

Cardiff Bay Barrage EIA

Evaluation of the EIA process



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1. Introduction

Basically defined, Environmental Impact Assessment (EIA) is ‘the process of predicting and evaluating the effects of an action, or series of actions, on the environment, then using the conclusions as a tool in planning and decision making’ (Pritchard, 1996). The system was first developed in the USA following the National Environmental Policy Act (NEPA) of 1996, and its goal was to provide a ‘systematic and integrative process’ to decide whether a project or proposal should be approved (Wood, 1995; 2002). Applying the EIA process should, in theory, lead to environmentally unacceptable actions halted, and mitigation to the point of acceptability implemented in the proposed project (Wood, 1995; 2002).

EIA was formally introduced to the UK over 30 years ago when it was included in the Town and Country Planning Regulations for England and Wales (Jha-Thakur and Fischer, 2016). This introduction came as a direct consequence of the requirements of European Community Directive 85/337/EEC on the ‘assessment of the effects of certain public and private projects on the environment’ (Commission of the European Communities (CEC), 1985). EC Directive 85/337/EEC was agreed in 1985 and Member States were under requirement to achieve formal compliance by July 1988 (Wood, 2000), with ‘mitigation of impacts’ the primary aim of the process (Reed, 2997).

Initially, UK government was reluctant to commit to such an idea (Wood, 2002), but as the European EIA Directive began to transpire, discussion on how to implement it in the UK commenced (Arts *et al.*, 2016). As a

result of this, EIA was introduced into the Town and Country Planning Regulations for England and Wales (Arts *et al.*, 2016). Around 70% of all EIAs undertaken are done so under the Town and Country Planning Regulations, making the regulation the most important for EIAs in the UK (Glasson and Bellanger, 2003; Glasson, 1999).

Regulations for the assessment have undergone various changes since 1988 in order to keep up with amendments to the EU-Directive; in particular, significant changes were seen in 1997, which led to the inclusion in the Town and Country Planning (Environmental Impact Assessment England and Wales) Regulations 1999 (Arts *et al.*, 2016). Further amendments were made in 2004 to implement the EU Strategic Environmental Assessment (SEA) Directive (Fischer, 2007) and again in 2011 when new EIA regulations were introduced in the UK which were seen to consolidate and update the mechanism (Arts *et al.*, 2016). Finally in 2014, another new Directive was published to be implemented by 2017 (Jha-Thakur and Fischer, 2016). Throughout the various amendments, the EIA Directive continued to, and will continue to, play a crucial role in strengthening the evolution of EIAs in the UK (Arts *et al.*, 2012).

The process undertakes multiple steps to ensure environmental considerations are included in project designs and proposals (Worldwide, E.L.A., 2010). EIA as a procedure ensures that any environmental implications are taken into account during planning and considered by decision makers, before any decisions are made (Orfrord and Henderson, 2017; Wood, 2000). It is an interdisciplinary procedure that helps to identify possible environmental effects of a proposed activity and how such impacts can be mitigated against (Worldwide E.L.A., 2010).

The need for an EIA is dependent on the likelihood of a project having an impact on the environment, by virtue of its nature, size or location (Orford and Henderson, 2017). The possible impacts of a range of projects are looked at in an EIA - for example, dams, motorways, airports, buildings etc. - and outline both positive and negative impacts (Orford and Henderson, 2017). In doing so, the EIA is also used as a technical tool to predict and analyse impacts on the: physical environment, social and cultural aspects of an area, and health impacts to local residents (Worldwide, E.L.A., 2010).

Whether or not an EIA is required for a particular project proposal can be determined at a number of different stages: it can be decided by the developer who will then submit an Environmental Statement (ES) with the planning application; the developer may request a 'screening opinion' from the local authority; or the local planning authority (LPA) might decide an EIA is required following receipt of a planning application (Orford and Henderson, 2017).

The process in the UK sees the preparation of an ES, usually by or on behalf of the proponent and is submitted with the planning application to the relevant Local Planning Authority (LPA) (Arts *et al.*, 2016). Research by Wood and Jones (1997) indicates that final outcomes and decisions are not altered by the inclusion of an ES, but rather that decisions may be more well informed due to the wealth of information. In contrast, Frost (1997) suggested that a fixation with creating an ES can draw attention away from the outcomes and as a result, despite acknowledgement that the EIA process should include monitoring and audit after the project is complete, very little is done in the way of measuring post project impacts. Therefore, the EIA pro-

cess enables an informed decision to be made, but does not necessarily ensure the most environmentally beneficial decision is made (Worldwide, E.L.A., 2010).

