

Estimates of Log Volumes on Tolaga, Kaiaua and Anaura Beaches

Summary

1. The Queens Birthday Storm generated a significant volume of debris some of which ultimately ended up on North and South Tolaga Beaches.
2. The material largely comprised pine (84%) with subordinate Willow and Poplar (12%), and indigenous (4%).
3. Approximately 24,850 M³ has been pulled into piles on north Tolaga Beach and 16,740 M³ on south Tolaga. There are a total of 28 piles; 16 in the north and the remainder in the south.
4. While the best option would be for the logs to be completely removed from site, it may be more feasible to remove the material to adjacent rough ground. There is an area suitable north of the Tolaga Bay Camping ground but land owner agreement would be necessary. It is not appropriate to bury this material in the coastal zone. Disposal in the north is more complex and may only be viable as a short term solution.
5. There is lesser material on Kaiaua Beach mainly concentrated around the mouths of small creeks. This material might take 3 days to remove and there may be ground suitable for full or partial burial on adjacent land subject to a risk assessment and landowner approval.
6. The amount of material on Anaura Bay is not significant and it differs in character to Kaiaua and Tolaga mainly comprising scattered short long resident logs. One short fresh cut pine log was found. A clean up of this beach should only take a day assuming a local contractor is used.
7. Tikapa Beach was also assessed but while the volume of material is significant, it differs in character from the Uawa event comprising a lot of pine and nearly as much indigenous with lesser willow and poplar. Fence battens and other constructed debris is also present. Removal is hard to justify.

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Introduction

Woody material, primarily comprising pine logs are an issue on Tolaga Bay beach, one of Gisborne/Tairāwhiti's most popular destinations. Smaller amounts of woody debris has washed up on Kaiaua and Anaura beaches. It is likely that there is also debris on Karaka beach and the bay north of Marau Point beach but these have not been assessed due to lack of access.

Estimating the volume and mass is not simple and this result is only approximate. Variables include the irregular shape of piles with logs of various diameters, orientation and length, the presence of voids, the incorporation of sand, and the specific gravity of the material. Additionally, the size of the log piles is not static with tracks cut through the main log pile on Tolaga South Beach sometime between the 24th and 28th of July 2018. Some logs have also been removed from the piles due to wave action after the piles were constructed and further logs have been introduced to the beach since the piles were constructed.

Methodology

Drone footage has been used to determine the location and approximate dimensions of the log piles. The drone footage was acquired prior to the south Tolaga Beach having the logs moved into piles apart from one pile immediately north of the Wharf. Sentinel satellite imagery dated 22nd July and at a resolution of 10m was used to supplement this data as were an initial series of photographs taken on the ground. The piles at Tolaga Bay were also measured on the ground using GPS waypoints and tracks to validate the analysis and the specific gravity of the material was taken as 0.59 which is the SG of the heaviest pine species.

Pile heights as estimated on the ground at Tolaga Bay varied from 1.5 to 2m. Obviously the piles are not perfect rectangles but are more ellipsoid in character but have been treated as rectangles to add a factor of safety. All of this data was used to plot the areas on the GIS and thus derive an area for each pile. The metadata was then exported to Excel and the total volumes and mass calculated.

The material at Kaiaua and Anaura Bays have not been organized into piles. In Kaiaua Bay the material has concentrated at the mouths of small streams with scattered logs elsewhere along the beach. At Anaura Bay the logs are mainly distributed at the southern and northern ends. At both Kaiaua and Anaura, as well as north Tolaga Beach the logs are almost entirely introduced after the

Queens Birthday event. At south Tolaga Beach, however, the logs comprise logs introduced by both the Queens Birthday event and some that were from the ex-Cyclone Cook event in 2017.

Tolaga Bay Results

There were twenty eight piles identified plus a small pile of logs in front of Ricky Kuru's place which are assumed to have been specifically placed there as potential firewood. Logs located south of the Tolaga Bay wharf have not been put into a pile but have been concentrated by wave action. The operation to construct the piles has not followed the same procedure in all cases.

