

WINDING BACK THE CLOCK IN DUNE MANAGEMENT AT WOLLONGONG

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Abstract

The local government area of Wollongong City Council has approximately 60 km of coastline, which includes 17 patrolled beaches. Use of the beach for various recreational activities is fundamental to the way of life for many local residents, as well as important for tourism. Vegetated areas on dunes at the back of these beaches are presumed to have been cleared following European settlement in the 1800's and the early 1900's. In the 1980's, in response to issues such as wind-blown sand and coastal erosion, an extensive program of re-vegetation was undertaken along many of Wollongong's beaches. As a result, the vegetation is now well established, and in many cases extends seaward over twice the area originally planted. Many in the community are now concerned about the impact of the dune vegetation on the beach amenity for recreational purposes and public safety.

In response to these concerns, Council has prepared a Dune Management Strategy for the patrolled beaches. This Strategy aims to achieve a balance between the need to provide a safe and desirable recreational area and the biodiversity value of the vegetated dunes and their role for protecting infrastructure assets. Some of the management options proposed, such as removal of some of the frontal vegetation and reshaping the dunes, are controversial, and had mixed reactions from the community and regulatory authorities. Nevertheless, Council made a decision to trial this option and monitor its progress to inform future management works.

The first location where vegetation removal and reshaping work has been undertaken is Woonona Beach. The coastal hazard assessment, design and approvals process, stakeholder engagement and implementation of on-ground work are presented. On-going monitoring and management, as well as the lessons learnt from this project are discussed and how they can help inform future management of dune vegetation.

Introduction

The term "Dune Management" is often interpreted as actions taken to restore degraded coastlines to a condition that is more reminiscent of the natural condition. This usually involves planting appropriate vegetation species to allow the dune building processes to occur. Success is viewed as a well-established and vegetated dune profile, with a foredune that is left to advance seawards over time. Actions taken to reverse this situation are usually rare. However, this has been recommended for a number of areas in Wollongong where dune restoration works carried out about 30 years ago have resulted in dune profiles that are now creating other management issues.

In order to avoid management conflicts arising in the future, dune management activities need to be imbedded into a holistic management framework, in which a reasonable balance is achieved between the different values the community expects of their coastline. Often, the value of a well-established dune in protecting infrastructure against coastal hazards and rising sea levels into the future is given far greater importance than any other value. In Australia, however, where the beach environment has been and continues to play a major part of people's lives, the other values of the coastline also need to be considered.

The beach environment can be the source of major economic activity for some areas, and in others it may be an integral part of the social fabric of the coastal communities that live around it. Managing beach environments for coastal protection alone can lead to situations which begin to compromise the other coastal values, and cause community dissatisfaction. This is the situation that Wollongong City Council found itself in. This paper describes the actions taken by Council to address the situation. The process that was undertaken to prepare the Dune Management Strategy and Implementation Plan for individual beaches is described in the Background section. Woonona Beach is the first beach where vegetation removal and dune reshaping works have been undertaken, and the process followed to implement these works is presented as a case study.

Background

Preparation of a dune management strategy for the Wollongong Local Government Area (LGA) was identified as an action in the draft Wollongong Coastal Zone Management Plan (CZMP) (WBM BMT 2012). During the public exhibition of the CZMP, strong community concerns were raised about Council's coastal dune management procedures with particular reference to excessive dune heights and the occurrence of scarping after storms, and the type, height and extent of vegetation occurring on the dunes. The concerns focused on the degradation of sightlines from the surf lifesaving facilities to the swimming zones and the reduced ability of lifeguards and lifesavers to properly observe people on the beach, and the effect of dune vegetation in reducing the public amenity use of the beach.

Council endorsed the Wollongong Dune Management Strategy (GHD 2014) and the associated Dune Management Implementation Plan in March 2014. The aim of the Strategy was to identify management options for the high use recreational areas of the 17 patrolled beaches in the Wollongong LGA to address safety and recreational amenity issues, whilst considering biodiversity values and the role of dunes in coastal processes. Tasks undertaken to identify management options included a literature review and desktop study, stakeholder consultation, and on-ground assessments of the dune morphology, vegetation species and distribution, and the lifeguard/surf lifesaving facilities and line of sight at each beach.

A range of consultation and communication activities were used to identify stakeholder and community issues of concern during development of the Strategy. All of the relevant comments and concerns about dune management that were raised during the preparation of the draft CZMP were compiled. An online community survey was conducted on the Council website with a total of 234 responses received. Targeted stakeholder meetings were undertaken with representatives of Surf Life Saving Illawarra and individual clubs, and other community groups. The draft Strategy project was displayed on Council's website and was the subject of an initial media release and three advertisements in the

local newspaper (Wollongong Advertiser) during consultation. Council has also responded to multiple media enquiries regarding the project.

