WESTPORT Beacon

Westport's long-list of options

ISSUE 6 | AUGUST 2019 | MULTI-CRITERIA ANALYSIS

Photo courtesy of Fremantle Ports

Westport reached an important milestone in narrowing down all possible scenarios to a 'long-list' of the 25 most feasible port and supply chain options.

Each of those potential options were tested further in the first multi-criteria analysis (MCA-1).

So, what is this 'long-list' and how is it different from the eight options explained in the *Westport: What we have found so far* report? How was the long-list determined and by whom?

How the options were chosen

The development of the 'long-list' was based on research and information, including historical data about container ports and Fremantle Ports, the latest port and freight innovations and modelling by both government agencies and the private sector.

It was shaped with input from Westport's expert project team, workstream groups, Taskforce members and experienced consultants, who undertook the investigation and analysis required to distinguish the viable port and supply chains.

The list is drawn from the Eight Strategic Options defined in the *Westport: What we have found so far* report, broken down into their variable components.

The Eight Strategic Options determined, at a high level, the possible locations and combinations for WA's container trade across Fremantle, Kwinana and Bunbury over the long-term. Currently, nearly all of WA's containers are handled at Fremantle's Inner Harbour.

The variable components included:

- different supply chain scenarios – such as variations between the amount of freight transported by road or on rail, different port capacity options, and different intermodal terminal locations;
- various shared port scenarios; and
- different port designs and locations in Cockburn Sound.

A number of different options and scenarios emerged from this break-down of the Eight Strategic Options but some were relatively easy to eliminate for reasons including:

- being commercially unviable;
- impacting too heavily on the environment, surrounding communities or other land uses; or
- being unable to handle the estimated long-term container trade task of 3.8 million TEU* by 2068 (Westport's 50-year horizon).

What remained was Westport's 'long list' of the 25 most viable port and supply chain scenarios, narrowing the focus for Westport's ongoing work.

*TEU = Twenty-foot equivalent unit, which is the volume measurement for shipping containers.

GOVERNMENT OF WESTERN AUSTRALIA

WESTPORT
Port and Environs Strategy

What are the 25 long-list options? Here are the detailed explanations.

The 25 options are grouped by location:

Fremantle – four long-list options (1-4)

Bunbury – four long-list options (5-8)

Kwinana – 17 long-list options (9-25)

The options include:

- stand-alone ports in Fremantle, Kwinana and Bunbury that can handle the full estimated 3.8 million TEU capacity by 2068;
- shared port options between Fremantle and Kwinana, or Fremantle and Bunbury;
- conventional island, hybrid and land-backed ports that feature an intermodal terminal (IMT) onsite;
- light footprint ports that rely on a nearby on-land IMT for its operation (see image below); and
- supply chains that use varying combinations of road, rail and even coastal shipping, as well as innovative transport solutions such as automated vehicles.

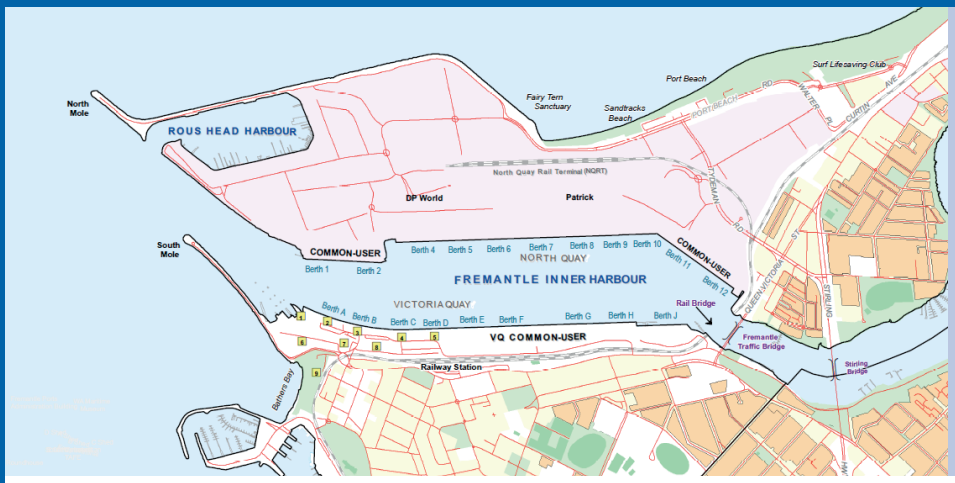
It is important to note that some assumptions underpin the 25 options:

1. containers will continue to be the main form of international trade in the foreseeable future;
2. the State Government made a clear election commitment not to build Roe 8, so Westport has not considered it in our technical studies. Westport is, however, investigating other road options to accommodate the additional freight movements that Roe 8 would have handled;
3. road and infrastructure upgrade commitments from Government will be in place before any new port would be constructed, including the Fremantle traffic bridge replacement (which will improve freight access to the Inner Harbour), the Bunbury Outer Ring Road, High Street upgrades and Tonkin Highway grade separations; and
4. all options would need to cater for an end-state port depth of 18m.

An example of a light footprint port: Terminal Teluk Lamong in Surabaya, Indonesia

Image courtesy of Antara/Eric Ireng

Fremantle | Four long-list options (1-4)



Map 1: Current layout of the Fremantle Inner Harbour

The Fremantle list has four options, which all rely on the Forrestfield Intermodal Terminal as the main hub for container storage and transfer, with supporting IMTs throughout the network.

Option 1 and Option 3

Options 1 and 3 see only Fremantle handling containers for the long-term. As the stand-alone container port, these two Fremantle options would require expansion to the existing port footprint to accommodate the increased container capacity to 3.8 million TEU, as represented by the green shading in the maps to the right.

The changes would include widening the berths, deepening the channel, adding additional deep-water berths along the north-west coast of North Mole, plus a breakwater for those berths. These modifications will extensively impact Rous Head, including infilling the harbour currently used by the Rottnest ferry service. The proposed breakwater would extend quite far out to sea compared to the current port footprint.

Supply chain upgrades would include Leach Highway expanded up to eight lanes with overpasses to remove traffic lights, High Street upgrades and Stirling Highway expansion. Rail upgrades would include a dedicated, duplicated freight line over the Swan River, significant changes to the rail corridor, an increase in the metropolitan intermodal terminal capacity and expansion of the North Quay Rail Terminal (NQRT).

Option 1, which is more reliant on rail, requires the sinking and duplication of the rail line on the current corridor, which runs along the West End of Fremantle, as depicted by the black dotted line in the Option 1 diagram (top right).

Option 1 proposes two-thirds of containers being moved on road and one-third on rail. Option 3 is heavily reliant on road, with nine out of ten containers being moved on road.

OPTIONS 1 & 3 KEY

- Proposed Port Footprint
- Berth
- Breakwater
- Shipping Channel
- Fremantle Rail Tunnel
- Stirling Hwy and Tydeman Rd
- Fremantle Rail Bridge

Fremantle | Four long-list options (1-4)

Option 2 and Option 4

Options 2 and 4 see Fremantle continue as a container-handling facility before spilling over to a second facility – either Bunbury (Option 8) or Kwinana (Options 10, 12, 16, 18, 20, 24 and 25). The current port footprint remains unchanged.

