DRAFT EXTENDED OUTLINE

Environmental Issues associated with Infrastructure

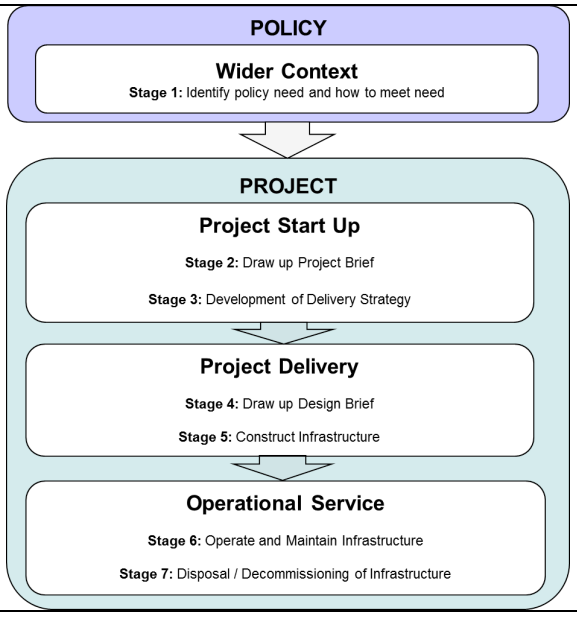
Contents

Introduction

Demands for investment in infrastructure come from the need to replace existing infrastructure and for additional infrastructure to support new ways of working and living for an increasing population and to support economic development and a transition to a low carbon economy. These demands are leading to significant infrastructure development in both developing and developed countries, for example in the energy, transport, health, education and flood relief sectors.

The development of infrastructure involves significant investment in assets which last over a long period and often sits within wider-ranging plans for development. New infrastructure development can bring significant benefits, including the opportunity to build in such a way as to meet the challenges posed by climate change and to enhance sustainability. It can, however, also have significant costs on the environment, both in its construction and use. There are some key stages in the development and operation of infrastructure at which it is possible to address the environmental costs and maximise the environmental benefits from the project. The report has identified seven key stages in the development of an infrastructure project; these are shown in **Figure 1** and are discussed in detail later in the report.

Figure 1: Generic 7 stage model of infrastructure development



The objective of the report is to provide an overview of the common environmental and sustainability impacts associated with infrastructure, along with governance structures that can be put in place to manage them. This paper is not an audit guide and does not present audit criteria, rather it provides a framework to help the auditor in designing an audit.

In some areas the private sector may deliver the investment required, to meet their own financial objectives and the public sector may be involved through considering requests for regulatory or planning appraisals. In other cases it may be for governments to support or

undertake investment directly and so they are directly accountable for the key decisions involved from initial proposals through to delivery, use and decommissioning. This paper provides an overview of the relevant issues for auditors to consider their value to audits of either aspect of government engagement.

The paper will be formed of four parts:

- **the common environmental and sustainability impacts associated with infrastructure development, operation, use and disposal**

  Impacts on the environment and sustainability from infrastructure project are wide-ranging and can be either adverse or positive. The paper provides a presentation of some of the types of environmental and sustainability impacts that can be created during the lifecycle of infrastructure projects. The section does not seek to be an exhaustive list of every possible impact rather to demonstrate the scope of considerations to be included in the assessment and evaluation of infrastructure projects during their lifecycle.

- **a generic model of seven key stages in an infrastructure project's lifecycle**
  The model of infrastructure development is made up of seven key generic stages that can broadly be applied to public sector infrastructure delivery. Each key stage consists of various actions that take place in order to lead to the overall development of the infrastructure. A commentary of each stage and its component has been provided along with the model to ensure clarity and consistency in the use of the various terms.

- **governance structures through which environmental and sustainability impacts can be identified, managed and mitigated**
  There are a range of tools, structures and processes which when incorporated into the governance of an infrastructure lifecycle can aid the management of the environmental and sustainability considerations throughout the project. The paper will broadly focus on governance structures in terms of:
    - Wider Policy Structures
    - Environmental and sustainability impact assessments
    - Environmental and sustainability integration into design and procurement
    - Mechanisms for the ongoing monitoring and evaluation of environmental and sustainability impacts

- **how Supreme Audit Institutes (SAIs) can audit the environmental and sustainability impacts of infrastructure**
  This will include summary of how SAIs can and have addressed environmental and sustainability impacts of infrastructure in their audits. It will include case studies to illustrate the breadth and scope of audits performed.

Part 1: Environmental and sustainability impacts arising from infrastructure development

Many of today's key global challenges, including population growth, climate change, increased energy demand and urbanisation, are creating increased demands for investment in infrastructure. These demands are leading to significant infrastructure development, in both developing and developed countries, across all areas of policy including the energy, transport, health, education and flood relief sectors.

Infrastructure developments can create wide-ranging environmental and sustainability impacts throughout their lifecycle (Figure 1). These impacts can either be adverse or beneficial by providing an opportunity for improvements and/or enhancements to the surrounding and wider environment. It is important when identifying impacts on the environment and sustainability to consider that their implications can be cumulative, direct or indirect, short or long-term and reversible or irreversible.

For the purpose of this paper, we have defined infrastructure to include the networks and systems in energy, transport, flood protection, telecommunications, water and waste management. Roads, railways, power stations, wind farms, sanitation networks, heating systems, and flood barriers are all examples of infrastructure that are within scope of this research paper. Defence, hospital and housing infrastructure have not been included in this paper.

In order to demonstrate the potential types and range of such impacts, this section provides a presentation of some environmental and sustainability impacts that can be created during the **construction, operation and disposal/decommissioning** of infrastructure projects. This does not seek to be an exhaustive list of every potential impact, but rather a means of highlighting the importance of considering these broad types of impacts and to provide a starting tool for auditors to consider the consequences of infrastructure projects and the adequacy of planning assessments and delivery during the project lifecycle. The impacts outlined are therefore not specific to any one type of infrastructure project.

For presentational purposes we have divided the impacts into the following categories:

1. **Ecology:** Impacts on ecology, biodiversity, natural habitats of both flora and fauna.
2. **Water resources and the water environment:** Impacts on groundwater; surface water such as lakes, rivers, and streams; oceans and seas; glaciers and ice caps; wetlands and aquifers; rainwater and wastewater. These impacts also affect the water cycle.

