REPORT

Tasman District Council

Jackett Island Long Term Erosion Management
Preliminary Practicable Options Report

Tonkin & Taylor

ENVIRONMENTAL AND ENGINEERING CONSULTANTS

REPORT

Tasman District Council

Jackett Island Long Term Erosion Management
Preliminary Practicable Options Report

Report prepared for:

Tasman District Council

Report prepared by:

Tonkin & Taylor Ltd

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Executive summary

This report sets out the preliminary assessment of practicable options to manage the erosion experienced along the seaward edge of Jackett Island to achieve the following objectives:

1. Reduce risk of erosion hazard affecting human life and physical assets
2. Restore the shoreline position to approximate the year 2000 shoreline
3. Provide a solution that considers the seaward edge of the Jackett Island shoreline for a period of 35 years (i.e. long term = 35 years), the maximum duration possible for a coastal permit.
4. Legitimise or remove existing groyne from the Coastal Marine Area.

Action is currently being progressed on Item 4.

The key erosion processes affecting Jackett Island are due to the following processes:

- Focussing of wave energy over the intertidal and sub-tidal terminal lobe of the Motueka Spit, which is presently adjacent to central Jackett's Island, leading to locally increased wave heights (erosion adjacent to the seaward (distal) tip of the spit has previously been observed and reported as the spit grew southward between breach cycles);
- Sand eroded from the beach (across-shore due to the short-period waves) is then removed from the site by the tidal current that run parallel to the beach;
- Due to the relatively close proximity of the distal tip of the spit to Jackett Island, the strong tidal currents of the main channel are forced closer to Jackett Island further exacerbating the erosion in this area, and;
- Loss of sediment supply to Jackett Island due to the presence of the main tidal channel between the spit and the Island. The sediment supply to Jackett Island was previously from the spit, with the biggest influxes occurring following breaching of the spit, with the remnant spit south of the new channel formed by the breach migrating shoreward to Jackett Island.

Considering the general options and approach as set out in Policy 27 of the New Zealand Coastal Policy Statement, the following options to provide erosion protection to Jackett Island provide a range of approaches consistent with the policy were considered:

- Do nothing
- Asset relocation
- Planning responses
- Channel maintenance
- New small channel dredging
- Channel reset
- Channel maintenance and training groynes
- Seawalls.

All long term physical work options have significant cost and impact on the physical environment. Options that maintain the channel (existing channel maintenance and the new small channel dredging) have increased benefit to the wider community through improving access to the Port. However, sand transfer and small scale channel improvement

options also have the greatest risk of failing to meet the required objectives unless ongoing maintenance is included. Therefore these options have a greater ongoing cost. Hard protections works have a high cost and high risk in terms of gaining consent approval. The reset option has a significant initial effect, but provides an option that could have no ongoing maintenance costs.

Asset relocation and/or planning responses should be considered as part of any long term plan for this area.

1 Introduction

This report sets out the preliminary assessment of practicable options to manage the erosion experienced along the seaward edge of Jackett Island. The following objectives were agreed in mediation between Richard Reinen-Hamill (T&T) and Shaw Mead (ASR) to form the basis of any long term resolution of the erosion issue at Jackett Island:

1. Reduce risk of erosion hazard affecting human life and physical assets
2. Restore the shoreline position to approximate the year 2000 shoreline
3. Provide a solution that considers the seaward edge of the Jackett Island shoreline for a period of 35 years (i.e. long term = 35 years), the maximum duration possible for a coastal permit.
4. Legitimise or remove existing groyne from the Coastal Marine Area.

1.1 Current progress

Consents are currently being sought for the removal of the existing groyne (addressing Item 4 above). The removal of the existing groyne along the Motueka Spit is unlikely to result in the restoration of spit breaching process, as other processes such as sand build up and vegetation are now acting at this location. However, removal of those portions of the groyne that currently extend into the Coastal Marine Area may have localised effects on alongshore sediment transport and sheltering of the southern (distal) end of the spit. This option is proposed rather than full groyne removal or reconsenting of the existing structure. Ongoing monitoring would be required and exposed areas of groyne removed as it becomes exposed.

2 The current understanding of coastal processes

Kirk (1990)[1] provides the most comprehensive description available of the coastal processes of the Motueka Spit/Moutere Inlet/Jackett's Island complex. This report presents the results of a technical investigation into the causes and nature of bar sedimentation, prior to groyne construction (1996) and considers methods of controlling infilling of the navigation channel. In summary:

- An offshore bar that is the submarine extension of Motueka Spit lies 400-500 m offshore and is nourished by sand transported south-eastward along the spit by waves and wave-driven currents;
- Offsetting of the channel (south-easterly propagation) and infilling develops over several years. Periodically the bar was breached nearer the Port by floods from the Moutere Inlet that augment the tidal compartment. An interval of generally improved navigation then ensued before offsetting again occurs. Kirk estimated realignment occurred naturally every 10-15 years.
- The offshore bar is controlled by longshore drifts of sand from the Motueka River under wave action and is periodically relieved by major freshwater flood from the Moutere River.
- Estimated net sand transport occurs from northwest to southeast in the ratio 3.6:1 and the best estimate of transport under dominant northerly waves is 47,500 m^3/year.
- Wave action drives alongshore sediment transport southeast down the spit. This amount approximates the average sediment supply from the Motueka River each year (64,000 m^3).
- Severe ongoing erosion of the mainland shore northwest of Port Motueka is considered to be due to spit capturing the longshore sand supply that once nourished this shore.
- One of the 5 control options suggested was a groyne or offshore breakwater to deflect southward transported sand and potentially stabilize the channel if located at the northwest distal (seaward) tip of the spit. However, Kirk recommended dredging as the best method of maintenance of the channel entrance.

A 700 m long groyne was constructed in 1996. Environment Court has determined that the consequences of construction of the groyne, which is more accurately described as a breakwater/seawall (depending on the elevation of a particular part of the structure), due to its' orientation largely parallel to wave crest orientation, has contributed to:

- Lengthening, widening and heightening of the spit to dimensions and at a rate not recorded since 1881;
- 'Plugging' of the area that usually breached in the past with a 700 m non-erodible structure;
- Interrupting of the estimated 10-15 year breaching cycle (the spit has not breached since the groyne was constructed 16 years ago and is now considered too wide and high to readily breach at present), and;
- Aggressive erosion of Jackett Island.

[1] Kirk, R. M., 1990. Coastal Sedimentation and Navigability at Port Motueka, Moutere Inlet. Report to Tasman District Council. July 1990

The aggressive erosion of central Jackett Island is due to the following processes:

- Focussing of wave energy over the intertidal and sub-tidal terminal lobe of the Motueka Spit, which is presently adjacent to central Jackett's Island, leading to locally increased wave heights (erosion adjacent to the seaward (distal) tip of the spit has previously been observed and reported as the spit grew southward between breach cycles);
- Sand eroded from the beach (across-shore due to the short-period waves) is then removed from the site by the tidal current that run parallel to the beach;
- Due to the relatively close proximity of the distal tip of the spit to Jackett Island, the strong tidal currents of the main channel are forced closer to Jackett Island further exacerbating the erosion is this area, and;
- Loss of sediment supply to Jackett Island due to the presence of the main tidal channel between the spit and the Island. The sediment supply to Jackett Island was previously from the spit, with the biggest influxes occurring following breaching of the spit, with the remnant spit south of the new channel formed by the breach migrating shoreward to Jackett Island.