The UK Government (2019) has outlined the process in 5 stages. These are:

- Screening - This is where decisions on whether a proposed project is likely to have significant environmental impacts are made. This step determines the need for a full EIA or not. A 'screening opinion' can be requested from the local planning authority if necessary.
- Scoping - This step determines the extent of issues to be considered in the assessment. These issues are reported in the Environmental Statement, and if required, the applicant can request a 'scoping opinion' from the local planning authority.
- Preparing an Environmental Statement - If it is decided that an EIA is required before a project can commence, the applicant must prepare and submit an Environmental Statement. This document must include the likely significant environmental effects the project might have. The Environmental Statement must be completed by 'competent experts', and the developer should include a statement outlining the expertise or qualifications of such experts.
- Making a planning application - The Environmental Statement and related development application must be made public, both electronically and by public notice. At this point, the statutory 'consultation bodies' and

the public must be given a suitable time to share their views about the proposed development.

- Decision making - At this stage, all information is collated (Environmental Statement, comments and representations made, and any other relevant information) and given to the local planning authority and/or Secretary of State to decide whether or not permission for the development should be granted. The public must be informed of the decisions again electronically and by public notice.

This process is detailed in figure 1:

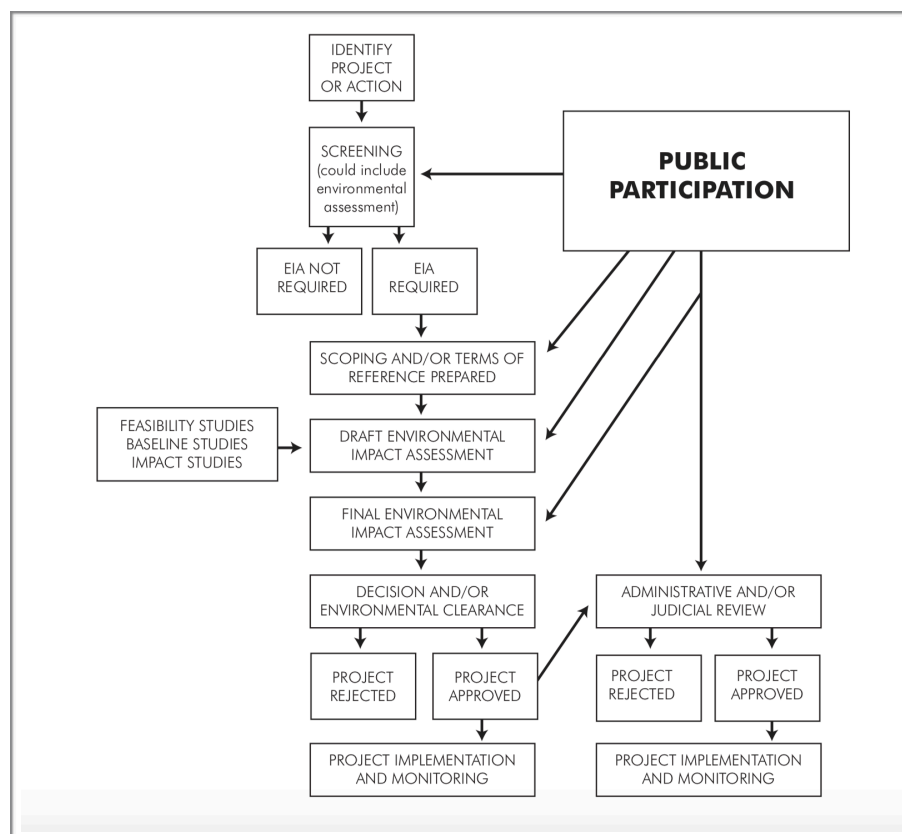


Figure 1: Flow diagram of EIA process. Sourced from: Worldwide, E.L.A., 2010. Guidebook for evaluating mining project EIAs. Eugene, OR: Environmental Law

Since its implementation in the UK in 1998, EIA has developed considerably through amendments and directives. However, EIA in the UK has been

criticised with respect to its 'somewhat unregulated scoping practice, lack of consideration of cumulative impacts, as well as lack of assessment of alternatives and somewhat complex public participation processes' (Glasson, 1999; Wood *et al.*, 2006; Wesson 2002). EIA's purpose is to inform decision makers of the environmental impacts of a project, but it's also there to inform the public of the impacts of a proposed project by promoting 'transparency and public involvement' (Worldwide, E.L.A., 2010). The importance of strengthening public engagement has been highlighted by Jha-Thakur and Fischer (2016) and although it has improved, it was stated that it is still 'patchy'. Further to these issues with either a lack of, or a complex public engagement, it is also important to recognise that completion of an EIA does not guarantee that a potentially harmful project will be rejected, and it has been seen in some countries that decision makers have chosen the most environmentally harmful option, as long as the consequences have been outlined in the EIA (Worldwide, E.L.A., 2010).

In light of its complexities, the more recently introduced 2011 regulations were done so in an attempt to simplify the process by amalgamating the various amendments (Arts *et al.*, 2016). Amendments were also made to the process by the European Parliament and Council of Ministers in an aim to clarify the rules for assessing the potential threats of proposed projects and also in an aim to reduce the 'administrative burden' (Orford and Henderson, 2017).

