MARIA CREEK
SUSTAINABLE INFRASTRUCTURE PROJECT
Question and Answer (Q & A)

These Q & A have been prepared to reflect key items identified through submissions to the Community Focus Group, as well as other Frequently Asked Questions from community members.

1. Throughout the Community Focus Group review there have been a few references to treating the 'symptom' and not the 'cause'. What does this mean and what are the key drivers that lead to sand and wrack accumulation at the Maria Creek?

The 'symptom' is a shallow entrance channel that has been blocked with sand and wrack build up. This symptom is relatively straightforward to understand, as we can see the impact that sand and wrack build up has on navigation within the Creek.

The physical drivers that 'cause' this symptom are much less obvious, as they can occur over long timeframes and often occur during severe weather. Understanding the causes of the wrack and sand build up is necessary to appropriately assess any management options and viability of any reinstate pathway. There are two key 'causes' of the Maria Creek closure, which we will consider in a bit more detail:

- **Sand:**
  - Sand naturally moves north, **saturating the southern breakwater** (i.e. the shoreline has moved seaward to the end of the breakwater).
  - This allows sand to move directly across the entrance channel as a sand bar, reducing depths.

- **Wrack:**
  - **Storm waves and winds** push seagrass wrack into the creek during Autumn and Winter.
  - Wrack settles within the calmer waters of the entrance channel.

These 'causes' are responsible for the 'symptom' of the blocked channel and unusable facility.

It is really important that whenever we are considering any novel proposals or concept options for reinstatement, that we go back to the key issues and causes (including key physical drivers) that lead to sand and wrack accumulation at the site.

Any novel proposals that do not address the key causes above, such as options that do not address the saturation of the southern breakwater and attempt to remove sediment only from within the channel, are unlikely to be effective in the long run. In other words, options that simply treat the symptom and not the key causes are more reactive management approaches and are unlikely to work.

Let's break these two causes down further.

Sand – Saturated southern breakwater

A key driver of sediment accumulation within the creek is the saturated southern breakwater. Sand has been accumulating to the south of the Maria Creek breakwaters since the facilities construction. Weather events in 2016 accelerated the sand movement to the north, leading to saturation of the southern breakwater in 2017.

With a fully saturated southern breakwater, sand volumes in the order of 30,000m^3 – 50,000m^3 per year will naturally flow across the channel entrance through the formation of a sand bar. This impacts directly on navigation at the creek entrance and results in increased sediment availability for wave and current transport directly into the creek (remembering that the creek is a net importer of sediment). This is shown in the photo below:

So, why can't we just dredge the entrance but leave the breakwater saturated?

The suggested approach would be a prime example of treating the symptom (i.e. the blocked channel) and not the cause (i.e. the saturated southern breakwater). With a fully saturated southern breakwater, around 30,000m^3 – 50,000m^3 of sand moves across the entrance each year. Any attempt to reactively manage the sand by removing sand only from the entrance will continue to have entrance depths impacted by the sand bar. This has several significant impacts:

- Sand bar formation immediately impacts on navigation, requiring **reactive daily (24/7) management**.
- **Very high costs**, with equipment required on site 24/7 and full-time management from Council staff, Contractors and/or Consultants.
- **Environmental impacts and approvals** are difficult to manage, with no break from active sand management.

Ultimately, any viable concept to reinstate the facility as a sustainable and long-term solution, needs to:

- address both the existing saturation of the southern breakwater (removal of approximately 300,000m^3 to create a buffer), and
- appropriately manage annual sediment transport (bypassing of 30,000-50,000m^3 per year).

This is shown in the photo below:

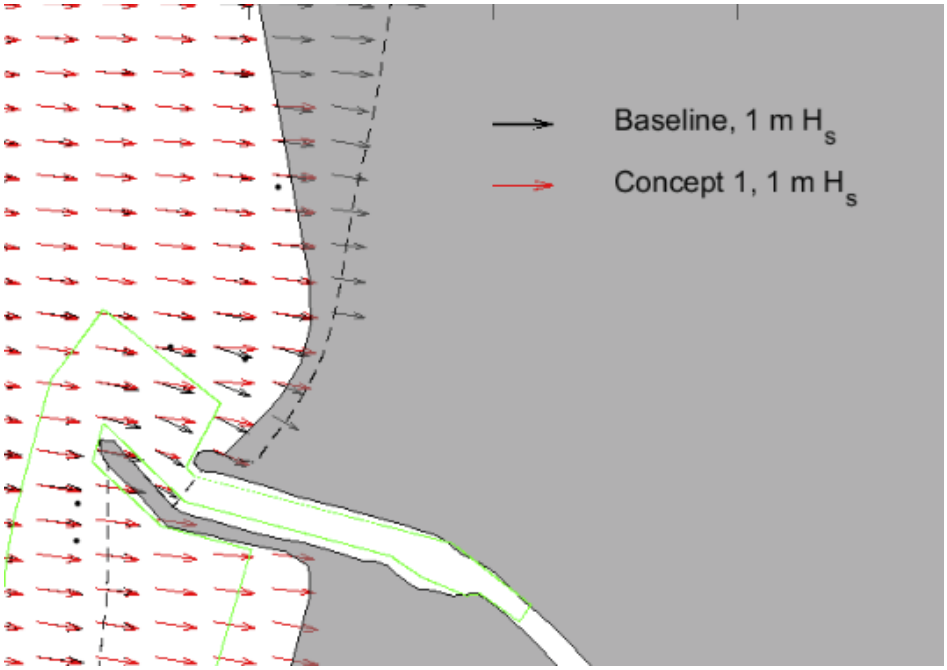
Physical Driver – Wrack Accumulation

There has been keen interest in the considerable loss of seagrass coverage within Lacepede Bay over the past 5 years, exposing the underlying sand, allowing greater volumes of sand to move north. This also allows greater wave action within the nearshore environment of Lacepede Bay.