Erosion rates of central Jackett Island have been up to 4 m/year since 2000.

The recent migration of the spit has been further assessed using a combination of historic bathymetric surveys and more recent LIDAR surveys. Data from 1993, 1997, 2001, 2008 and 2011 were available for analysis. Figures 1 to 5 in Appendix A show the progression of various contours ranging from 2 m above Nelson Vertical Datum datum to 2 m below Nelson Vertical Datum (i.e. the 4.2 m, 3.2 m, 2.2 m (approx Mean Sea Level), 1.2 m and 0.2 m level). LIDAR data was not available for the lower levels (i.e. 0.2 m contour) and we note that 2011 hydrographic survey data is not yet available.

Figures 1 to 5 show that the spit has been extending at around 60 to 80 m/yr since 1993 (some 1200 m) and the focus of erosion along Jackett Island is also moving to the south, currently affecting some 800 m of shoreline based on the comparison of the 2.2 m and 4.2 m contour lines measured in 2008 and 2011.

Figure 4 shows the low tide line has moved significantly landward in the vicinity of the Van Dyke Property from 1997 to 2008 with as much as 120 m landward movement, although this level has not changed significantly from 2008 to 2011. However, erosion of the upper shoreline has continued to occur along the central beach area, with associated accretion to the north.

3 Potential solutions

Considering the general options and approach as set out in Policy 27 of the New Zealand Coastal Policy Statement, the following options to provide erosion protection to Jackett Island provide a range of approaches consistent with the policy. An outline of each approach and potential issues are identified.

3.1 Do nothing

The do nothing option is assuming no additional works are carried out apart from the progressive removal of the existing groyne. We would expect the spit to continue to extend and shoreline at Jackett Island to continue to retreat. Based on the changes between 2008 and 2011 the volume of loss along the beach face is estimated at around 6,000 to 8,000 m^3/yr along the 800 m of shoreline affected by erosion in this time period.

The future trend and behaviour of the spit is difficult to determine. However, it is likely that the ongoing southerly growth of the spit would continue at least in the short term. If the same rate occurs as recently experienced the spit will reach the southern end of Jackett Island in 10 to 15 years. This progression is likely to increase erosion pressures at the southern end of the Island as well as to Kina, although the sheltering effect may limit storm induced erosion.

As the northern end of the spit appears to be getting thinner, the source of sand and spit growth appears to be as much from transfer of sand along the spit as well as sand transported from the Motueka River delta. As the spit continues to extend southward it is possible that a breach may occur in the spit and the outlet change position. If this does occur it is likely that this would be within the spit area to the south of the existing groyne.

The implication of spit development on Jackett Island is that erosion is likely to continue as there is a reduction in sand supply from the spit as the bypass is occurring further to the south and there will be ongoing channel induced erosion as the spit forces the outlet channel closer to the island. Therefore the area of most risk extends from the central area of Jackett Island to the southern end of the island. It is also possible that Kina peninsula may also be affected by the change in bypassing as some point in the future.

The do nothing option does not meet the requirements of the Environment Court decision and would only be an option should all other options not be practicable.

3.2 Asset relocation

Removing the dwellings further landward to remove assets from risk is a form of risk reduction. The issues associated with landward relocation of private assets on Jackett Island includes the low lying nature of the land, with some parts of the island being only slightly higher than Mean High Water Springs. So relocation to remove the physical asset at risk from erosion would need to be done in conjunction with raising land levels in the vicinity of the proposed building platform. This option would need the support of those land owners affected, or alternative options (such as property purchase, relocation and then resale or removal) would need to be considered.

Unless this option included private property purchase and removal or relocation, this option in isolation does not address the loss of private land area or meet the requirements of the Environment Court decision and would only be an option should all other options not be practicable.

3.3 Planning responses

This may include establishment of hazard lines and development of planning policies within the District Plan to reduce increasing risk of hazards as done in many parts of New Zealand (e.g. Canterbury, Hawke's Bay and Bay of Plenty). Such policies have included prohibition of new development within extreme hazard areas and preventing inter-generational passing on of land. The planning responses need to recognise the timing needed to achieve this which may require the implementation of engineering or structural solutions in the short to medium term. This option may have merit for future development but does not address the existing properties that have status and existing use rights.

This option is recommended as a parallel process with other physical works options to provide a consistent approach in managing coastal hazards. However, this option does not address the loss of private land area or meet the requirements of the Environment Court decision.

3.4 Existing channel maintenance

This option involves regular mechanical bypassing of sand from the distal end of the spit to Jackett Island, replicating the natural process affected by the original groyne. A conceptual sketch of this option is shown on Figure 6 (Appendix B). The works would involve an initial capital dredge of the landward side of the spit and transfer of this sand along the seaward edge of Jackett Island to realign the existing channel further seaward from its current position. It is estimated that around 110,000 m^3 of sand (possible range from 80,000 m^3 to 140,000 m^3) would need to be placed along the foreshore of Jackett Island to restore the shoreline to the 2000 shoreline position. The lower bound assessment of volume was based on an 800 m length of shoreline affected with a profile height of 4 m and an average shoreline retreat of 2.3 m per year for the last 11 years with the potential upper bound based on 4 m/year erosion, that was the upper rate of annual shoreline change recorded along the Van Dyke property in the centre of the island.

After the initial placement, regular transfer of sand would be required to maintain the channel position away from Jackett Island and to maintain the beach position. The rate of sand loss along Jackett Island is estimated to be around 10,000 m^3/yr (lower and upper bound range is 7,400 m^3/yr and 12,800 m^3/yr respectively) which is less that the longshore drift rate of 47,500 m^3/yr estimated to occur along the spit.

This work could be done by a cutter suction dredge with a slurry pump discharging the dredged sand to the Jackett Island shoreline. Initial costing of dredging is based on indicative costs of sand dredging of \$10/m^3 presented by OCEL for the Motueka Port Users Ltd[2] that included mobilization costs, but not for contingencies, engineering and environmental costs (design/contract supervision/monitoring etc) and also not for the costs of placement and shaping of sand along the Jackett Island shoreline. We have included additional cost for P&G (10%), sand shaping and management along Jackett Island of \$6/m^3, 20% contingency and 30% for engineering and environmental management. Based on this approach the preliminary estimates of initial cost for this option is in the order of \$2.0M to \$3.0M.

Annual maintenance costs assuming a similar distribution of costs but with a smaller volume could range between \$200,000 and \$330,000 per annum.