Revisions of the EIA Directive have been carried out in an obvious attempt to improve the process and its outcomes. As a process, EIA has a number of benefits, such as: its potential to 'screen out' projects with potentially

detrimental environmental impacts; proposal of modified or alternative designs that are more environmentally sensitive; identifying mitigation measures prior to a project commencing; providing information to those at potential risk in local communities; and can have an impact on decision making (Worldwide, E.L.A., 2010).

2. Overview of Project

The area now known as Cardiff Bay has a rich history dating back to the 1790s. Information of its changes through time can be found on the Discover Cardiff Bay (2020) website, and has been adapted below.

The Industrial Revolution in the 1790s is responsible for the growth of Cardiff, and in particular coal mining in the Valleys and the construction of the Glamorganshire Canal in 1794. As the mining industry grew, it became apparent that a more time efficient means of transport was needed, and so the Taff Vale Railway opened in 1840. This rapid trade resulted in the construction of a number of docks during the 1830s, including the Bute West Dock in 1839.

During this time, the area surrounding the dockland was transformed into a 'cosmopolitan community' with seafarers from all around the world. This put Cardiff on the map and people from over 50 countries around the world settled in Cardiff, in an area then known as 'Tiger Bay'. By then 1880s, Cardiff had become one of the largest towns in Wales and handled more coal than any other port in the world. This increased up until and throughout the First World War, where coal exports peaked at over 13 million tonnes.

However, after the Second World War, demand for coal greatly decreased, and exports virtually ceased. By the early 1980s, Cardiff Bay had become a neglected wasteland and its population suffered from social exclusion and unemployment.

The area has since undergone huge regeneration, mainly through the construction of the Cardiff Bay Barrage that impounds the rivers Taff and Ely to create a 500 acre freshwater lake with 8 miles of waterfront. This has given

rise to businesses such as: boat tours, cafés, restaurants, water taxi services and entertainment centres. The construction of the barrage was one of the largest engineering projects in Europe, and was completed in 1999.

In 1986, the then Secretary of State for Wales put forward that studies be launched into the possible construction of a barrage across Cardiff Bay (EAU, 1991). The closure of the barrage in 1999 signified the end of the Taff and Ely estuaries that originally made up Cardiff Bay (Reed, 2007). Closure of these estuaries would in turn mean the end to estuarine maturation in the area and in turn change the area into a freshwater system. This would have a number of impacts to both flora and fauna in the area, and because of this, an EIA was written by the Environmental Advisory Unit (EAU) of Liverpool University in 1991.

The reason for the construction of the barrage was to improve the appearance of the area, and the proposal was also aimed at providing the ‘opportunity for major redevelopment of the area, which would lead to national or international importance’ (EAU, 1991). Predominantly, the Cardiff Bay barrage is an amenity barrage, although it does also act as protection against surges (Reed, 2007).

3. EIA of Project

The main purpose of the barrage was as a means to improve the amenity and economic value of the Cardiff Bay area, however it was met with strong disapproval from two main groups: those concerned over water quality, and those concerned about the potential loss of ecologically valuable habitats (Reed, 2007). Of all barrage types, amenity barrages are likely to have the greatest ecological impact as they function by entirely changing the physical environment, often by total tidal exclusion (Reed, 2007) as was the case in Cardiff Bay. This section of the report will focus mainly on the loss of ecologically valuable habitats that support waders and wildfowl, however will also discuss water quality briefly.

3.1 Site of Special Scientific Interest

The bay was notified as a Site of Special Scientific Interest (SSSI) in 1980, and was later renotified under the 1981 Wildlife and Countryside Act. The SSSI covers the intertidal area of mudflats and salt marshes, with an area of 165 hectares (EAU, 1991). A SSSI is a 'formal conservation designation' that describes an area that is of particular importance due to species of flora and fauna that live there (Cottam, 2019). In the case of the bay, it was certain that construction of the barrage would change the habitat from an estuarine habitat of mudflats and salt marshes to a freshwater habitat, however what was not certain was whether this change would lead to an overall loss in biodiversity, and what the newly created habitats would look like in terms of ecological and conservation value was unclear (Reed, 2007). Therefore, changes to this habitat would be significant, and would require significant mitigation to be in place prior to construction to reduce these impacts.

The site is important not in its own right, but has an international importance for its support of a significant proportion of several species of waders and wildfowl for which the wider Severn estuary is of national and international importance (EAU, 1991). The EIA report states that for an estuary to be considered of international importance, it needs to regularly hold 1% of the 'estimated geographical population of a species or a sub-species'. For sites in Great Britain, this refers to the East Atlantic Flyway population of waders and the North-West European population of wildfowl (Rehfisch *et al.*, 2003; EAU, 1991). Moreover, it is the bird population of Cardiff Bay that were the reason the site was designated and protected as a wildlife site (Reed, 2007).