On north Tolaga Beach, there are sixteen discreet piles of variable shapes. Some have been piled into discreet ellipsoids while others are far more extension linear piles (**Figure One**). On South Tolaga there is one large shaped pile between the wharf and the fishing boat entry point but north of there the logs were pushed up into to very long linear piles. Tracks have been pushed through these since the 24th to provided walking access to the beach from the camp ground. The volume at the spit by the Uawa river mouth remains to be assessed. This is the location of the NZ Dotterel and leucistic Oystercatchers.



Figure One. Drone image of the south end of south Tolaga Beach showing the logs caught up south of the wharf, pile # 28, and the scatter logs introduced to the beach after the construction of the piles.

It is estimated that the logs for all of Tolaga Bay cover an area of just under 23,707 M², have a volume of around 41,585 M³, and a mass of 24,535 tonnes (**Table One**). The largest volume is on north Tolaga Beach which has an area of 13,809 M², a volume of 24,846 M³, and a mass of 14,659 tonnes. The equivalent on south Tolaga Beach is 9,897 M², 16,739 M³, and 9,876 tonnes. There are also disaggregated areas of logs not counted, plus the material on the spit which is hard to quantify.

Pile number	area	Volume m2	Tonnes m3
Pile 1	325.11	585.19	345.26
Pile 2	1579.68	2843.42	1677.62
Pile 3	3998.82	7197.88	4246.75
Pile 4	405.58	730.05	430.73
Pile 5	445.16	801.29	472.76
Pile 6	365.69	658.24	388.36
Pile 7	231.19	416.13	245.52
Pile 8	357.33	643.19	379.48
Pile 9	1861.29	3350.32	1976.69
Pile 10	1021.41	1838.53	1084.73
Pile 11	501.00	901.80	532.06
Pile 12	841.16	1514.09	893.31
Pile 13	327.84	590.11	348.16
Pile 14	374.68	674.43	397.91
Pile 15	739.81	1331.66	785.68
Pile 16	410.33	738.59	435.77
Logs in front of Ricky Kurus place	23.81	30.96	18.26
North Tolaga	13809.88	24845.88	14659.07
Pile 17	3199.87	5759.77	3398.27
Pile 18	685.28	1233.50	727.77
Pile 19	594.81	1070.65	631.68
Pile 20	209.96	377.93	222.98
Pile 21	471.49	848.69	500.73
Pile 22	499.45	899.00	530.41
Pile 23	436.93	786.47	464.02
Pile 24	722.46	1300.43	767.26
Pile 25	464.49	836.08	493.29
Pile 26	315.52	567.94	335.08
Pile 27	361.58	650.84	384.00
Pile 28	1218.42	2193.15	1293.96
Not piled	717.24	215.17	126.95
South Tolaga	9897.50	16739.64	9876.39
Total	23707.38	41585.52	24535.46

Table One. Approximate estimates of the area, volume and mass of logs on Tolaga Beach.

Location of the Tolaga piles

The location of the log piles on the north and south Tolaga beaches are shown in Figures two and Three below).



Figure Two. Orthomosaic image of North Tolaga Beach showing the plotted location of the log piles.



Figure Three. Orthomosaic image of South Tolaga Beach showing the plotted location of the log piles.

Composition of Tolaga Bay woody debris

Work undertaken by counting all woody material within three 10m^2 plots after Ex-Cyclone Cook demonstrated that the woody debris excluding dross (small disaggregated material) was dominated by pine (68%) with the remainder willow or poplar (32%) (**Figure Four**). That work also showed that the pine material comprised cut pine (19%), fresh cut pine (2%) long resident process logs (67%), and “windthrow” (12%) (**Figure Five**).

It is noted that “windthrow” is a misnomer as these logs can comprise windthrow, trees displaced by slips, and trees knocked over on flood plains by the large volumes of migrating woody debris during the event.

