COLLAROY-NARRABEEN BEACH & FISHERMANS BEACH CZMP: CAN BOTH SENSIBLE DEVELOPMENT AND PUBLIC BEACH AMENITY BE ACHIEVED?

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Introduction

The Collaroy-Narrabeen and Fishermans Beach embayment (in the Warringah Council Local Government Area) is a highly capitalised coastline, with private beachfront land valued at hundreds of millions of dollars. It is also a valued recreational area, including four Surf Life Saving Clubs and a National Surfing Reserve at North Narrabeen.

Much of the development at these beaches is potentially at medium to very high risk from coastal erosion at present, although the risk along much of the southern end of Collaroy-Narrabeen Beach is reduced due to seawalls/revetments constructed in the past. Development along the northern portion of the beach is setback further landward and has a reconstructed dune located seaward, further reducing risk.

A Coastal Zone Management Plan (CZMP) is being prepared for these beaches by Haskoning Australia, a company of Royal HaskoningDHV. The study team includes coastal engineering, planning, legal, economic, ecological and community consultation expertise.

The challenge for the future is how to manage development (with appropriate setbacks and other design factors to mitigate risks to an acceptable level) while maintaining public beach width, in the context of envisaged long term recession due to sea level rise. Managing risk to development and maintaining amenity needs to be achieved in a legally enforceable manner consistent with planning controls and NSW legislation, with acceptable economic impacts (on Council, landowners and ratepayers) and acceptable social and environmental impacts (so as to maintain the recreational value of the beach and surf zone area).

In the paper, potential measures to enable Council to both manage risk to development and maintain beach amenity are outlined.

Note that the paper herein is based on the opinions of the authors, and does not necessarily reflect the policies or intended actions of Warringah Council.

Sensible Development

Defining Hazard Lines

There are a number of ways in which coastline hazard lines can be defined, for example:

- for various planning periods, such as Immediate, year 2050, rolling 50 years (year 2063 at present), year 2100, or rolling 100 years (year 2113 at present); and
- at various locations, such as at the landward edge of the Zone of Wave Impact (ZWI), Zone of Slope Adjustment (ZSA), or Zone of Reduced Foundation Capacity (ZRFC), see Figure 1 modified from Nielsen et al (1992).

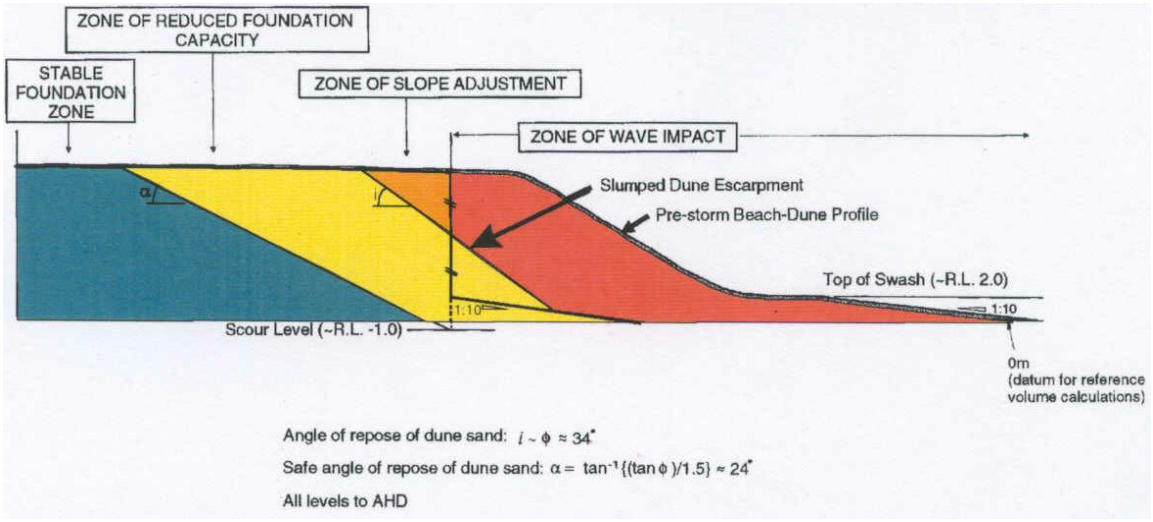

Figure 1: Schematic representation of coastline hazard zones for an immediate planning period