The issues identified through the stakeholder consultation process were grouped into two categories. The first category related to the current state of the dunes and vegetation conflicting with the recreational use of the beach. Key issues in this category were:

- Deterioration of line of sight for lifeguards/lifesavers due to the height of the vegetated dunes,
- Reduction in recreational amenity due to storm scarps and a reduction in beach width due to encroaching dune vegetation,
- Degradation of beach access ways, and
- The presence and extent of native vegetation, in particular Coastal Wattle *Acacia sophorae*, which had been planted on the dunes.

The second category related to the precautionary measures required if there was management interference with the dunes and vegetation. Key issues in this category were:

- Ensuring that any proposed dune or vegetation modification action did not increase the risk from coastal hazards and processes,
- To consider the biodiversity value of the dune vegetation, and
- Conduct a community engagement program to improve understanding of the role of dunes and vegetation in the coastal environment.

The issues of reduction in line of sight, recreational amenity, and beach access, were considered to be the key management issues. The severity of these key issues was determined for each of the 17 beaches. Management options that were assessed for their potential suitability to address one or more of the key or other issues were of a structural nature, involved vegetation management or involved dune profile modification. Management options assessed for each beach were:

- Build a tower;
- Relocate existing tower;
- Raise level of observation area in Surf Life Saving Club;
- Improve beach access ways;
- Remove trees and shrubs affecting line of sight;
- Remove vegetation from frontal zone;
- Reduce dune height by re-profiling;
- Build a seawall;
- Management of subspecies of *Acacia longifolia*;
- Additional management of noxious and invasive weed species; and
- Maintain current management.

Combinations of different options were also considered to address the key issues occurring at a beach. Identification of the relative effectiveness of the management options (individually or in combination) in addressing issues at each beach was undertaken using a multi criteria analysis (MCA) that incorporated criteria covering both categories of issues. The three most important criteria were impacts on line of sight, on recreational amenity, and the risk from coastal hazards. The MCA used to rank the management options used a scoring system of positive to negative scores. Each management option was given a score for its impact on the criteria (sightline, beach access, recreational amenity, coastal hazard

impacts, ecology and pest animals and vermin) allowing negative impacts (risks) as a result of implementing management options to be captured in the MCA.

For each management option, indicative initial and maintenance costs, and the timeframe to implement were determined. Council also identified the legislative approval pathway that would need to be followed to implement each option. An Implementation Plan was prepared on the basis of this information.

One of the high priority actions identified in the Strategy was removal of the frontal dune vegetation at Woonona Beach to improve the line of sight for lifeguards and lifesavers and the recreational amenity for beach users, and this is where the first works were undertaken.

Woonona Beach Case Study

Existing Situation

Historical aerial photographs of Woonona Beach available to Council date back to 1948, and these do not show the presence of any significant vegetation in the areas where vegetated dunes occur in more recent times. Whether vegetation was previously present on the beach is unclear, although many in the community remember a time when there was a wide, open, sandy beach with unobstructed views from the back beach area

In 1986, Council in conjunction with NSW Public Works and the Soil Conservation Service undertook dune restoration work at a number of beaches, including Woonona Beach. Sand from the beach berm was moved to fill in lower areas at the back of the beach. A 20-40 m wide stretch of back beach was then fenced and planted (Figure 1). Species planted are listed on Council's records as *Acacia longifolia*, *Acacia sophorae*, *Banksia*, *Leptospermum laevigatum*, Marram Grass and *Spinifex*. The original dune restoration vegetation became well established, but had also spread up to 30 m seaward beyond the original planted zone (Figure 2). The decrease in area of sandy beach available for recreation was of concern to some of the community. As well as the seaward growth of the vegetation, dune heights had increased, leading to obstructed sightlines from the surf lifesaving and lifeguard viewing areas, creating a public safety issue of concern to the community.

Proposed Works

The dune reshaping works at Woonona Beach aimed to improve the recreational amenity (usable width of sandy beach), and line of sight for surf life savers and Council lifeguards within the patrolled beach area. Works were proposed to be undertaken over a 250 m stretch of beach and dune in front of the Woonona Surf Life Saving Club (SLSC) and lifeguard patrol tower. An area of vegetation at the front of the dune was to be removed and higher areas of dune were to be reprofiled to improve line of sight, with the excess sand moved to the lower beach.