[2] OCEL (2011). Establishing and maintaining a new navigation channel for Port Motueka (Draft). Unpublished report for Motueka Port Users Ltd. May 2011.

This option would effectively maintain the existing situation in terms of channel orientation and improve the erosion situation along Jackett Island through active management. It also has the benefit of limiting dredging within the more sensitive ecological areas of the spit. However, it would not result in the potential for the natural system to be restored and would need ongoing maintenance and monitoring costs unless alternative land management options were brought in over time that reduced the need for ongoing maintenance works.

3.5 New small channel dredging (PMUG Option)

This option is discussed in the draft report prepared by OCEL for the Port Motueka User Group (PMUG). The objective is to dredge a channel across the spit, based on the recommendation by Kirk (1991) to provide improved access to the port. The proposal as illustrated in Figure 7 and involves a channel 50 m wide set at 3 m below Nelson Vertical Datum (or approximately Mean Sea Level). They estimated some 132,500 m^3 of sand would need to be moved to form this channel and they identified that the existing channel would need to be closed off. OCEL proposed an extension of the gravel berm to the end of the existing training wall would be sufficient in combination with the flows from the inlet through the new opening being sufficient to reinforce the new channel position and that full closure of the existing channel would not be required. Sedimentation rates of between 14,250 and 23,750 m^3/yr were estimated by OCEL based on work done by Kirk (1991).

While not identified in the OCEL plan, their draft report identified that the material dredged for formation of the channel and ongoing maintenance could be used to replenish the foreshore of Jackett Island. This would be done by a cutter suction dredge with a slurry pump discharging to an area in the lee of the existing training groyne and then the sand transferred by truck to place along the Jackett Island shoreline.

We note the proposal does not cut off the existing channel and there is a risk that flows both from the inlet and the area to the north between the mainland and the spit may divert back into the existing channel should the new channel block or be less hydraulically efficient than the existing channel. The likelihood of this occurring would require additional assessment and modelling.

Initial costing of dredging is based on indicative costs of sand dredging of \$10/m^3 presented by OCEL for the Motueka Port Users Ltd included mobilization costs, but not any allowance for contingencies, engineering and environmental costs (design/contract supervision/monitoring etc) and also not for the costs of placement and shaping of sand along the Jackett Island shoreline. Therefore, OCEL's cost estimate of \$1.4M is unlikely to cover the actual costs of the proposed activities required to maintain the coastal edge along Jackett Island.

To provide a comparative costing assessment with our channel maintenance option we have included additional cost for P&G (10%), sand shaping and management along Jackett Island of \$8/m^3, 20% contingency and 30% for engineering and environmental management. The sand transfer is higher than the previous option as there is a longer haul required to move sand in this option. We have assumed 120,000 m^3 is transferred to the shoreline along Jackett Island. Based on this approach the preliminary estimates of initial cost of the PMUG option is in the order of \$3.7M.

Annual maintenance costs including the transfer of a portion of the sand to Jackett Island could range between \$200,000 and \$330,000 per annum. However, if the new channel functioned as desired, then there may be less need to transfer sand to Jackett Island and the by-passing would involve transfer of sand to a location down drift (south) of the new channel.

This option would work towards restoring the situation at the spit that existed prior to the geotextile groyne being constructed and would also provide a mechanism to manage erosion

along Jackett Island. It has a wider benefit than just for the management of erosion to Jackett Island residents.

Maintaining the flows through this channel location would result in the southern spit migrating towards land as the hydraulic control from the existing channel flow would not be present. This is likely to result in the southerly migration of the channel unless maintenance works were carried out to maintain the channel position in the original location.

There are risks associated with not addressing the closure of the existing channel that would need to be further assessed. This option also needs ongoing maintenance and monitoring both for the channel opening and the erosion along Jackett Island.

3.6 Reset of channel position

This option has the principle objective in setting up the system to a position where the spit dynamics could operate with no further human interference. This differs from the PMUG option in that there is no further maintenance works proposed. The reset option requires forming a major dredged channel through the Motueka Spit with the volume sufficient to provide a closure bund to the existing channel and to restore the Jackett Island shoreline to the 2000 position. The channel would need to be hydraulically efficient and the bund of sufficient volume to minimise the risk of the flows breaching and returning to the existing channel. This concept is shown in Figure 8. With this option, there is no ongoing maintenance proposed as the natural system would be replicated as far as possible, with nature dictating the ongoing development and movement of the channel, spit and bars. It is expected that over time the channel will drift to the south, moved by the southerly longshore drift and that the breach-and-channel-reset mechanism will operate as-and-when nature dictates.

There are currently no accurate estimates of volumes of this option as there is no hydrographic survey data available or studies done to assess the volume of material required to form the bund. However, assuming a similar order of sand is required as is to be placed along Jackett Island (say 110,000 m^3), the total volume required to be dredged is around 220,000 m^3. Assuming a 50 m wide bund with 8:1 side slopes and a crest level of 2 m above MSL and the average base around Chart Datum, the volumes required to form the bund could be up to 200,000 m^3. Therefore the upper bound of material required to be dredged could be in the order of 310,000 m^3. It is noted that this bund could be seen as a reclamation, even though the intention would be to allow nature to take its course and over time the bund could erode or its position be modified by natural processes.

The sand to form the bund and to use for restoring Jackett Island would need to be double handled, similar to the PMUG option. A rate of \$10/m^3 has been assumed for the initial dredging and an additional \$10/m^3 for the formation of the bund and transfer to Jackett Island, reflecting the potentially greater costs required to form the bund. Contingencies for this option have also increased to 50% for the lower bound and 30% for the upper bound volumes reflecting the lack of current lack of certainty on this option. Indicative costs for the reset option range from \$8.3M to \$10.5M.

This is a significant option, with both dredging and forming of a reclamation (the bund). The works extend through the existing spit, affecting the existing values and attributes of the spit. This would create extensive consenting issues that would need to be worked through. However, as a one off “reset” with no further works/maintenance proposed, might reduce effects that ongoing maintenance works would create. There may be less direct benefit to the port community for this option, unless they continue with the maintenance dredging regime.

3.7 Training Groynes with nourishment from existing channel maintenance

This option is an extension of the existing channel maintenance option. In this instance the placed sediment would be stabilized by the construction of channel training groynes. These groynes would extend along the seaward edge of Jackett Island to move the tidal currents away from the existing shoreline. The issue with these type of structures is that they can transfer erosion effects down drift as sediment is locked up by the structures. This means that they will need to extend along the seaward edge of Jackett Island and most likely extend along Kina Peninsula. Figure 9 shows an indication of the typical configuration, with 250 m long groynes along the majority of the Jackett Island shoreline at 500 m centres, with the length reducing towards the southern end and Kina to enable a transition to natural shores. We note that these are indicative only and would need further analysis and testing.