3.2 Waders and Wildfowl

The mudflats of the bay provide feeding grounds for several species of wader and wildfowl over the winter months, and those of highest importance are:

- Dunlin (*Calidris alpina*)
- Redshank (*Tringa totanus*)
- Curlew (*Numenius arquata*)
- Knot (*Calidris canutus*)
- Shelduck (*Tadorna tadorna*)
- Teal (*Anas crecca*)

Counts of these birds included in the EIA were provided by the Wildfowl and Wetlands Trust and British Trust for Ornithology. The species regularly feed on exposed mudflats where invertebrates can be found in the sediment at the tide's edge, and also on seeds from salt marsh plants (EAU, 1991). Particular consideration is given to dunlin and redshank as populations of these species have approached nationally important levels in Cardiff in the years prior to the report (EAU, 1991).

The report sites Cardiff Bay as a 'refuelling station' within the Severn estuary for migrating birds. However, it also states that permanent flooding caused by construction of the barrage would result in flooding of intertidal

flats preventing waders and wildfowl from using the area for feeding. If displaced birds were to remain in the Severn estuary, densities of these birds on other sites could increase, and thus the competition for food will also increase (Crayford, 1993; EAU, 1991). Dunlin are most likely to suffer as evidence suggests that when displaced, they are not able to easily establish elsewhere (EAU, 1991). Unlike dunlin, there is evidence that redshank can be accommodated elsewhere from the British Trust for Ornithology, who state that there is capacity to accommodate redshank in SW England within the Severn estuary (EAU, 1991).

Prior to its construction, EAU (1991) stated that if the barrage were to go ahead the designation would not maintain its SSSI status, even if measures were taken to increase the potential for wildlife in the area. The report also stated that between the years of 1983-1985, a large number of SSSI sites were lost due to 'technical shortcomings' of the act - 5500 in total in the UK. Therefore in this respect, the potential loss of the SSSI designation in the area is due to shortcomings in the EIA act, rather than shortcomings of the EIA conducted by EAU (1991). That being said, it could be interpreted that the construction going ahead whilst knowing of these shortcomings is almost 'cashing in' on the gaps in legislation, and disregarding the species of waders and wildfowl that will suffer as a result.

The EIA report outlines methods in the 'mitigation' section that were proposed in an attempt to maintain SSSI status in the area. Those investigated but rejected included:

- Clearance of *Spartina anglica*. This was rejected as there was only 2.5 hectares in the immediate area and therefore potential removal was

limited. The report (EAU, 1991) also stated that there was evidence that dunlin numbers have not consistently increased in estuaries where *Spartina* has decreased.

- Creation of a breakwater to encourage the deposition of sediments. This was disregarded as evidence pointed at questionable ecological benefits as the elevation would not be suitable and would be exposed at less time than the existing high levels, therefore this would not increase feeding time for dunlin.

This shows that some consideration of alternatives was given before selecting the methods that would be used. Consideration and identification of alternative mitigation methods are important in the designing of a successful EIA (Worldwide, E.L.A., 2010). That being said, the alternatives previously mentioned are relatively small scale in comparison to the entirety of the barrage construction.

The method that was selected was a compensatory method rather than mitigation which was the creation of new feeding grounds to reduce the impact of barrage construction on bird species in the vicinity. A lengthy section was included in the report detailing the selection process for appropriate compensation, which on the one hand suggests the process and associated feasibility studies were done so thoroughly, but on the other hand can be a criticism of the EIA documentation. Jha-Thakur and Fischer (2016) expressed that in its earlier years, EIA suffered from what they termed 'technical obesity', suggesting that the EIA system in the UK produced documentation that was 'too lengthy' (Arts *et al.*, 2012).

The aim was to create new 'high-level' mudflats, as well as a provision for the construction of a lagoon at the Wentloog levels as part of the Gwent Levels Wetlands Reserve. The way in which the lagoon was to be constructed went through consideration for its design and location. There was, however, some controversy surrounding this selection as it was not designed as mitigation for the loss of inter-tidal mudflats, but instead construction of the site was done so to provide compensation for the species predicted to be lost from the bay (Reed, 2007). Essentially, this suggests that the target habitats of the area were not expected to be able to support the same species or numbers as Cardiff Bay, rather it was hoped that the attraction of different species with some conservation importance would compensate for this loss (Reed, 2007).

It was decided that an 'L-shaped' structure would be used which would enclose an area of 23 hectares where tidal water would enter the lagoon through 16 pipes and 12 bearing tidal flaps. These pipes and bearings can be controlled to maintain optimal conditions. The profile of the lagoon was selected to keep the height of the mudflat between +1.5m and +3.5m as it was recommended in the report that above +4.0m there would be a reduction in invertebrates which would impact the feeding potential of dunlin. The report also states that dredging will be necessary to maintain the rear of the lagoon below +3.5m, and the preferred method of doing this would be small amounts yearly rather than more major dredging carried out infrequently. It was decided that this strategy should allow the area to be recolonised by species migrating from other parts of the lagoon; for example: *Hedisite*, *Hydrobia* and *Corophium*. The EIA states that migration like this has been observed in other parts of the Severn estuary by fern species, and localised

migration of this kind was reported as taking three months. However, this same colonisation was reported later in the EIA as taking six months, thus highlighting a discrepancy in the data.