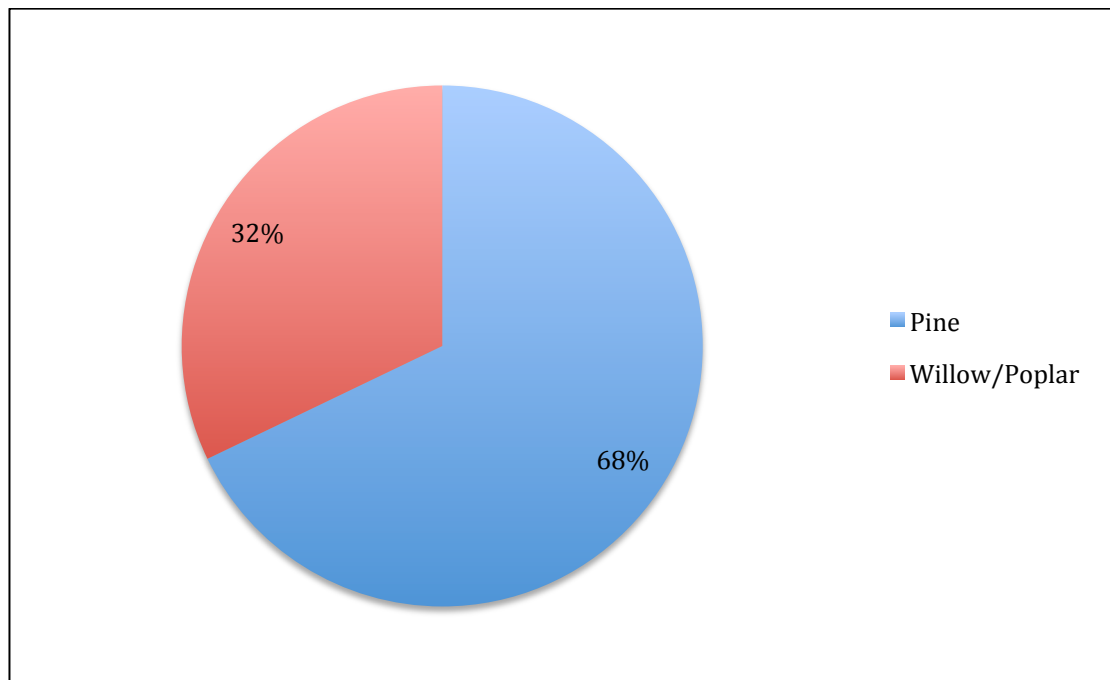


Figure Four. Composition of woody debris ex-Cyclone Cook event.