The groynes could be constructed using a similar construction methodology to the existing training groyne (concrete panels and steel) or from rock armour. Costing of these structures has been done assuming a rock armour structure 4 m high with 1.5:1 side slopes and a crest width of 2.5 m and a rock armour costing of $\$90/m^3$ based on recent rock revetment works at Ruby Bay. An additional allowance of 10% of the rock costs has been included for geotextile and associated works. This equates to a linear metre cost of around $3,350 for a rock groyne. We note alternative structures may be lower cost, but have used this rate to provide an initial estimate of costs. The total length of groynes shown on Figure 9 is around 1,680 m.

The costs for these works using a similar allowance for P&G, contingency and engineering and environmental design as the channel maintenance option results in a cost of around $12M for this option. It is anticipated that ongoing maintenance costs would be low, but may still be in the order of $50,000 to $100,000 per annum.

There are significant issues that will need to be addressed with this option, including the potential risks to the down drift (northern) coastline. Extensive studies and assessments would be required. The structures would also create significant visual impacts and be problematic with regard to gaining consent.

3.8 Seawall (land protection)

This would be a substantial structure, occupying the existing upper beach extending around the majority of the island's perimeter. The structure would have a similar appearance to the seawalls recently constructed at Ruby Bay. They would create issues of access and visual amenity and may also result in down drift erosion effects as they would reduce the volume of sand transferred to the south.

Based on the Ruby Bay seawall rock costs and taking into account the more challenging access location, a rock revetment would cost in the order of $2,000 to $3,000 per linear metres and would need to extend along some 2000 m of shoreline. Costs for this option, excluding access ways, etc would be in the order of $6M to $10M.

There are significant issues that will need to be addressed with this option, including the potential risks to the down drift (northern) coastline. Extensive studies and assessments would be required. The structures would also create significant visual impacts and be problematic with regard to gaining consent.

3.9 Alternative options

It is possible to place sand from another source along the Jackett Island shoreline. However, this option does not adequately address the causes of erosion. Without modifying the channel

location the rates of erosion that could occur would be significant and would create a larger requirement for ongoing maintenance. The cost of imported sand and transportation would also be significant. Sand haulage for the recently constructed sand bag wall along the Van Dyke property was around $28/m^3$. This did not include the cost for the sand. The processed sand used for the Oriental Bay beach nourishment that was brought to site by barge cost the order of $90/m^3$. Therefore costs in range of $60/m^3$ to $100/m^3$ for imported sand is possible. This is a 6 to 10 fold increase in the local sand source rate.

There are alternative locations for a dredged channel through the spit than those shown for the options presented in this report. However, the success of a successful channel breach is that it provides a preferable alternative for the flows leaving and entering the inlet and that it provides sufficient sand volume to restore the seaward edge of Jackett Island. Without some form of bund to prevent flows re-establishing along the existing channel there is a risk that these options will not be successful in the long term.

3.10 Summary

All long term physical work options have significant cost and impact on the physical environment. Options that maintain the channel (existing channel maintenance and the new small channel dredging) have increased benefit to the wider community through improving access to the Port. However, sand transfer and small scale channel improvement options also have the greatest risk of failing to meet the required objectives unless ongoing maintenance is included. Therefore these options have a greater ongoing cost. Hard protections works have a high cost and high risk in terms of gaining consent approval. The reset option has a significant initial effect, but provides an option that could have no ongoing maintenance costs.

Asset relocation and/or planning responses should be considered as part of any long term plan for this area.

4 Applicability

This report has been prepared for the benefit of Tasman District Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
Richard Reinen-Hamill	Tim Fisher
Senior Coastal Engineer	Project Director

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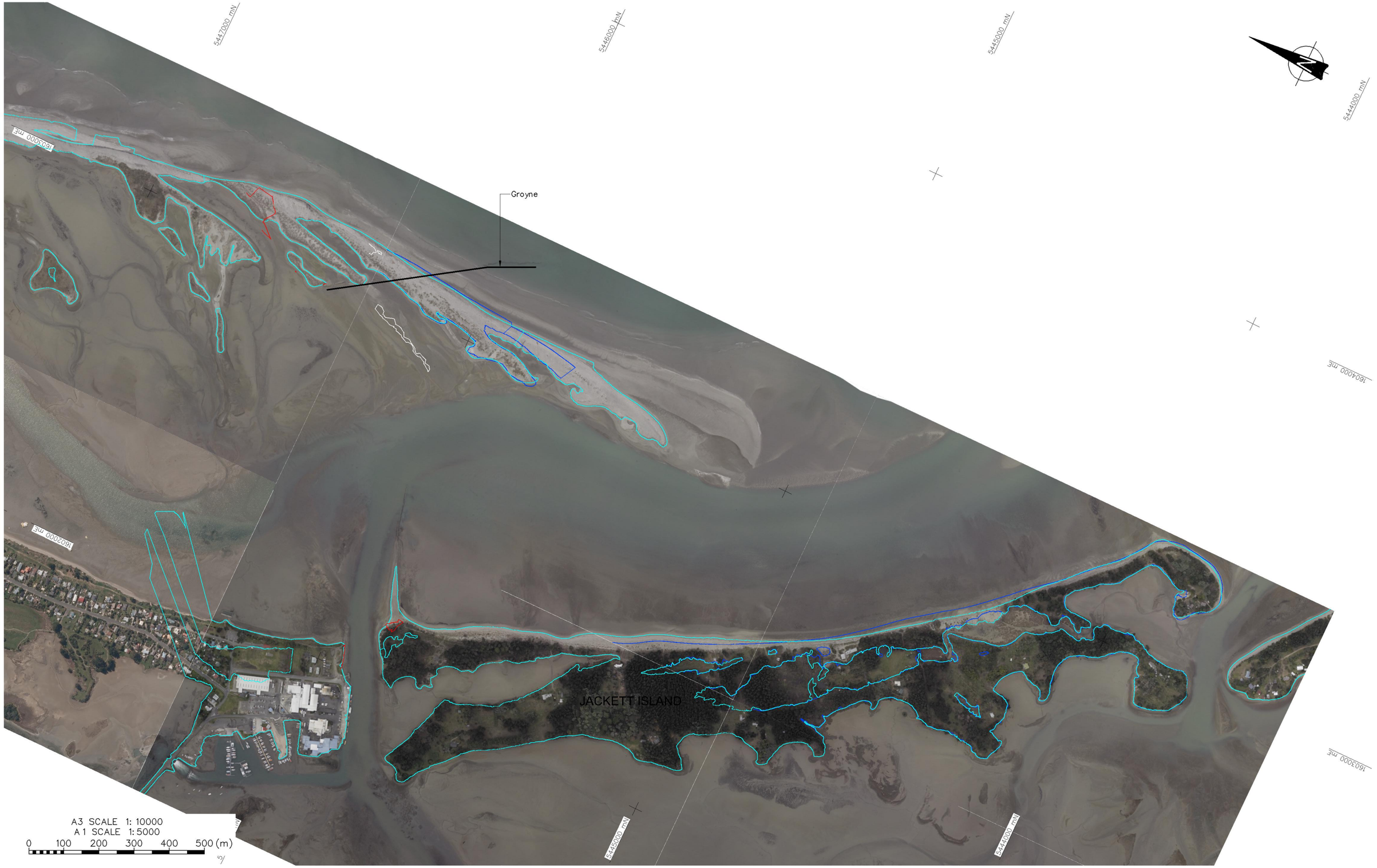
Appendix A: Changes to the Spit from 1993 to 2011