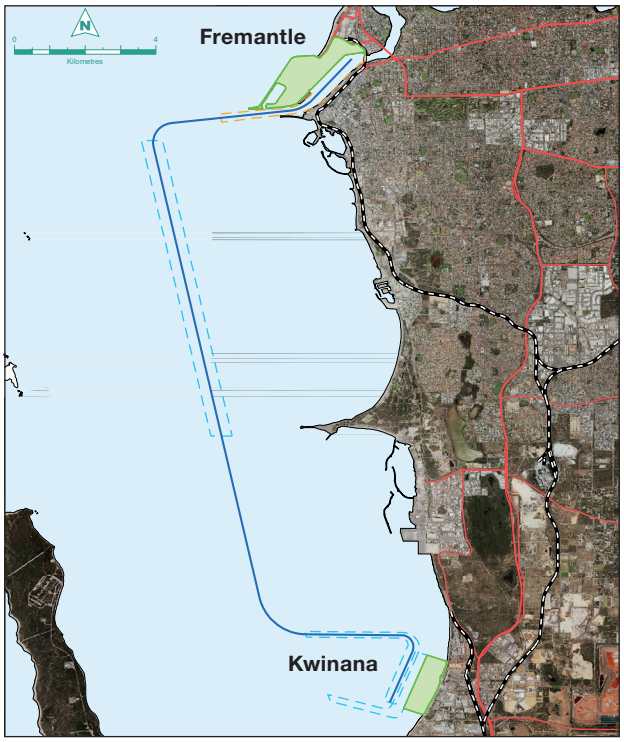
This inherently assumes that Fremantle will have reached a natural capacity that is likely to be influenced by the limitations of the road and rail network feeding into the Inner Harbour. Westport is working with Fremantle Ports, Main Roads WA and other agencies to confirm the likely range of the Inner Harbour's supply chain capacity.

The biggest difference between these two options is that Option 2 relies on road and rail, while Option 4 implements a new freight mode known as a 'Blue Highway', where a significant proportion of containers are shipped on smaller, shallow draught vessels down to a second port in Kwinana for intermodal handling.

Leach Highway remains as it is currently configured with both options, with the addition of the High Street upgrade. As with Options 1 and 3 above, rail upgrades would include a dedicated freight track over the Swan River, significant changes to the rail corridor, an increase in the metropolitan intermodal terminal capacity and expansion of the NQRT.

For the land-side logistics, both Options 2 and 4 are heavily reliant on road over rail, with more than two-thirds of containers being moved on road.

OPTION 4 BLUE HIGHWAY



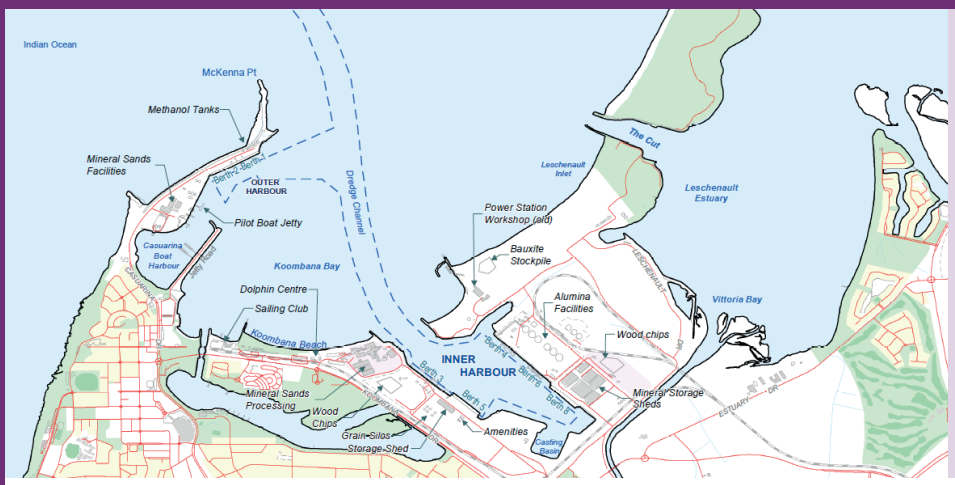
OPTION 2 KEY

- Proposed Port Footprint
- Berth
- Shipping Channel
- Freight Rail
- Freight Roads

OPTION 4 BLUE HIGHWAY KEY

- Proposed Port Footprint
- Dredging Required
- Existing Channel
- Proposed Blue Highway
- Freight Rail
- Freight Road

Bunbury | Four long-list options (5-8)



Map 2: Current layout of the Bunbury Inner and Outer Harbours

The Bunbury list has four options. Two options are stand-alone ports — one is road-reliant, the other is rail-reliant. Two are options which share the container task with Fremantle — one is road-reliant, the other is rail-reliant.