Council engaged consultants to develop design options for the proposed vegetation removal and reshaping work, undertake a Review of Environmental Factors including assessment of risk from coastal hazards and prepare detailed design plans suitable for construction.



Figure 1. Photographs showing the dune restoration works carried out at Woonona Beach in 1986.



Figure 2. Aerial photographs of Woonona Beach showing vegetation spread over time (not georectified; for illustrative purposes only)

Coastal Hazard Assessment

The first step involved considering the coastal hazard impacts of different extents of vegetation removal and reshaping. The options involved clearing various strips of vegetation between 15 to 35 m wide along the frontal dunes and reshaping it to reduce the foredune height. Immediate post-work and longer term 'equilibrium' profiles resulting from these works were developed. The option selection was based on the need to maximise recreational amenity and minimise the exacerbation of the coastal hazard risks identified in the Coastal Zone Study (Cardno Lawson Treloar 2010). The immediate hazard line, the zone of reduced foundation capacity and the ocean inundation extent were calculated for the equilibrium profiles, using SBEACH modelling. The various options considered resulted in a 1.6 to 4.4 m shift of the reduced foundation capacity landwards from the results reported in the Coastal Zone Study (Cardno Lawson Treloar 2010). This amount of change was considered to be within the range of variation likely to result from natural fluctuation of the beach profile around the mean. The inundation extent for the new profile did not vary from the previously reported position, as vegetation is excluded from the SBEACH storm demand modelling, and the crest level of the post-storm dune scarp in any of the new options did not differ significantly from the Cardno Lawson Treloar (2010) modelled profiles. Given that the impact on coastal hazard risks was not considered to be significant, the selection of a preferred option was driven by the need to improve beach amenity, whilst also minimising environmental impacts due to the extent of vegetation clearing.

Design and Approvals

The selected option involved clearing the vegetation seaward of the area in which it was planted in 1986. Vegetation, predominantly *Acacia longifolia* subsp. *sophorae*, had spread approximately 15-30 m past the original fenceline (15 m at the northern end of the beach and 30 m in front of the SLSC). Design plans, including earthworks layout plans with set out points and cross sections, and a construction specification were prepared. Generally, dune height was to be reduced by up to 1 m, with a few small areas reduced by up to 2 m. Excess sand was to be moved further seaward.

The Dune Management Strategy (GHD 2014) had identified the approval pathway for all the management options, including dune reshaping. Land at Woonona Beach is Council Community Land, Crown Land under Council's care and control, and non-reserve Crown Land below mean high water mark. For the first two land categories, Council used provisions of the State Environmental Planning Policy (Infrastructure) 2007, Division 12, Clause 65(3)(e) to facilitate the vegetation removal and dune reshaping work. As such, consent for the work was not required and the potential impacts of the project were assessed under Part 5 of the Environmental Planning and Assessment Act 1979, which requires Council to carry out a Review of Environmental Factors (REF). For the non-reserve Crown Land, Council obtained a licence for temporary occupation of Crown Land from NSW Trade and Investment to allow the works to be undertaken.

The REF emphasized the need to stabilise the seaward edge of the vegetated area following the completion of the reshaping and to monitor the site to ensure the works were adequate to prevent erosion. *Spinifex sericeus* was to be planted at a density of one or two plants per square metre in line with the Coastal Dune Management Manual recommendations (DLWC 2001). Planting was undertaken within bare areas amongst the

secondary vegetation prior to the removal of the frontal vegetation to allow the plants time to establish. Due to presence of rabbits at the site, additional planting is planned to be undertaken to replace lost plants. The REF also specified that noxious weeds were to be treated prior to clearance of native vegetation. Noxious weeds treated within the works zone were *Chrysanthemoides monilifera* subsp. *rotunda*, *Lantana camara* and *Asparagus spp.* This allowed the native vegetation to be disposed of as green waste and recycled elsewhere.

Stakeholder Engagement

Key stakeholders were regularly informed and consulted throughout the project. The dune reshaping work is part of Council's adopted Dune Management Implementation Plan. Councillors, as well as Council's Aboriginal Reference Group and Estuary and Coastal Zone Management Committee were briefed on the project. Office of Environment and Heritage were consulted regarding the draft design profiles, coastal hazard assessment calculations and REF.

The Woonona SLSC was consulted at decision points throughout the process, with suggestions incorporated. The northern beach access way was kept open to allow access to a popular surf break. Works were also adjusted to allow use of the beach for a Surf Life Saving NSW Inflatable Rescue Boat event to be held during the middle of the construction period. Prior to the event, vegetation debris was moved off site, site fences moved and the main SLSC access way graded and reopened to allow public access to the beach for the weekend of the event.

