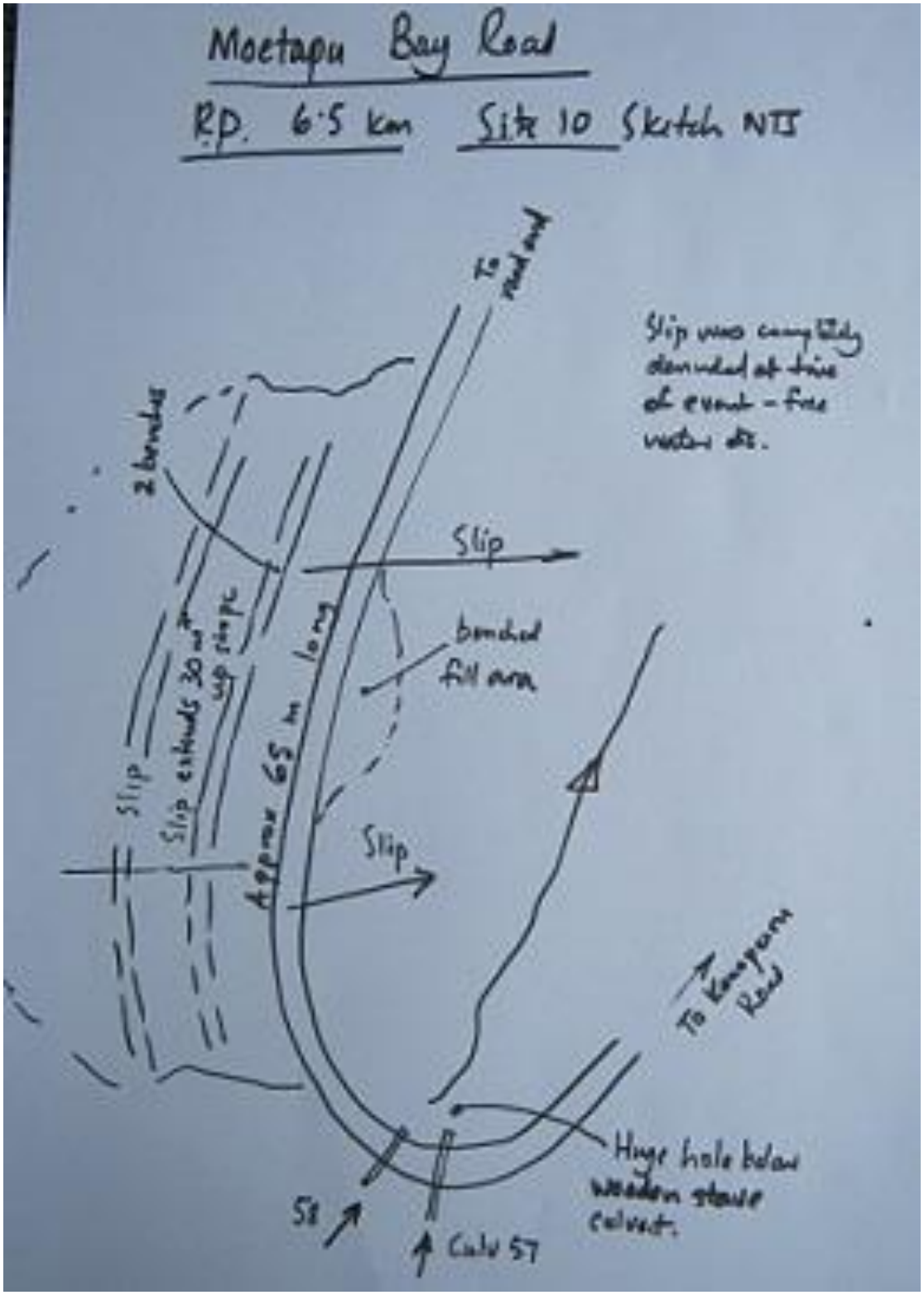
Material also came from above the road down the watercourse discharging through culvert 57 – culvert 57 is a 1.5m wooden stave culvert constructed on site ; I think this is the last of this type in Marlborough (they came on the market in about 1982 so this section of road must have been constructed post that date.)

The fault seems to have been caused by erosion and collapse of the road batter but may have been affected by ground water which ran from the LHS bank for many years (and still may do so – was dry at my survey date)

In total there would have been about 2500 m3 to the sea , the event occurred in app. 2000

This photo is taken from near culvert 58 (next to culvert 57) the start of the slip area above the road commences near the broom bush – photo centre.

See also attached sketch.


Moetapu Bay Road
R.D. 6·5 km Site 10 Sketch NTS
Slip was completely demolished at time of event - free water etc.
2 benches
Slip
bonded fill area
Slip extends 30 m up slope
approx 65 m long
Slip
To Kaingaroa Road
Huge hole below wooden stave culvert.
SE
Culv 57

Onahau Road Site 1

R.P. 1.0 km

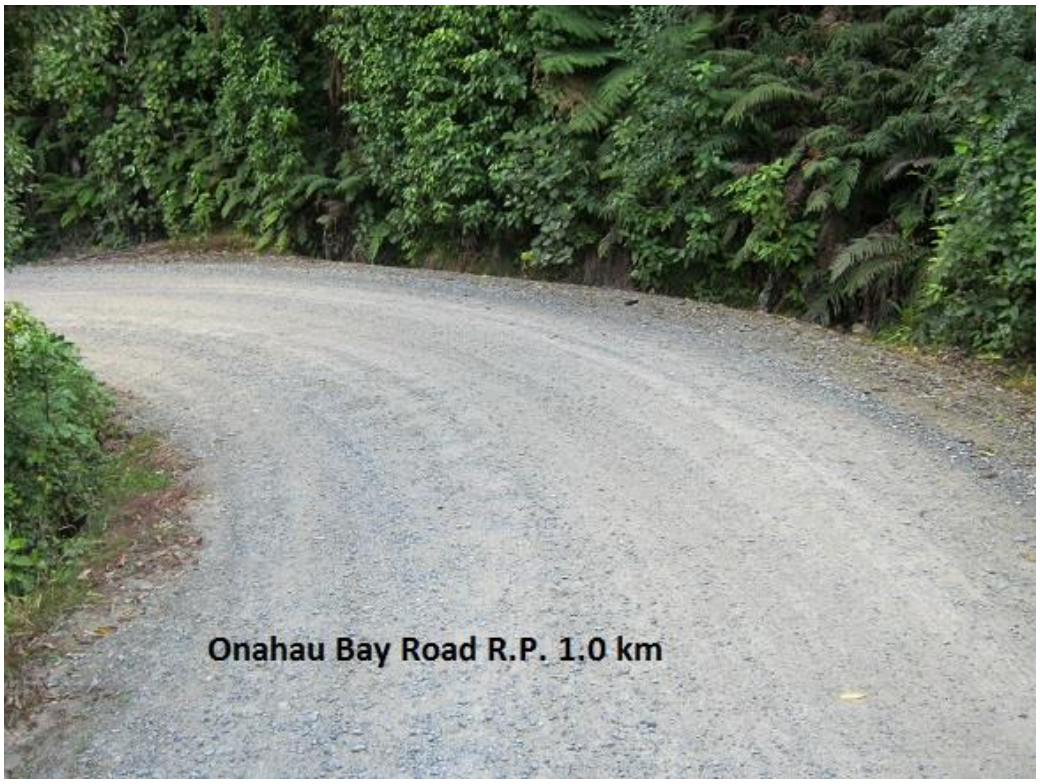
Coordinates : 2590937 / 5997920

There is evidence of the old slip which emanated from above the road and flowed across the road and down the watercourse into Onahau bay

The road is part of the old slip area.