Option 5 and Option 7

These two options are stand-alone ports, seeing Bunbury Port employed as the main port of entry to WA for containers, handling the full estimated container task of 3.8 million TEU by 2068. Each option would require significant expansion of the existing port footprint to include container berths and intermodal capacity, as proposed in the preliminary draft Bunbury Revised Inner Harbour Concept Plan (see image below right). This concept will be subject to an upcoming public consultation process by Southern Ports. The port will not only be significantly expanded but also require extensive deepening, from 12.7m currently to 18m.

Option 5 relies heavily on rail and proposes duplicating the South West Main rail line all the way to Kwinana Industrial Area, while Option 7 requires duplication only to Brunswick Junction as it is nearly entirely reliant on road transport. A rail connection close to the port dock would be required in both options.

Roads are an important consideration, as they work in conjunction with rail to move the freight from the port. Both options assume construction of the Bunbury Outer Ring Road (BORR), duplication of Willinge Drive and some grade separations (overpasses) constructed on Forrest Highway and Old Coast Road.

BUNBURY PORT CURRENT VIEW

BUNBURY REVISED INNER HARBOUR CONCEPT PLAN (DRAFT ONLY – SUBJECT TO PUBLIC CONSULTATION)

Images above both courtesy of Southern Ports

Bunbury | Four long-list options (5-8)

Option 6 and Option 8

Options 6 and 8 would share the container task with Fremantle Option 2, seeing Bunbury and Fremantle handle a total of 3.8 million TEU between them by 2068.

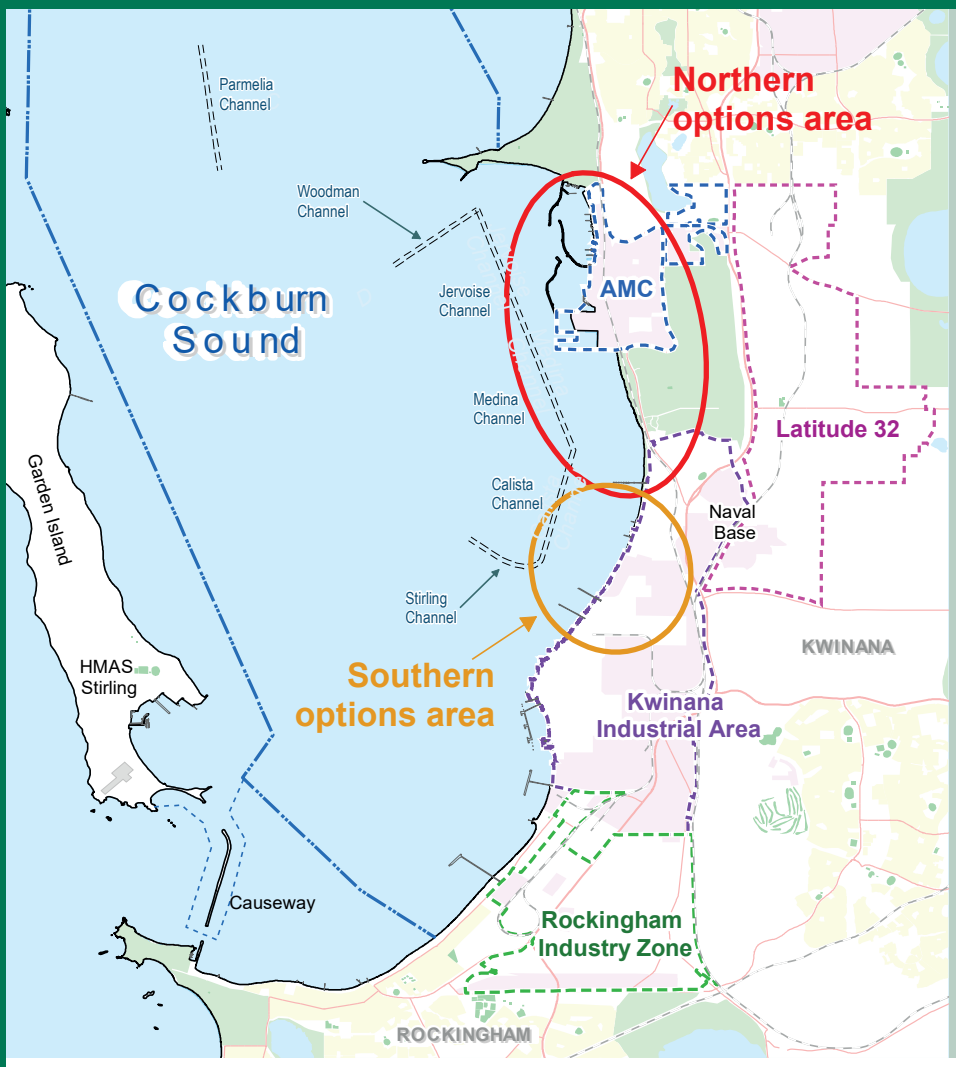
Option 6 is heavily reliant on rail and requires duplication of the South West Main rail line all the way to Kwinana Industrial Area. As Option 8 is almost entirely reliant on road transport, the rail duplication would only extend to Brunswick Junction. A near-dock rail connection would also need to be constructed for both options.