Historically, it has been typical NSW practice to site beachfront development landward of a hazard line defined to be at the landward edge of the ZSA over a 50 year planning period (but often with piled foundations also required). However, in the *NSW Coastal Planning Guideline* (Department of Planning, 2010), the "suitable" location for beachfront development (implicitly with no additional controls applied) became the 2100 landward edge of the ZRFC, see Figure 2. It is important to note that Department of Planning (2010) defined hazard lines to be at the landward edge of the ZRFC (not ZSA as per typical historical NSW practice).

It is conservative to include the ZRFC in hazard line definition, given that any development in a ZRFC is not directly impacted by wave action or dune slumping, and it is not unusual for foundation conditions to be influenced by certain geotechnical conditions or proximity to natural hazards. Use of the ZRFC rather than ZSA may become particularly significant when considering the area "typically unsuitable for development" in Figure 2. For a 6m high dune and sand angle of repose of 35°, the landward edge of the ZRFC is located about 12m landward of the landward edge of the ZSA.

Recent advice from the NSW Department of Planning & Infrastructure would indicate that the guidance in Department of Planning (2010) does not mandate a setback line, and a

Council can use its own judgement to decide whether or not to include the ZRFC in hazard definition for setback purposes.

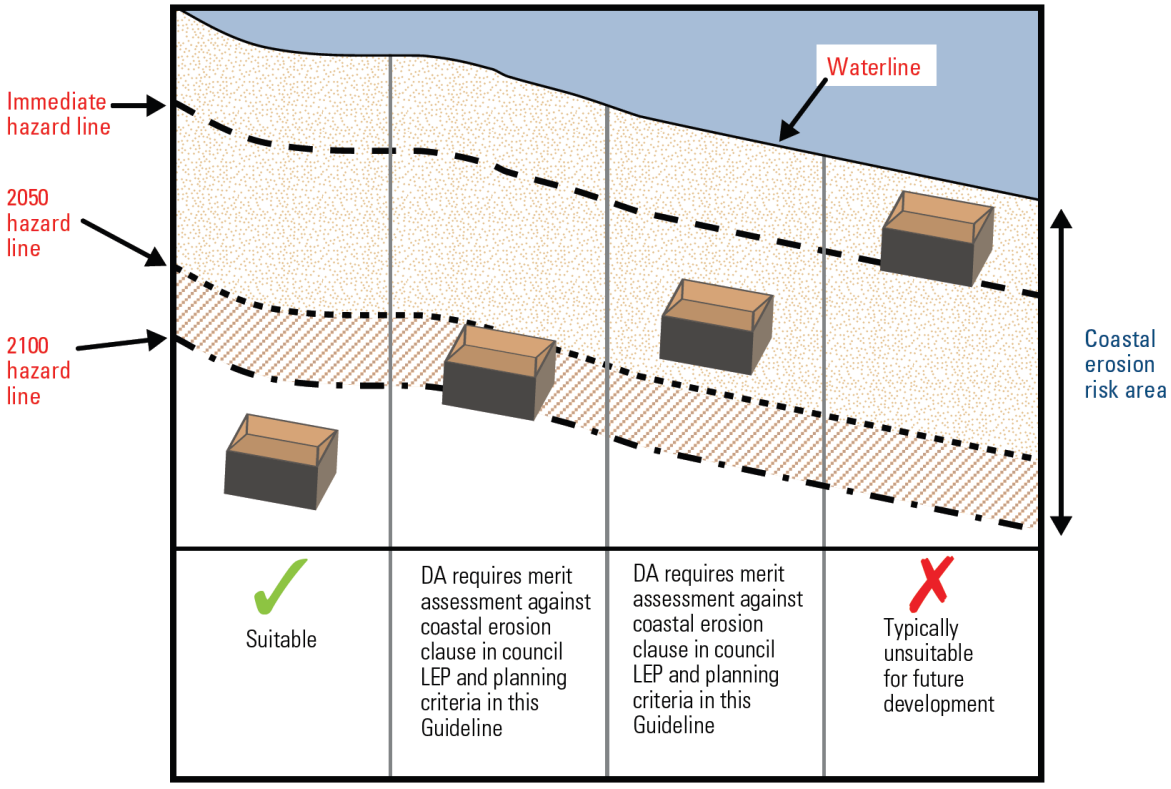

Figure 2: Coastal erosion consideration in DA assessment (Department of Planning, 2010), in which hazard lines are defined including the ZRFC