LEGEND

- Hydrographic Surveys 1993
- Hydrographic Surveys 1997
- Hydrographic Surveys 2001
- Hydrographic Surveys 2008
- Hydrographic Surveys 2011

NOTES:

1. All dimensions in metres unless noted otherwise
2. Aerial photo supplied by Tasman District Council dated 2011
3. Hydrographic survey data (1993, 1997 and 2001) supplied by Eliot Sinclair
4. Hydrographic survey data (2008 and 2011) Supplied by Tasman District Council.
5. Horizontal Datum: NZTM, New Zealand Transverse Mercator
   Vertical Datum: Chart Datum, 2.20m below MSL/Nelson VD 1955,
   Origin of Levels: N60 (AC4J) Rothmans Monument, RL 6.452

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APPROVED		
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SCALES (AT A1 SIZE)	AS SHOWN	
PROJECT No.	27882	

TASMAN DISTRICT COUNCIL

JACKETT ISLAND

Hydrographic Surveys 4.2m Contour for (1993, 1997, 2001, 2008 and 2011)

FIG. No. Figure 1

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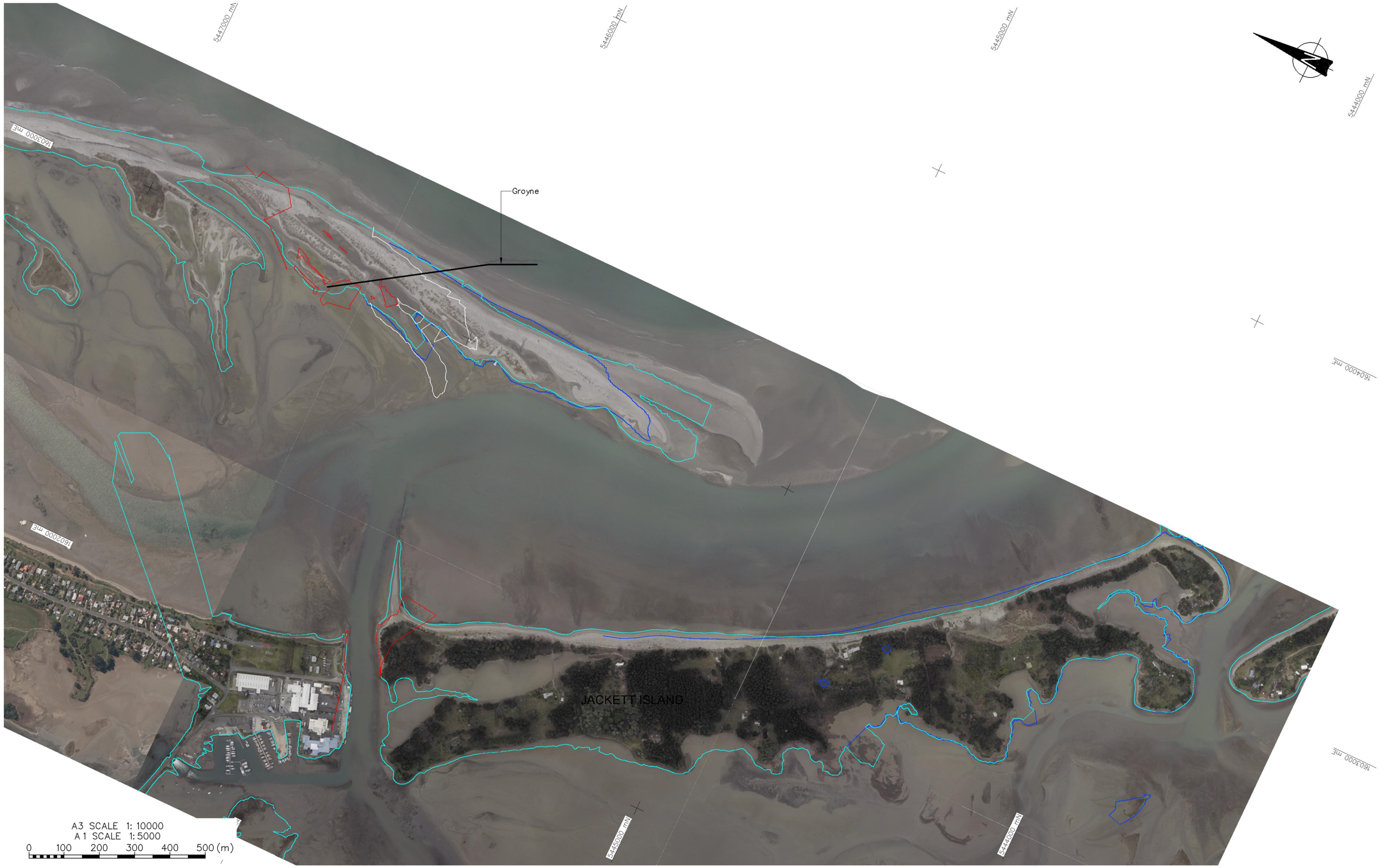

A3 SCALE 1: 10000
A1 SCALE 1: 5000
0 100 200 300 400 500 (m)

LEGEND

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- Hydrographic Surveys 1997
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JACKETT ISLAND

Hydrographic Surveys 3.2m Contour for (1993, 1997, 2001, 2008 and 2011)