On-ground Works and Outcome

Prior to on-ground work, key stakeholders were notified, public notices were placed around Woonona, surrounding residents were letter dropped, information was posted on Council's website and a media release was issued. Most community feedback received over the project was in the form of positive comments about the works being undertaken.

On-ground works were undertaken by contractors and took three weeks including a pre and post works survey. During this time, four beach access ways were closed and the beach and dune area fenced off from public use. Vegetation (*Acacia longifolia* subsp. *sophorae*) removal was undertaken by two bulldozers. A shaker bucket attachment was used to sift roots and other plant debris from the sand. The beach was then regraded by excavator. Figure 3 shows the beach before and after the vegetation removal and reshaping.

During the course of the work an unexpected and considerable amount of buried litter (mostly bottles) was uncovered. Eight cubic metre bags of litter were collected by hand over the course of the works. Upon immediate completion of the works the beach looked free of debris and litter. However, strong westerly winds over the following two weeks exposed more plant debris and litter including broken bottles. Consequently, the beach was raked on three occasions and litter such as broken glass was collected by hand. Fortunately as works were undertaken during winter there was only limited use of the beach during this time so this did not pose too serious a hazard.



Figure 3. a) View of Woonona Beach from the north (a) and south (b) before reshaping (i) 10 days after (ii) and four months after (iii)

Beach and Dune Monitoring

Council has been monitoring dune transects monthly within and adjacent to the project site since July 2013 as part of its broader Dune and Beach Monitoring Program. Three transects are located within the reshaped area, one on the southern edge, and one 50 m to the south of the site. Figure 4 shows a transect within the reshaped area and the one to the south. The June 2014 survey was undertaken a few days before the reshaping work and the July 2014 profile three weeks after completion.