3. **Energy, Greenhouse Gases and other emissions to air:** Impacts arising from energy use during the construction process including operation and use of machinery; transportation; lighting and other electricity use.
4. **Materials:** Impacts embedded in the materials used during construction.
5. **Land:** Impacts on land use.
6. **Human environment:** Impacts on the local community, local and non-local economy and the built/historic environment e.g. heritage sites.

Ecology

Infrastructure development has significant impacts on ecology and biodiversity.

Adverse impacts

i. Infrastructure projects may hinder the movement of animals (habitat fragmentation), result in habit destruction or introduce new predators, pests or other invasive species from other areas (e.g. brought in by vehicles or workers). This can impact on species population dynamics e.g. distribution and abundance, for rare species, this can affect biodiversity and in extreme cases the destruction can result in species extinction.

ii. Degradation of the environment through noise, vibration and light pollution or waste (e.g. dust created during construction) may disturb habitats and wildlife and can affect plant and fruit growth. For example, a power station may increase water temperature as a result of discharge of cooling water this in turn may alter growth, metabolism, feeding habits, reproduction or migration of aquatic species.

iii. Infrastructure development can also have offsite impacts on the ecology in surrounding areas. For example, offsite impacts such as air and water pollution, habitat isolation or fragmentation may result in the displacement of populations of species leading to increased pressure on surrounding areas, thereby reducing these sites' capacity to support the wildlife present. These areas may also, as a result, suffer a reduction in ecological quality so that the sites are no longer able to support the migration, dispersal or genetic exchange of wild species. Offsite impacts are especially important in cases where infrastructure development is taking place in close proximity to nature preservation areas.

Positive impacts

i. Infrastructure development and disposal can present opportunities for existing wildlife and other habitats to be extended, improved or even for new habitats to be created. For example, existing habitats, important species, buffer areas and landscape features of major importance for wildlife can be retained and incorporated within the development – ensuring that the site retains at least the same capacity to support the diversity, abundance, migration, dispersal and genetic exchange of wildlife as it did prior to development.

ii. Features lost to development can be compensated for through:
    - re-creation as nearby as possible of features and landforms capable of maintaining the same ecological functions and with the same capacity to support at least the same quantity and quality of habitats and species as would otherwise be lost or displaced through development;
    - restoration and enhancement of surrounding features unaffected by development;
    - creation of new or additional buffer areas to reduce impacts; translocation, where possible, of habitats and species that would otherwise be lost.

Water resources and the water environment

Infrastructure can have impact on water resources (including water quality); flood risk; consumption of water during construction and operation; and water embodied in the materials used to build and maintain the infrastructure.

Adverse impacts

i. There are a variety of potential sources of on-site groundwater and surface water contamination/pollution during construction through to decommissioning, these include:
    - Leaks and spills from tanks, pipes, vehicles (e.g. sewage from a water treatment facility);
    - Accidents or spillage during storage or transport of raw materials, manufactured products and waste materials;
    - Storage of waste arising from the construction/operation of the infrastructure on or adjacent to the site e.g. nuclear power stations;
    - Materials used to build or maintain the infrastructure could leach pollutants into the environment;
    - Discharge of poor quality water after use in technological processes during infrastructure construction, operation or decommissioning;
    - Fly ash from power stations (e.g. combustion of solid fuel such as wood, peat, coal etc.) contaminates groundwater.

    This contamination/pollution can alter the acidity, pH balance and salinity of water negatively impacting on aquatic flora and fauna.

ii. The operation of water management infrastructure over time can lead to wear and tear of the network of pipes and valves resulting in water leaks. Water leaks are a waste of a valuable natural resource and can result in the discharge of untreated waste water. Burst pipes can disrupt water supply and lead to flooding of areas and properties.

iii. An infrastructure site may be vulnerable to flooding or change the flood risk to those downstream or adjacent to it.

Positive impacts

i. There are opportunities with new infrastructure or technology to minimise the consumption of water through the re-use or the utilisation of rainwater during construction and operation.

Energy, Greenhouse Gas emissions and other emissions to air

Energy and greenhouse gases are consumed/emitted (both directly and indirectly) during:

- the production and transport to site of the construction material;
- the operation of heavy construction machinery;
- the operation and maintenance of the infrastructure;
- treatment of wastewater; and
- the demolition of infrastructure i.e. the operation of heavy machinery and the transport of waste material.

Adverse impacts

i. Energy infrastructure such as heating and electricity energy systems can be inefficient with a lot of energy being lost along the way as it moves from the source to the end-user.
ii. Energy used in construction is often not from renewable sources.
iii. Transportation of staff and raw materials to and from the site can result in emissions to air of carbon dioxide, carbon monoxide, nitrous oxides (NOx), sulphur oxides (SOx), dust, polyaromatic hydrocarbons (PAHs) and particulate matter (PM). These emissions have impacts on air quality which can result in both health and contribute to climate change.

Positive impacts

i. Infrastructure design may incorporate energy-saving features which make them more efficient than the infrastructure services they replace.
ii. New infrastructure can itself create greener energy (e.g. wind farm)
iii. Transportation arrangements for infrastructure development can be used by other users to reduce third party energy use e.g. bus services also operating as public services.

Materials

Enormous amounts of materials and energy can be embedded in the construction and operation of an infrastructure project. Construction of infrastructure uses a significant volume of materials which are derived from natural resources e.g. timber, concrete, steel etc and can increase the depletion of limited or rare natural resources. The sourcing, processing, manufacture, distribution, use and disposal of construction materials can have significant local and global environmental impacts.

Adverse impacts

i. The extraction of some materials used in construction can damage the environment and create pollution e.g. use of quarried stone or timber from unsustainable forests.
ii. Some materials are produced in an energy intensive process (e.g. cement production for concrete releases about 5% of global CO_2 emissions). As a result, enormous amounts of materials and energy can be embedded in the final infrastructure project.
iii. Some material used to construct infrastructure needs to be treated with chemicals e.g. pre-treatment of timber or treating railroad ties with creosote ; and this can result in the emission of chemicals such as polycyclic aromatic hydrocarbons, which represent air pollution and health hazards.
iv. The construction and disposal of infrastructure can create a large and complex waste stream, covering a wide array of materials some of which can be hazardous e.g. asbestos, lead dust.
v. The operation of power stations such as coal or nuclear fired power stations consumes finite natural resources. The sourcing of these materials can have significant embedded local and global environmental impacts. For example, mining of coal can release methane, a potent greenhouse gas.