FIG. No. Figure 2

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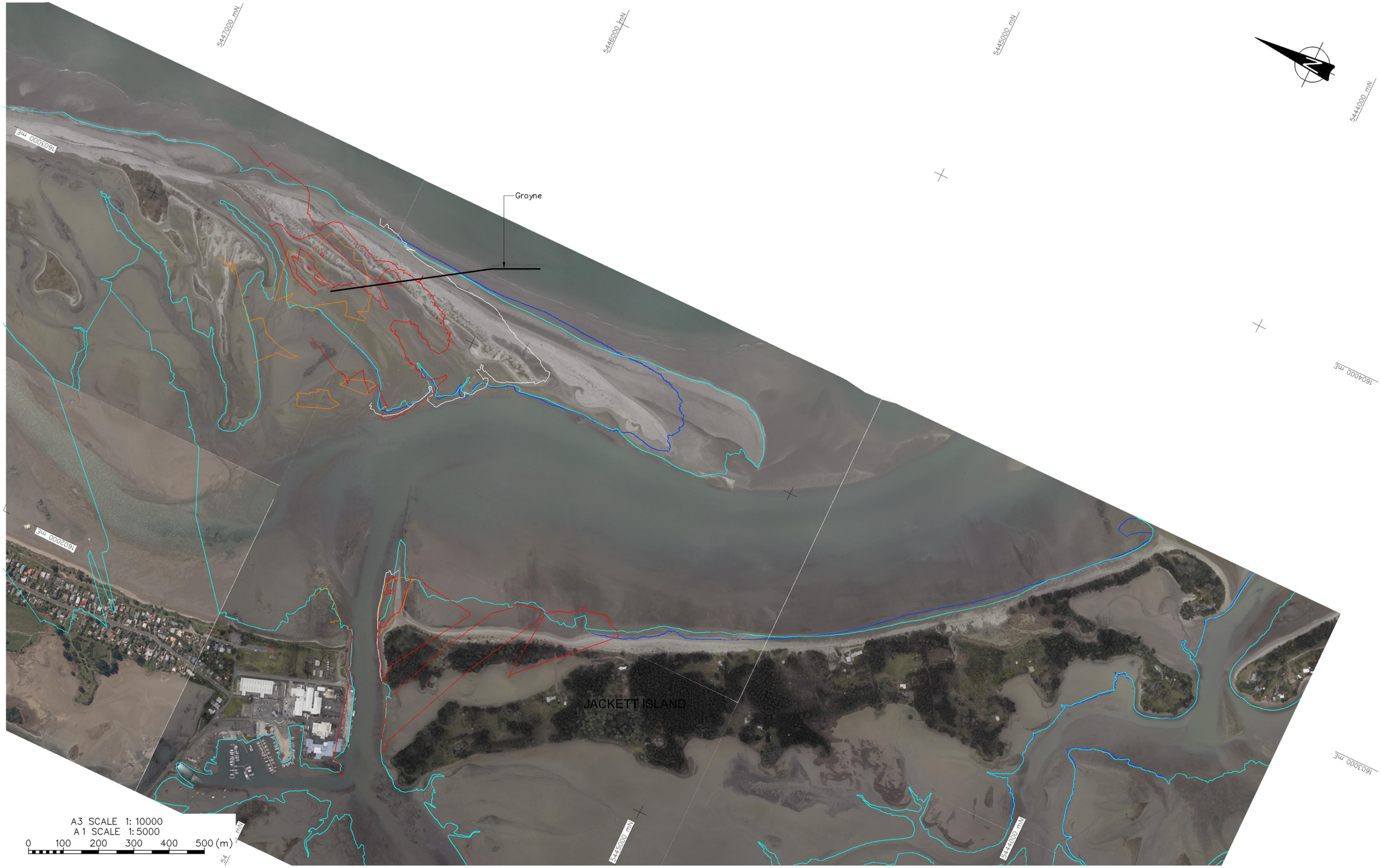

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SCALES (AT A1 SIZE)	AS SHOWN	
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JACKETT ISLAND

Hydrographic Surveys 2.2m Contour for (1993, 1997, 2001, 2008 and 2011)

FIG. No. Figure 3 REV. 0

5447000 mN

5446000 mN

5445000 mN

5444000 mN

1603000 mE

1602000 mE

1604000 mE

1603000 mE

Groyne

JACKETT ISLAND

5445000 mN

5444000 mN

A3 SCALE 1: 10000
A1 SCALE 1: 5000

0 100 200 300 400 500 (m)

LEGEND

- Hydrographic Surveys 1993
- Hydrographic Surveys 1997
- Hydrographic Surveys 2001
- Hydrographic Surveys 2008
- Hydrographic Surveys 2011

NOTES:

1. All dimensions in metres unless noted otherwise
2. Aerial photo supplied by Tasman District Council dated 2011
3. Hydrographic survey data (1993, 1997 and 2001) supplied by Eliot Sinclair
4. Hydrographic survey data (2008 and 2011) Supplied by Tasman District Council.
5. Horizontal Datum: NZTM, New Zealand Transverse Mercator
   Vertical Datum: Chart Datum, 2.20m below MSL/Nelson VD 1955,
   Origin of Levels: N60 (AC4J) Rothmans Monument, RL 6.452

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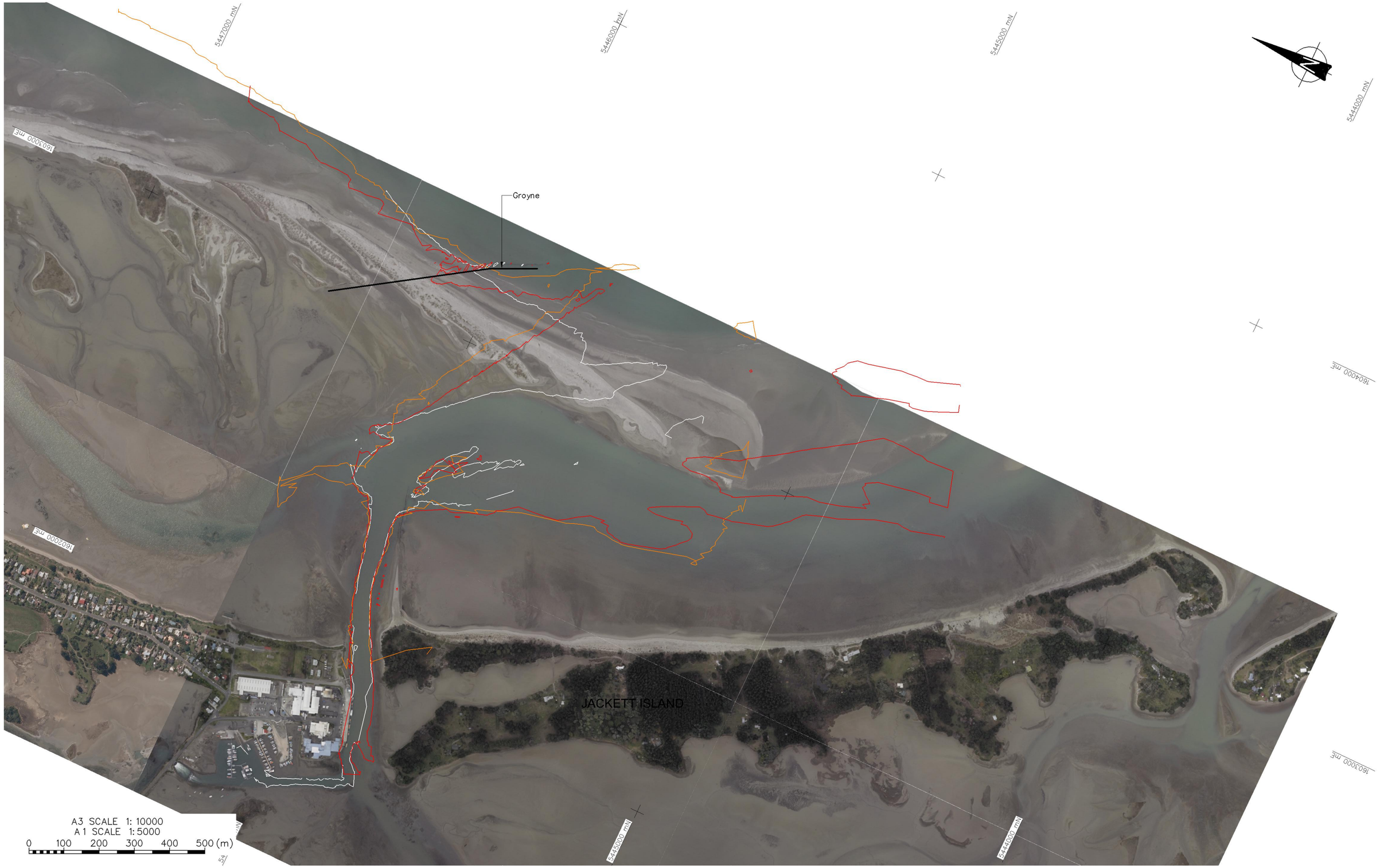
Hydrographic Surveys 1.2m Contour for (1993, 1997, 2001, 2008 and 2011)

