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**RIVER HAMBLE HARBOUR AUTHORITY – PATROL CRAFT REPLACEMENT OPTION PAPER**

Issue

The timely, efficient and sustainable replacement of operational afloat patrol capability.

Background

All three River Hamble Patrol Craft are approaching their end of service. This is a planned event and capital has been set aside for their replacement. This is essential operational business to fulfil statutory responsibility.

Funding

Sufficient allocated capital is earmarked in the Harbour Authority's reserved Asset Replacement Reserve (ARR) for this purpose.

Risk

Minimal.

Benefits

- Resilient improved operational capability assured until at least 2050;
- One month increase in hull availability each year;
- 100% recyclable hulls, enhanced carbon efficiency in production;
- Preparedness for reduced carbon propulsion technology when ready;
- Forecast total year on year savings (propulsion, maintenance and labour) of around £11k;
- Forecast increase in ARR minimum holding in 2037 from £101k to around £200k.

Recommendations

1. Purchase in 2022 of three replacement craft, constructed from High Density Polyethylene, within allocated budget.
2. Harbour Master to present commercial-in-confidence paper on suitable candidate vessels to the Harbour Board.

The supporting paper is at Appendix 1.

J A Scott
Marine Director and Harbour Master

Appendix 1: RHHA Patrol Craft Replacement Option Paper.

Appendix 1 to RHHA Paper Dated 30 Sep 2022

**RIVER HAMBLE HARBOUR AUTHORITY – PATROL CRAFT REPLACEMENT OPTION PAPER – SUPPORTING STATEMENT**

## Introduction

The River Hamble Harbour Authority holds statutory responsibilities for Navigational Safety and Environmental Compliance within its jurisdiction for 5 ½ miles to Botley and Curbridge. The River's mouth, where it joins the Solent South of Warsash, is wide and exposed to the generally-prevailing Westerly weather. Here, the water is relatively deep with a long 'fetch'. Wave conditions occasionally reach 1.5m in height. The narrower section of the River North of the M27 motorway bridge is more sheltered but is characterised by very shallow water and confined space. Wave height is negligeable. Vessels must operate in this context.

In order to deliver its responsibilities, the RHHA requires persistent 'pillars' of operational capability. Among these mission-critical pillars are suitable patrol craft. These are the subject of this paper as they are reaching the end of their forecast lifespan.

The Management Committee and Board are briefed on our Asset Review programme annually and will be aware of the need for replacement. Both will be aware that plans have been made within the Asset Replacement Reserve for capital investment. This paper will therefore be expected.

## Concept and Scope

The RHHA's establishing Act of Parliament and the Port Marine Safety Code require the Authority to provide an afloat capability to enforce Bye Laws and take reasonable steps to ensure that risks are maintained at levels that are as low as reasonably practicable. Patrol craft must be certified as being capable of carrying out a variety of tasks in all weathers, by day and night. Tasking and operational constraints relating to the nature of the environment drive the decision-making process. These are:

- Day and night patrol in all weathers;
- Towing;
- Search and Rescue;
- Shallow and confined water operations;
- Pursuit at speed;
- Recovery of material hazardous to navigation;
- Maintenance tasking, including but not limited to Aids to Navigation, chainsaw work;
- Persistence of the capability.

Our current patrol capability rests in three vessels because of this last crucial point. Three vessels are the minimum number required to ensure persistence of operational

availability. Whereas three vessels will usually be available for tasking, it is a reality that each of our current craft will undergo planned maintenance at some stage in each year. With two vessels then available, experience and common sense mean that one of those remaining vessels may conceivably suffer a defect, leaving operational delivery vested in the remaining craft. This reasonable and prudent measure affords the Duty Holder assurance that his or her statutory responsibilities can be met.

This paper will address the totality of the patrol vessel capability and consider options for all three vessels. It will take into account developments in production and propulsion technology commensurate with both tasking primarily and secondly the need to take account of our policy to become more carbon-efficient.

## Current Capability

| Vessel | Number | Purchased | Length | Beam | Draft |
|---|---|---|---|---|---|
| **Cheetah Catamaran** | **2** | **2010** | **6.9m** | **2.4m** | **50cm** |
| **Cougar Rigid Inflatable Boat (RIB)** | **1** | **2012** | **6.0m** | **2m** | **50cm** |

## Cheetah Catamarans

Our primary patrol capability relies on two Cheetah 6.9m catamaran craft which are 12 years old. Good husbandry and regular maintenance means that these excellent craft remain in good condition. They have a good degree of residual value with their modern petrol twin engines. The Cheetah craft were originally purchased at a cost of £100k in 2010 to replace two similar craft of an older model when the latter were 12 years old. Both current craft were originally planned for replacement in 2022.