Positive impacts

i. There are opportunities during both the construction and disposal process to source materials that are re-used or recycled (e.g. tiles, timber, and brick) reducing waste from other sites that would otherwise need disposal.
ii. Using materials from local resources and supplies can lower the construction process's environmental impacts from transportation.

Land

The most important impact on land is land use change. The selection of the site plays an important role and will need to take into account various factors, including whether the land is:

- of special consideration to the local community e.g. indigenous populations;
- on or near an area(s) of architectural significance;
- on land that is part of a nature conservation area, national park or a site of particular scientific interest;
- in a forest (issue around deforestation);
- on a floodplain (resilience to flood risk) ;
- contaminated by hazardous material;
- agricultural land.

Adverse impacts

i. The construction and disposal of infrastructure can impact on the condition of the soil structure e.g. the use of vehicles and heavy machinery may cause compaction of soils, whilst soils may become eroded as land is cleared or contaminated with toxic materials.

ii. Once the infrastructure has been built it will impact on the visual amenity of the land e.g. power stations or telecommunications pylons, and may act as a barrier in the recreational use of the land by local communities.

iii. There could be accumulation of heavy metals and organic pollutants as a result of waste management infrastructure. This will affect the potential use of the land post-decommissioning. There is the potential for off-site contamination of surrounding land by toxic materials transported by wind or water.

Positive Impacts

i. The land selected may have previously been contaminated and the infrastructure development offers an opportunity to regenerate it.

ii. The land may be contaminated by hazardous material and disposal of the infrastructure provides a good opportunity for remediation of the land. The level of clean up/remediation of the contaminated land will depend on the intended use of the land following decommissioning e.g. for agricultural use the level of land remediation will have to be of a very high level.

Human environment

Infrastructure projects can affect the physical, cultural, social and economic factors in an area. The nature and scale of the impacts on the human environment will be substantially determined by the location of the infrastructure.

Adverse impacts

i. Displacement of local populations, including indigenous populations, during construction may threaten the sustainability of community structures and cultures.
ii. There is a possibility of demolition of commercial properties during construction which can mean the loss of jobs in the local economy. Combined with a change in demand for local services such as education, health, housing etc. due to influx of non-local workers may stretch resources and impact the local population. Decommissioning of infrastructure may also impact on jobs and local economy.
iii. Construction may impact on archaeological and other heritage sites with architectural or historical importance.
iv. Once built, infrastructure can have negative impacts on the local community. For example, in addition to impacts on ecology and the water environment, a road generates traffic which can be a nuisance and hazard for the local community.
v. There can be health effects (real or potential, in the event of an incident) from infrastructure on the local community e.g. electromagnetic radiation from telecommunication pylons; sewage contamination from wastewater plants; radioactive leakage from nuclear plants.
vi. Decommissioning and disposal of infrastructure could be a burden on the economy if the funds for disposal have not been budgeted for adequately and if responsibility for disposal has not been appropriately assigned.
vii. Construction, operation and disposal poses health and safety considerations of the workers. For disposal of infrastructure, specific issues of relevance are:
    a. structural stability of buildings;
    b. stability of earth slopes/retaining walls, hazards from voids;
    c. hazardous materials either on site or remaining in buildings;
    d. hazardous materials contained within the fabric of buildings;
    e. redundant services ducts or pipes containing hazardous materials.

Positive impacts

i. Construction can strengthen the local economy through using local companies and local employees at all stage of the infrastructure lifecycle.
ii. Infrastructure such as transport and telecommunications can increase tourism, employment or quality of life in remote areas as they become better connected and have improved facilities in their own community or through travel outside their local community.

iii. Waste management infrastructure will lead to increased sanitation for the local community which has a positive impact on amenity and health.
iv. Development of flood defences can protect local communities and their livelihoods from flooding.
v. The presence of infrastructure such as a railway or a power station may affect property prices (may be a positive or adverse effect)

Part 2: Model of infrastructure development

Sustainability and environmental implications, as discussed in Part 1, should be considered and integrated throughout the lifecycle of an infrastructure project. This section will develop further the generic infrastructure model presented in the introduction (**Figure 1**) to highlight the need for a continuous, iterative assessment of environmental impacts; to provide a tool for thinking practically about the how to consider the impact on the environment at each stage; and how to integrate this into the decision-making process.

The model (**Figure 2**) is not based on any specific type of infrastructure project; rather it presents a generic model of the typical lifecycle of infrastructure development (and use) which could be applied to a variety of contexts.