The feasibility study showed that the creation of a lagoon would provide a feeding area for wading birds, and was also within cost constraints (EAU, 1991). However, the report could not predict with any certainty the number of waders the lagoon could support. The EIA could only give an indication by making comparisons between areas of similar elevation in the original bay area and the lagoon. The indication given was done so based on the 80 hectares available to dunlin in the original bay area, however the area available to dunlin in the new proposed site would be 23 hectares - around one quarter of the original area. This therefore suggests that around one quarter of the dunlin population will be supported by the new lagoon. In addition to the height of the feeding area, the length of tide-edge was stated as an important consideration (EAU, 1991). This is because the tide-edge in the lagoon has been calculated as only 150m in length, suggesting that the use of the lagoon during some neap tide cycles might be limited. The report does not offer any suggestions of how this can be mitigated against and thus suggests that dunlin populations could be further affected by this oversight.

Redshank populations have also been paid considerable attention in the report, and present a differing issue when analysing tidal cycles to dunlin. Redshank remain in the original bay area throughout the tidal cycle and at low water in lower levels of the shore (EAU, 1991). The lagoon would replace a smaller proportion of the habitat provided in the bay for redshank than dunlin as 150 hectares out of 190 hectares of mudflats are to be lost which would have originally been used by redshank for feeding. This equates

to approximately 15% of redshank feeding ground being replaced by the lagoon. That being said, the 'sheltered-ness' of the lagoon would increase the feeding time for redshank in the lagoon (EAU, 1991). Despite this knowledge, the report again fails to offer any suggestion as to how this reduction in feeding grounds could be mitigated against or compensated for in the new lagoon site or beyond. This is particularly alarming as the report also states that redshank remain in the Cardiff Bay mudflats throughout the tidal cycle and do not make use of other parts of the Severn estuary. The loss of this site will greatly impact this species, yet there are a lack of alternatives suggested. This is a weakness of the EIA when looking at redshank, and the EIA process as a whole (Glasson, 1999).

As noted previously, amendments to the EIA Directive (2014/52/EU) in recent years have changed to ensure that at least two alternatives should be assessed, along with a 'zero alternative' which would detail how the site would mature if no action went ahead (Jha-Thakur and Fischer, 2016). Should this have been completed for the Cardiff Bay Barrage EIA it could have signified to decision makers the ecological importance of an alternative or 'zero action alternative' to the redshank population.

The report stated that the location of the lagoon was analysed and the selected site of the Wentloog Levels was chosen based on such studies. The Wentloog Levels are situated within the Gwent Levels, which are an area of land that is made up by a low-lying, flat and expansive coastal plain which is up to 6km wide and extends into the Severn Estuary (Living Levels, 2018). However, the EIA report also describes the locality of the lagoon being only 500m from the Lamby Way landfill site.

There are two issues related to this: attraction of gulls and their subsequent interactions with wading birds, and the potential for leachate to enter the lagoon. Gulls have been ‘frequently observed’ chasing away waders, in high densities this could reduce the value of the lagoon as wader feeding ground (EAU, 1991). It was suggested that the landfill site should attempt to limit the number of gulls that can access the tipping face by using a mobile net system, which has reportedly been successful at Saltlands in Somerset, Preseli and the Isle of Skye.

Secondly, leachate from the landfill may enter the lagoon, and the report recommends that water is monitored to assess if this has occurred. The report does not suggest any ways in which this potential leachate contamination could be stopped before it enters the lagoon, nor does it allude to reasons for leaving this out. It would be reasonable to assume that at some point in the future, the lagoon could experience contamination from landfill leachate which could be hazardous to flora and fauna in the lagoon.

As well as design and location, timing of the construction is important. The report recommends that new mudflats should be created ‘well in advance’ of the loss of the bay site, as this would allow colonisation and growth of sufficient densities of invertebrates to provide food for waders (EAU, 1991). Timing is also important considering that waders and wildfowl commonly frequent the bay during the winter months. Despite this recommendation, the barrage was completed and closed in November 1999 (Reed, 2007) and the land for the lagoon was not acquired by Land Authority Wales until 1998, and the lagoon was founded in March 2000 (Living Levels, 2018; Cardiff Harbour Authority, 2019). This suggests that for the winter months of 1999, waders and wildfowl that use the Cardiff Bay site for a ‘fuelling

station' would not have been able to. The timing also illustrates that the Wentloog site did not have sufficient time to colonise in order to be viable for waders and wildfowl to use, adding to the potential loss of species following the closure and impoundment of the bay.