This event occurred in about 1990 and was most likely natural erosion as the material came from well above the road ; approx.. 400 m3 reached the coast although the total quantity involved was nearer 1000 m3.

There is a small gabion wall at the site



There were two significant spoil sites in Onahau Bay at 1.2 km which were simply flat areas of swamp and covered with reeds , marsh grasses etc.

The site above the road (SW) contains approx.. 2800 m3 of spoil dumped over a period of about 5 years commencing in 1990.

The lower site near the residence and right to the foreshore was utilised over a similar period (access was quite difficult sometimes in inclement weather)

Both sites have been levelled , contoured for drainage and grassed and really add value to the properties.

The lower (NE) site contains approx.. 7000m3 of spoil.

Onahau Bay Spoil site looking upstream R.P. 1.2 km

Onahau Bay R.P. 1.2 km looking downstream

Torea Road Site 1

R.P. 1.1 km

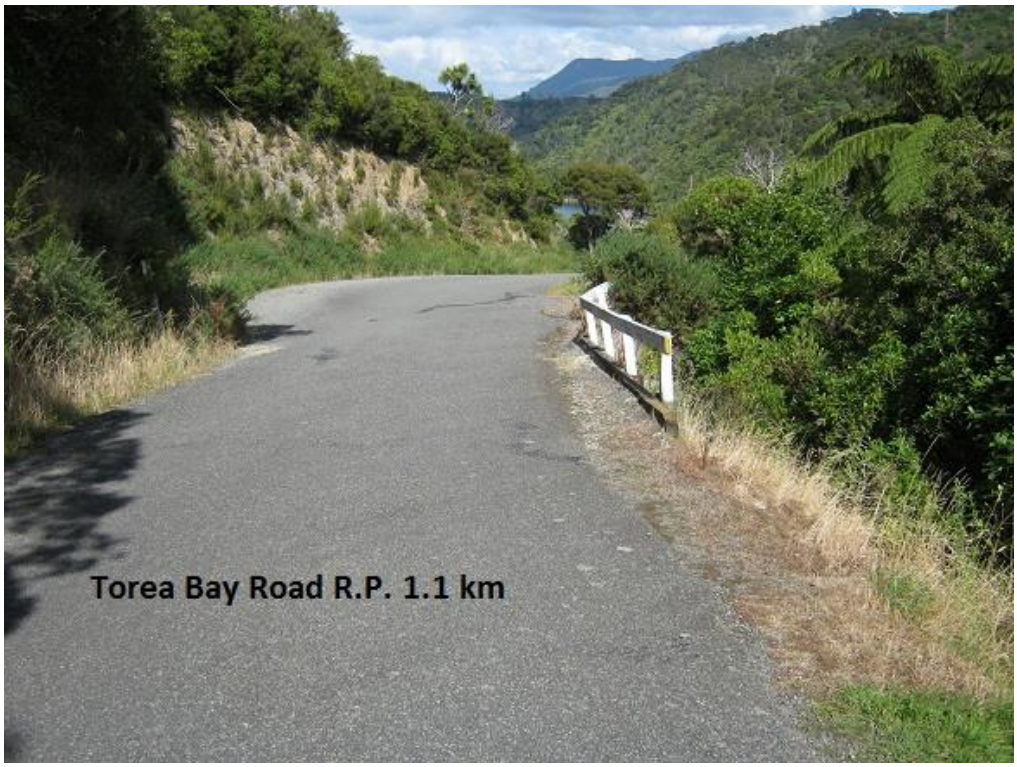
Coordinates : 2596651 / 5993318

A major event where a large slip emanated from above the road , took away a large section of the road and then flowed into the sea via a watercourse just beyond the Wharf access.

I consider road widening works may have contributed to the event .

The complete section of road was retreated to the east over a length of app. 30 metres x 10m wide ; most material to the sea was from below the wall site.

There was approx. 1200 m3 flowed into the sea and the date was 1992.



Note the 2 areas at 1.6 and 1.7 km did not reach the sea.

Summary :

Moetapu Bay Road

Site	R.P.	Coordinate	Coordinate	Quantity	Date
1	0.65	2582333	5994041	900	1992
2	0.95	2582263	5994006	600	1992
3	1.2	2582177	5993766	600	1996
4	1.3	2582102	5993741	1400	1992
5	1.5	2581953	5993712	1500	1990
6	1.7	2581800	5993707	600	1990
7	1.9	2581611	5993688	1500	1998
8	4.1	2580167	5993671	600	1998
9	6	2578707	5993511	1500	1990
10	6.5	2578453	5993510	2500	1997

Onahau Road

1	1.0	2590937	5997920	400	1990

Torea Road

1	1.1	25996651	5993318	1200	1997

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ROADING AND FLOOD DAMAGE IMPACTS

MARLBOROUGH SOUNDS – PART TWO

SECTION 3 :

PORT UNDERWOOD AND TUMBLEDOWN BAY ROADS

Introduction :

In the beginning Marlborough County Council maintained a road from Waikawa to Whatamango Bay and another route from Rarangi to Whites Bay.

I am not aware of when they were first formed but I do know that a road was constructed commencing at Whites Bay and ending at Fighting Bay (Cook Strait) . This road was formed in about 1965 when the Benmore DC line was constructed to connect to the Cook Strait cable at Fighting Bay.

The line had been constructed as a DC transmission as it was more suited to long hauls without any 'take offs' , DC is a better system than AC with greatly reduced line losses, highly suitable for undersea cabling and cheaper due to less conductor and insulation costs. As the 'Angel' who looked after the roads I was invited into Fighting Bay for a cup of tea periodically and viewed the inside of the huge facility which is basically just a shed for 3 switches (albeit great big ones !! ; both the shed and the switches)

I had occasion to discuss the route with Alan Ferry (a noted Engineer in NZ and overseas for his knowledge especially in regards to low volume gravel roads – Alan and I had delivered some joint papers on this subject) ; he advised me that the route was to pretty minimal standards as it was only a major shift and establishment and thence a role for servicing and access to the pylons alongside the route . It had been surfaced with 50 mm of gravel course only.

I don't know how Council was talked into taking over the route as a public road or when it subsequently constructed the link from Whatamango Bay to Tumbledown Bay , however the information is available in Council records and a book by Mr Berry ' Scrutiny on the County' (I recall)

I do not know how, or when the section of Tumbledown Bay road beyond Fighting Bay road was constructed ; I do know it was historically a clay track about 3m wide . Since I left it has been considerably upgraded and there are a number of new houses and accesses constructed.

The initial roads would have been to a standard , probably 12 feet on the solid with additional and excavated material cast over the side , minimal culverts and steep grades , which still exist.

It is in some ways fortunate, that a lot of the route is remote from the coast ,so that although there have been some large slips along the route there has not been much material to the sea except Tumbledown Bay road in particular and a few sections near Waikawa on Port Underwood road.

I do make a few general observations in areas not specifically identified and between sites reported on.

Locations are expressed distance wise to conform to Councils RAMM database and co-ordinates are in the same datum as the previous report delivered to Council.

There are significant forests in the general area and in the Tumbledown Bay area in particular.

The NZ Forest Service had planted large tracts and there are also large private holdings ; the NZFS blocks have been sold.

The roads have been exposed to forestry haulage traffic for a long time and for some early periods significant damage was occurring when the routes became almost unpassable for extended periods especially in inclement weather .

Council has made arrangements with the forest industry including restrictions on wet weather cartage , NOT allowing cartage from some blocks , accessing funds for barging in lieu of road haulage and progressive improvement and strengthening of the route which has advantaged the roads in the area.