Policy Level

Stage 1: Identify policy need and how to meet need

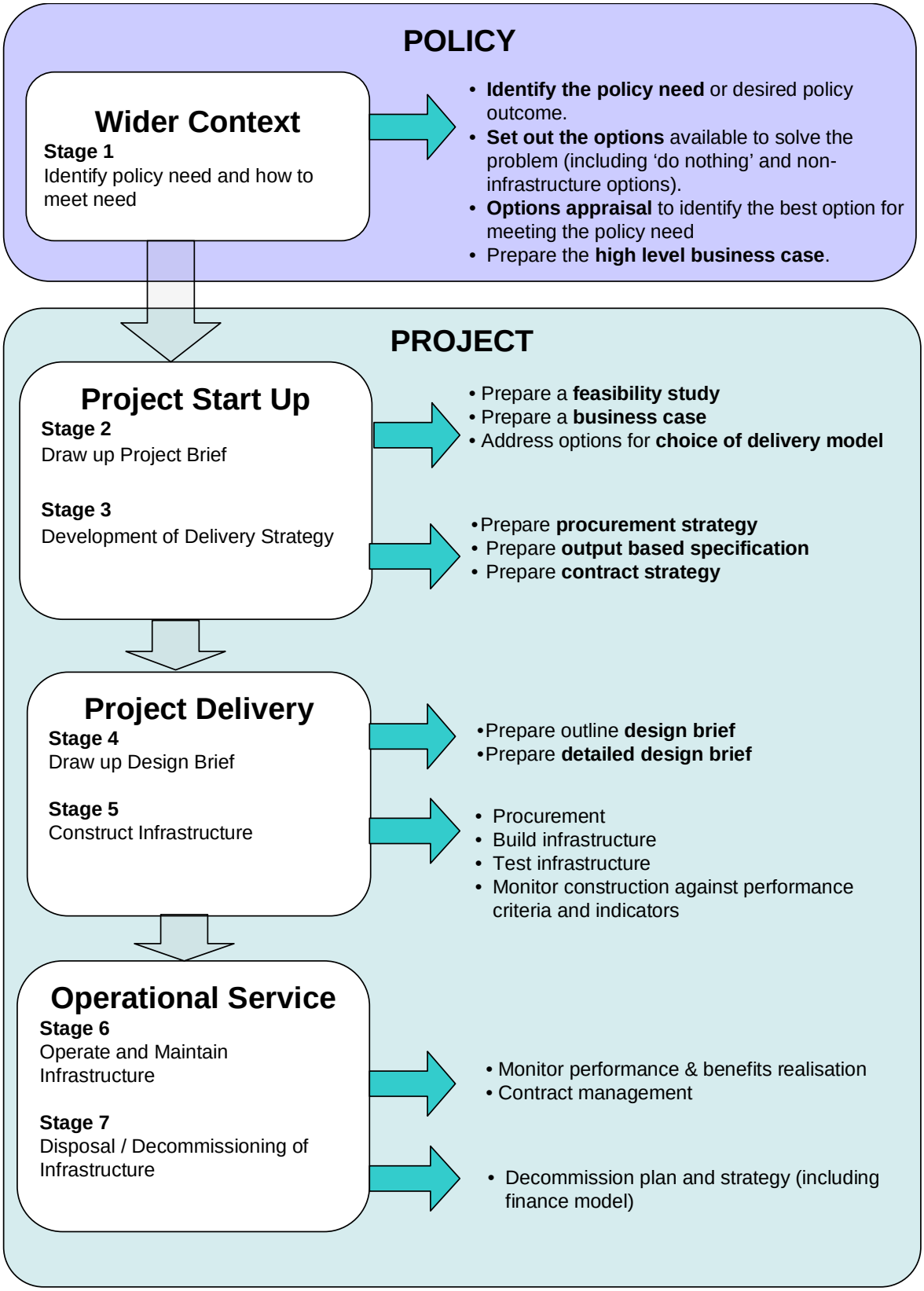
The first step in an infrastructure development project is to clearly identify the policy or business need for it. This is achieved through clarifying and assessing the situation of a public service and deciding what is needed. Examples of policy needs for infrastructure development include: 1) a lack of capacity of a public service to meet the community needs - e.g. water treatment capacity; 2) a low service level; and 3) a risk of service level falling. This will allow identification of the full range of options that are available to achieve the objectives.

Setting out the options: Once a need for change in a public infrastructure service has been established, then the various options available to fulfil the need must be identified. The list of options identified must include the "do nothing option" and options such as a demand reduction approach, as well as infrastructure solutions. This is important because all infrastructure solutions will involve environmental or sustainability costs and impacts and so these must be compared to the costs and benefits of other potential solutions.

Options appraisal: Option appraisal is a technique for setting objectives, creating and reviewing options for meeting the objectives and analysing their relative costs and benefits. It assists in making decisions on whether to proceed with a project and in identifying the best option for delivering it. During this stage there should be an evaluation of the risks as well as the costs and benefits of each option, including environmental and social costs.

High level business case: This sets out the high level rationale for why the infrastructure is needed and justifies the business option selected.

Figure 2: Generic Model of Infrastructure Development



Project Level

Stage 2: Draw up project brief

To progress beyond the initial concept and develop a more detailed project definition, the **Project Brief** provides the formal basis for assessing whether the proposal is viable and achievable. This defines the infrastructure's objectives in outline and is a statement of the user requirements and other relevant technical, administrative and financial information. It must contain sufficient detail for an informed decision to go ahead or abandon the programme. It is likely to include:

1. Background to the infrastructure need
2. Preferred option
3. Main stakeholders, especially service users
4. Benefits expected and how they will be measured
5. Estimate of overall effort required and who will do it
6. Outline of activities required
7. Key milestones, including critical stages

The **Project brief** stage may include a Feasibility Study and Business Case:

Feasibility study: This examines the issues that will make the project feasible or unfeasible. It considers various aspects of the infrastructure project in enough detail to inform a final decision of whether to proceed or not. It indicates whether the infrastructure is practicable in engineering terms, confirms its possible costs and decides on the methods that should be adopted for design and construction. The following may be addressed in a feasibility study:

- Budget and scope of the project: Will the proposed project work at the desired budget?
- Site analysis: Is the site chosen suitable?
- What is the best strategy for developing the project on a given site?
- What other cost, planning, and design constraints might the project run into?

A feasibility study culminates with the preparation of a report which documents its findings and makes recommendations for proceeding with the next stage of infrastructure development.

It is important at this stage to identify key environmental and sustainability impacts and how these will be addressed, and how they have already informed the scope, site chosen, strategy or design constraints.

Business case: The business case provides justification for undertaking a project, in terms of evaluating the benefit, cost and risk of alternative options and rationale for the preferred solution. This can involve putting values on the environmental costs and benefits identified at the feasibility stage.

Choice of delivery model This involves choosing the best way to deliver the policy object identified at the beginning. The choices available to Governments include: direct delivery by central Government department; delegation of delivery to other public sector bodies e.g. particular agencies or local authorities; outsourcing to the private sector through partnering with external contractor or Public Private Partnership; and regulation.

The choice of delivery model has lasting implications for the mechanisms available to Government to influence the design, construction and operation phases. It also affects the project's value for money. For example, the government may conclude it needs to retain control of the design and operational stages and the ability to manage the key risks including those to the environment. Alternatively, the government may consider it can achieve its objectives through regulation of the building and operation of the infrastructure.

The assessment of the delivery model can include consideration of the environmental and sustainability impacts that will be created and addressed through the alternative delivery options, and this could influence the delivery model decisions taken.