Again, both options assume construction of the Bunbury Outer Ring Road (BORR) and duplication of Willinge Drive, while Option 8 requires some grade separations constructed on Forrest Highway and Old Coast Road.

OPTIONS 6 & 8 KEY

- Proposed Port Footprint
- Berth
- Shipping Channel
- Bunbury Port Rail
- Bunbury Port Road
- Bunbury Port Bridge

Kwinana | 17 long-list options (9-25)



Map 3: Current layout of the Outer Harbour across Kwinana and Rockingham

Given the customised infrastructure it requires, a new container port in Kwinana/ Cockburn Sound would primarily be a greenfield development.

This allowed Westport to consider several locations along the Cockburn Sound coast, along with numerous port design and supply chain networks. By comparison, the Fremantle and Bunbury options were limited to their existing ports. Therefore, Kwinana has the most long-list options - 17 in total.

The Kwinana options can be summarised in three ways:

1

- **9** stand-alone port options that can handle the full **3.8 million TEU**; and
- **8** port options that share the container task with Fremantle and handle the total container task of 3.8 million TEU between them.

2

- **11** port options in the **north** of Cockburn Sound, serviced by Rowley Road (2 connect to land north of the shacks, 9 connect to land south of the shacks); and
- **6** port options in the **south** of Cockburn Sound, serviced by Anketell Road (connect to land at the Kwinana Industrial Area (KIA) between Kwinana Bulk Jetty and Alcoa).

3

- **10 conventional** port designs – land-backed, island and hybrid – with an onsite intermodal terminal (IMT) and yard; and
- **7 light footprint** port options that rely on a nearby, land-based IMT at Latitude 32 (see Map 3 above).

Option 9 and Option 10

Options 9 and 10 are both conventional island ports with an IMT within the immediate port precinct in the north of Cockburn Sound. These options are essentially the same, except Option 9 has a slightly larger port footprint to be a stand-alone option handling the full 3.8 million TEU, while Option 10 has a smaller footprint to handle the total container task in partnership with Fremantle.

Both options connect to land immediately south of the Naval Base shacks, extending south-west into Cockburn Sound past the Alcoa jetty. They utilise the existing channel, but it requires deepening to 18m over time. Ships would enter and leave the port from the south.