Port Underwood Road site 1

R.P. 1.6 km

(All RP's commence from the 50 kph sign at the start of PU road, Waikawa to match the RAMM database)

Co ordinates : 2598425 / 5993522

This site has a rail iron wall 16m long x 2m high approx..

There is evidence of old slips emanating from above the road and on the face below the road .

The damage is considered roading related and there was approx.. 400 m3 of material to the coast .

The event was in approx.. 1995.

NOTE stormwater bunds divert water flows away from the site .

NOTE There was an event at Wharetukura Bay at approx.. 1.0 km (ie. before this site) where material sluiced out the large culvert , however was deposited mainly in the creek invert . This occurred approx.. 2004

Port Underwood Road Site 2

R.P. 2.75

Coordinates : 2599002 / 5993907

This site evidences the underslip of the outer edge of the road , there is a minimal amount of material from above the road.

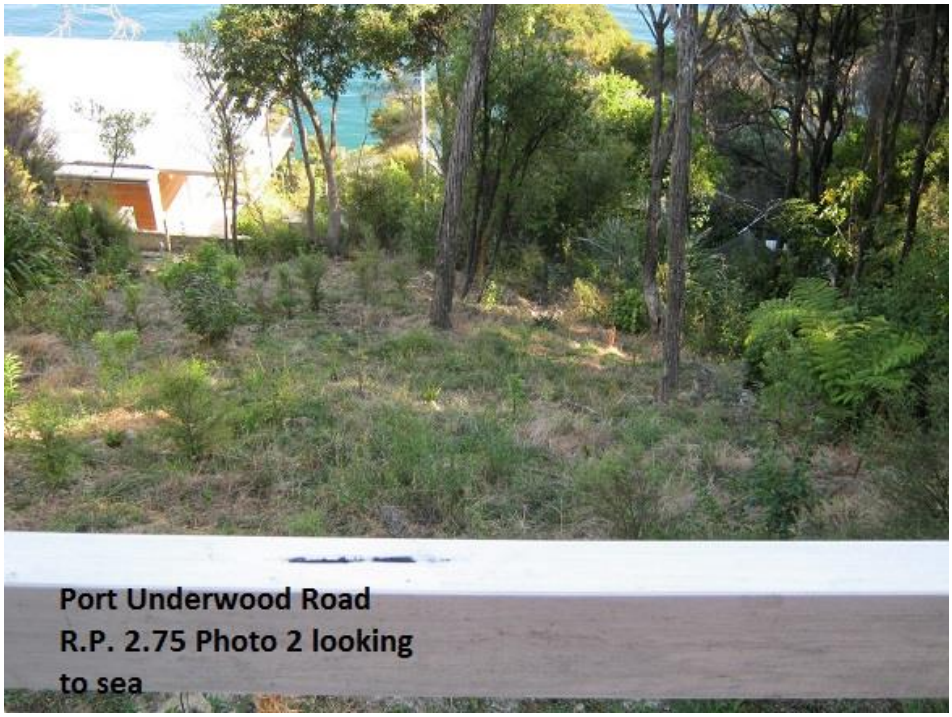
There is a retaining wall at the site approx.. 15m long x 3m high.

There was approx.. 400m3 which would have reached the coast line in an event which occurred app. 2000.

The damage is considered roading related ; the collapse of unsupported shoulders to the road and water ingress.

Note that new Stormwater manholes and corrugated conduits carry stormwater away from the road to deliver near the foreshore ; there are a number of such instillations towards Karaka Point. These are quite recent.

This is at the site of the event .See following photo 2



This photo is looking down the slip face towards where it flowed to the sea (to the photo right) the face has been planted to stabilise .

There are a further 3 wall sites before the next identified site ; material at these locations did not reach the coastline in any significant quantity.

Port Underwood Road site 3

R.P. 4.0 km

Coordinates : 2599670 / 5993502

There is a retaining wall at this site some 15m long x 4 m high (this is the height limit for this design of wall)

The road collapsed as well as slip material emanating from above the road , evidence of an old collapsed gabion wall exists below the current wall.

The road culvert collapsed and was replaced with a 450 Armco resited to the East side of the wall

This event can be attributed to the road I consider with uncompacted shoulders and possibly unstable ‘cut’ batters and involved near 600 m3 flowing to the sea . The event occurred app. 1996.

Port Underwood Road site 4

R.P 4.5 km

Coordinates : 2599973 / 5993213

There is an apparent slip above the road and collapsed edge below the road .

There is retaining wall app.10m long x 2m high at the site.

I could not observe any especial material deposited to the sea , very clear water at the time of my survey. There was approx 600 m3 at this site deposited to the sea , probably roading related damage and occurring app. 1994.

Note there was a 300 mm dia Armco culvert installed near the West side of the wall – this culvert has been undermined by approx.. 2—3 metres !!

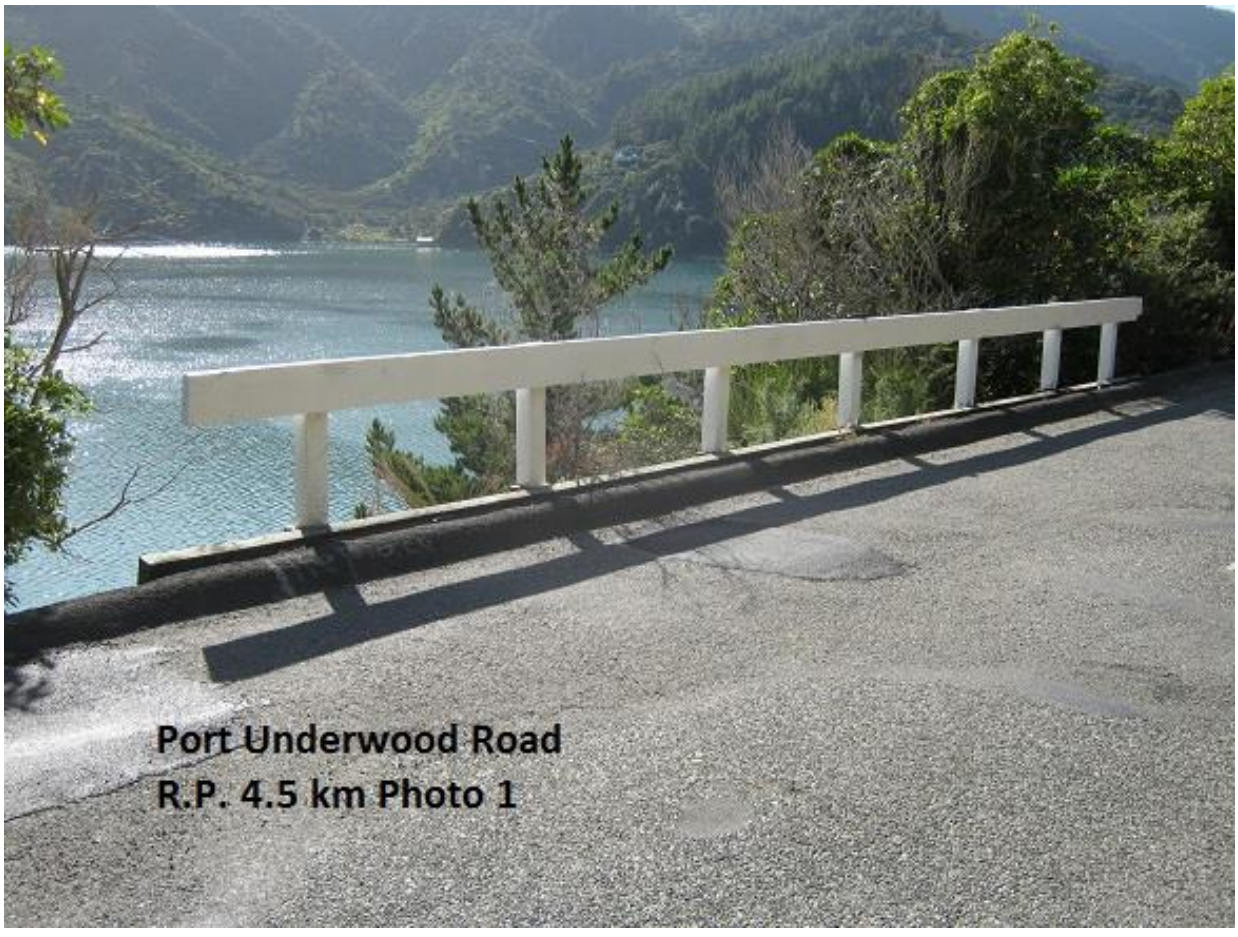


Photo at the wall site See also photo 2 (follows)

Note 1: there are wall sites at 4.55 , 4.7 and 5.0 and some shoulder protection sites , there was no material deposited to the coast at these sites.