Acceptable Risk

A key aim of a Council in approving (or not approving) beachfront development should be to ensure that the development has an acceptably low risk of damage. This would generally be achieved by having adequate setbacks and controls.

An example of a control would be to have a requirement that a structure is founded on deep piles, designed to withstand wave and debris impact and sand slumping as appropriate, or taking account of the ZRFC if sited further landward.

Another option to reduce the risk of damage to beachfront development would be the construction of engineered protective works (such as a seawall or revetment) seaward of the development, where environmental and other impacts can be demonstrated as being acceptable. Based on *State Environmental Planning Policy (Infrastructure) 2007*, landowners in NSW are entitled to submit a development application (with accompanying environmental assessment) for any form of protective works (such as constructed from rock, concrete or sand-filled geotextile containers), which must be considered on its merits by a consent authority. Until a CZMP is in force on the land, the NSW Coastal Panel is the consent authority for such applications. Council becomes the consent authority when a CZMP has been certified by the Minister administering the *Coastal Protection Act 1979* (currently the Minister for the Environment).

It is a common misunderstanding from many involved in the coast that protective works applications are limited to "temporary coastal protection works" as per Part 4C of the *Coastal Protection Act 1979,* that is only sand-filled geotextile container works. This is not the case, and the general protective works as per *State Environmental Planning Policy (Infrastructure) 2007* are likely to be of far more interest to NSW beachfront landowners than the generally ineffective temporary works (Horton et al. 2011), although obtaining approval can be expected to be difficult for isolated seawalls in areas with surrounding development due to potential "end effects". This puts the onus on multiple landowners working together to overcome this issue.

If a development is positioned far enough landward of a beach, it reaches a point of having an acceptable risk with no controls, that is it could be constructed from conventional housing foundations (such as slab on ground or shallow footings). This acceptable level of risk "no control setback" position has generally not been rigorously defined in NSW coastal engineering practice.

It is considered that the most reliable method of determining this "no control setback" position is through a risk assessment approach, much like that applied by the Australian Geomechanics Society (AGS, 2007) for landside risk management. This is being developed for the study area by the authors of the paper herein. It is expected that more on this matter will be available in future papers from these authors.

At Collaroy-Narrabeen Beach, much of the southern portion of the beach already has some form of intermittently buried and exposed seawall/revetment located seaward of the development (Figure 3). These are generally sloping rock structures with armour rocks of several tonnes in mass. However, the protective works are variable in standard. Most of the works are not engineer designed nor approved structures, and were generally implemented by various landowners and authorities and constructed from the 1920's onwards, and mostly in the 1960's and 1970's during or immediately after erosion events. That stated, the works have successfully provided property protection over the last 40 or so years.

Looking at the typical Collaroy-Narrabeen Beach, there is little evidence of the extensive lengths of buried protective works, as they are usually not visible. As an example, views of the "Flight Deck" residential flat building (at 1114 Pittwater Rd Collaroy) under typical conditions, as well as with protective works exposed, are provided in Figure 4.

Collaroy-Narrabeen Beach can be divided into two sections based on the proximity of public and private development to the beach and presence of protective works, namely the areas north and south of Devitt Street. South of Devitt Street there is limited dunal vegetation, relative proximity of development to the beach, and extensive lengths of (mostly usually buried) protective works. North of Devitt Street, development is generally setback further landward and there is typically a well-developed dune with healthy coverage of dunal vegetation seaward of development (with no known protective works in this area). An oblique aerial view of the transition between south and north of Devitt Street is provided in Figure 5.

For many in the community, there is generally no awareness that much of the area South of Devitt Street has buried protective works. Long term measurements of beach volume changes at Collaroy-Narrabeen Beach would indicate relative stability over the last 70 or so years. That is, these buried protective works are not leading to significant long term beach recession, contrary to the view of some that protective works always cause loss of beaches.