In addition to the 30,000m^3 – 50,000m^3 of sand management, approximately 30,000m^3 of seagrass wrack management is required each year. It is important that we understand the physical drivers of wrack accumulation, as this is key when considering the effectiveness of any reinstatement option.

The key driver of wrack accumulation within the channel is storm winds and waves which mobilise wrack into the creek channel. The general process is outlined below:

- Wrack is mobilised offshore by storm events, typically in Autumn and early Winter;
- Storm winds and waves keep wrack on surface and push it onshore;
- Existing entrance is exposed from westerly to northerly storm conditions;
- Wrack settles out within the sheltered creek where wave and wind energy decreases.



The modelling diagram above shows the effect of storm direct on wrack accumulation within the channel. Any concept option should aim to reduce storm wind and wave exposure where possible.

2. Seems like none of the options put forward are acceptable and are far too expensive. Why can't we just keep doing what we were doing? Seemed cheaper than all these options? (BM)

As mentioned in the question above, once the southern breakwaters were fully saturated (i.e the shoreline moved seaward of the end of the breakwater), reactive management of the facility, as seen over the past 20 years, was not going to be able to maintain a usable facility.

Whilst there was historically a buffer on the southern side, this meant that only small amount of material entered the channel and required removal. We started to see the full impacts (both sand and wrack) on navigation after the saturation of the southern breakwater in 2017.

As the community would be aware, Council attempted to reopen the facility in 2017/18 with a significant 6 week excavation campaign. The facility was unable to be reopened at the time due to the significant volumes of sand moving into the entrance from the south. This was due to a sand bar forming across the entrance from the saturated southern breakwater.

Given the community pressure and discontentment at the closure of the facility, Council committed significant resources (financial, contractual and staff) in an attempt to open this facility in 2018/19. Whilst this resulted in opening of the facility in December 2018 for approximately 8 weeks and an additional campaign to reopen the facility for the Easter Fishing Competition in April 2019, the campaigns were extremely challenging to manage because of the reactive management of the sand within the creek and complexities of water quality and constant works presence on site. In other words, this was treating the 'symptom' (i.e. blocked channel) and not the 'cause' (i.e. full saturation of the southern breakwater).

The challenges with the 2018/19 campaign included:

- EPA dredging licence, dredging approval with associated Dredging Management Plan (DMP) requirements;
- Sediment ponds on northern side for dredge and seagrass (requirement of DMP);

- Silt curtains required to be installed and managed;
- Water quality testing at key locations 24/7 before, during and after campaign;
- Excavator could only be used on outgoing tides due to water quality and sensitive environment (regularly, contractor would mobilise to dig for 1 hour commencing anywhere from 4am-7am and then stop due to tides);
- Engineering of 'seagrass rake' attachment for material to be removal from middle of channel (unable to be reached by 2 long reach excavators from each side);
- Sand and seagrass would mobilise into channel faster than it could be removed;
- Barely maintained a navigable channel and was subject to tide level and daily inflows, often with shallowing of entrance;
- Constant presence and management of entrance was required, to the point where the contractor would have to excavate a path for returning boats upon their approach;
- Seagrass management on southern side of jetty and north of breakwater to reduce inflows into channel;
- Estimated 35,000m^3 sand and seagrass removed from within the channel (upon reflection, this aligns with anticipated sediment transport expected into channel whilst breakwater at saturation);

A Buffer of 24,000m^3 (equivalent of 10 Olympic sized pools) was also created on southern side in attempt to ensure facility remained navigable (see photo below). **This buffer was filled within 9 days:**

Whilst this campaign did allow the facility to open for a period during peak season, as well as for the Easter Fishing Competition with an additional campaign immediately prior, it was at a reduced service capacity with hazards often present due to the constant changes in sediment build up within the channel. Conditions changed rapidly and were unpredictable.

Realistically, the costs incurred (whilst not insignificant at $316,666 for approximately 12 weeks of open facility) do not reflect the full extent and challenges of the campaign, as the contractor was not charging the full cost to the Council for lost time, machinery mobilisation and staff/machinery standby.

To try and maintain a useable and navigable facility without addressing the saturation of the southern side, as well as repairs required to the breakwater structures themselves, is realistically unachievable – not only financially, but operationally. It is reiterated that the challenges at the facility are extremely complex and cannot be considered in isolation.

3. As a child I did my swimming lessons off the jetty and there was plenty of depth to jump from the top. When I was last in Kingston I was shocked to see the sand movement. What I did notice is that the "white holes" in the weed as I knew them seem to be considerably larger than they were in the 80's and 90's. Is the seaweed coverage decreasing the cause of the sand shifting? (PR FB)

The changes to the coastal environment within Lacepede Bay within recent years has been raised by a number of community members, both through the Maria Creek Sustainable Infrastructure Project as well as the Kingston District Coastal Adaptation Strategy. Specifically, the FAQ for the Kingston CAS in October 2020 included the following:

A number of community members identified that the coastal environment within Lacepede Bay has changed significantly in recent years. What has caused this change?

- There has been considerable loss of seagrass coverage within Lacepede Bay over the past 5 years, exposing the underlying sand, allowing greater volumes of sand to move north. The loss of seagrass also allows more wave action at the shore.
- Through 2016, a number of significant storm events eroded the beach and dune by up to 15m at Wyomi Beach, releasing a large 'slug' of highly mobile sand which was able to be transported north.
- Ongoing sand bypassing of Cape Jaffa Marina has returned more sand to the system, which moves north and needs to be managed.

What has caused the loss of seagrass and can it be replanted?