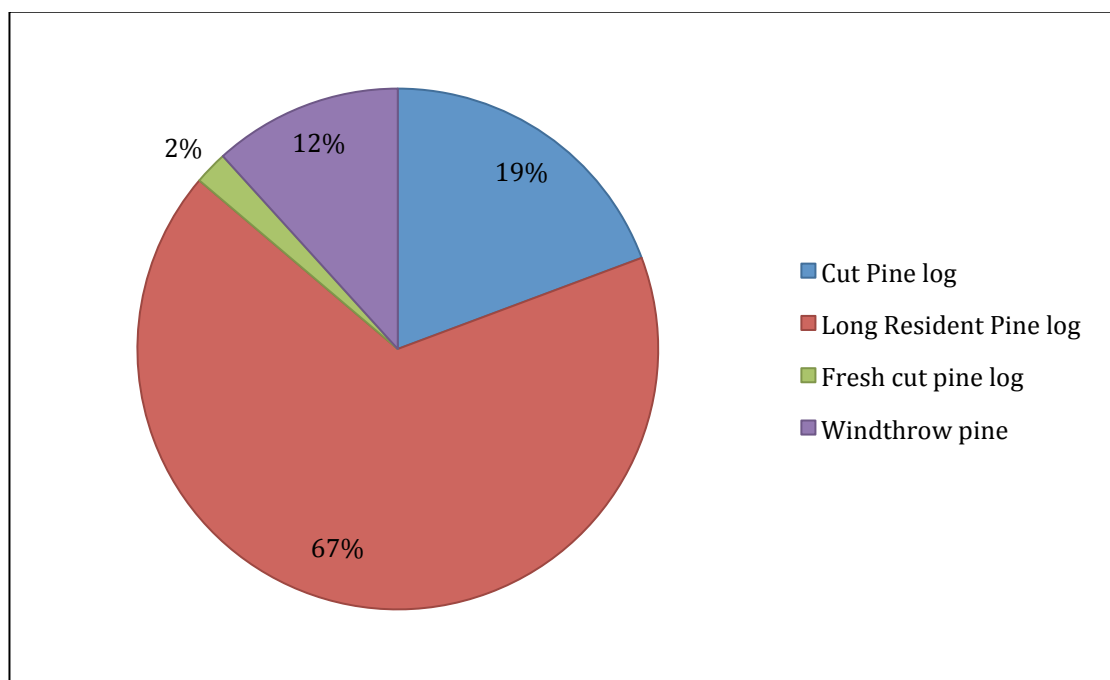


Figure Five. Types of Pine ex-Cyclone Cook event

It was not possible to re-occupy the plots used in 2017 as material within these areas had been highly modified during clean up that happened immediately post the Queens Birthday storm. One 10m² plot was counted in the area immediately south of Tolaga Bay wharf. This showed that the Queens Birthday event was largely comparable to ex-Cyclone Cook with 13% cut pine,

54% long resident pine logs and 17% “windthrow” pine, while willow and poplar comprised 11.5% and indigenous 4% (**Figure Six**). On an aggregate basis 84.5% was pine and when recalculated to total pine, cut pine comprised 16%, long resident logs 64% and “windthrow” pine 20% (**Figure Seven**).

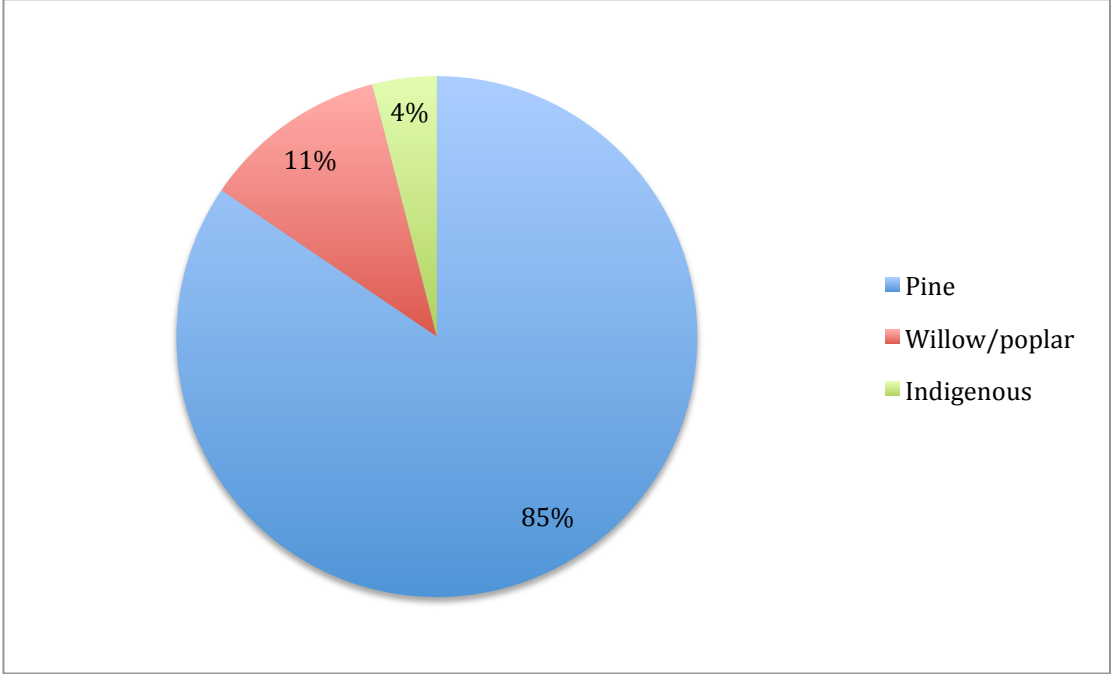


Figure Six. Percentage of pine, willow and poplar and indigenous.