Both options would be serviced by an expanded Rowley Road which links directly through to Tonkin Highway. These two options require freight rail duplication between the Cockburn Triangle and Kwinana Industrial Area.

Both options propose roughly two-thirds of containers moved on road and one-third on rail.

OPTIONS 9 & 10 KEY

- Proposed Port Footprint
- Berth
- Shipping Channel
- Rowley Rail Link
- Port Access Road

Option 11 and Option 12

Options 11 and 12 are both light footprint ports, which means a physically smaller port precinct than a conventional port as the IMT operations are de-linked from the port and located in a separate area. Containers would be moved to or from the ship via Automated Guided Vehicles (AGVs) that transfer them over a 4km 'land bridge' to the IMT at Latitude 32.

These options in the north of Cockburn Sound are essentially the same, except Option 11 has a slightly longer port footprint capable of handling the full 3.8 million TEU, while Option 12 has a smaller footprint and will handle the total container task in partnership with Fremantle.

The supply chain links for Options 11 and 12 are the same as for Options 9 and 10; they connect to land immediately south of the Naval Base shacks and extend south-west into Cockburn Sound past Alcoa jetty utilising the existing channel. Ships would enter and leave the port from the south.

Both options will be serviced by an expanded Rowley Road which links directly through to Tonkin Highway, forming a freight ring road around the Perth metropolitan area. Both also require freight rail duplication between the Cockburn Triangle and the Kwinana Industrial Area.

Option 11 proposes roughly two-thirds of containers moved on road and one-third on rail.

Option 12 is more heavily reliant on road, with only a quarter of containers moved on rail.

OPTIONS 11 & 12 KEY

- Proposed Port Footprint
- Berth
- Shipping Channel
- AGV Link
- Port Service Road

Option 13

Option 13 is a conventional hybrid port, which is a partial land-backed and partial island port. It would be a stand-alone port handling 3.8 million TEU located in the southern area of Cockburn Sound, adjacent to the Kwinana Industrial Area.

This option is serviced by a significantly expanded Anketell Road that connects seamlessly to Tonkin Highway. It requires duplication of the freight rail line between the Cockburn Triangle, the Kwinana Industrial Area and the port precinct itself.

Connecting the last kilometre of Anketell Road and the rail line through to this port option may be challenging, given existing land holdings and infrastructure in the area.

Option 13 is more reliant on road transport than rail.

OPTION 13 KEY

- Proposed Port Footprint
- Berth
- Breakwater
- Shipping Channel
- Anketell Rail Link
- Port Access and Anketell Road

Option 14, Option 15 and Option 16

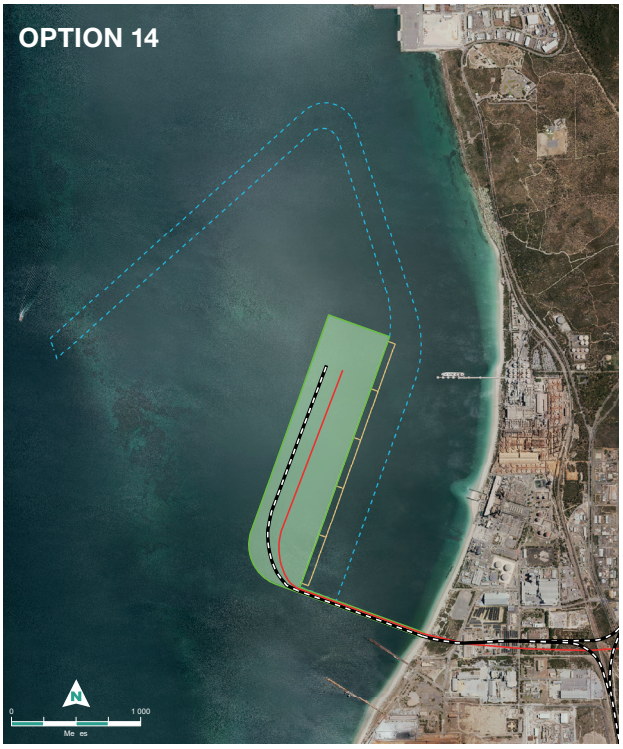
Options 14, 15 and 16 are all variations of a conventional island port with ships entering from the north, located in the southern area of Cockburn Sound, connecting to land at the Kwinana Industrial Area and serviced by an expanded Anketell Road.