Figure 3: Location of known protective works at Collaroy-Narrabeen Beach

Figure 4: Rock seawall exposed at "Flight Deck" in the 1970's after a major storm (top, courtesy of Don Champion), and (bottom) the same site in 2009, with the rock seawall buried under sand (typical conditions)

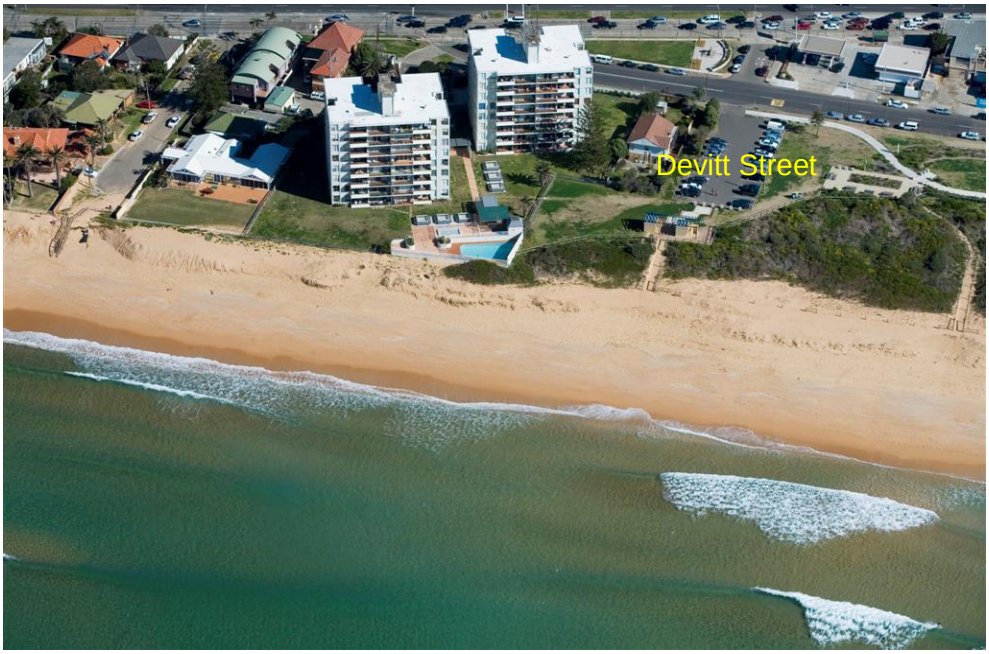

Figure 5: Oblique aerial view of Devitt Street area at Collaroy-Narrabeen Beach

The acceptable risk approach is not only useful for defining the "no control setback" position", but can also be used to define the required controls for development seaward of this position. The approach is particularly useful at Collaroy-Narrabeen Beach as a means of taking into account the existing protective works in assessing the risk to development. The approach is also useful in areas with a partly non-sandy subsurface, such as at Fishermans Beach (just south of Collaroy-Narrabeen Beach) where there is rock and stiff clay near the ground surface.

It should also be noted that a risk management approach was recommended in *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010).

It must be recognised that a structure can be designed to not be damaged for a suitably low probability event no matter where it is located, as demonstrated by structures located in the ocean such as oil rigs. Therefore, the risk assessment approach is not without limits, and other planning considerations (such as visual and other impacts on the public amenity of the beach and surf zone) must also be evaluated.

So to answer the question "is sensible development achievable at Collaroy-Narrabeen and Fishermans Beach?", it can be stated that it is, and that this can most appropriately be evaluated through a risk assessment process taking into account setbacks and controls such as piling, seawalls and ground conditions. This approach is considered to be more suitable than adopting an arbitrary coastline hazard line as a development setback.

Without a risk assessment approach, a consent authority may end up making philosophical decisions on beachfront development that unnecessarily sterilise development, or political decisions to appease landowners that may lead to development being approved which would have an unacceptable risk of damage. The evidence is there in NSW practice of both of these outcomes happening.