- Seagrass coverage is believed to have been affected by poor water quality caused by outflows from various drains along the Kingston coastline, including Maria Creek.
- Climate change is also likely to be a factor. Seagrass can be impacted by increasing water temperatures, and more severe and frequent storms.
- Replanting of seagrass is possible in some cases, however it is often difficult, costly and has a variable success rate. Coastal environments exposed to swell, such as Lacepede Bay, are particularly challenging for seagrass replanting.
- The loss of seagrass in coastal environments is an issue across the state. Ongoing support and funding is being directed at improving technologies and expertise in this area.

4. Why have the pontoons at the existing Maria Creek ramp been removed? (CW / KJ FB)

At the Community Focus Group meeting of 21 September 2020, the temporary removal of the pontoons was discussed and approved by the group. The removal of the pontoons is in an effort to preserve the pontoons which were under stress from the seagrass accumulation, as well as to allow the trapped seagrass to mobilise where possible. If the pathway is to progress reinstatement of facility, then they would have needed to be removed anyway. The recommendation of Community Focus Group was to remove and store at Council depot.

As a result, these pontoons were removed in early 2021 and were cleaned prior to being stored at the Kingston Council depot. Some mobilisation of trapped seagrass has already been observed since removal. Unfortunately, these pontoons are unable to be reused at an alternate location as considered through previous Q & A.

5. Was further investigation done into a finger jetty off the end of a modified Southern breakwater? It seems easily dismissed in the Concept Study report? (PK FB)

A single Lane ramp and finger jetty concept was considered through the review of alternate locations and was not recommended to be pursued in the study. The Community Focus Group did not raise this location or option as an item for further investigation or review, and as such further technical analysis has not been undertaken to date.

Broadly speaking, the study had four (4) key objectives which extended further than the boat launch facility in isolation and included:

1. Provide a boat ramp during peak times (October to May), that is financially sustainable (low maintenance) through an affordable capital solution.
2. Provide a jetty that services the needs of community and visitors.
3. To create an opportunity to activate open spaces and facilities, specifically the area between the jetty and breakwaters.
4. Consider the effects of the natural processes and the coastal environment.

This particular option (being for an 'alternate location') was only considered an option under the 'Do Nothing' approach/pathway, which is identified to have a negative effect on the jetty sand accumulation and therefore broader study objectives.

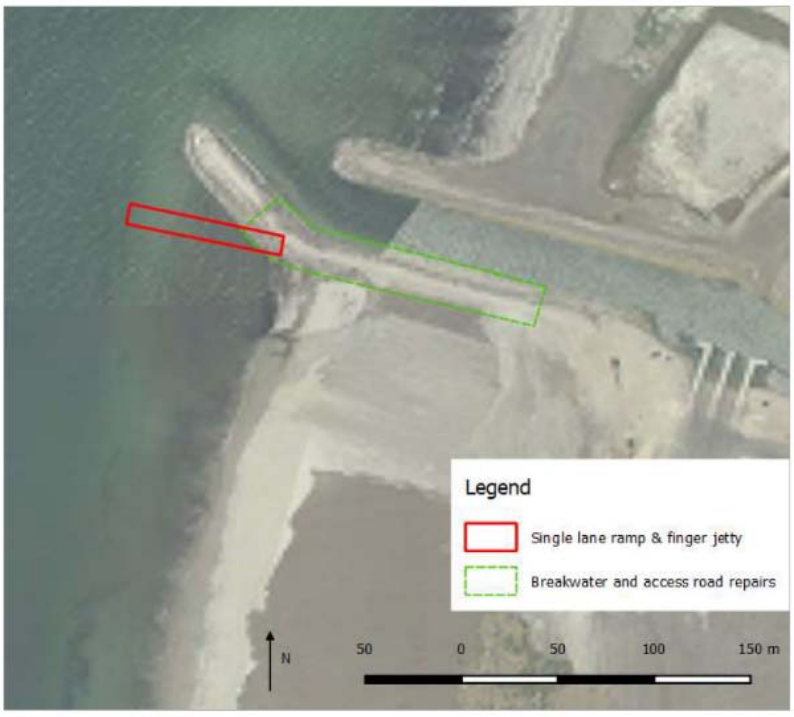


Figure 23: Single lane ramp and finger jetty concept at end of southern breakwater

There were a number of other limiting factors to this alternate option, including:

- High risk nature of an approximate 300m reverse along the breakwater;
- Costs of breakwater repairs required to ensure the access road is in a suitable condition for ongoing use;

- Realistic accessibility and potential congestion during peak season, being a single lane ramp;
- Providing a turnaround and reversing area for boat trailers;
- Indicative cost of $7.5M (being comparable to costs of concept options put forward to reinstate the existing facility).

Additionally, without a protection structure to the south of the extension, the location would be exposed to S-SW events with floating pontoons generally not able to be located in open coastal waters due to wave/swell action.

The Community Focus Group did consider many alternate options, locations and novel ideas for boat launching in Kingston, however after significant analysis, the Community Focus Group determined that any alternate location would provide an inferior offering for a comparable investment and as a result, the preferred pathway was for reinstatement of the existing facility.

6. **Could you remove the groyne and replace it with a sea wall parallel to the shoreline, say 200m out (similar to Port MacDonnell)? Correctly positioned, it would provide protection and allow sand and weed migration to happen unimpeded from South to North. A parallel wall provides the ultimate protection for boaties. I don't think Wavelength raised this option. (PF)**

It appears that the Port MacDonnell location has a connected breakwater with an orientation that extends from the shoreline to be parallel to the shoreline (as seen below). The photo also shows that the breakwater is not saturated on the western side, so it will continue to trap sand and prevent it from entering the harbour from the west. A detached or offshore breakwater would allow sand to move directly into the harbour from the west, impacting navigation.