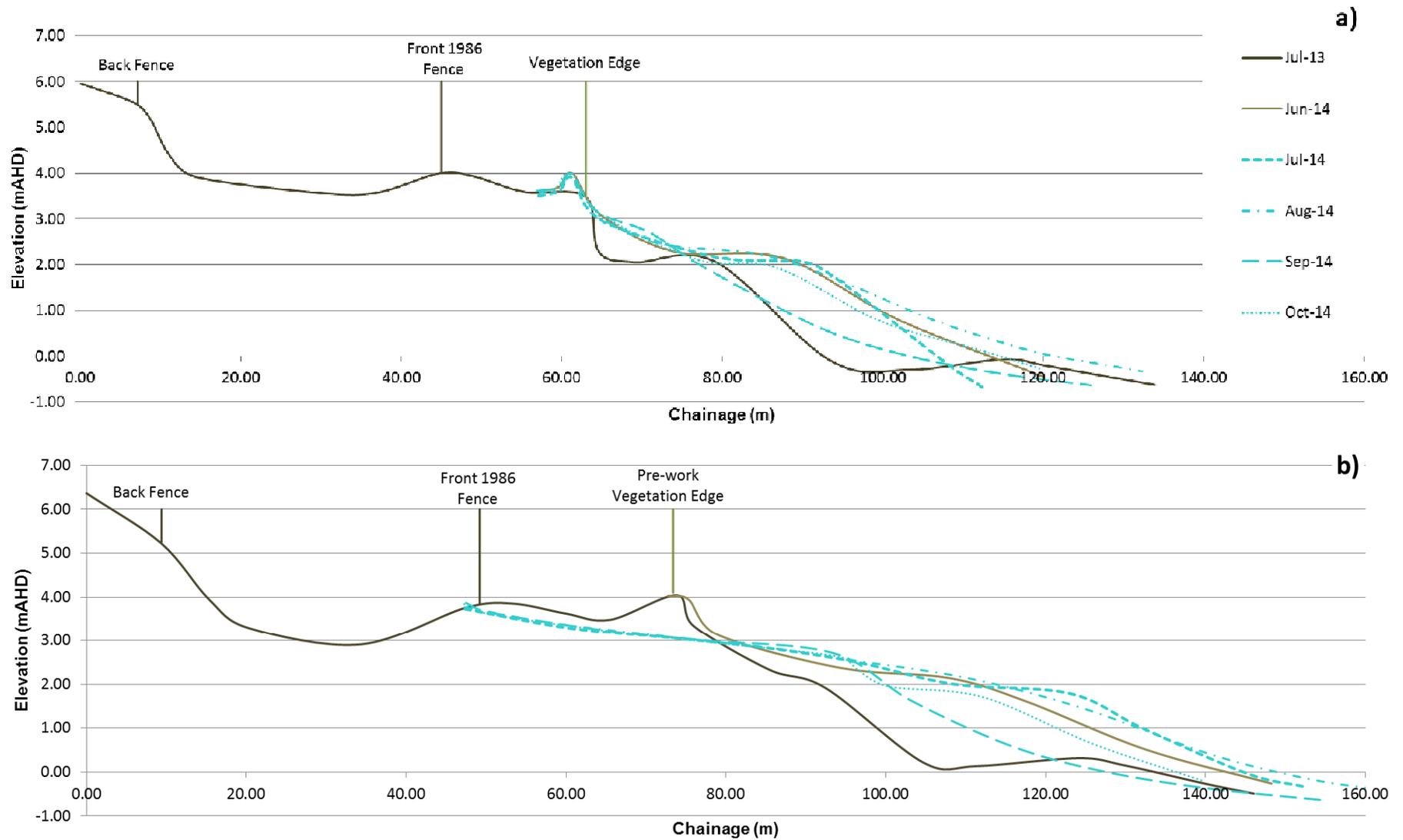


Figure 4. Transects through Woonona Beach in the non-worked (a) and worked (b) area for selected months

In the four months following the completion of the works, the mean beach width, defined as the distance to the 0 m AHD mark (i.e. mean sea level), has increased by about 20 m in the works area, as against about 10 m in an adjacent non-worked area. The on-ground works also reduced the foredune height in the works area by about 1 m, and there has been no change in this since the works. This suggests that the additional beach width achieved in the works area by moving sand to the lower beach and the reduced height of the foredune are continuing to be maintained, at least over this time period. These transects will continue to be regularly monitored to determine the longevity of the project.

A vegetation monitoring and management program has also been established. The aim is to transition the vegetation behind the patrolled beach area over the next few years from taller growing species to shrubs, ground covers and grasses in the back zone, and primarily *Spinifex* in the front zone. As part of the Dune Management Strategy (GHD 2014), Council has adopted a species list for future planting in different zones in the dunes.

On-going Management

Both the beach and dune profile monitoring and the vegetation monitoring and management programs will assist in ensuring that the outcomes achieved through the on-ground works are maintained in the longer term. The vegetation monitoring and management program, in particular, will aim to prevent vegetation from spreading out again into the cleared areas, and to establish only the frontal section of a typical vegetated dune profile in the dune area at the back of the cleared area.

Lessons Learnt

While it is still early days to determine whether the Woonona project has achieved its desired objectives or not, there are some learnings from this exercise which will be of interest to others contemplating such dune reprofiling and/or vegetation removal works for their areas. These are discussed below.

The planning to undertake the works can take a considerable amount of time, as together with preparing the technical studies and specifications, stakeholders of the project have to be kept informed and engaged. These stakeholders can include those who are strongly opposed to the proposed works, and can take action to disrupt the implementation phase of the project. Therefore, adequate time has to be allocated for the purpose of communicating the clear objectives of the project, and addressing any concerns that may arise. This means that any timeline for such a project should allow at least up to a year for the planning phase.

Another lesson is to ensure that the community understands and accepts that the works undertaken are on a trial basis, and their ongoing maintenance and management will be informed by monitoring of the impacts over time. If this is not clearly communicated, an expectation can be created for works to be carried out quickly at other areas which may or may not have similar issues. For example, following the works at Woonona, other Wollongong surf clubs started canvassing for vegetation removal at their beaches as well, even though the seriousness of their problems had not been clearly established.

The cost of implementing such a project is another factor to consider. The Woonona project cost almost \$150,000 for a 250 m stretch along a beach which is almost 2 km long. Several million dollars would be necessary to do such works along the whole beach, and such funding is not readily available in council budgets. Therefore, in areas where such issues are yet to arise, managing dune maintenance practices to avoid such problems occurring in the future might be a more cost-effective strategy than responding when problems have become entrenched.

Conclusions

Beaches and dunes are dynamic environments where changes can occur over both short and long periods of time as a result of coastal processes impacting on them. However, the community expectations of this area may not always be aligned with the changes that are occurring, and it is within this dynamic that coastal managers have to operate. This is not easy, as management intervention cannot always overcome the forces of nature, but an attempt can be made to create change in areas where the human use of the beach environment is getting seriously compromised by the natural changes. Wollongong City Council has attempted to do this at one of its beaches, and while this appears to have achieved the desired objectives in the short term, the longer term impacts are not yet clear. A comprehensive beach and dune monitoring program is being undertaken to understand the impact of the activity, and to inform the management strategy for other beaches.

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