Whatever the case, it is considered that a consent authority as the Regulator has the responsibility of defining the level of risk that is acceptable. As stated in the Frequently Asked Questions accompanying Department of Planning (2010), "why can't private

developers and landowners be allowed to decide on the level of risk they are willing to take in their investment decisions?", with the response:

"The Guideline [Department of Planning (2010)]:

- recognises that today's property owners/developers will not be the ones to bear the risk of their decisions; and
- supports councils in their duty of care to make decisions that will not adversely impact on future owners and on future costs to the broader community."

Property Boundaries

Before moving on to a discussion on public beach amenity, it is relevant to consider what may happen to property boundaries along Collaroy-Narrabeen Beach and Fishermans Beach as beaches recede (move landward) in the future. Such long term recession would be particularly expected due to sea level rise.

The seaward property boundaries at Collaroy-Narrabeen Beach and Fishermans Beach are understood to be "right-line" boundaries, that is surveyed boundaries not defined by Mean High Water Mark (MHWM). Corkill (2013) has contended that case law shows that when the ambulatory boundary formed by a receding shoreline crosses a right-line private property boundary originally defined by survey, the ambulatory MHWM will become the new seaward property boundary. That is, the seaward boundary would then move landward coincident with the MHWM. However, there are questions as to whether this was the intent of the key judgements.

This is a NSW-wide issue that needs be resolved, for example through a "stated case" In which the Crown puts the matter (states the case) before the Supreme Court for determination in the absence of an opposing party. It is inappropriate that the burden of resolving this issue is placed on individual Councils completing CZMP's.

It is postulated that if Corkill (2013) is correct:

- private land without seawall works will diminish in size if the MHWM recedes landward of the current seaward property boundary;
- if the land area and land value is then re-determined, a Council will have reduced rates income from these properties so that the overall rates burden will need to be redistributed across the broader community (and landowners may eventually not be able to develop on the land);
- the Crown may be able to take possession over what is now considered private land and make it public land without compensation to landowners;
- landowners may find it more attractive to fortify their seaward boundaries by constructing seawalls, as this would limit the extent to which their seaward boundary could move landward; and
- a consent authority may have a desire to reject new seawalls on private land given that these may eventually impede the natural landward progress of the public beach and therefore be perceived to not be in the public interest.

If Corkill (2013) is incorrect then:

- the concept of planned retreat makes little sense unless there was also some mechanism to transfer land ownership from private to public; that is, even if development was sterilised, private ownership would be maintained;
- the public beach would narrow over time, and only beach nourishment or Council purchasing private property could ameliorate this; and
- arguments that seawalls on private land may impact on public beach width and amenity located seaward of that land (as the coast recedes) would have little standing, as the landward limit of the public beach would be at a fixed location.

At this point in time, and until proven otherwise, it has been assumed that seaward property boundaries are fixed in the study area.

Public Beach Amenity

In the study area, under the assumption that Council desires to allow private landowners to maintain existing beachfront development (where the risk of damage to development from coastal processes can be demonstrated to be acceptably low), and given the extensive lengths of existing seawalls/revetments, there are limited options available to maintain public beach amenity into the future. Maintaining public beach amenity in the future would largely be achieved if beach width is maintained over time.

In Patterson Britton & Partners (1993), it was concluded that the most suitable coastline management option at Collaroy-Narrabeen Beach was to upgrade and integrate the existing seawalls/revetments (to a consistent design standard) combined with moderate beach nourishment to enhance and maintain beach amenity. This option was adopted in the Collaroy Narrabeen Coastline Management Plan completed by Council in 1997.

Beach nourishment as defined here involves adding sand to the study area beaches, with the sand obtained from a location separated from the beach.

To add a sufficient quantity of sand to Collaroy-Narrabeen Beach so that seawalls would be unnecessary to protect development and the seawalls could be removed (so-called "massive" beach nourishment), in the order of 2,600,000 m^3 (4,200,000 tonnes) of sand would be required to provide initial protection (with ongoing sand required to replenish sand loss over time). Initial costs would be in the order of $130 million using land-based sand sources. Even using generally less expensive offshore sand sources (which currently cannot be accessed under NSW legislation) the costs would still be prohibitive (in the order of $65 million). Due to additional sand in the surf zone, there may also be unwanted impacts on surf quality if this was undertaken.