## Cougar RIB

The single Cougar RIB is 10 years old. This craft was purchased to provide a suitable degree of resilience to the patrol capability in the event that both primary vessels (the Cheetah catamarans) became unserviceable. This has proved essential on occasion. More economical in terms of capital outlay, this smaller vessel also provides extra capability for large scale support to events such as the Regattas. The same husbandry and regular maintenance means that this vessel will also have a good degree of residual value. This vessel was also planned for replacement after 12 years (2024).

## Replacement – the Balancing Judgement

Whereas the condition of our vessels does not mean that immediate replacement for any is required, there nevertheless comes a point when a balancing judgement will be necessary to take advantage of the position of greatest opportunity. With the current second-hand market for all vessels strong in a post COVID and Ukrainian War context and with the cost of new vessels increasing, the timing of our investment should aim to match a point where the difference between residual value and capital outlay are

closest, using the capital accrued for that specific purpose. Commissioning new capability with the long-term in mind is recommended now.

The 'staged' plan for replacement briefed in our current Asset Review Work is indicated here and shows how the need for replacement had been extended by sound husbandry:

| Vessel | Original Replacement Date | Extended Replacement Date | Capital set aside from ARR |
|---|---|---|---|
| Cheetah 1 'ROSE' | 2022 | 2025 | £150k |
| Cheetah 2 'CROWN' | 2022 | 2030 | £150k |
| RIB 'HYDRA' | 2024 | 2028 | £50k |

There is an opportunity to have a positive long-term impact of investment now on the Asset Replacement Reserve. Column two shows that capital investment in new craft has been budgeted for originally in 2022 and 2024. The volatility of manufacturing and material costs means that replacements will be increasingly expensive over the next few years. It follows that extensions in the lifespan of these crucially important assets, while intuitively a prudent economic measure, are likely to be counter-productive because of the rate of increase in manufacturing costs and a strong current second-hand market for vessels in good condition. As they become older, the value of our current fleet will peak and then deteriorate, making the future net cost of replacement greater. The attractiveness of the longer lifespan of some craft on the market (conservatively, 30 years) and their requirement for less frequent maintenance and engine replacement mean less year-on-year draw on both revenue and the Reserve with favourable effect.

**Future Specification**

The specification for patrol craft is set to deliver the task. It will also take account of the Harbour Board's policy, set out in the Strategic Vision and Plan[1]:

Within the Vision:

*The RHHB is aware of the impact of climate change and sea level rise and will continue to recognise, monitor and raise awareness of the effect on the Harbour. Promoting an understanding here will assist in improving the Harbour's resilience to climate change. The RHHB will therefore seek, where practicable, to support initiatives that will enhance the environment, restore nature and reduce carbon emissions and activities that contribute to climate change.*

And within the Plan:

*To be pro-active in monitoring the River for the impact of Climate Change and identifying the implications of decisions. Additionally to implement where practicable initiatives and inform, encourage and support the initiatives of other river users in reducing carbon emissions and activities that contribute to climate change.*

[1] Strategic Vision and Plan 2022-24 (hants.gov.uk)

The Harbour Authority will prioritise long lasting recyclable materials and look to take advantage of zero-emission propulsion systems either immediately or as they become technologically practicable.

**Hull Manufacturing Options**

Hull options will be driven by the requirement to perform the full range of patrol tasks in all weathers as well as berthing constraints at the Harbour Master's Jetty at Warsash and the need to operate and turn in confined narrow and shallow waters at the top of the River. They will also be driven by durability, through-life maintenance requirements and sustainable production and disposal advantages.

Options for hull construction are either metallic (steel or aluminium), glass-reinforced plastic (GRP) or High Density Polyethylene (HDPE). Metallic options in the size of boat required are fewer, more expensive and tend to be of the Rigid Inflatable Boat (RIB) type with the greater vulnerability to damage (and loss of capability) tubes bring. Metal hulls are robust (notwithstanding any RIB tubing application) and through-life costs are less than that of GRP, the materials out of which our current craft are constructed. They can also retain a greater residual value than GRP which is more susceptible to impact damage and, over time, 'crazing', Ultra Violet (UV) damage and osmosis. Our existing GRP primary patrol craft have performed well and the heavier 'lay-down' of GRP has generally resisted UV and crazing damage so far. Both metal and GRP require greater energy to build generally than a newer material whose use is becoming more prevalent as its merits are realised: HDPE.