Option 14 is a stand-alone option with a larger port footprint to handle the full container task of 3.8 million TEU.

Option 15 is the partner to Fremantle's Option 4 which features the 'Blue Highway' shipping lane. It would handle a significant proportion – up to two thirds – of the containers and has a slightly smaller footprint than Option 14.

Option 16 is a shared-port option partnered with Fremantle Option 2 and has the same port footprint as Option 15.

For the land-side logistics, all of these options are more reliant on road transport than rail. They also face challenges in connecting the last kilometre of Anketell Road and the rail line through to the coast due to existing land uses.



OPTIONS 14, 15 & 16 KEY

- Proposed Port Footprint
- Berth
- Shipping Channel
- Anketell Rail Link
- Blue Highway
- Port Service and Anketell Road

Option 17 and Option 18

Options 17 and 18 are both light footprint ports in the far north of Cockburn Sound, connecting to land immediately south of the Australian Marine Complex (AMC) and extending north-west into the Sound past the AMC. Option 17 is a stand-alone option handling the full 3.8 million containers with a longer port footprint. Option 18 shares with Fremantle Option 2, so it has a smaller port footprint.

As with Options 11 and 12, they rely on innovative container movement by Automated Guided Vehicles (AGVs) from the port to the IMT at Latitude 32 via a 4km land bridge. They are serviced by an expanded Rowley Road connecting through to Tonkin Highway and duplicated rail.

Option 17 would have more than two-thirds of containers transported by road with the remainder on rail.

Option 18 proposes roughly three-quarters of containers to be transported on road.

OPTIONS 17 & 18 KEY

- Proposed Port Footprint
- Berth
- Shipping Channel
- AGV Link
- Port Service Road

Option 19 and Option 20

Options 19 and 20 are both light footprint ports in the north of Cockburn Sound, connecting to land south of the Naval Base shacks and extending north-west into the Sound up to the Australian Marine Complex (AMC). Option 19 is a stand-alone option handling the full 3.8 million containers with a longer port footprint. Option 20 shares with Fremantle Option 2 and has a smaller port footprint.

As with the other light footprint ports, they rely on innovative container movement by rapid AGVs from the port to the IMT at Latitude 32 via a 4km land bridge. They are serviced by an expanded Rowley Road connecting through to Tonkin Highway and freight rail duplications.

Option 19 proposes around two-thirds of containers being transported by road, one-third on rail.

Option 20 is more reliant on road, with up to three-quarters of containers being moved on road.

OPTIONS 19 & 20 KEY

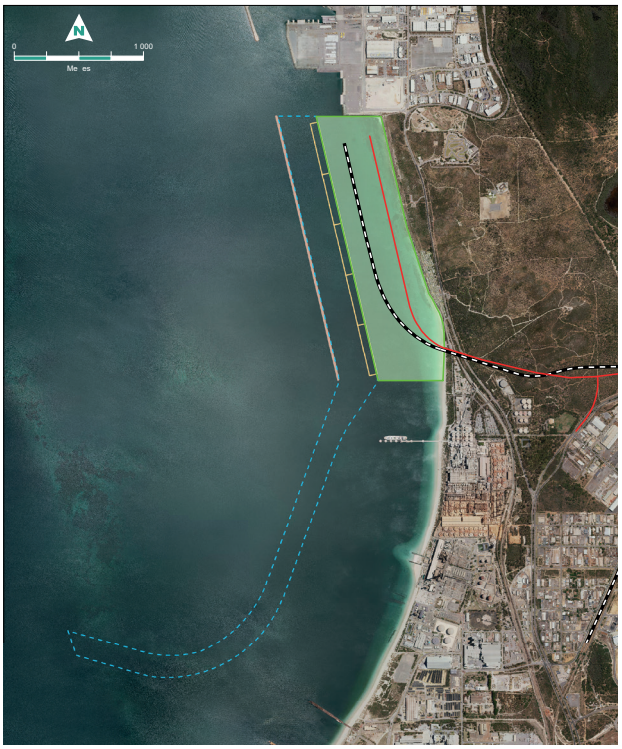
- Proposed Port Footprint
- Berth
- Shipping Channel
- AGV Link
- Port Service Road