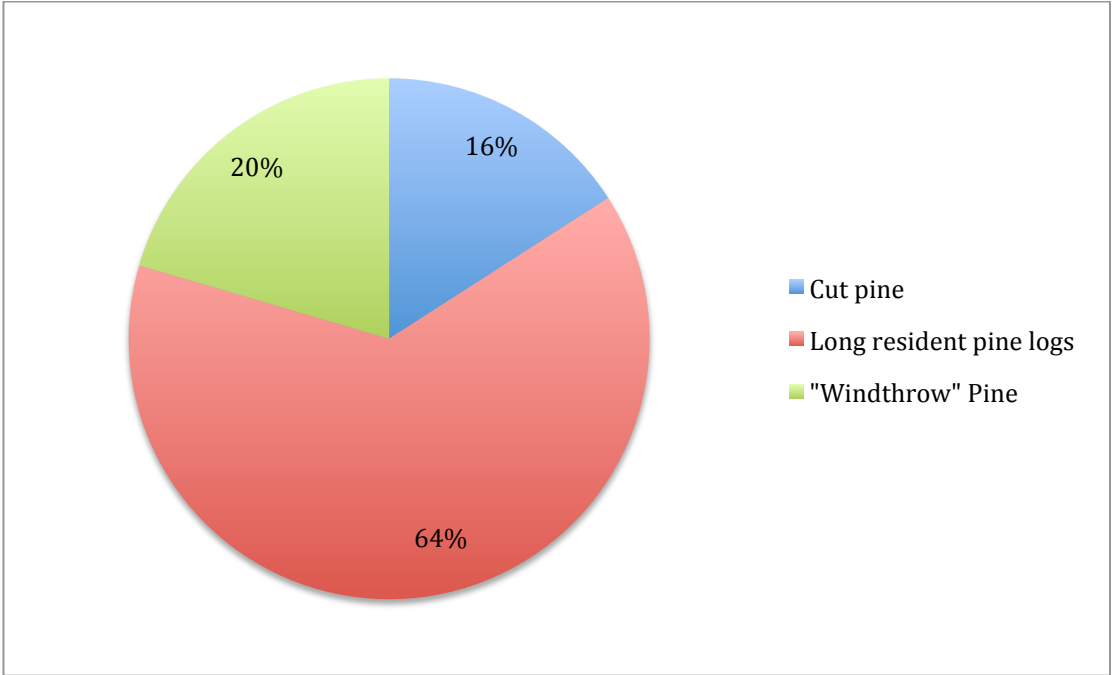


Figure Seven. Percentages of pine types.

Options for Remediation

Tolaga Beach is popular with locals and tourists alike and the presence of large piles of logs is unsightly. It is beyond the scope of this report to fully assess options, however, some partial solutions are suggested.

South Tolaga

No solution is perfect, however, the most pragmatic solution for south Tolaga beach would be to relocate the debris to unused ground between the camping ground and the spit (**Figure Eight**). This land belongs to the proprietors of Huaiti Incorporation and full engagement with the incorporation and local iwi would be necessary. Burial or partial burial in this area would need to be carefully considered. Although this would reduce fire risk, contamination of ground water and other impacts would need to be risk assessed. Spreading the logs over the disposal area would reduce the visual impact and would also partially reduce the risk of fire compared with constructing a large pile since there would be a great volume in contact with the ground. Options for accelerated decomposition by compaction could be considered.



Figure Eight. Possible disposal area south Tolaga.

North Tolaga

A short term solution would be to relocate the logging debris to GDC reserve land at either end of the north Tolaga Beach (**Figure Nine**).



Figure Nine. Possible short to medium term disposal sites, north Tolaga.