HDPE is newly worthy of consideration because of its indestructibility with very high impact resistance. It requires minimal maintenance and intrinsically does not require anti-fouling. It is not susceptible to chemical damage and has additional appeal by virtue of its low carbon footprint. HDPE uses less than 20% of the carbon needed in production than aluminium, for example, is 100% recyclable and does not require anti-foul treatment. Boats manufactured from this material are very durable with a predicted lifespan in thicker forms of over 30 years.

**Propulsion Options**

There is understandably significant pressure to move towards more sustainable propulsion options. Our current vessels are powered by outboard petrol engines which remain operationally attractive because they provide the power needed for towing large vessels, for incident response and delivery of our oil spill protection capability. Diesel inboard and outboard propulsion units perform similarly and are a proven though more capitally expensive alternative. They last much longer typically and so through-life costs are less. Power transmission is achieved either via a propellor (from a lifting 'leg') or via a water jet. Both are reliable and proven capabilities. A water jet facility is more expensive but offers useful benefits - first, extremely good manoeuvrability, second, enhanced safety because it has no rotating parts to impact objects under the water and finally, a reduction in draft useful in shallow water.

Electrical propulsion has developed significantly over the past few years but is not yet a practicable proposition. Both outboard and inboard options are marketed and could be made to fit a variety of hull options. The principal practical challenges lie in

endurance, weight and, currently, much higher cost. Whereas offering good performance over short distances, if high power is used, the endurance of the batteries with current technology tails off dramatically, rendering them unsuitable for the extended and unpredictable duties our craft are required to perform. At low speeds (6 knots), 12 hours endurance will be achieved. However, when maximum power is used as is often required for incident response, towing or oil spill response boom work, endurance can drop to one hour. It is true that fast-charging systems are improving. Nonetheless, the unpredictability of 'events' will bring with it the risk that the capability is 'on-charge' when it is needed. A typical set of batteries add significantly to the weight of the boat and reduce carrying capacity. The batteries from an example provider weigh 400kg and a single 120hp equivalent electric engine married to the battery set weighs an additional 250kg. Finally, the cost of such a system from one representative provider of suitable craft will double the overall cost of a vessel.

While electrical propulsion systems continue to develop and become a more viable solution, perhaps withing the next few years, only petrol and diesel options are feasible. It will however be important to ensure that new craft are 'retro-fittable' with lower emission systems as they become more advanced.

**Vessels in Scope**

The Harbour Authority will present to the Board offers from three manufacturers. Details are not published here for reasons of commercial confidence. Ten vessels will be considered for our primary capability and three for the secondary capability. The combination of craft considered will be in line with budgeted figures.

Information considered will be taken from quotations received and manufacturers' own advertised information and figures.

**Through-Life Cost Considerations**

<u>Propulsion</u>

Principal current through-life costs relate to routine replacement of 5 outboard engines. Other lesser costs are incurred in periodic lift-out, refurbishment and hull maintenance, including anti-fouling. Reducing these costs will reduce the overall cost of the capability.

Outboard engine replacement for our current vessels has been extended over the past 5 years. The Harbour Authority operates engines of the same type in our current configuration. Each engine has a purchase and fitting cost of just under £10k. Replacement for each engine now takes place at year 4 in the life of an engine because of the operating cycle (high usage levels and, generally, slow speed operations). This plan allows used engines to either be retained for spares affording greater resilience in serviceability or sold on and the balance recovered set against replacement cost.

It is assumed reasonably that all replacement craft will be able to be fitted with alternative electrical or other propulsion within 10 years. We should also plan for the eventuality that an alternative will be available earlier or later. A chosen system will

therefore be considered as an interim solution and last as long as possible or minimise year-on-year costs.

Inboard diesel propulsion systems will, subject to caveats such as correct maintenance, last longer than petrol outboards. Diesel powered craft will not, barring catastrophic failure, require a replacement unit within 10 years or more. It is assumed that petrol outboard engines will require replacement at the existing rate. The higher capital cost of a diesel engine will need to outweigh the 10 year costs for cheaper petrol engines in primary and secondary craft.