Stage 3: Development of delivery strategy

Refinement and expansion of the delivery strategy includes the preparation of procurement and contract strategies and the development of key infrastructure specifications.

Procurement Strategy: The procurement strategy identifies the best way of achieving the objectives of the project and value for money, taking account of the risks and constraints, leading to decisions about the funding mechanism and asset ownership for the project. The aim of a procurement strategy is to achieve the optimum balance of risk, control and funding for a particular project. Consideration of risks and their ownership should include environmental and social risks e.g. in the building of a Carbon Capture and Storage (CCS) plant who would be responsible in the event of a leakage from the carbon storage.

Output-based Specifications: The development of output-based specifications sets out the functional requirements of a project. Output-functional specifications help to:

- focus the end-user's mind on what functions the facility is to perform
- allow the supply team the greatest opportunity to innovate and find ways of enhancing the function of the facility while reducing its whole-life costs, including environmental and sustainability costs.

Contract Strategy: The contract strategy determines the level of integration of design, construction and ongoing maintenance for a given project, and should support the main project objectives in terms of risk allocation, delivery, incentivisation and so on.

Stage 4: Draw up design brief

This is a technical document which describes the functional and operational requirements of the infrastructure to be constructed. It defines all design requirements for the infrastructure and is the foundation on which the final design will be developed. It may include the following:

- Schematic drawings of the proposed infrastructure
- General specifications of the infrastructure and the performance criteria once complete
- Site information
- Any technical details which may affect the infrastructure development

The design requirements can be precise on the environmental or social requirements or be specified in outcome terms to enable the development of innovative designs.

Detailed or final design drawings: The detailed design is used for construction. It contains all the information necessary to build a particular type of infrastructure. This information can also be used to support the application for the various permits required before construction can begin. The detailed design shows what the finished work will look like, how materials and components will be integrated together and the dimensions and layout of the infrastructure.

Stage 5: Construct infrastructure

Construction involves the building or assembly of infrastructure and can have significant impacts on the environment as well as local communities and economies. Construction can cause contamination to land, air and water supplies. However it can also provide opportunities for preserving and enhancing the natural habitat.

Stage 6: Operate and maintain infrastructure

Operation and use is the longest stage in the lifecycle of infrastructure. As a result it is considered to have the greatest potential environmental and sustainability impacts.

The long-term maintenance regime and its affordability can significantly affect the sustainability and environmental performance of infrastructure. In the case where maintenance and the funds required are not considered adequately from the outset of developing the infrastructure, it may be that long-term funds for maintaining the infrastructure are not available. This affects the sustainability of the infrastructure and inadequate maintenance regimes can lead to the sustainability and environmental impacts that occur to becoming more acute.

Stage 7: Disposal/decommissioning of infrastructure

Infrastructure - whilst having a long lifetime - is not permanent. In countries where infrastructure has been in place for over 50 years, it is likely that some of these structures will be coming to the end of their design life and will need to be decommissioned and/or disposed

of. This is particularly the case where the costs of maintaining the infrastructure are very high and the economic case for maintaining the systems is very weak.

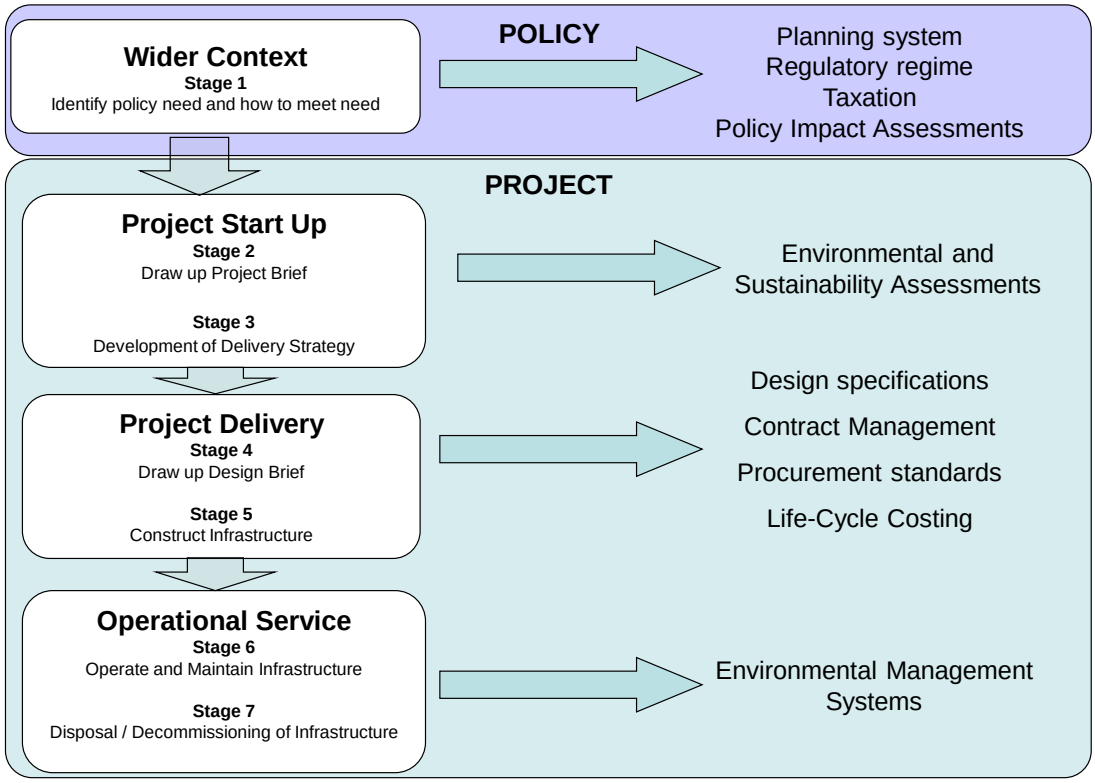
The adverse impacts of infrastructure disposal, like construction, can be reduced by considering disposal at the design stage. Decommissioning can include complete removal, partial removal (e.g. re-using a steel framework) or modification or alteration of the operations of the infrastructure system. Infrastructure decommissioning and disposal can offer immense opportunities for ecological restoration, land reclamation or decontamination and the re-use of materials.