Note 2: There have been some hugely significant road slips generally emanating from above the road , between Whatamango Bay and the Summit at 10.1 km.

There will have been in excess of 40,000 m3 in total over a number of years and at various sites . While they will not have directly flowed to the sea one would imagine there would have been considerable fine sediment deposited to the receiving creeks below the road and thence into the sea at the head of Whatamango Bay.

Note 3 : Near the culverts at 12.7 and 12.8km ('Archers culvert ') there was massive damage to the road .especially at the first site where the complete road was scoured out with significant reconstruction works required . This event occurred in approx.. 2000 and there would have been approx.. 2000 + m3 of material flowing into the receiving watercourses , while this did not reach the coast there would have been considerable water borne finer material and sediment to the sea.

Port Underwood Road site 5

R.P. 16.8 km

Coordinates : 2603597 / 5987576

This is the site of an underslip probably the result of uncompacted shoulders when the road was constructed.

The damage is obvious and some material in the form of rocks was apparent in the sea at the time of my inspection (water was very clear) although I cannot be certain these were from the slip event.

The event occurred app. 1998 and about 500m3 of material would have entered the sea.

Just beyond this site is a 'turn area' this was constructed with slip material carefully benched , compacted and levelled etc. at about the same date .

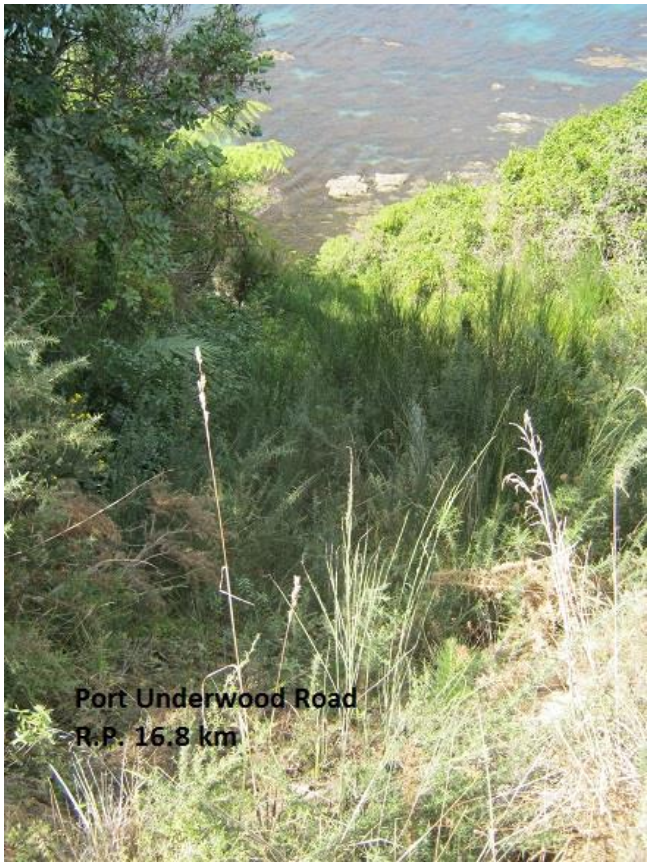


Photo 1 looking down slip towards sea See over for photo 2

Site location Note turn area in photo centre foreground.

Note numerous small walls and underslips to 20.1 km but none reached the sea to any extent.

Port Underwood Road site 6

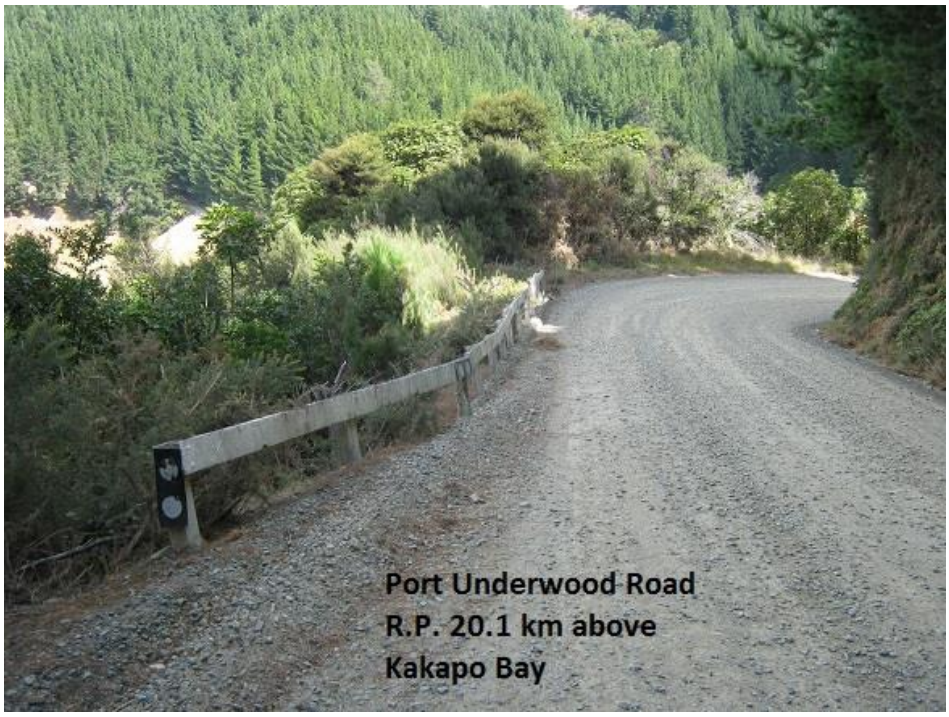
R.P. 20.1

Coordinates : 2602745 / 5986446

An underslip from the road shoulder to the sea

The quantity was app. 250m3 and the event occurred in app. 1990

The structure is not a retaining wall , just defining the road edge and reinforcing the shoulder.