The photo shows the breakwaters protects the area from the SW wave action, however, Port MacDonnell has a very different site orientation in comparison to Kingston. We have also found that the area around Port MacDonnell, such as Carpenters Rocks, has lower sediment availability and thus transport than Kingston and has nearshore reefs and natural headlands that the breakwater is tied into.

Moving away from the example from Port McDonnell, offshore breakwaters were broadly considered in the Coastal Adaptation Strategy:

Offshore breakwaters are generally designed to dissipate wave energy impacting the shore. They are suited to locations where there is low or negligible net longshore sediment transport as they can limit the movement of sand downdrift.

They have high design and implementation costs and high maintenance options, and they would need to be modified over time for sea level rise to maintain their performance.

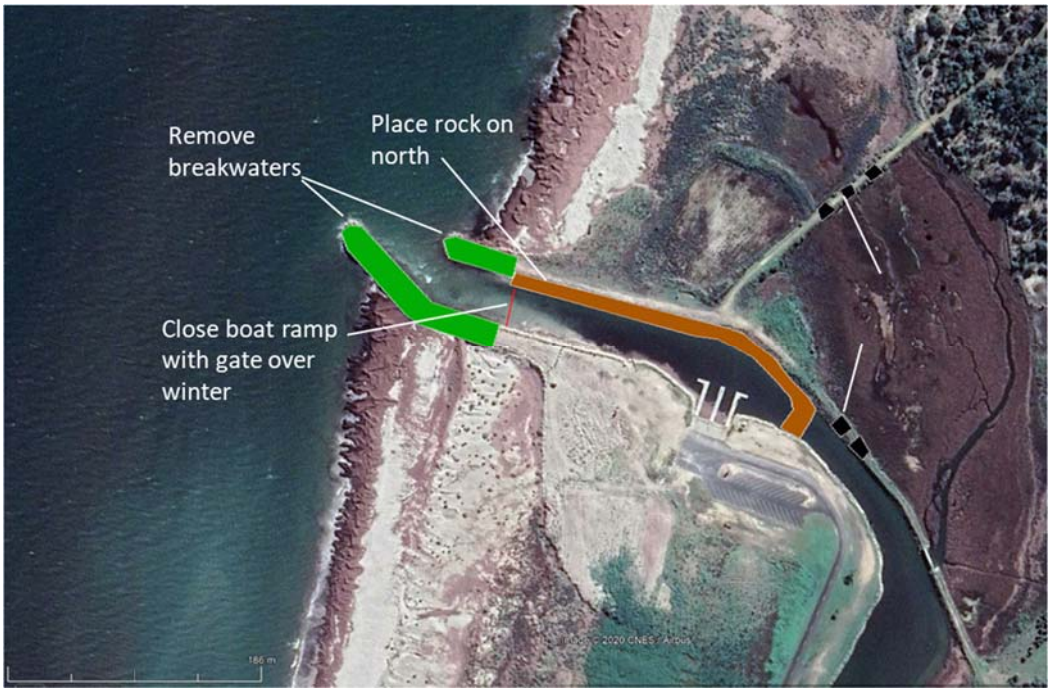
The existing offshore seagrass beds are located < 40m from the shoreline (defined as 0m AHD) and are protected under the Native Vegetation Act 1992. They would likely be directly and indirectly impacted by construction and on-going performance of these types of structures.

Given this, an offshore breakwater or artificial reef is likely not a viable option as it could have significant adverse impacts on longshore sediment transport, may not be effective in trapping sand where required and could potentially require the removal of a significant area of protected seagrass beds.

In the case of the Maria Creek, the removal of the existing breakwaters and replacement with an offshore breakwater would result in the loss of Maria Creek as a usable boat launching facility. The sand saturation level of the southern beach would remain at 100%, resulting in nearshore sediment transport accumulating within the Maria Creek channel in the protected wave shadow created by the offshore breakwater. This would encourage sand to settle out in the calmer waters behind the breakwater (in the entrance channel), leading to siltation within the channel and an unnavigable entrance.

Offshore breakwaters can be used successfully as an adaptation strategy (erosion protection) in some locations, however, is not a viable option for the challenges faced at Maria Creek.

7. **A community submission proposed to divert the creek flows and widen the creek channel (EL). A first pass assessment was provided at the Community Focus Group meeting and an overview of the assessment is provided:**



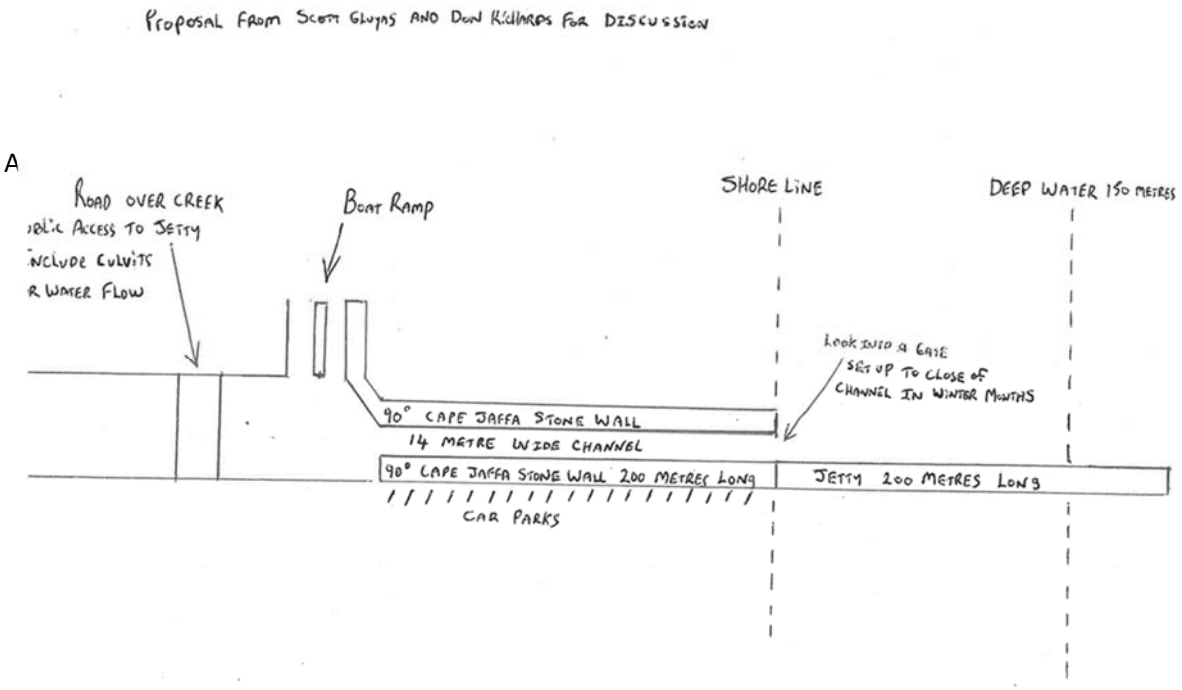
The proposed option was discussed at length in the Community Focus Group Meeting 4 held on 26 October 2020. There were a number of challenges identified in this proposal, which broadly included:

- Capital cost to remove breakwaters, cartage and placement on north ~$3.2M (doesn't include costs for culverts, ongoing maintenance, gates etc);
- Southern breakwater still at full saturation (i.e. doesn't treat the main cause of sand build up);
- Increased sand management costs (reactive management as no buffer on southern side):
  - Dredging of entrance in October
  - Maintain dredging full time from October to May to remain navigable
- Increased wrack from more exposed entrance;
- Requires management of two entrances (responsibility to ensure creek flows are maintained even if diverted);
- Potential environmental impacts of closing basin over winter due to low flushing rates;
- Significant impact on creek flows and flooding from culverts.

Given these challenges, this proposal was not recommended to be pursued further in the presentation by Wavelength. The community submission and this concept was put to the Community Focus Group who advised it had been adequately assessed and they did not require any further investigation into this particular concept.

Whilst it is acknowledged that the proposals put forward by members of the community have some merit in improving accessibility to the channel for reactive maintenance when required, the key driver of the saturated southern breakwater is not addressed, and therefore it is unlikely that the proposals will provide a viable or sustainable solution for the long term.

8. **A community submission proposed a significant infrastructure change including stone walls and jetty to allow for excavator access (SG/DR). A first pass assessment was provided at the Community Focus Group meeting and an overview of the assessment is provided:**

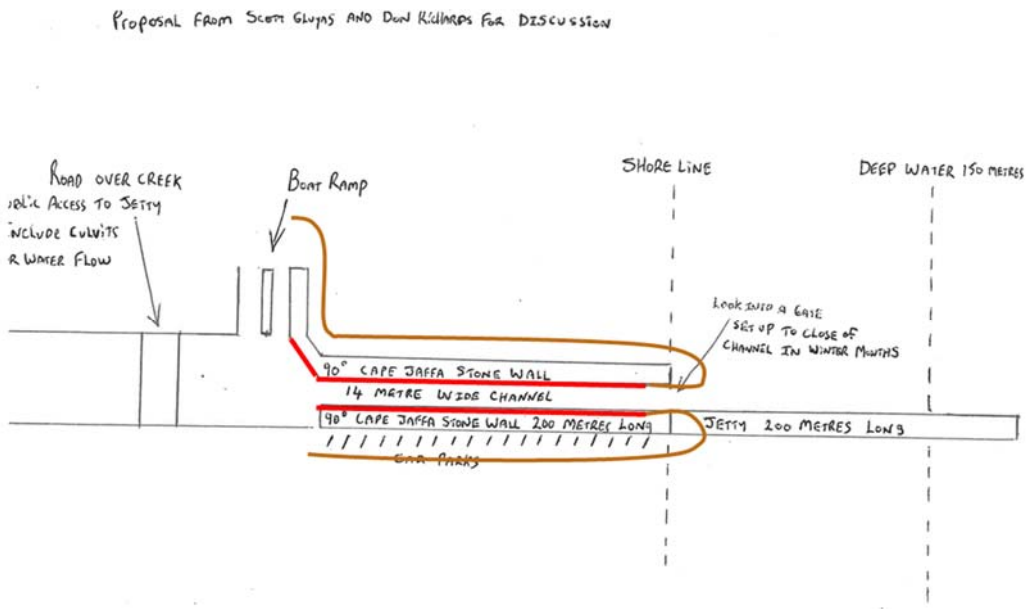


The proposed option was discussed at length in the Community Focus Group Meeting 4 held on 26 October 2020. The proposal put forward involved significant new infrastructure, which incorporates the following components:

- improved access for long-reach excavators to remove sand and wrack;
- new jetty, with excavator access;
- vertical walls along entrance for reach across channel from north to south;
- improved public access to northern breakwater via bridge across channel;
- narrower entrance channel to increase currents on outgoing tides.

However, upon first pass assessment, the proposal requires further infrastructure considerations including the following:

- Rock breakwaters are still required on the ocean side of the vertical walls (see brown lines in image below), as vertical walls would be unable to withstand loadings or wave energy as standalone vertical walls;
- Significant load rating required on all proposed structures to withstand access by 30-40t long-reach excavators as proposed. Sheet pile walls likely to be required within the creek (see red lines below).