The impact of the afore mentioned oversights in the EIA can be seen in bird populations in the years following impoundment. The extreme loss in the total abundance of waders and wildfowl is clear (Reed, 2007). In the period of time from 1998 - 1999, a mean total of 500 birds were lost per annum, and this figure further increased to 800 birds per annum until 2004, with dunlin and redshank among the most affected (Reed, 2007). When comparing the period after barrage closure to the five year period prior to barrage closure, dunlin went from a mean winter peak count of 5,229 (± 378.7) individuals, down to a mean winter peak count of 0.2 (± 0.2) (Reed, 2007). This data is stark and shows that dunlin, which were a species in the bay of significant importance prior to barrage construction, have greatly suffered.

Data collected by the British Trust for Ornithology from the Wentloog Levels as part of the Gwent Levels states that in October 2006, the reserve had reached the target of attracting two species of water bird in nationally important numbers over a five year average - Shoveler (*Anas clypeata*) and BlackTailed Godwit (*Limosa limosa*) (Living levels, 2018). Whereas this is a successful measure of the compensation, dunlin and redshank are only reported as visiting the site during summer months, thus highlighting that formally important species are no longer found in abundance in the area.

3.3 Water Quality

The other area of particular concern given the ‘amenity’ purpose of the Cardiff Bay site post impoundment is water quality. The EIA report breaks water quality down into a number of sections and each contains discussion about how the water quality in the bay will differ once it becomes a freshwater lake. The sections included are as follows:

- Sources of pollutants (including nitrogen and phosphorus) - the report states that effluent discharges would be far greater in the post impoundment lake than the previous tidal system. Known effluents will be diverted to the estuary, but surface drainage components and leachate from contaminated industrial sites will not be diverted. There is no suggested mitigation against this.
- Dissolved oxygen - it was noted in the EIA that levels from rivers would not be high enough in the winter months, and so the ‘Vitox system’ (developed by British Oxygen Company) was proposed. The system uses a water jet to mix the body of water and, if necessary, oxygenated water can also be injected. A trial was undertaken to determine the potential success of such the system, but was done so in Greenland Dock in Surry. The report goes on to state that the physical shapes of both water bodies are not comparable, and also that the amount of wind-induced mixing was also different at each site. Therefore, the trial did not ‘demonstrate unequivocally that oxygen would be effectively dissolved, dispersed and retained in the water body’ (EAU, 1991), yet the method was accepted.

- Trace metals - the report outlines that impacts could be seen from trace metals which could increase in the impounded lake due to a reduction in day to day flushing and from annual dredging of the lake. Studies were carried out into the potential for release from sediments but were found to be inconclusive, and further investigations would be required (EAU, 1991). However, there was no mention of trace metals in the mitigation section of the report, nor was there any further mention of the investigations recommended.

- Microbial Contamination - The microbial quality the bay was not considered of importance in terms of public health as bathing and water sports were not encouraged, and as a result a number of serious waterborne diseases pose a risk (EAU, 1991). The report states that the main sources of contamination are the Taff and Ely rivers. The mitigation against the risk posed by these contaminants was to ensure that only water sports that involve 'accidental water contact' should be participated in. It was also stated that a water quality monitoring programme will be essential to monitor microbial content of the water. However, as the bay was designed as an amenity barrage, it seems careless to only include monitoring in the mitigation against the risks posed by waterborne diseases from microbial contamination.

As mentioned, the mitigation for water quality was continuous monitoring. There was no suggestion of stopping contaminants entering the bay or possibly treating them before they enter the lake. Monitoring has previously been identified as a weakness by Glasson (1999) and the role of environmental management plans (EMPs) in delivering mitigation of unwanted

environmental impacts have instead been emphasised (Tinker *et al.*, 2005; Marshall, 2002).

4. Conclusion

‘Good intentions do not always become good practice’ (Glasson, 1999). There are two criterion that are frequently recognised as effective when producing an EIA: whether environmental awareness has been raised and whether it leads to environmental values being included in decision making (Runhaar and Driessen, 2007; Runhaar *et al.*, 2013).

If the Cardiff Bay Barrage EIA were to take place in the present day, under current EIA Directive and legislation, the EIA would be required to report on a ‘zero action’ scenario. Assuming that no action would mean that numbers of nationally important bird species (predominantly dunlin and redshank) would remain unchanged, or at least would not suffer the significant decline they have as a result of the barrage construction. The argument presented by the EIA is that increasing the ecological value of the Wentloog Levels site by increasing bird populations to numbers of national significance is ample compensation for the loss of nationally significant numbers of dunlin and redshank. This raises the interesting question of how the importance of one species can be judged against another (Reed, 2007).

The EIA document itself is incredibly long, and as previously mentioned this is a criticism of the EIA process (Arts *et al.*, 2016). Despite this criticism, it must be noted that sections of the EIA report, although long, were detailed. The ‘Baseline Data and Evaluation’ section, and the ‘Impacts’ section were thorough. However, the ‘Mitigation’ section was considerable shorter, this is concerning for a project of this size and environmental impact.