Port Underwood Road Site 7

R.P. 20.4 km

Coordinates : 260 2422 / 5986554 (at photo point)

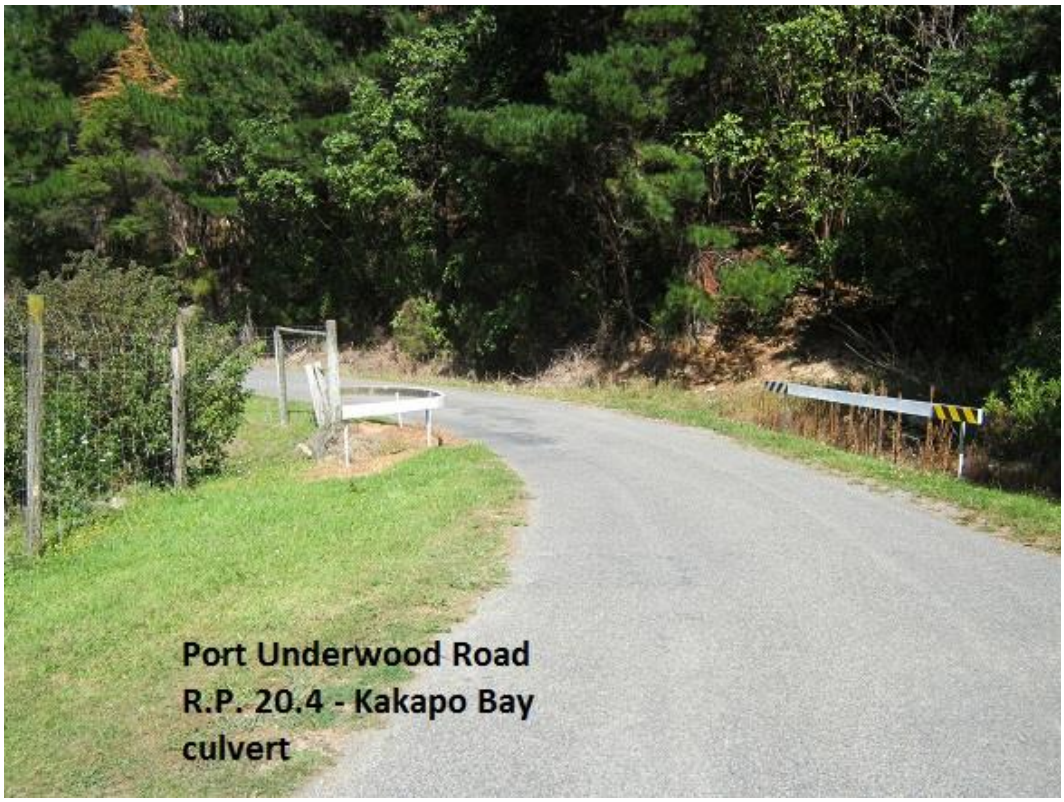
This is the Kakapo Bay culvert .

There was a huge slip in the catchment above this culvert with considerable slash and other debris which completely overtopped the culvert and scoured the small watercourse up to 2 m deep in places.

I was informed by G----- , who are long term residents in the Bay that this was the worst damage in this area they had ever seen .

The culvert was replaced and there is a rail iron structure driven in the creek bed upstream of the culvert and road to collect any future debris.

I consider the event was a direct result of recent forestry extraction at the time. The date was approx.. 1990 and there would have been possibly 500 m3 + or – to the sea .



Port Underwood Road site 8

R.P. 34.9

Coordinates : 2599059 / 5980439

This is an old site typical of the collapse of the outer edge of the formation , as a result of the unbenched and uncompacted side cast material during the road construction (fairly typical of other damage in the area)

It is significantly elevated and app. 500m3 + or- would have fallen the coast

The date was approx.. 1986.

This picture is looking back up the road and shows Robertson Point in the photo background

Tumbledown Bay Road Site 1

R. P. 1.8 km

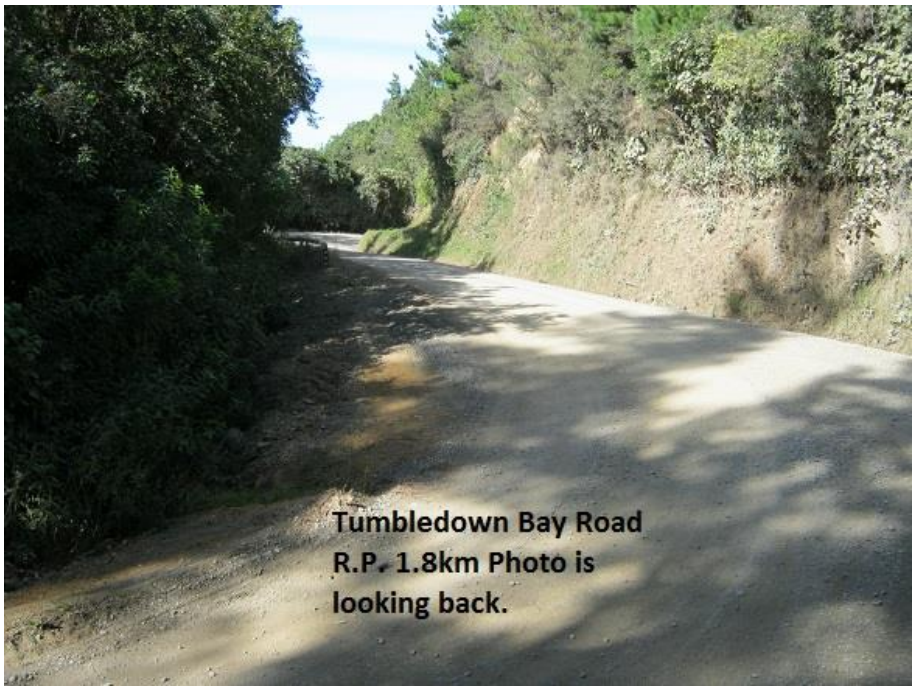
Coordinates : 2604092 / 5989447

This site is near the 'single lane' sign

There were slips from above the road and dropout of the shoulder encroaching into the road . The road was relocated into the RHS but there is still restricted width at the site.

There was approx.. 1800 m3 of material in total of which perhaps 50% has reached the coast below.

This event occurred in approx. 1990



The material over the side extended from the photo left foreground all the way right through to the South end of the wall in the photo. There was also significant material from a gully right of this photo location.

Note to 4.1 km numerous slips delivering sediment to coast but not large quantities of material

Tumbledown Bay Road Site 2

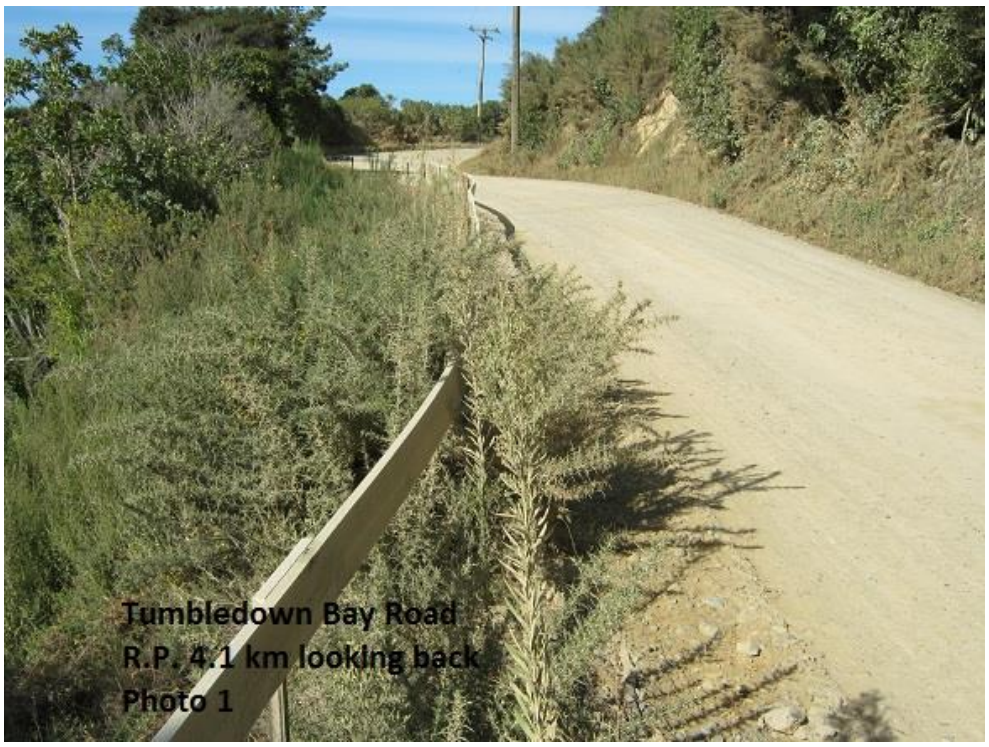
R.P. 4.1 km

Coordinates : 2604845 / 5990534

There was a significant collapse of the road edge together with slips from above the road and there would appear to be some evidence of residual material at the coast line.