A high level cost estimate was developed for the proposal, using realistic rates for key infrastructure components:

- Concept capital cost of **~$25M**, includes:
  - Construct new vertical sheet pile walls (excavator loads) $8.1M
  - Remove breakwaters $3.2M
  - Reconstruct new breakwaters and reclamation area $5.8M
  - Construct new bridge (excavator loads) $1.4M
  - Construct new 200m jetty (excavator loads) $6.9M
- On-going sand and wrack management costs ~$440k per year
- Indicative 25-yr NPV of $32.7M

The proposal also provides a number of challenges, which were broadly considered in the presentation to the Community Focus Group and include:

- Significant capital cost;
- Increased wrack and sand volumes, as more exposed to west due to partial removal of existing southern breakwater;
- Southern breakwater remains saturated (i.e. doesn't treat the main cause of sand build up);
- Reactive sand management required for daily removal of sand with a long-reach excavator;
- Accessibility and sediment spoil area on northern side;
- Similar on-going costs to Concept 2 but nearly twice 25-yr NPV cost;
- Aboriginal heritage impacts of car-park to north.

Given these challenges and particularly the significant capital costs, this proposal was not recommended to be pursued further. As discussed at length in previous questions, this proposal is focussed on increased accessibility (therefore reactive management), with the southern side still saturated, allowing the full 30,000 – 50,000m^3 of sediment to move into the entrance channel.

9. Have any other options been considered for the annual sand bypassing (as opposed to dredging)? There must be a cheaper option?

As we know, once the initial capital campaign is completed to create the initial buffer, the annual sand bypassing and wrack management is crucial to maintaining a navigable facility. It is important to firstly acknowledge that no structural options work without annual sand bypassing (30,000-50,000m^3) and annual wrack management (approx. 30,000m^3).

These ongoing costs are a minimum of $430,000 per year (and heavily dependent on the concept option pursued), with sand bypassing being a significant component of this at approximately 70% of ongoing costs.

If reinstatement of the facility is pursued, further work is required to ensure that any option is accepted by regulatory authorities and able to be sustainable long term. A high level review of possible sand bypassing options has been considered through the process:

- Dredging - $10-$15 per m^3
- Terrestrial bypassing (eg Slurrytrak) - $10-$15 per m^3
- Trucking - $15-$20 per m^3

However, it should be noted that whilst these costs are provided as a high level comparison, there are additional considerations and challenges for each option. For example:

- Terrestrial bypassing is a relatively untested option in SA, with known challenges with handling seagrass and may not be effective at Maria Creek;
- The dredging cost is very similar when comparing internal versus contractor dredge;
- Trucking is likely not considered an acceptable option to the community based on traffic disturbance and amenity.

10. What happened to the old Kingston dredge? Why did it have to be stopped being used as a volunteer operation? Why can't it be used to help at Maria Creek? Has it been sold? (KR / LM)

There is understandably significant frustration and disappointment surrounding the cessation of the use of the volunteer dredge in 2017. The time, effort and success of volunteer operations over many years is acknowledged and commended. The intent of this Q & A is not to defend a very emotive topic but rather, to clarify items where there appears to be some confusion.

A high-level overview of background and context is provided:

- The dredge was built by volunteers approximately twenty (20) years ago, with volunteer operators spending many hours on the vessel during its years of operation.
- The circumstantial timing of extreme weather events in 2016 and saturation of the breakwater in 2017 is important. This saturation did not happen overnight, or as a result of any one action, or of any one staff changeover – this was a combination of events and management since the original construction of the facility some 20 years ago.

- The use of the volunteer dredge prior to 2016/17 was addressing relatively small amounts of material as the southern breakwater was not saturated and was preventing any sand from moving into the entrance channel from the south.
- Prior to 2016/17, this dredge was being operated without an EPA dredging licence and without an approved dredging management plan. This resulted in regulatory disciplinary action to the Council (Environmental Protection Order).
- The dredge was previously operated by volunteers only, however its last campaign was with volunteers in conjunction with Council staff. This was largely due to requirements for water quality testing and strict requirements around hours of operation due to environmental impact and licensing requirements, but also included safety concerns and incidents.
- Inspections undertaken by maritime vessel experts/consultant/engineers were **not** related to survey, but were operational hazard assessments for safe operation and maintenance. It is reiterated that these inspections were not in the context of being in survey, as survey has very specific requirements under DPTI (at that time) and subsequently now with Australian Maritime Safety Authority (AMSA).
- Both of these departments (DPTI & AMSA) have been contacted previously, who both confirmed they have no record of the dredge ever being in survey, nor has it ever been issued a Unique Vessel Identifier (UVI).
- In 2018 council finalised the procurement and delivery of a Damen CSD350 cutter suction dredge. This was after extensive consideration given to sand management at Cape Jaffa, where there is legal and contractual obligations around the navigable channel. The Damen dredge is required to be at Cape Jaffa until a sustainable position has been achieved, which is likely not in the foreseeable future.

In September 2019, Council considered the assessment for disposal of the old Kingston Dredge in accordance with Council's Disposal of Land and Other Assets Policy. The following key items were raised:

- The dredge is not in survey as required by AMSA. It has been advised that it is highly unlikely that the vessel will ever meet requirements and standards to be appropriately 'in survey' and would not be able to operate outside the breakwater or in any open marine environment.
- Given the significant increase and change in material accumulation (being primarily seagrass wrack within the Maria Creek environment), the original dredge is not capable of successfully removing this material. Seagrass wrack is most effectively and efficiently removed by a long reach excavator, which council has engaged contractual services when required.
- The dredge would be unlikely to be approved as part of any Dredging Management Plan as required under Council's EPA licence. Given that there is no engineering or specifications on the vessel, the environmental impact of the vessel is unable to be appropriately assessed by the authorities. It is already known that the vessel's mechanics create water quality issues, as the vessel is not capable of containing or capturing its own 'plume' (i.e. suspended sediment within the water column). Particularly at Maria Creek, where there is known sensitivities and water quality issues, this can be extremely detrimental to the marine environment.
- There is no engineering specifications or documentation associated with the dredge, but is believed to be approximately twenty (20) years old. It is considered that it has reached the end of its useful life, particularly given the environment of which it previously operated in, as well as considering the ongoing alterations that occurred to the vessel throughout its lifecycle.