From the deficiencies noted throughout this report it would suggest the decision to commence with the project had already been made, and the EIA was conducted as a 'tick-box' exercise; ensuring that consequences were disclosed in the report (Worldwide, E.L.A., 2010), but not necessarily acted upon in every sense possible.

5. References

Arts, J., Runhaar, H.A., Fischer, T.B., Jha-Thakur, U., Laerhoven, F.V., Driessen, P.P. and Onyango, V., 2016. The effectiveness of EIA as an instrument for environmental governance: reflecting on 25 years of EIA practice in the Netherlands and the UK. In *Progress in Environmental Assessment Policy, and Management Theory and Practice* (pp. 171-210).

Atlantic Consultants. 1999. Volume 2: Design Guidelines for the Wentloog Levels. Final Report. Available: <https://www.cardiff.gov.uk/ENG/resident/Planning/Local-Development-Plan/EvidenceBaseDocs/Volume%202%20-%20Design%20Guidelines%20for%20Wentloog%20Levels.pdf>. Last accessed 07.04.2020.

Cardiff Harbour Authority. 2019. Barrage Story. Available: <https://cardiffharbour.com/barrage-story/>. Last accessed 08.04.2020.

Cayford, J., 1993. Wader disturbance: a theoretical overview. *Wader Study Group Bulletin*, 68, pp.3-5.

Commission of the European Communities (CEC). 1985. Council Directive on the assessment of the effects of certain private and public projects on the environment (85/337/EEC), *Official Journal of the European Communities*, L175/40 (Brussels, CEC).

Cottam, L. 2019. SSSI definition: what is it and what does it mean for conservation and development?. Available: <https://www.woodland-trust.org.uk/blog/2019/03/sssi-definition/>. Last accessed 06.04.2020.

Discover Cardiff Bay. (2020). Our History. Available:
<https://www.cardiffbay.co.uk/history/>. Last accessed 06.04.2020.

Environmental Advisory Unit (EAU) 1990. Cardiff Bay Barrage-Environmental Statement. United Kingdom: Liverpool University. 5-143.

Fischer, T.B., 2010. The theory and practice of strategic environmental assessment: towards a more systematic approach. Routledge.

Frost, R., 1997. EIA monitoring and audit. Planning and environmental impact assessment in practice, pp.141-164

Glasson, J., 1999. The first 10 years of the UK EIA system: Strengths, weaknesses, opportunities and threats. Planning Practice and Research, 14(3), pp.363-375.

Glasson, J. and Bellanger, C., 2003. Divergent practice in a converging system? The case of EIA in France and the UK. Environmental Impact Assessment Review, 23(5), pp.605-624.

Living Levels. 2018. Part One – The Scheme Plan / Summary of Engagement . Available:
https://static1.squarespace.com/static/5a1d5fb38a02c70db7c34f81/t/5b239fb70e2e72064cb509bb/1529061317842/LL_Part_2_Introducing+the+Gwent+Levels+Landscape_reduced.pdf. Last accessed 08.04.2020.

Marshall, R., 2002. Developing environmental management systems to deliver mitigation and protect the EIA process during follow up. *Impact Assessment and Project Appraisal*, 20(4), pp.286-292.

Orford, K., and Henderson, E.. (2017). Research Briefing The Planning Series: 10 - Environmental Impact Assessment . Available: <https://www.assembly.wales/Research%20Documents/17-016/17-016-Web-English.pdf>. Last accessed 31.03.2020.

Pritchard, D.E., 1996, March. Environmental Impact Assessment towards guidelines for adoption under the Ramsar Convention. In *Proceedings of 6th Meeting of the Conference of Contracting Parties to the Ramsar Convention*, Brisbane, Australia (pp. 19-27).

Reed, J.P., 2007. Plant and animal community changes associated with the Cardiff Bay Barrage. Cardiff University.

Rehfishch, M.M., Austin, G.E., Armitage, M.J.S., Atkinson, P.W., Holway, S.J., Musgrove, A.J. and Pollitt, M.S., 2003. Numbers of wintering waterbirds in Great Britain and the Isle of Man (1994/1995–1998/1999): II. Coastal waders (Charadrii). *Biological Conservation*, 112(3), pp.329-341.

Runhaar, H. and Driessen, P.P., 2007. What makes strategic environmental assessment successful environmental assessment? The role of context in the contribution of SEA to decision-making. *Impact assessment and project appraisal*, 25(1), pp.2-14.

Runhaar, H., van Laerhoven, F., Driessen, P. and Arts, J., 2013. Environmental assessment in the Netherlands: effectively governing environmental protection? A discourse analysis. *Environmental Impact Assessment Review*, 39, pp.13-25.

Tinker, L., Cobb, D., Bond, A. and Cashmore, M., 2005. Impact mitigation in environmental impact assessment: paper promises or the basis of consent conditions?. *Impact Assessment and Project Appraisal*, 23(4), pp.265-280.

UK Gov. (2019). Environmental Impact Assessment. Available: <https://www.gov.uk/guidance/environmental-impact-assessment#overview-of-the-environmental-impact-assessment-process>. Last accessed 03.04.2020.