The cause was likely to be roading related and the event occurred app. 2005

There was app. 1500 m3 of material in total.



This photo is at the site looking back to the South

See following photo

This photo shows the slip face to the sea ; still unstable ??

Note there have been major slips at 5.6 km , and from 9.7 – 11 km a total of app. 4000 m3 in total , although no significant amounts of material went to the sea there would have been considerable amounts of sediment.

Tumbledown Bay Road site 3

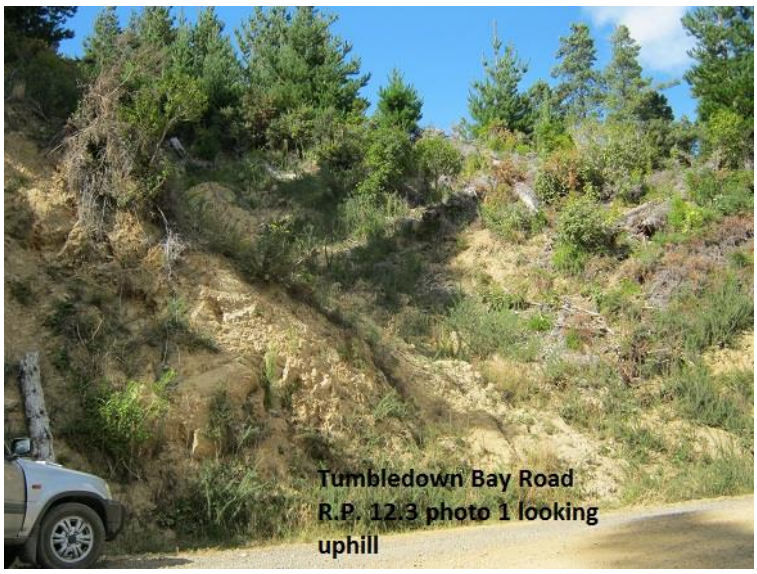
R.P. 12.3 km

Coordinates : 2609347 / 5990145

This is a large event emanating from Forestry activities as evidenced by the large amounts of 'slash ' above and below the road .

There was over 1500m3 in total of which perhaps 200 m3 reached the distant coast.

This event occurred in app. 2008



Tumbledown Bay Road Site 4

R.P. 13.75 km (at photo)

Coordinates : 2609392 / 5989245 (at photo)

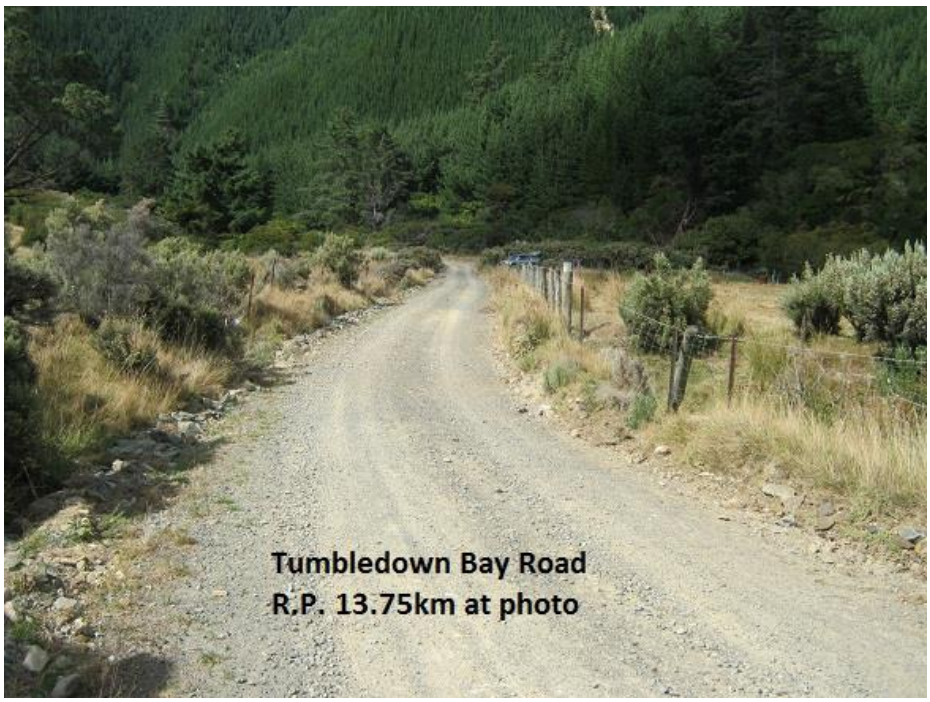
This site was the subject of damage from a slip OR slips emanating from Fighting Bay road ; these are visible from near the beach with the large slip on the RHS of fighting Bay Road being the likely cause of the event.

There were huge quantities of slip material and debris coursing towards the sea across the paddock to the left of the photo ; the complete road formation was scoured out up to 1 metre deep in places and this material also flowed to the sea. There appears to be a significant 'beach' evident where this material would have been deposited.

The road reconstruction is evident (note the new rock foundation that was placed)

I would estimate at least 1500 m3 and possibly more would have flowed to the sea (there would be almost 900m3 alone from the road formation material)

The event occurred in approx.. 1996 and was close to forestry harvesting near the visible slip , however , I was unable to access Fighting Bay road at the time of the event so I do not know the actual cause.