Part 3: Governance structures for managing the environmental impacts of infrastructure development

This section examines a range of tools, structures and processes which when incorporated into the infrastructure lifecycle can aid the management of the environmental and sustainability considerations throughout the project.

It aims to provide an overview of the types of mechanisms that exist and an understanding of the roles that they can play in minimising or mitigating adverse environmental and sustainability impacts, or maximising take-up of the potential positive impacts, which occur across the lifecycle of infrastructure projects. Where practicable we have elected to detail generic governance structures, to ensure the broad applicability to any international context. For illustrative purposes **Figure 3** maps the governance processes which are discussed in this section to the Model of Infrastructure Development (**Figure 2**). The timing categorisations are not fixed, however and the tools should be monitored and re-visited throughout the project lifecycle.

Figure 3: Governance Structures for incorporating environmental & sustainability considerations mapped to the Infrastructure Model



Wider Policy Structures

These structures form part of wider government or international systems which may seek to control, incentivise or monitor the environmental and sustainability framework within which infrastructure projects are pursued. As governance structures, they do not operate at an individual project level, but are included here for discussion as they form key parameters in which a project must operate and such should themselves feed into project decision-making.

The wider policy context in which infrastructure projects are embedded will include policies operating at local, national and even international scales. There are many international environmental and sustainability agreements and conventions which governments sign-up to and then integrate into domestic policy, examples include the World Heritage Convention and Convention on Biological Diversity. At a national and local level, policy structures will influence decisions on infrastructure projects by setting the wider context and requirements over their construction, operation and disposal. Mechanisms discussed here include planning systems, regulatory regimes, environmental taxes and policy impact assessments.

Planning systems enable governments to control how land is used as well as requiring individual applications and approvals for what is built and where. This can allow a government to make decisions on whether a proposed development should go ahead or not and the form it should take[1]. The planning system can be used as a tool to ensure that the environment in the proposed development area is not negatively affected by any proposed development (i.e. limiting pollution and requiring the provision of habitat for individual species) and that the needs of the community are met in a sustainable manner (i.e. long term needs as well as the needs of future generations). Planning systems can be used to mediate between short term social and economic benefits, and longer-term social and environmental needs (e.g. low carbon economy), to enable development impacts and requirements to be considered over their whole lifecycle. [2]

In general, when planning permission is granted it is subject to **conditions** which may further regulate the way a development takes place and is subsequently maintained. These conditions can be used to ensure that any development that takes place minimises its impact on the environment, is positive for the community and takes into account the needs of future generations. A list of example conditions which may be attached to planning consents are included in **Figure 4**.

[1] http://www.planningportal.gov.uk/planning/planningsystem
[2] http://www.rtpi.org.uk/item/298/23/5/3

Figure 4: Examples of conditions which may be attached to planning consents

- Re-uses sites in areas that need regeneration to make them attractive places to live
- Is built where shops, services and employment can be provided locally, reducing the need to travel and boosting the local economy
- Avoids building over, or being close enough to cause damage to, certain sites - for example, areas of local landscape importance, conservation areas or sites of special interest to indigenous populations
- Ensures buildings are energy efficient and use renewable energy
- Ensures that groundwater is not over-exploited, for example by capturing and using rainwater and recycling mains water
- Provides adequate space for wildlife to flourish, by, for example, planting trees, creating more green corridors to link habitat, creating ponds and leaving areas wild and uncultivated.

Development activity, operation of infrastructure or decommissioning activities that may cause pollution or otherwise damage the environment can be governed through **environmental regulation** to provide protection to the environment. The authorisation regime can be achieved through, for example, the use of environmental permits, licences, consents, notifications, registrations or exemptions. The approach will vary according to the type of infrastructure project and its use and operation:

- environmental **permits** may be required for the construction or operation of a regulated infrastructure facility (e.g. water treatment plant or waste handling plant).
- trade effluent **consents and agreements** may be required for operations or activities that discharge trade effluent into the public foul sewer
- water abstraction and impoundment **licences** may be required for infrastructure building or operations that take water from surface waters or groundwater, or obstruct them in any way
- waste carrier, broker and dealer **registration** may be required for the transport of waste
- operations that produce or move hazardous waste generally require hazardous waste **registrations**.

As with planning consents, the permissions granted by the regulators may often have conditions attached, examples of such conditions are given in **Figure 5.** [3]

Figure 5: Examples of conditions attached to environmental regulatory permissions

- Proof that the developer has the means available to provide the required standards of environmental protection;
- Equipment must be designed and installed to a suitable standard ;
- Use of a maintenance schedule of all equipment whose failure may lead to pollution, ensuring that it continues to operate effectively;
- Identification of potential accidents, and putting in place any necessary measures to minimise

[3] http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1080480220&r.l1=1079068363&r.l2=1086048470&r.l3=1080480296&r.s=sc&type=RESOURCES

the chances of them happening and to minimise the effects of any accidents that do occur;

- Staff must be trained in pollution prevention and procedures for handling pollution incidents.

Environmental taxes can also be used as a tool to increase the cost of a more environmentally destructive activity to encourage use of less damaging options. Environmental taxes can be used for example to favour recycling and hence discourage investment in landfill (e.g. the Landfill Tax in the EU). Taxes can also be used to encourage infrastructure to be built on previously used sites to support regeneration.

Governments can require or incorporate use of **policy impact assessments** to make policymakers compare various options for achieving an objective by assessing its likely costs and benefits. Impact Assessments can include the economic impacts; social impacts; environmental impacts and sustainability impacts arising from a proposed policy, and should take account of the other policy structures and commitments in operation.

Consideration of the impacts on the environment at an early stage of the policy process will ensure that sufficient time is available to assess where wider environmental impacts are significant and quantify and monetise where appropriate[4]. This work can feed into a **cost-benefit analysis** to integrate the environmental and sustainability considerations into the overall policy or project assessment and can identify potential policy impacts that can be mitigated. Appraisal can help identify any significant impacts that may fall disproportionately on future generations[5] and evaluate the benefit of the infrastructure proposal against the 'do nothing' option and non-infrastructure options.

Environmental and sustainability assessments

A large variety of specific assessment tools exist which can either focus specifically on, or look to integrate, environmental aspects into the decision-making process. At a project level, these assessments provide an opportunity to understand and, where possible, quantify the impacts of different design and delivery options to allow informed assessments of projects.

