Costing Principles

The quantities for each element of the proposed Scheme were estimated and rates applied to produce an option construction cost. The preliminary and enabling costs were added to the construction cost, along with the operation and maintenance costs over the design life of the Scheme. The option construction cost, and operation and maintenance costs were discounted over the design life of 100years to give the relevant present value costs. An optimism bias (contingency) was then applied to the total of all these costs produce the total outline Scheme cost.

An option construction cost for the proposed Scheme has been built up based on the items required to construct each element. Each of the elements are made up of a number of different items. General elements include site clearance, property level protection, pipe crossings, landscaping, reinstatement etc. Embankment elements include items such as excavation and disposal of material, import and placing clay and topsoil, geotextiles, grassing, back drainage etc. Wall elements include provision and placing of concrete, reinforcement, formwork, patterned liners, cladding, glass panels, back drainage, ground anchors and rig, floodgates etc. Pile elements consist of items including install and removal of in-channel working area, mobilisation and de-mobilisation of piling rig, pre-auger time, provision and installation of piles etc. The quantities, volumes and lengths for each of the items of the proposed Scheme were calculated using the AutoCAD drawings and the pre and post 3D Civils ground models. Unit costs for the various items were either derived from the RPS cost database, from the SPONS unit cost database or the SEPA unit cost database. These were multiplied by the required quantity to obtain the Scheme option construction cost.

The preliminary costs include for the site preparation work required before any construction work can take place. This covers items such as setting up the site compound areas, traffic management and the provision of general temporary access. The cost was calculated as a percentage of the option construction cost. A figure of 10% was applied based on the size of the scheme, and factors such as location, remoteness of the works or urbanised area, environmental and technical restrictions.

The enabling costs have been based on a percentage of the option capital cost (option construction costs plus preliminary costs), with a figure of 10% applied based on the size of the scheme. This covers items such as professional and planning fees.

The yearly operation and maintenance (O&M) costs have been estimated for each of the elements in the proposed Scheme. The whole life costs were calculated by discounting the costs over the design life of 100 years. The discounts applied were 3.5% over years zero to 30, 3% for years 31 to 75 and 2% for years 76 to 99. It is assumed that the preliminary and enabling costs are fully spent in year zero and therefore are not discounted, and that the option construction costs are spent by year one and therefore discounted in year one. The O&M costs start at year two and continue to year 99.

The sub-total of the costs detailed above was then factored to account for unforeseen additional costs arising during the life of the project (optimism bias). The optimism bias consists of risk components, such as design complexity, environmental impact, funding availability, economic influences (higher than expected cost inflation) and site characteristics etc. Each risk component contributes a pre-defined percentage of the overall optimism bias. In accordance with the Multi-Coloured Manual the starting optimism bias at the optioneering stage was 60%. This was then adjusted down where there was confidence and where evidence allowed e.g., preliminary ground investigation and topographical surveys. The optimism bias applied at outline stage was 37.8%. This reflects the risk at that point in the design process.

The total outline cost of the Scheme at this stage is £9,847,899.

Other Considerations

- Surface Water (Secondary Flooding and Sewage Discharge)

The issue of surface water has not been ignored. Back drainage has been included and costed as standard and will be further considered at detailed design stage. Any additional specific measures will be incorporated into the Scheme if required. The standard method of managing surface water and sewer surcharging behind defences is the installation of underground storage tanks with pumps designed to maintain levels within the sewers network where surcharging does not cause an increase in flooding.

- Existing Infrastructure and Utilities

Surveys of existing infrastructure and utilities have been undertaken as part of the development and costing on the Project. Specific costs of such work is not undertaken until the detailed design stage. However, an allowance based on survey data, trial pits, information supplied by utility companies etc is included in the overall Scheme cost as a percentage in the enabling and preliminary costs. This is the industry standard method of applying these costs in such Schemes.

- Optimism Bias and Risk

Increases in costs are factored into the Scheme cost using the industry standard Optimism Bias method. This was set originally at 60% at optioneering stage (as recommended in the guidance) but as we now progress through outline design and have more information (such as ground investigations, topographic and utility surveys etc), and following the guidance, this has been adjusted to 38%. We continue to mitigate against risks as the Scheme develops.

- Damage (Benefit) Assessment

Damage assessments are carried out in order to quantify the economic risk to the study area. The damage assessment methodology undertaken and applied for the Langholm Flood Protection Scheme follows the guidance in “Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal" (Penning-Rowsell, et al., 2013) and is supplemented by the manual and handbook “The Benefits of Flood and Coastal Defence: A Manual of Assessment Techniques" (Flood Hazard Research Centre, Middlesex University, UK, 2005). This document was often referred to as the ‘Multi-Coloured Manual’ (MCM). The methodology is presented in more detail in the Flood Management Options Report.

Flood damage to properties are assessed based on the building use (residential/commercial), property type and age floor area, finished floor level, depth damage data and the depth of flooding at each property for each return period. This damage is a combination of the likely items within the building and the building structure itself. Indirect costs count for tangible costs incurred during or after a flood event that are not included in the direct damages. These include costs associated with emergency services dealing with a flood event, damage to infrastructure utility assets and evacuation costs.

The direct and indirect costs are used to calculate an Average Annual Damage by assessing the likelihood of an event occurring in any given year and applied as a percentage to the damage. This is then discounted over the design life of the Scheme to give a present value damage.

Where the overall damage associated with a property far exceeds the market value of the property, the damages are capped at the market value.

Stress, health effects and loss of memorabilia are intangible benefits that are associated with flood defence improvements. The calculated intangible benefits are summed with the benefits derived from direct damage avoided to provide the total benefit.

The total economic benefit for a study area is calculated as the sum of the direct and indirect damages avoided plus the intangible benefits.

A quality check on the data being used was carried out, as well as checks on the top contributing properties, thresholds of large commercial buildings and spot-checking depth damage data. Additional sensitivity analyses were also carried out to account for electricity costs associated with dehumidification equipment, and sewage depth damage data in place of depth damage data.

The damage assessment methodology was then independently checked and verified by an industry expert.

- Benefit-Cost Ratio

The benefit-cost analysis is undertaken to demonstrate the economic case for each of the identified options. This involves an assessment of the benefits (i.e. reducing flood impact) and the costs of the options over a 100 year design life span. The benefit calculations and costs are detailed above. If the BCR is greater than 1, this is considered an indicator of economic viability. The BCR of the Langholm Scheme is above 1 indicating that it is an economically viable Scheme.

Note: Further details on the methodology and a detailed breakdown of individual elements are already published on the Project Webpage in the Flood Management Options Report and Appendices at www.dumgal.gov.uk/langholmfloodprotection