At the north end of the beach, this reserve land is presently informally occupied (**Figure Ten**) while in the south there would be a greater visual impact than would be the case for the south Tolaga. Another option would be to lease land at the northern end but this would ultimately necessitate double handling. As is the case for south Tolaga, burial in this area would need to be carefully considered. Although this would reduce fire risk, contamination of ground water and other impacts would need to be risk assessed. Spreading

the logs over the disposal area would reduce the visual impact and would also partially reduce the risk of fire compared with constructing a large pile since there would be a great volume in contact with the ground. Options for accelerated decomposition by compaction could be considered.



Figure Ten. GDC reserve land north end of Tolaga beach. This area may be large enough to hold the debris from Sites One to Three if the material is compacted and this site may be suitable for burial of material with soil placed over the top to mimic a dune form. Part of this land is presently informally occupied.

Other options at the north end of Tolaga Bay are more limited. Pile site Six may be a good candidate for an assessment of mulching options as it has a reasonable number of clean logs on the landward side (**Figure Eleven**).



Figure Eleven. Clean logs on the landward side of Pile Site Six.



Figure Twelve. Linear log pile north of the BP Surf Rescue Building. While the pile looks large, there is a lot of sand mixed in due to a bulldozer being used to construct the pile and volumes would reduce if much of the large logs were pulled using a small bucket and thumb.

Kaiaua Beach

Kaiaua Beach was assessed by a drone overflight and an on the ground inspection. It is clear from the overflight and on the ground inspection that the overall volume of material is far less significant than at Tolaga Bay. The material is, however, collected at key points against headlands and in the mouths of creeks (**Figure Thirteen**). At the north end, pine logs are clustered around the creek and for about 100m to the north (**Figure Fourteen**). South of this creek there are some logs which concentrate towards the headland immediately south (**Figure Fifteen**).

It is envisaged that a digger with a small bucket and thumb loading to a tractor with a large caged trailer would be able to move the material to an adjacent rough paddock for burial within ½ to 1 day. There is poor access to the beach just south of the creek but a better option would be via the farm and the north side of the creek. Access to the paddock for burial would, of course, need to be negotiated.