FIG. No. Figure 4

REV. 0



LEGEND

- Hydrographic Surveys 1993
- Hydrographic Surveys 1997
- Hydrographic Surveys 2001
- Hydrographic Surveys 2008
- Hydrographic Surveys 2011

NOTES:

1. All dimensions in metres unless noted otherwise
2. Aerial photo supplied by Tasman District Council dated 2011
3. Hydrographic survey data (1993, 1997 and 2001) supplied by Eliot Sinclair
4. Hydrographic survey data (2008 and 2011) Supplied by Tasman District Council.
5. Horizontal Datum: NZTM, New Zealand Transverse Mercator
   Vertical Datum: Chart Datum, 2.20m below MSL/Nelson VD 1955,
   Origin of Levels: N60 (AC4J) Rothmans Monument, RL 6.452

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Hydrographic Surveys 0.2m Contour for (1993, 1997, 2001, 2008 and 2011)

FIG. No. Figure 5

REV. 0

Appendix B: Sketches of potential solutions

Groyne to be removed progressively

Extraction area up to 110,000 m^3 initially then 6,000 to 10,000 m^3/yr

Area of sand placement (110,000 m)

JACKETT ISLAND

5447000 mN
5446000 mN
5445000 mN
5444000 mN
1602000 mE
1603000 mE
1604000 mE

A3 SCALE 1: 10000
A1 SCALE 1: 5000
0 100 200 300 400 500 (m)

LEGEND

- Hydrographic Surveys 2011 (Contour Interval 0.5m)
- 1.0 Hydrographic Surveys 2011 (Contour Interval 1.0m)
- Extraction Area
- Area of Sand Placement

NOTES:
1. All dimensions in metres unless noted otherwise
2. Aerial photo supplied by Tasman District Council dated 2011
3. Hydrographic survey data 2011 Supplied by Tasman District Council.
4. Horizontal Datum: NZTM, New Zealand Transverse Mercator
   Vertical Datum: MSL/Nelson VD 1955, 2.20m above Chart Datum,
   Origin of Levels: N60 (AC4J) Rothmans Monument, RL 6.452

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Potential Solutions

Existing Channel Maintenance

FIG. No. Figure 6

REV. 0

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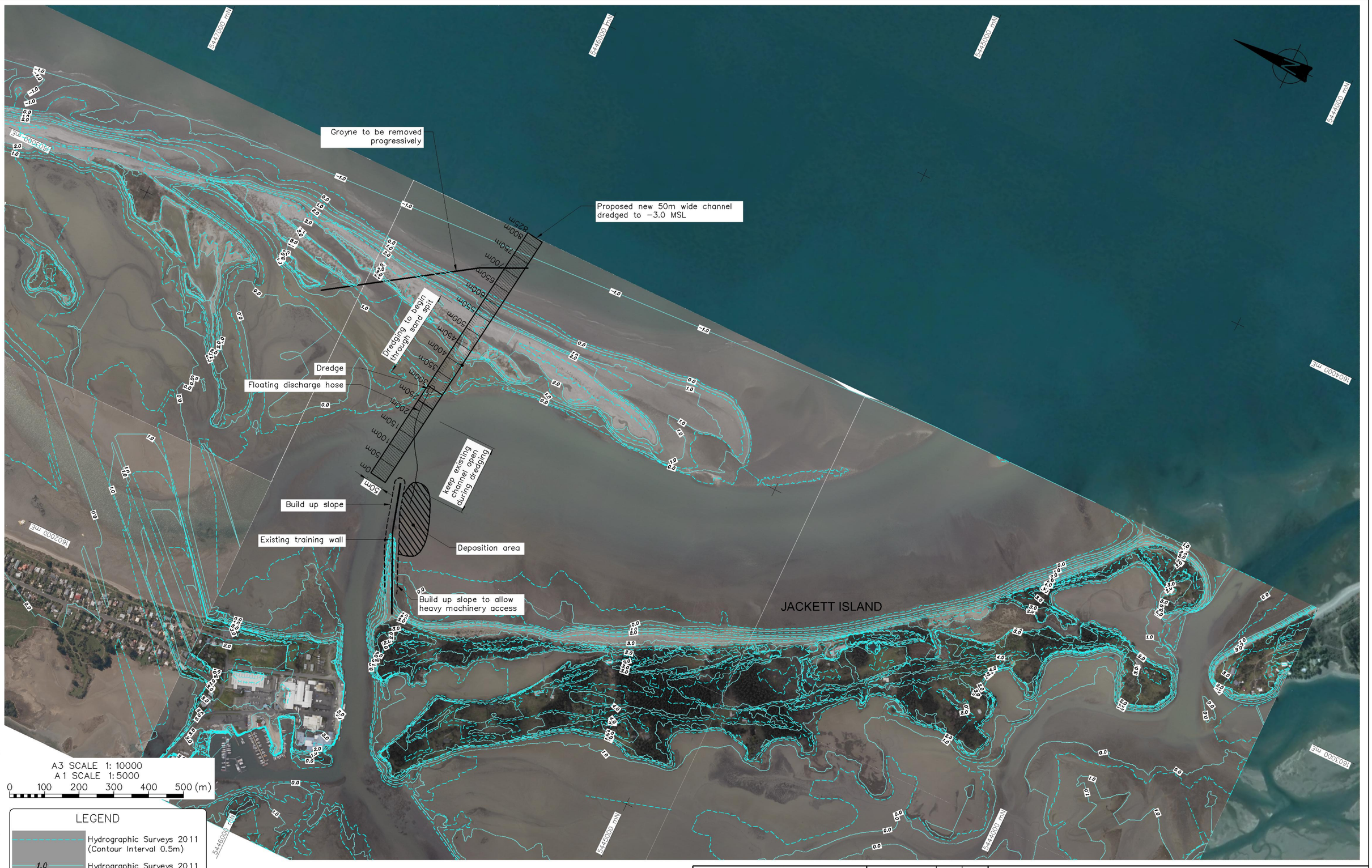

A3 SCALE 1: 10000
A1 SCALE 1:5000
0 100 200 300 400 500 (m)