Option 21 and Option 22

Options 21 and 22 are both stand-alone, land-backed ports that can handle a container capacity of 3.8 million TEU by 2068. They both extend along the coast from the AMC down past the Naval Base shacks.

Option 22 is a conventional land-backed port with an onsite IMT and container-handling operations within the port precinct. It has a larger footprint than Option 21, which is a light footprint port. As with the other light footprint ports, Option 21 would move containers by AGVs from the port to the IMT at Latitude 32. Ships would access the ports from the south. Both options are heavily reliant on road transport.

Both options would be serviced by an expanded Rowley Road linking the port to Tonkin Highway. Freight rail track duplication between the Cockburn Triangle and Kwinana Industrial Area is required for both options.



OPTION 21 KEY

- Proposed Port Footprint
- Berth
- Breakwater
- Shipping Channel
- AGV Link
- Port Service Road

OPTION 22 KEY

- Proposed Port Footprint
- Berth
- Breakwater
- Shipping Channel
- Rowley Rail Link
- Port Access Road

Option 23 and Option 24

Options 23 and 24 are both conventional land-backed ports with IMT operations within the port precinct. Option 23 is a stand-alone option handling the full 3.8 million TEU, while Option 24 would work in conjunction with Fremantle Option 2 to handle a total of 3.8 million TEU between them.

Both options are reliant on road over rail for container transportation.

Both options extend along the coast between the Kwinana Bulk Terminal and the Alcoa jetty, and are serviced by an extended Anketell Road that connects through to Tonkin Highway.

Rail upgrades for these options include rail track duplication between the Cockburn Triangle and Kwinana Industrial Area.

Connecting the last kilometre of Anketell Road and the rail line through to these port options may be challenging, given existing land holdings and infrastructure in the area.

OPTIONS 23 & 24 KEY

- Proposed Port Footprint
- Berth
- Breakwater
- Shipping Channel
- Anketell Rail Link
- Port Access and Anketell Road

Option 25

The final Kwinana option is a medium-sized, conventional land-backed port in the north of Cockburn Sound, extending along the coast from south of the Naval Base shacks up to the Henderson cliffs. It would share the container task with Fremantle Option 2, handling a total of 3.8 million TEU between them.

Option 25 is highly reliant on transporting containers on road.

Intermodal operations for this option would be scaled-back operations utilising Latitude 32. It would be serviced directly by an expanded Rowley Road connecting through to Tonkin Highway.

Most of the containers would travel by road, with the rest of the freight transported via the South West Main line. This would mean duplicating the track between the Cockburn Triangle and Kwinana Industrial Area.

OPTION 25 KEY

- Proposed Port Footprint
- Berth
- Breakwater
- Shipping Channel
- AGV Link
- Port Service Roac

Next steps

Westport assessed these 25 options through MCA-1 using a series of intensive sessions where subject matter experts analysed the options against a chosen list of criteria and gave them a ranking.

The five top-ranked options are outlined in detail in *Westport Beacon 7: Westport's shortlist.*

GOVERNMENT OF WESTERN AUSTRALIA

WESTPORT
Port and Environs Strategy