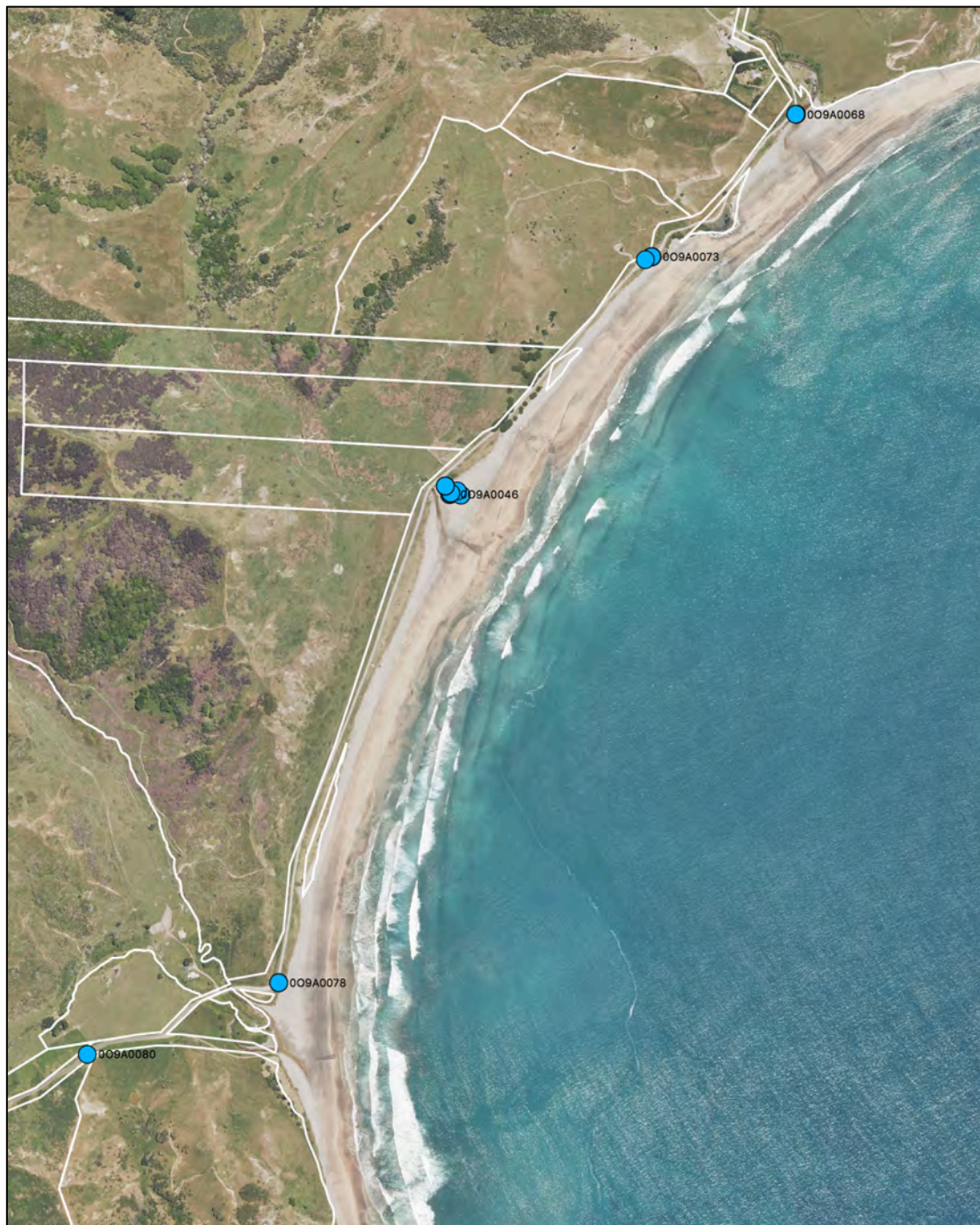


Figure Thirteen. Kaiaua Beach showing locations where photographs of debris were taken. This coincides with debris locations except the southern images where the debris is further south.



Figure Fourteen. Creek at Northern end of Kaiaua showing the logs concentrated in the creek mouth and to the north.



Figure Fifteen. Logs concentrated between headland and northern creek.

South of the headland noted in **Figure Fifteen** logs are again concentrated immediately before the headland but there are still significant numbers of logs scattered along the beach south of the headland (**Figure Sixteen**).



Figure Sixteen. A concentration of logs against the headland and scattered to the south.

There is another creek positioned in the middle of the bay (see **Figure Thirteen**) that also contains a significant volume of logs (**Figure Seventeen**). As was the case for the northern end, a digger with a small bucket and thumb loading to a tractor with a large caged trailer would be able to move the material to an adjacent rough paddock for burial within ½ to 1 day. Access to this site is good.



Figure Seventeen. Logs deposited at the creek mouth, middle Kaiaua beach.

South of the access road to Kaiaua Beach there is a small concentration of logs (**Figure Eighteen**) and a similar number of logs accumulated against the banks from where the road meets the beach and the creek at the middle part of the beach (**Figure Nineteen**).



Figure Eighteen. *View looking south from the bend in the road immediately before it heads inland showing logs concentrated in an area south of the creek. Some logs are also concentrated at the creek itself but not as much as the middle and north parts of the beach.*



Figure Nineteen. Logs between the middle part of Kaiaua Beach and the southern creek.

Anaura Beach

Anaura Beach was also assessed by a drone overflight and an on the ground inspection (**Figure Twenty**). The amount of debris on this beach is not significant and ordinarily there would be little justification to undertake a clean up of the logs. Only one obvious very short fresh cut pine log was noted (**Figure Twenty One**). In addition, the character of the material differs from Tolaga and Kaiaua with a general absence of large logs and those logs present being small long resident logs possibly from prior events (**Figures Twenty Two and Twenty Three**).