An **Environmental Assessment** is a process which ensures that the likely effects of a specific new development on the environment are fully understood and taken into account before the development is allowed to go ahead.[6] This enables environmental factors to be given due weight, along with economic or social factors, when planning applications are being considered. There are variations in the form of individual assessments (which may form a regulatory requirement) with some looking strategically across multiple projects to assess

[4] http://www.defra.gov.uk/corporate/about/how/policy-guidance/env-impact-guide/
[5] http://www.defra.gov.uk/corporate/about/how/policy-guidance/sd-impact/
[6] http://www.communities.gov.uk/documents/planningandbuilding/pdf/157989.pdf

cumulative impacts coherently and others focussing on a single project in isolation. Conducting an environmental assessment is an iterative process which should be carried out alongside the development of the plan or programme.

Like at the policy assessment stage, the environmental assessment may identify adverse effects which can be avoided and consultation may identify ways of doing this. The environmental assessment process may require a substantial and full consultation by the developer with bodies which have an interest in the likely environmental effects of the development proposal as well as the local community and other interested stakeholders e.g. indigenous populations.

Whilst the various requirements for an environmental assessment differ from country to country and are often determined by legislation, they usually require collection of information to help planning authorities to make the appropriate decisions:

- Characteristics of projects, in particular: the size of the project; the accumulation effect with other projects; the use of natural resources; the production of waste; pollution and nuisances; and the risk of accidents.
- An outline of the main alternatives studied by the developer and an indication of the main reasons for the final choice, taking into account the environmental effects.
- A description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.
- A description of the likely significant effects of the proposed project on the environment resulting from: the existence of the project; the use of natural resources; the emission of pollutants, the creation of nuisances and the elimination of waste.
- A description of the measures that will be used to prevent, reduce and where possible offset any significant adverse effects on the environment. [7]

A **social or sustainability impact assessment** is an additional tool which has widened the scope of an environmental assessment to incorporate concepts of community, health and wellbeing, culture and the human environment. The broad format follows that of the environmental impact assessment and seeks to ensure affected parties are identified and engaged in the decision-making process and that the long-term sustainability considerations underpin the assessment process.[8]

Key to the environmental and sustainability assessment is the consideration of costs and benefits across the whole life cycle of the project. This approach allows governments to

[7] http://www.sea-info.net/content/main.asp?pid=230
[8] http://www.socialimpactassessment.com/documents/0303%20Vanclay%20IAPA%20V21N1%20SIA%20International%20Principles_1.pdf

make informed choices over the long term and avoid short term decisions that lead to environmental degradation. It also encourages governments to avoid shifting problems from one life cycle stage to another, from one geographic region to another and from one environmental medium (air, water or soil) to another[9]. Techniques exist to convert these identified impacts into monetary terms, so that they can be brought into a **Cost-Benefit Analysis**. The cost-benefit analysis can then gauge which design/procurement option represents the best value for money, taking into account both financial and environmental impacts, for the user and for society as a whole. A number of economic techniques exist to monetise the societal cost of environmental and social impacts including whole-life costing. However, these techniques are difficult and in some cases controversial and research is still developing in these areas.

Environmental and sustainability integration in design and procurement

A key opportunity to incorporate environmental and sustainability considerations is in the design, procurement and construction processes. Decisions taken at this stage can minimise any adverse impacts identified in the earlier assessments as well as seeking to enhance potentially positive impacts.

The **design phase** gives the project owner opportunity to influence the environmental and sustainability performance of an infrastructure development. The design phase is key in identifying construction materials that help achieve sustainability targets[10]. Considerations for the design process may include:

- Enhancing biodiversity, for example through incorporating new and existing flora and fauna, creating habitat and generally enhancing the local environment through good design of structures;
- Incorporating energy saving features;
- Using, where possible, materials with low environmental impact e.g. materials that: 1) have low embodied energy; 2) can be sourced locally; 3) maximise the use of recycled products; and 4) have a long life and low maintenance requirements.
- Minimising waste both during construction, operation, maintenance and demolition. Consideration should be given to building into the design provisions for the segregation, storage and recycling of waste material during the operation stage;
- Incorporating water saving features both for consumption and discharge of wastewater; and incorporating grey water recycling and rainwater harvesting;
- Taking into account the local climate to ensure that the infrastructure is robust to cope with future climate change with provision for future possible;

[9] US Environment Protection Agency, *Lifecycle Assessment: Principles and Practice*, May 2006 http://www.epa.gov/nrmrl/lcaccess/pdfs/600r06060.pdf
[10] Office of Government Commerce, *Achieving Excellence in Construction*, 2007

- Enhancing the historic or local environment through using local materials and traditions. Where appropriate, the design should focus on achieving a style, scale, proportion and quality in keeping with the surrounding area;
- Assessing the possible impact on the heath or safety of the facility's occupants or those involved in construction when specifying materials or installing equipment; and
- Consulting on the design with the local community and other relevant stakeholders.

Procurement is the purchase of goods or services from third parties, covering a wide spectrum, from commodities such as energy and contracted out services like building maintenance, to major IT systems and construction projects.[11] Procurement can play a key role in delivering government, with effective procurement having the capacity to drive the efficiency of suppliers and their supply chains. The procurement process formally starts from the point where the need to make a purchase to deliver an objective has been identified. It should consider the whole life cycle, from the identification of the need to purchase, through supplier selection and contracting, to the delivery of the required goods (e.g. waste water plant) or services (e.g. maintenance of waste water plant) through to the disposal of the asset(s) or service closure.

The procurement process provides an excellent opportunity for the project owner to influence the delivery of the infrastructure and ensure that environmental and sustainability considerations are built into the construction and operation of the infrastructure (**Figure 6**). The most effective way to pursue environmental objectives through procurement is to consider them at the earliest stage of the procurement process; at the business case and when defining needs and specifications.

[11] http://www.ogc.gov.uk/documents/Introduction_to_Public_Procurement.pdf

Figure 6: Addressing environmental and sustainability issues during the procurement process

Business case. This is the stage at which there is most scope for considering environmental and sustainability impacts. A key step is considering the need to procure. Through effective demand management the need to procure may be avoided. Alternatively, the need can be defined in such a way as to minimise resources consumed.