However, in the future (if funding and sand sources become available), there may be the opportunity to undertake "moderate" sand nourishment in order to reduce the time that seawalls are exposed and to restore or improve beach amenity as recession occurs.

It would be most cost efficient if the beach nourishment was undertaken using offshore sand sources (assuming environmental impacts of such works would be demonstrated to be acceptable), recognising that Council is unable to implement this strategy at present without the support of the NSW government in modifying the *Offshore Minerals Act 1999*, providing funding, and taking a coordinating role as nourishment would only be cost effective if it was to be implemented over a wide geographical area covering numerous Local Government areas.

Such works would typically be undertaken using a trailing suction hopper dredger. These dredgers work like a vacuum cleaner sucking sand up from the seabed and storing the sand in a hopper in the vessel hull prior to release at the placement site. From highest to lowest cost, placement can be undertaken using a pipeline pumping sand on to the subaerial beach, or "rainbowing" sand to subaqueous areas just offshore of the subaerial beach (Figure 6), or placement even further offshore (but still in the nearshore zone) by direct release under the vessel through hopper doors. In all cases, if a sufficient volume of sand is placed offshore at appropriate depths, the sand would over time be expected to work its way onshore to increase beach width.

Figure 6: Example of trailing suction hopper dredger placing sediment using "rainbowing" in Dubai (Van Oord, 2005)

There are numerous suitable sand sources offshore of Sydney, and these have been extensively mapped and investigated. As noted by Gordon (2013), sources include offshore of Broken Bay (with over 12 million m^3 available), south of the Sydney Harbour entrance to Bondi (about 24 million m^3 available), and offshore of Botany Bay (about 60 million m^3 available). Studies have also been undertaken assessing environmental impacts of offshore sand dredging in Sydney and it has been established that to avoid any significant impacts on shorelines the inshore limit of extraction directly off beaches could be 35m depth, reducing to 25m offshore of rocky cliff coasts. A medium size trailing suction hopper dredger can dredge to about 60m depth, with larger dredgers capable of dredging to 150m depth.

Based on the chart *Broken Bay 82310-575, Seabed Information*, which was derived from surveys completed between 1979 and 1985 and published by the Public Works Department in 1989, the extent of sand offshore of Broken Bay is as depicted in Figure 7. A polygon is depicted in Figure 7 which has an area of 9.3km^2 (and extends between 34m and 40m depth relative to Indian Springs Low Water, that is from about 35m to 41m relative to AHD). If sand was dredged to, say, 2m depth in this area, a sand volume of 18.7 million m^3 would be obtained. The sand source is far more extensive than this example.