Optimising the cost of engines over a ten-year period does not necessarily mean that the same propulsion system (diesel or outboard) need be procured in every craft. Combinations of propulsion are considered. Either a single diesel or two outboard engines would be required in our primary craft to provide the manoeuvrability and power requirements needed for tasking. The propulsion system for our secondary craft could be either diesel, if it were economical enough on purchase, or petrol. Where petrol engines are considered, the Harbour Authority would either require 5 such petrol units (2 each for the primary capability and one for the secondary), or just one for the secondary capability (the other two craft being diesel driven).

Costs of petrol outboard 4 yearly replacement over a ten-year period, charged to the Asset Replacement Reserve can be seen in the table below. Over ten years, the saving achieved by investment in diesel engines for primary craft is £80k.

| Option | Primary Patrol Craft | Secondary Patrol Craft | Total cost |
|---|---|---|---|
| Diesel in Primary Craft | Nil | £20k | £20k |
| All petrol propulsion | £80k | £20k | £100k |

Fuel costs

Current fuel costs are for petrol. Amortisation over the past seven year period gives a reasonable sense of usage for five outboard petrol engines. Current average annual usage is 5750 litres. Fuel rebate is recovered annually from HMRC at a current rate of 52.95 pence per litre. Marine fuel costs are higher than standard pump prices at around £2.18 per litre for petrol and £1.53 for diesel at the time of writing, recognising current volatility in pricing. Gross annual fuel costs are currently around £11k. The secondary patrol craft, with one engine and less use accounts for a fraction of this.

Overall consumption rates will depend on, inter alia:

- engine efficiency;
- The nature of the task and the amount of power required to perform it;
- Hull shape and form and the effort required to propel the craft:
- The weather and sea state;
- The number of engines used – eg single or twin.

Taking this into account, fuel consumption of a single diesel in each primary craft would be approximately the same as the twin outboard engines currently used. The

cheaper cost of diesel (currently) will realise savings. Raw data would indicate that savings in year one of any change would be around £2.5k. Over ten years, £25k saving might be achieved at current rates.

Lift out and Maintenance

The use of a 'versadock' (floating dock) for the secondary patrol craft means that associated costs are negligeable for that vessel.

For current GRP patrol craft, annual hull maintenance and anti-fouling/engine replacement routines mean that each vessel is subject to lift out and two weeks of shore maintenance each year. This means that one month's worth of primary craft capability is lost each year.

The cost of each lift-out and re-launch is £400. Ashore storage is £100 per week. Anti-fouling and other material costs for each ashore period can be expected to reach £1000, which includes patrol officer hours to conduct the in-house (and therefore more economical) work. The patrol capability vested in the craft ashore also has a degree of financial value because of additional usage of the remaining afloat craft. There is also always a risk that a defect may occur in the afloat primary vessel, leading to a degradation in overall capability.

HDPE vessels do not require anti-fouling and fewer lift-outs for maintenance are necessary. Were outboard engines to be selected as the means of propulsion, lift outs would be required for engine checks and possible exchange at half the current interval. For diesel engines, the requirement to lift out might reasonably be extended to periodicity of three years for general programmed checks.

The associated costs and savings are illustrated here for a ten-year cycle with each period costing £1000:

| Option | Primary Craft (4 petrol engines) | Secondary Craft (single petrol engine)* | Primary Craft (2 diesel engines) | Total |
|---|---|---|---|---|
| Current | £20k | £2k | N/A | £22k |
| All Petrol | £10k | £2k | N/A | £12k |
| Diesel/Petrol combination | N/A | £2k | £6k | £8k |
| All diesel | N/A | N/A | £6k | £6k |

*On a versadock – fewer lift-outs required.

## Conclusions

- Investment now is correct, given increasing costs of new craft and the residual value of our current craft.

- The effect of investment will be to reduce revenue costs, draw on the Asset Replacement Reserve and increase hull availability:

- Fuel costs expected to reduce, at current rates potentially saving £25k over ten years.

- Lift out and maintenance costs for HDPE diesel craft could deliver savings of £6k over the same period.

- Total through-life savings over GRP petrol craft of a mixed HDPE-hulled fleet of two larger inboard single diesel-engined craft and a single petrol-engined smaller craft are forecast to be over £110k over ten years. Estimated year on year savings are £11k.