Weston, J., 2002. From Poole to Fulham: a changing culture in UK environmental impact assessment decision making?. *Journal of environmental planning and management*, 45(3), pp.425-443.

Wood, G., 2000. Ten years on: an empirical analysis of UK environmental statement submissions since the implementation of Directive 85/337/EEC. *Journal of Environmental Planning and Management*, 43(5), pp.721-747.

Wood, C., 2002. *Environmental impact assessment: a comparative review*. Pearson Education.

Wood, G., Glasson, J. and Becker, J., 2006. EIA scoping in England and Wales: Practitioner approaches, perspectives and constraints. *Environmental Impact Assessment Review*, 26(3), pp.221-241.

Wood, C.M. and Jones, C.E., (1997) The effect of environmental assessment on UK local planning authority decisions, *Urban Studies*, 34(8), pages 1237-1257

Worldwide, E.L.A., 2010. Guidebook for evaluating mining project EIAs. Eugene, OR: Environmental Law Alliance Worldwide.

6. Appendices

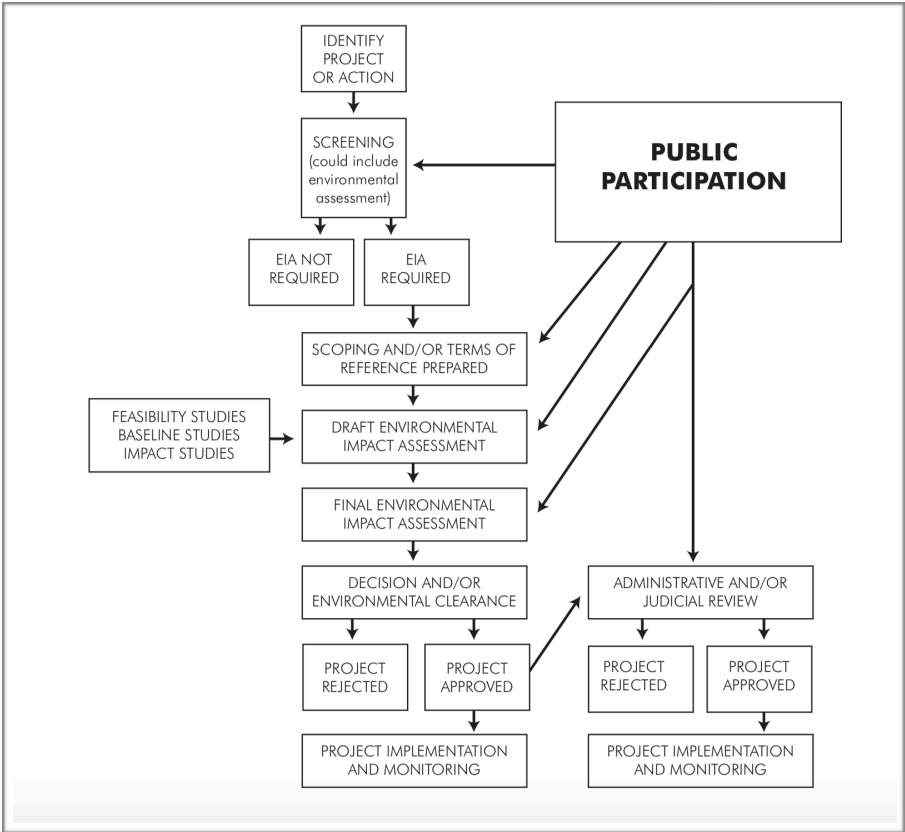
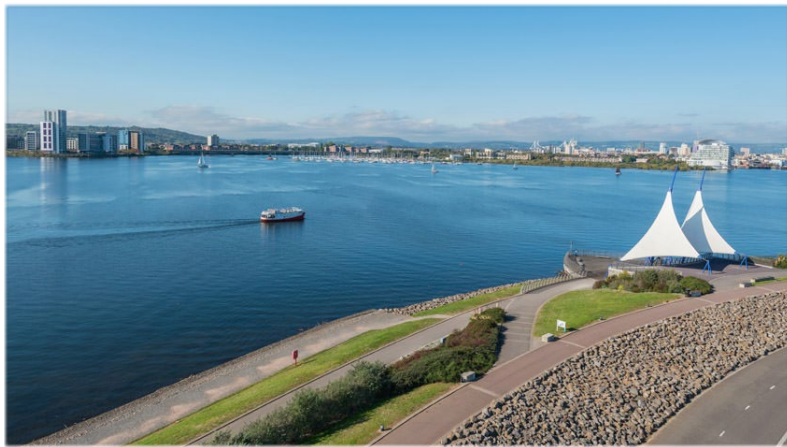


Figure 1: Flow diagram of EIA process. Sourced from: Worldwide, E.L.A., 2010. Guidebook for evaluating mining project EIAs. Eugene, OR: Environmental Law

Figure 1



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