- Significant regulatory and governance challenges exist if operations are to continue in the same manner as they have in the past. This includes water quality management, dredging licencing requirements, dredging management plan conditions, management of spoil, WHS systems and high risk works, volunteer management, asset renewal & maintenance, AMSA survey requirements etc;
- Overall, it was assessed that the asset is no longer financially viable or suitable for the marine environment it needs to operate in and would not be able to be utilized.

Notwithstanding the 'red tape' considerations, once the southern breakwater became saturated, both the ongoing management requirements (being 30,000-50,000m^3 of sand and approximately 30,000m^3 of seagrass), as well as the capital campaign (300,000m^3) are far beyond the quantities previously managed by the dredge, and beyond what its capacities were ever intended - it simply would not manage what is now required.

As a result of the assessment undertaken in September 2019, the Council resolved to sell the asset. Given the specialist nature of the asset, as well as limitations on its use (i.e. it was not able to be in survey, nor accompanied by engineering designs), the dredge was on the market for approximately 12 months until its successful sale in December 2020. The dredge was mobilised/transported to its new location in Victoria, where it will be utilised in a land-based operation.

11. Can we partially remove the breakwater for the sand to mobilise naturally and get some of the jetty back, and then reassess in a few years? There might be an opportunity once the breakwater is removed to just dig out the entrance? (JP / GH / TH)

There has been a recurring sentiment and questions from community members regarding the partial (or full) removal of the breakwaters, with the aim of allowing the sand to mobilise unimpeded to the north and improving the jetty, with the intention of reassessing the boat launch facility after the expected initial mobilisation of sand from the southern side (ie in 2-3 years time).

The concept study considered full removal of both breakwaters at Concept 4 at a cost of **$2.4M**. Detailed modelling was undertaken of the longshore transport rates and expected shoreline change over time. This is shown in the image below (full removal of breakwaters):

Figure 18: Potential shoreline positions for Concept 4

The concept study also touched on the partial removal of the southern breakwater, however, this option did not proceed to detailed modelling during the completion of the study. The high level inclusions from within the study are provided below:

'A shorter section of the southern and northern breakwater/s could also be removed, with associated reductions in beach width at the Jetty. For example, removal of the southern breakwater extension (seaward 80m of length), would result in a shoreline similar to the green dashed line shown in Figure 18.'

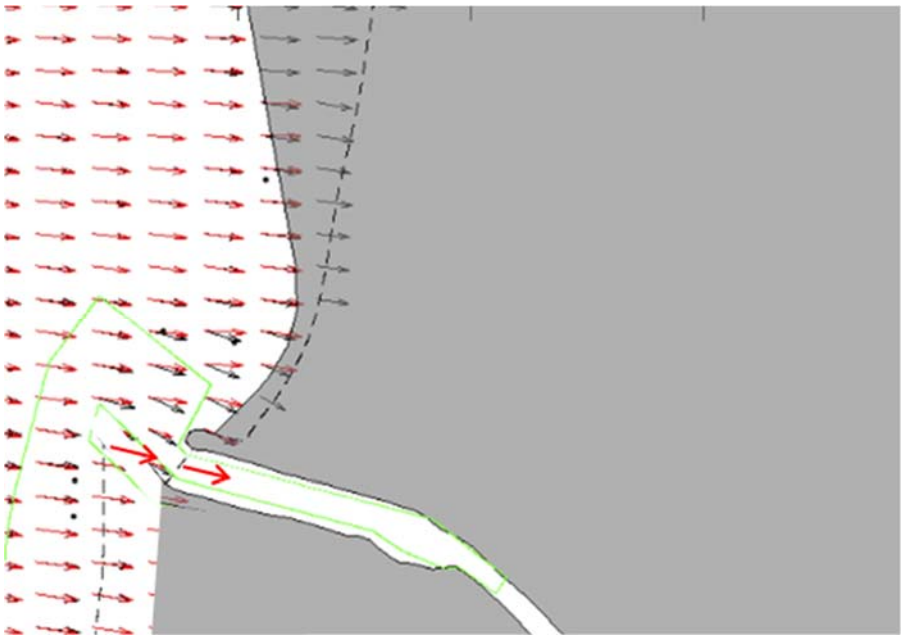
'The length of breakwater removal could be fine-tuned to achieve a desired balance between jetty amenity and capital costs of breakwater removal. For example, the seaward 80m of southern breakwater could be removed to reduce jetty beach widths by approximately 50m at a relatively low capital cost of ***$0.7M****.'*

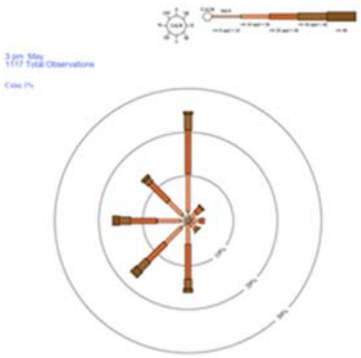
80m length partial removal (being the 'leg' or 'to the elbow')

There are a number of considerations and challenges when considering the partial removal. A full model and technical note of the concept to understand the affects and impacts would be required, however, a high level first pass overview and key points are provided below:

- Partial (or full) removal of breakwaters would accept loss of the facility;
- The southern breakwater would still be at full saturation, resulting in the same challenges as present, just at a different shoreline position;
- 80m partial removal of breakwater would likely result in approximately 50m sand reduction at the jetty within 12-24 months following removal;
- Without the following sand management, partial removal would not result in a renewed opportunity to use the ramp:
    - Capital dredging campaign to create buffer on southern side;
    - Ongoing sand bypassing of 30,000m3 to 50,000m3 per year;
- Increased wrack volumes and costs due to westerly storm exposure (existing breakwater provides some protection to these events currently);
- Likely additional flood risk mitigation will need to be undertaken at entrance;
- Breakwaters must be removed to -2.7m AHD, requires a very methodical approach with specific marine experience and heavy equipment;
- Majority of the existing armour rock would not be usable as external armour to rebuild breakwaters or at other locations due to inadequate size/density/material. It's possible some of the removed armour could be used for core or internal armour but would require intensive sorting for quality assurance.