LEGEND

- Hydrographic Surveys 2011 (Contour Interval 0.5m)
- 1.0 Hydrographic Surveys 2011 (Contour Interval 1.0m)
- Proposed Channel Dredge
- Deposition Area

NOTES:
1. All dimensions in metres unless noted otherwise
2. Aerial photo supplied by Tasman District Council dated 2011
3. Hydrographic survey data 2011 Supplied by Tasman District Council.
4. Horizontal Datum: NZTM, New Zealand Transverse Mercator
   Vertical Datum: MSL/Nelson VD 1955, 2.20m above Chart Datum,
   Origin of Levels: N60 (AC4J) Rothmans Monument, RL 6.452
5. Channel layout Design by OCEL NZ limited, dated July 2011, reference data "DR−081117−004 rev 1" for Port Motueka Users Group (PMUG)

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Potential Solutions

New Small Channel Dredge (PMUG)

FIG. No. Figure 7

REV. 0

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Groyne to be removed progressively

Excavated channel sized to provide sufficient sand for bund and Jackett Island nourishment. Cross-sectional area sized to replicate existing channel

Sand bund closing off existing channel

Area of sand placement (110,000 m^3)

JACKETT ISLAND

5447000 mN
5446000 mN
5445000 mN
5444000 mN
1602000 mE
1603000 mE

A3 SCALE 1: 10000
A1 SCALE 1: 5000
0 100 200 300 400 500 (m)

LEGEND

- Hydrographic Surveys 2011 (Contour Interval 0.5m)
- 1.0 Hydrographic Surveys 2011 (Contour Interval 1.0m)
- Area of Sand Placement
- Excavated Channel
- Sand Bund

NOTES:
1. All dimensions in metres unless noted otherwise
2. Aerial photo supplied by Tasman District Council dated 2011
3. Hydrographic survey data 2011 Supplied by Tasman District Council.
4. Horizontal Datum: NZTM, New Zealand Transverse Mercator
   Vertical Datum: MSL/Nelson VD 1955, 2.20m above Chart Datum,
   Origin of Levels: N60 (AC4J) Rothmans Monument, RL 6.452

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JACKETT ISLAND

Potential Solutions

Reset of Channel Position

FIG. No. Figure 8

REV. 0

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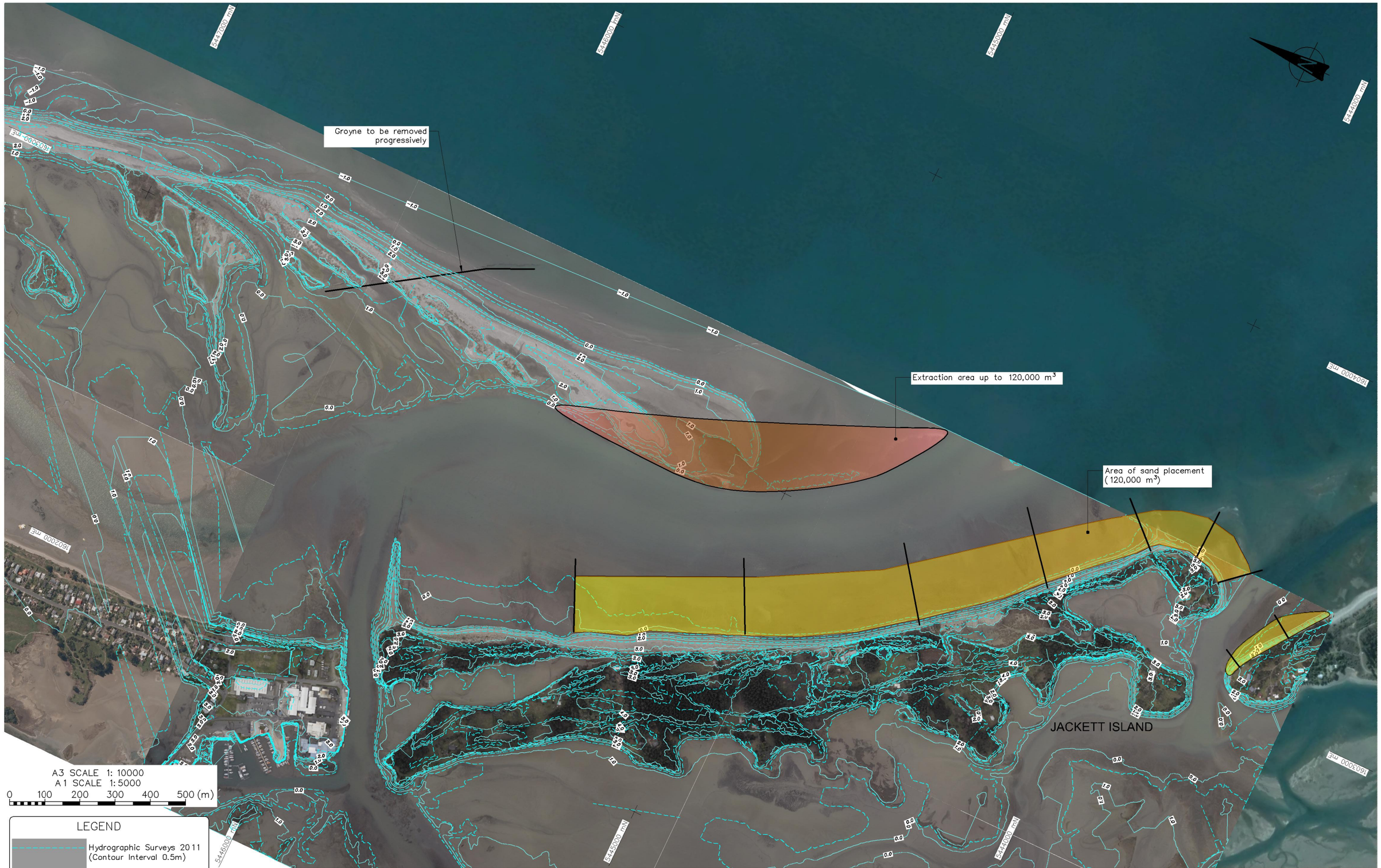

A3 SCALE 1: 10000
A1 SCALE 1: 5000

0 100 200 300 400 500 (m)

LEGEND

- Hydrographic Surveys 2011 (Contour Interval 0.5m)
- 1.0 Hydrographic Surveys 2011 (Contour Interval 1.0m)
- Extraction Area
- Area of Sand Placement
- Training Groynes

NOTES:
1. All dimensions in metres unless noted otherwise
2. Aerial photo supplied by Tasman District Council dated 2011
3. Hydrographic survey data 2011 Supplied by Tasman District Council.
4. Horizontal Datum: NZTM, New Zealand Transverse Mercator
   Vertical Datum: MSL/Nelson VD 1955, 2.20m above Chart Datum,
   Origin of Levels: N60 (AC4J) Rothmans Monument, RL 6.452

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JACKETT ISLAND

Potential Solutions

Training Groynes with Nourishment

FIG. No. Figure 9

REV. 0