- HDPE's strength, resilience to damage, low maintenance, life-span, carbon-efficient production and recyclability make it the preferred material for hull construction.

- All-diesel propulsion offers the greatest efficiency over an initial ten-year period in terms of through life costs, noting that it would involve greater initial capital investment.

- Diesel engines should reasonably last at least 10 years, negating the requirement for investment in replacement outboard engines and saving around £80k over that period. This will allow alternative propulsion methods to be re-assessed in due course.

**The Budget**

£150k has been set aside for each of the primary patrol craft and £50k for the secondary patrol craft within the Asset Replacement Reserve. Any amount recovered from the sale of our existing fleet will offset net expenditure by a corresponding amount.

Our Asset Review process allows modelling on the effect of expenditure on all or some patrol craft. The effect on the ARR graph of immediate expenditure on all three craft is at Figure 1. The effect on our predicted minimum holding in 2037 is to increase that value from £101k to £117k, principally because of engine savings. Evidence of the longer-term advantages in reducing through-life costs is apparent across the graph. Figure 1 does not include the value (as yet unknown) of the sale of our current inventory. Figure 2 is illustrative only and includes notional sale values of £30k for each of our current catamarans and £15k for our RIB. In this case, albeit yet to be realised, the effect on our predicted minimum holding in 2037 would be to increase that minimum forecast value from £101k to £199k.