Tumbledown Bay Road site 5

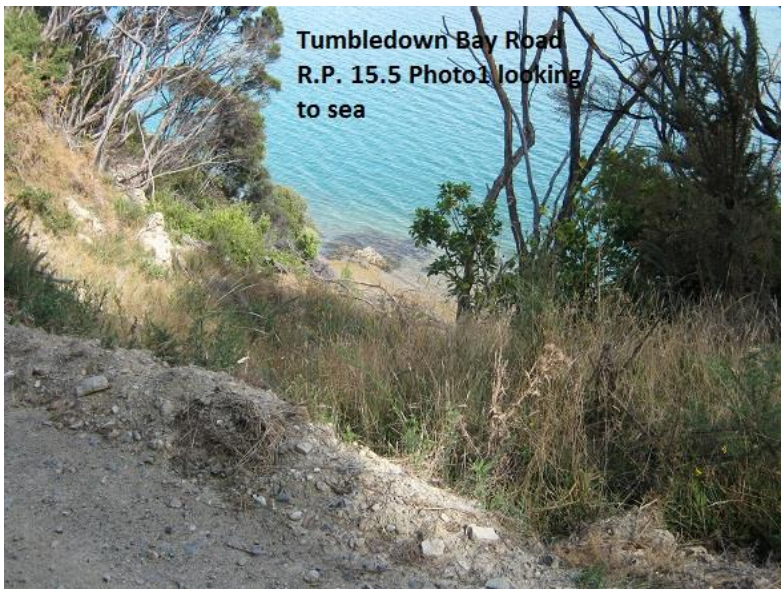
R.P. 15.5 km

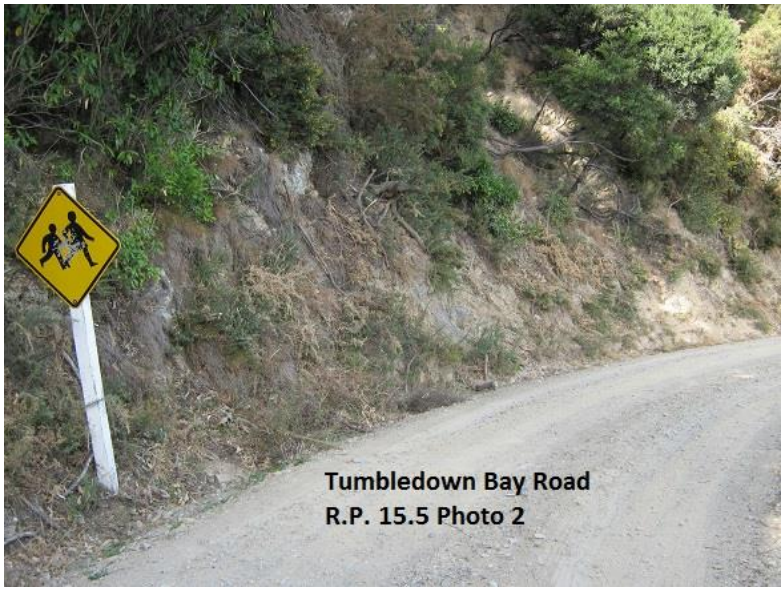
Coordinates : 2608644 / 5988650

There is evidence of the old slip which flowed from the road to the sea following a collapse of the outer edge of the road.

There was approx. 900 m3 at this site and the damage occurred in approx.. 1999

This site is just after a ‘ Children’ sign.





Tumbledown Bay Road Site 6

R.P. 15.95 km

Coordinates : 2608444 / 5988367

This site was a similar event to Site 5 above ie. slips from above and collapse of the outer road edge.

Roading related damage involving app. 400m3 of material to the sea.

This event occurred approx.. 2007.

Tumbledown Bay Road Site 7

R.P. 16.08 km

Coordinates : 2608351 / 5988271

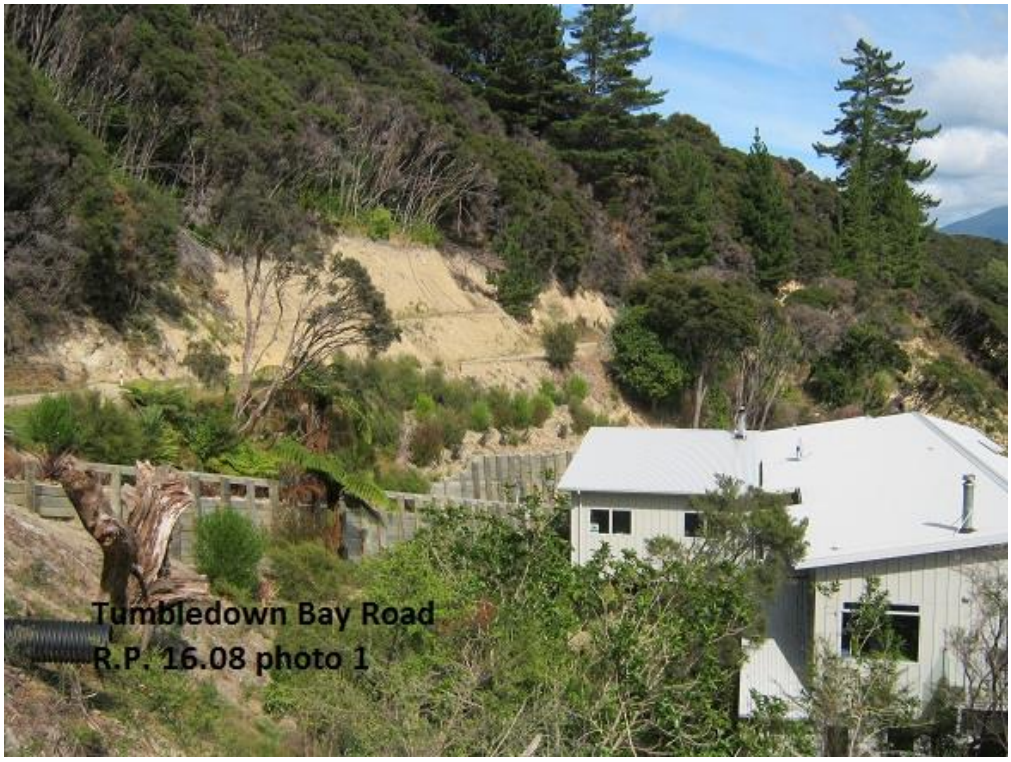
This site is just forward of the previous site (no. 6) and just around a LH corner

Slips emanated from the above the road and the distant event has been 'benched ' above the road to control and possibly arrest future debris . Material also crossed the road before the house which has been constructed very close to the potential slip zones .

No doubt there is a site specific Engineering soil stability report .

There was approx. 800 m3 in total from the 2 locations that went to the coast

There are extensive plantings and site works evident , the slips occurred in app. 2008



Note 'benching' of slip slope near photo centre , slip face below road is just visible behind house . Earlier slip is at site of photo and before house access .

Tumbledown Bay Road Site 8

R.P. 16.75 km

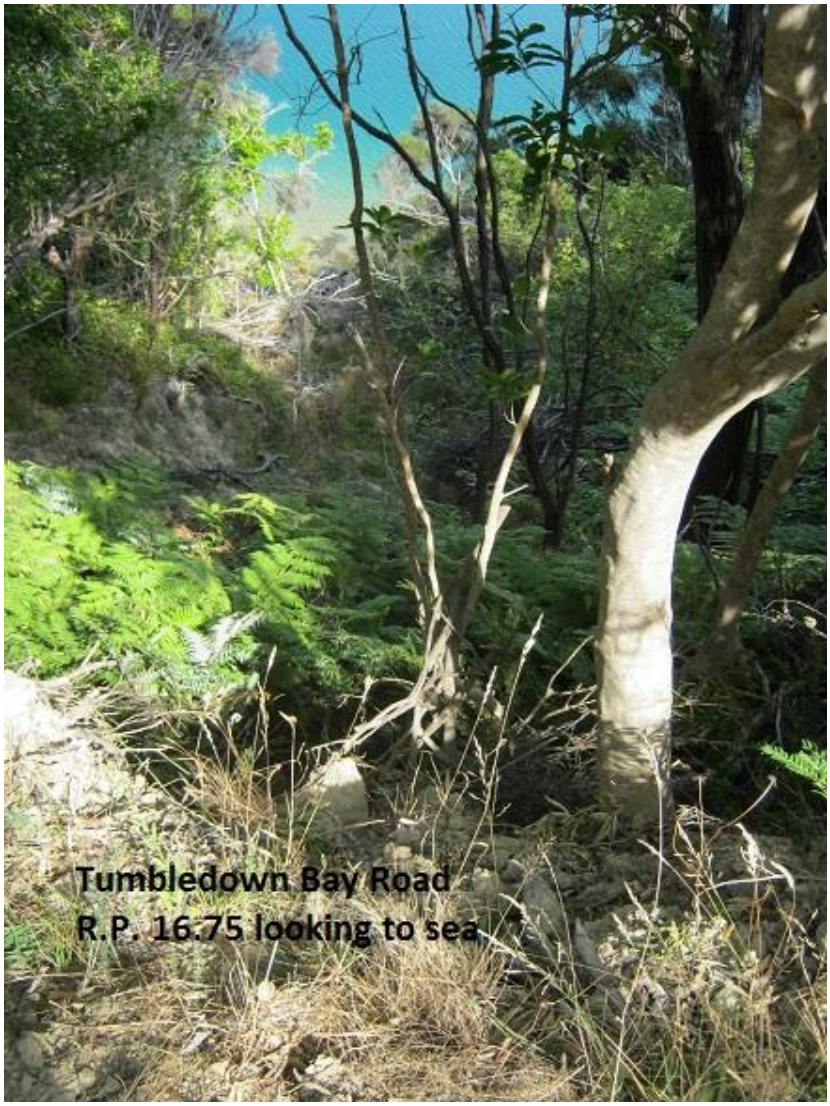
Coordinates : 2608052 / 5987882

This site is just forward of and around a LH corner from a house in the Bay

There was a significant underslip together with material from above the road , the damage appeared to be roading related.