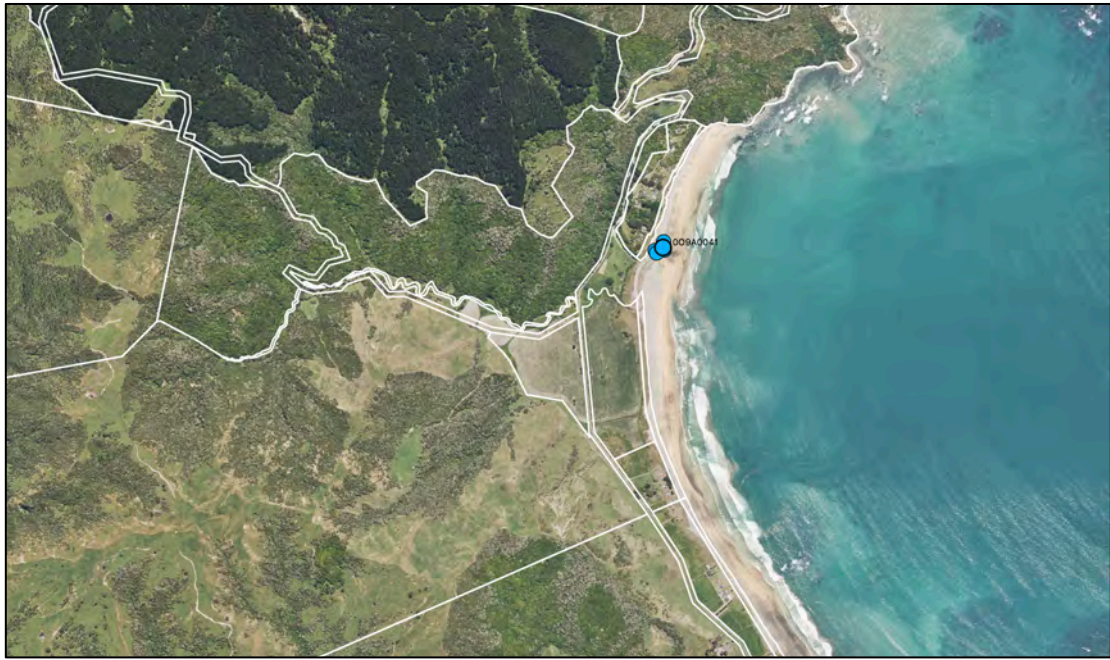


Figure Twenty. *Orthomosaic of Anaura Bay showing location of logging debris.*



Figure Twenty One. *Short fresh cut pine butt.*



Figure Twenty Two. North end of Anaura Bay showing a small amount of scattered woody debris.



Figure Twenty Three. South end of Anaura Bay showing a small amount of scattered woody debris.

Summary and Conclusions

The Queens Birthday Storm was a significant storm and generated a significant volume of debris some of which ultimately ended up on North and South Tolaga Beaches.

The material was compared with the composition plots for the 2017 Cyclone Cook event and found that the types of material was largely comparable between the two events with the woody material largely comprised pine (84%) with subordinate Willow and Poplar (12%), and indigenous (4%).

Approximately 24,850 M³ has been pulled into piles on north Tolaga Beach and 16,740 M³ on south Tolaga. There are a total of 28 piles; 16 in the north and the remainder in the south.

While the best option would be for the logs to be completely removed from site, it may be more feasible to remove the material to adjacent rough ground. There is an area suitable north of the Tolaga Bay Camping ground but land owner agreement would be necessary. It is not appropriate to bury this material in the coastal zone. Disposal in the north is more complex and may only be viable as a short term solution.

There is lesser material on Kaiaua Beach mainly concentrated around the mouths of small creeks. This material might take 3 days to remove and there may be ground suitable for full or partial burial on adjacent land subject to a risk assessment and landowner approval.

The amount of material on Anaura Bay is not significant and it differs in character to Kaiaua and Tolaga mainly comprising scattered short long resident logs. One short fresh cut pine log was found. A clean up of this beach should only take a day assuming a local contractor is used.

Tikapa Beach was also assessed but while the volume of material is significant, it differs in character from the Uawa event comprising a lot of pine and nearly as much indigenous with lesser willow and poplar. Fence battens and other constructed debris is also present. Removal is hard to justify.