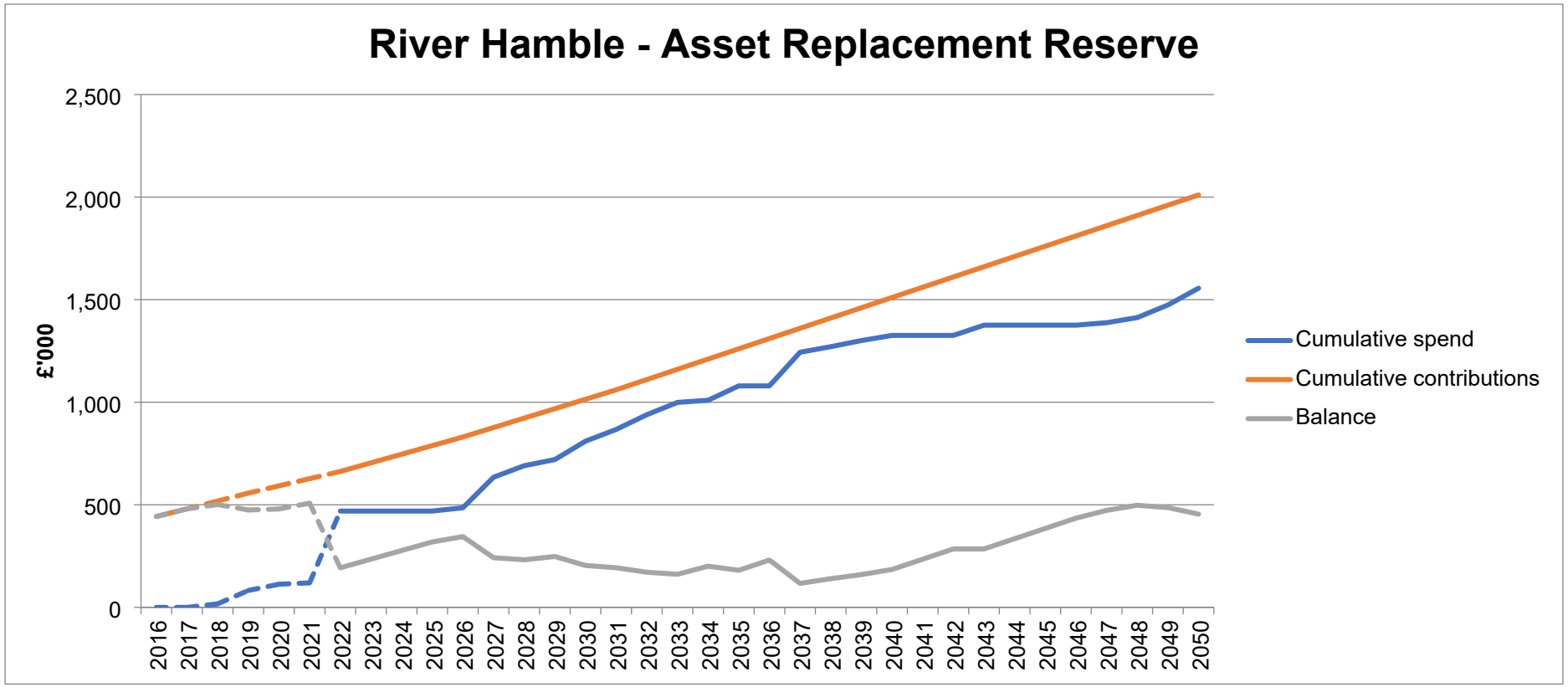


Figure 1 – ARR position with purchase of three new vessels immediately at budgeted cost.

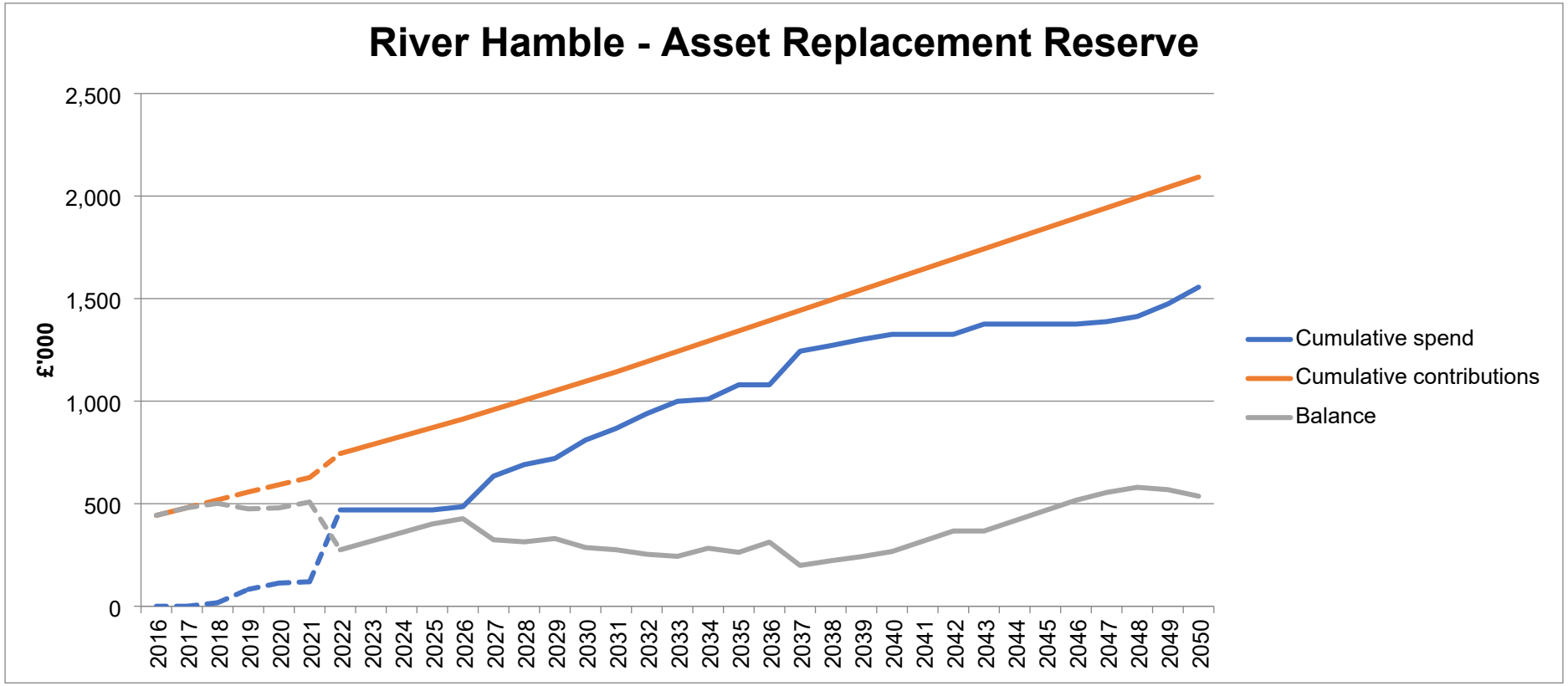


Figure 2 – ARR position with purchase of three new vessels immediately at budgeted cost and sale of current craft at a notional £75k.