In total some 700m 3 has flowed to the coast , the photo looks down to the sea.

This event occurred app. 2008



Tumbledown Bay Road Site 9

R.P. 17.15km

Coordinates : 2608166 / 5987604

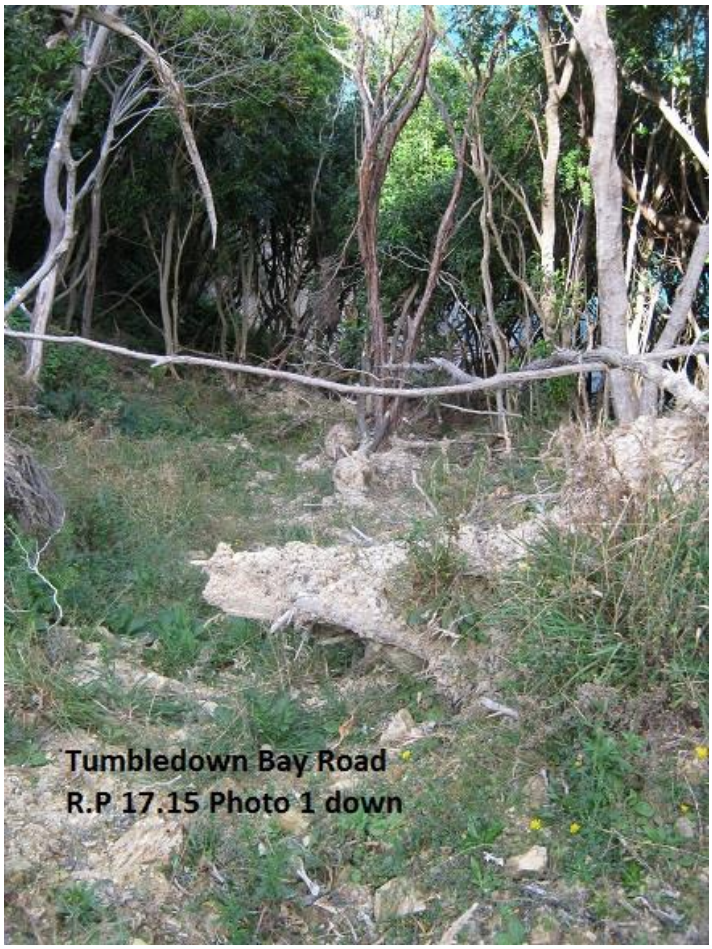
This site is near the end of the Councils maintained section (ends in Bay forward at 17.5 km)

There was a dramatic and severe event at this site and the complete road was severed for some time ; the current section of road sits on the old slip material .

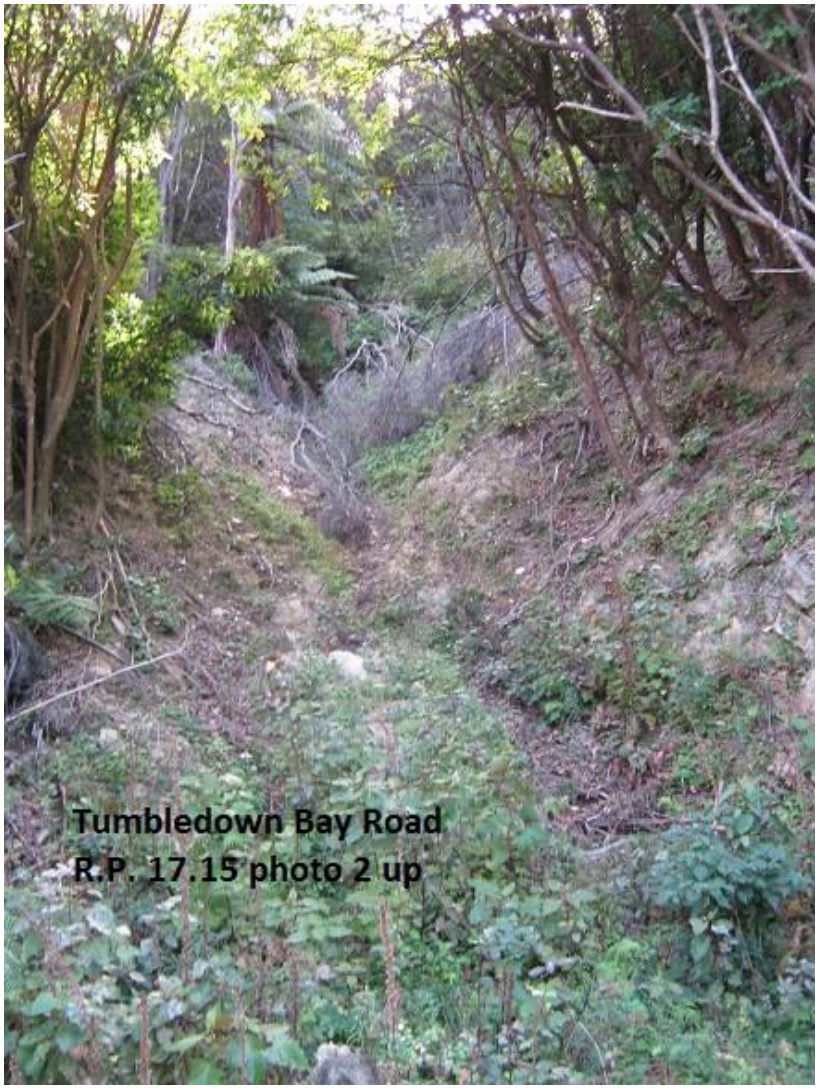
The uphill slip and the downhill results are evident at the site and app. 1600 m3 of material flowed to the sea.

The event occurred in approx.. 1990

NOTE there is a slip site above the road at 16.9 km ; this material did NOT reach the sea.



see also photo 2 (over)


Tumbledown Bay Road
R.P. 17.15 photo 2 up

SUMMARY OF SITES – SECTION 3

PORT UNDERWOOD ROAD

Site	R.P.	Coordinate	Coordinate	Quantity	Date
1	1.6	2598425	5993522	400	1995
2	2.75	2599002	5993907	400	2000
3	4.0	2599670	5993502	600	1996
4	4.5	2599973	5993213	600	1994
5	16.8	2603597	5987576	500	1998
6	20.1	2602745	5986446	250	1990
7	20.4	2602422	5986554	500	1990
8	34.9	2599059	5980439	500	1986

TUMBLEDOWN BAY ROAD

1	1.8	2604092	5989447	400	1990
2	4.1	2604845	5990534	1500	2005
3	12.3	2609347	5990145	600	2008
4	13.75	2609392	5989245	1500	1996
5	15.5	2608644	5988650	900	1999
6	15.95	2608444	5988367	400	2007
7	16.08	2608351	5988271	800	2008
8	16.75	2608052	5987882	700	2008
9	17.15	2608166	5987604	1600	1990