The diagram below provides an indication of the likely exposure to waves and westerly storm exposure if the southern breakwater were to be partially removed:





Importantly, any removal (either full or partial) will accept loss of the facility and should not be undertaken as a short term reactive response**.** Any removal of the breakwater should only be pursued if the facility is closed permanently and loss accepted.

12. What would need to happen for the partial breakwater removal option to be progressed? (NT)

As broadly mentioned in the question above, the partial breakwater removal was not considered in detail in the Concept (only through the consideration of Full Removal at Concept 4).

To progress the concept of partial removal and accept loss of the facility, the following would need to be undertaken in the first instance:

- Wave modelling and longshore transport calculations for conceptual understanding;
- Technical note detailing modelling results, financial impacts and environmental considerations.

Once the technical note is received and impacts understood, if the partial removal was resolved to be further progressed (again, accepting loss of the facility long term) the initiation and planning phase would likely be minimum 12-18 months with the following required:

- Detailed shoreline evolution modelling in conjunction with a 1-month wave measurement campaign would be recommended to confirm the findings of these conceptual investigations. (modelling and wave measurement is likely to cost in the order of $50,000).
- Detailed design and methodology for removal (including full specification and scope of works);
- Methodology for intensive sorting and storage of material once removed;
- Engagement with key stakeholders:
    - South Eastern Water Conservation & Drainage Board

  - Coast Protection Board (CPB)
  - Environment Protection Authority (EPA)
  - Department for Infrastructure & Transport (DIT)
- Dredging Management Plan and Dredging Licence as required by the EPA;
- Development Application and Approval (including mandatory referrals to CPB, EPA & DIT);
- Procurement/tender process to engage suitably qualified contractor;
- Budget approval (and/or consideration of external grant funding opportunities).

Even the partial removal of the breakwater is not a simple or easy pathway. There is significant infrastructure and environmental impacts as a result of this pathway that need to be appropriately managed. Notwithstanding the initiation and planning considerations, the actual execution phase is not simple and must be methodically managed to ensure that no hazards are created in the marine environment, including removal of rocks to -2.7m AHD, as well as the water quality impacts during the works themselves.

There would be a high level of regulatory interest and influence in this pathway given the location and associated environmental risks.

13. What would be done with the rocks if the breakwater was fully or partially removed? (NT)

This is broadly mentioned in the question/s above, with the following considerations for the material removed if the breakwater were to be partially or fully removed:

- The majority of the existing armour rock would be unable to be utilised as external armour (ie could not be reused to rebuild breakwaters) due to inadequate size, density and/or material. Some granite rocks on the breakwater heads may be suitable for reuse but these are a very small proportion of the total rocks;
- Some of the rocks may be able to be used for core or internal armour on other existing Council infrastructure, but would require intensive sorting for quality assurance upon removal. This would be based on best practice marine infrastructure guidelines, such as the CIRIA Rock Manual.
- There is a significant element of double handling if rocks are assessed, stockpiled and reused in any way;
- Rocks that were assessed as able to be reused for core or internal armour would need to be transported and stockpiled at an appropriate location until required;
- Any other material could potentially be crushed for use as material if deemed appropriate upon assessment.

The reuse of material specifically at the Wyomi erosion location has been raised in previous Q & A and is revisited for reference:
'The majority of the breakwater rock is unlikely to be suitable for use in a seawall adjacent to Wyomi, as it has a low density and strength. Additionally, whilst an extension of the seawall at Wyomi may reduce erosion at the seawall site, it is likely to increase northerly sediment transport rather than reduce sediment volumes.'

14. Is there an increased chance of flooding if the Maria Creek remains closed? (JD FB)

Maria Creek is the outlet for the 'Kingston Main Drain' and forms part of the SE drainage network, with drainage board responsibility finishing at the East Terrace/Princes Highway Bridge. There is a long history of challenges with flooding surrounding the drain, particularly upstream. This flooding is primarily due to:

- low lying areas susceptible to flooding
- the general topography of the area; and
- nature of the existing drainage system.

These flood risks, including potential impacts of sea level rise, are considered in further detail in Council's Coastal Adaptation Strategy.

The current closure of the Maria Creek facility does not change the existing drainage/flooding challenges experienced upstream of the creek. Council has previously and will continue to manage the area for flood risk (in conjunction with the South East Water Conservation & Drainage Board) through appropriate use of the weir boards, as well an ongoing budget allocation allowed for minor excavation works at the channel entrance to restore flows for drainage purposes. During the winter months, when there is an increased accumulation of seagrass within the area, the entrance is monitored at least daily (sometimes multiple times per day) to ensure outflows to sea. This is the key aspect of flood risk mitigation required by Council whilst the facility is closed.

Council does have a responsibility to ensure the creek is appropriately managed for flood risk mitigation, with Council working closely with the Drainage Board to understand its obligations and impacts. However, at this time, it is understood that there is no increase to existing flood risks or challenges historically seen.

For further information and supporting documents, please refer to the Maria Creek Sustainable Infrastructure Project page on Council's website:

https://www.kingstondc.sa.gov.au/our-services/major-projects/maria-creek-sustainable-infrastructure-project