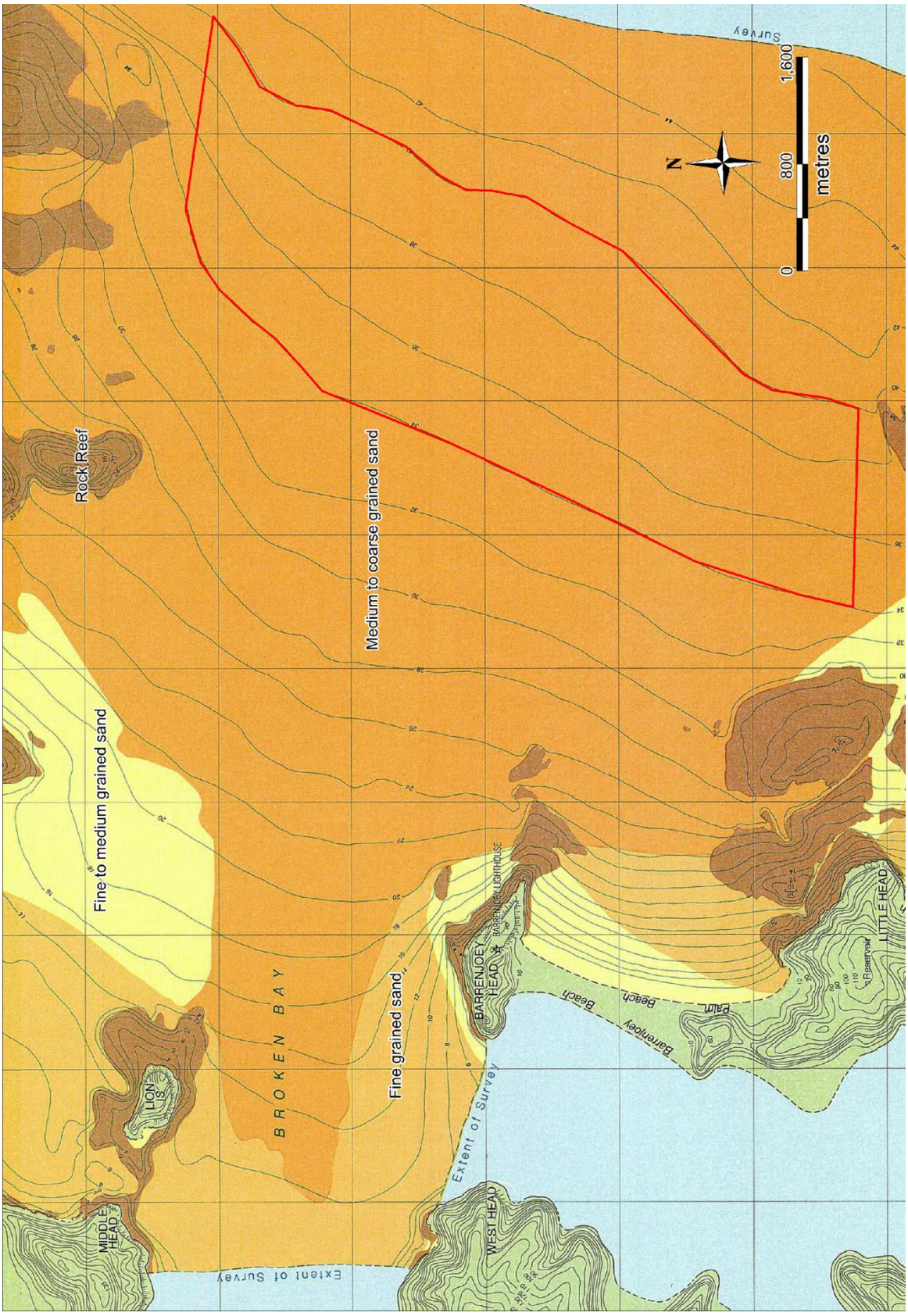

Figure 7: Seabed mapping offshore of Broken Bay (depths relative to ISLW), with example dredging footprint shown

So to answer the question “can public beach amenity be maintained at Collaroy-Narrabeen and Fishermans Beach (while maintaining beachfront development)?”, the answer is yes, but only if beach nourishment is undertaken when required in the future (in conjunction with development setbacks and controls). This is a challenge while offshore sand sources are inaccessible and NSW Government funding is unavailable.

Sensible Development and Public Beach Amenity

Both sensible development and public beach amenity are achievable at Collaroy-Narrabeen and Fishermans Beach, but this is reliant on hurdles to beach nourishment being overcome. If the situation does not change with regard to accessing offshore sand and funding beach nourishment, some hard decisions will need to be made regarding development at these beaches, or it will have to be accepted that public beach amenity will reduce over time.

Given the reality of existing protective works in much of the study area, which are largely on private land and cannot be ordered to be removed (unless there was a clear public safety issue), it is evident that beachfront development at Collaroy-Narrabeen Beach is likely to remain in some form well into the future. Even if development was sterilised, this would not substantially improve beach amenity in much of the study area, given that existing protective works would remain while the beachfront lots are in private ownership.

Conclusions

Sensible development is achievable at Collaroy-Narrabeen and Fishermans Beach, and this can most appropriately be evaluated through a risk assessment process taking into account setbacks and controls such as piling, seawalls and ground conditions.

At this point in time, and until proven otherwise, it has been assumed that seaward property boundaries are fixed in the study area.

Public beach amenity can most sensibly be maintained into the future at Collaroy-Narrabeen and Fishermans Beach (while maintaining beachfront development), by undertaking beach nourishment as required.

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