Specification. Considerations should be included where they are relevant to the subject matter of the contract. They include what the product consists of (e.g. cleaning services using products with low chemical content), how it performs its function (e.g. energy efficient light bulbs), and its suitability for responsible disposal (e.g. easily recyclable parts). Certain production processes can also be specified (e.g. electricity from renewable sources, timber from sustainably-managed forests).

Selection. At this stage, the procurer should ask tenderers for relevant evidence of technical capability to deliver the environmental specifications.

Award. All public contracts should be awarded on the basis of value for money on a whole-life cost basis, not lowest up-front price. They should be evaluated from the point of view of the procurer; wider costs or benefits to society should have already been considered and built in to the specification.

Contract and supplier management. Contract conditions should be used to ensure suppliers provide appropriate information on their performance against environmental/sustainability requirements. Outside of formal conditions, there are often opportunities to work with suppliers and their own supply chain on a voluntary basis to raise awareness of environmental and sustainability objectives.

Source: NAO 'Addressing the environmental impacts of Government procurement', 2009[12]

The key stage in which environmental and sustainability issues are considered is when the project brief is developed into an output based specification in which the environmental and sustainability objectives are defined. Where appropriate, performance or functional specifications should be used and apply over the lifetime of the infrastructure and cover construction, operation and disposal.[13] Sustainability considerations should be used in the tender pre-qualification, evaluation and award process, in order to select the most suitable contractor. The evaluation methodology should test the compliance of the bids against the criteria and requirements set out in the specifications. Examples of ways in which environmental and sustainability considerations can be included in the infrastructure specifications are included in **Figure 7.**

Figure 7: Examples of environmental infrastructure specifications in procurement contracts

- Setting out biodiversity standards that need to be met and how performance will be measured. This may include a requirement for a Biodiversity Management Plan.
- Setting targets for energy consumption during construction and in operation as well as how they will be monitored.

[12] http://www.nao.org.uk/publications/0809/addressing_sustainable_procure.aspx
[13] Office of Government Commerce, *Achieving Excellence in Construction*, 2007

- Setting targets for water consumption both during construction and when the infrastructure is in operation.
- Setting targets for re-use and recycling and waste minimisation and reduction during the construction and operation of the infrastructure. This could also include a requirement that contractors provide a Waste Management Plan.
- Setting out requirements that the materials used will contribute to the sustainability and environmental performance of the infrastructure. E.g. re-use of materials; avoidance of environmentally damaging materials or those that are harmful to humans, flora and fauna.
- Setting out requirements on health and safety of the workers; targets for use of the local population; targets on equality and diversity (e.g. ethnic minorities; women; indigenous groups);
- Setting out provisions for consultation of the local community to identify their needs, views and opinions on design, construction and operating issues.

As with the impact assessments, it is important to make decisions about procurement by considering all the impacts of products and services throughout their lifecycle. **Life Cycle Assessment** (LCA) or **Whole-Life Costing** provides a tool to quantify and assess the consequences of products or services.[14] From an environmental perspective, this assessment can include consideration of construction materials, air emissions, water effluents, solid waste, and the consumption/depletion of energy and other resources and be used to help to ensure that a government's choices are environmentally sound, whether in the design, manufacture or use of a product or system.

In considering environmental/sustainability impacts for infrastructure the LCA technique may involve[15]:

- Compiling an inventory of the flows of energy and materials to and from the environment at each stage of development;
- Calculating and evaluating the relevant impacts, including the impacts embedded in materials used in construction and operation of the infrastructure;
- Interpreting the results to help make informed decisions. Assessing whether results are in line with project goals, providing, defining significant impacts, and recommending methods for reducing material use and environmental burdens as well as potentially increasing efficiency and productivity.

Contract management is the phase of the procurement cycle in which a supplier delivers the required goods or services in accordance with a procuring authority's specification[16].
A contract establishes a set of rules between the contractor and the infrastructure owner. It assigns rights and responsibilities to each party and sets out the rules that will govern the

[14] A product's life cycle is generally broken down into stages.: 1) Product design ; 2) Raw material extraction and processing; 3) Manufacturing of the product; 4) Packaging and distribution to the consumer; 5) Product use and maintenance; 6) End-of-life disposal

[15] Royal Society of Chemistry, *Environment, Health and Safety Committee Note on: Life Cycle Assessment,* February 2010. http://www.rsc.org/images/LCA_20100215_tcm18-97943.pdf

[16] http://www.ogc.gov.uk/policy_and_standards_framework_contract_management_.asp

behaviour of each party throughout a set period of time[17]. The contract provides the opportunity to set in place mechanisms for the contractor to monitor and report performance against the environmental criteria laid down in the tender specification. The criteria should be well-defined and measurable in order to be used as the basis of performance measurement of the contract. It is vital to establish effective contract management processes and resources in good time to drive excellent supplier performance throughout the contract. Furthermore, the contract should be drawn up in such a way so that it is responsive to change. There could be changes to policy requirements; funding availability or there may be changes in technology which can make a step change in performance possible and the benefits of which could be shared. The contract should also allow the infrastructure owner to act on any poor performance identified, beyond monitoring it.

Governments can set out guidance on voluntary **best practice** (at a given point in time) in sustainability and environmental considerations and there may also be professional best practice standards. Governments may elect to make **official standards** which form mandatory specifications to ensure that sustainable outcomes are achieved[18]. There are a huge range of both national and international standards providing guidance on materials which can be used and on achieving sustainable outcomes in infrastructure development, examples include the Forest Stewardship Council certification for sustainable forestry products; UK BREEAM assessments of the sustainability of building specifications; and Health and Safety standards for working environments.

Case Example 2: UK Government Buying Standards[19]

In the UK, the Government has a set of Government Buying Standards which have been designed to help government buyers procure sustainably. The standards have been developed so that products which meet the criteria save more money over their whole life than products that do not. Currently, there are around 50 standards in ten priority groups that are updated on a rolling basis and all central government departments must ensure that they meet these minimum mandatory specifications when buying products and services. Government Buying Standards simplify sustainable procurement by:

- Providing minimum and best practice standards for around 50 different products;
- Giving straightforward specifications can be inserted directly into tenders;
- Asking suppliers to prove their compliance with these standards.

We would welcome additional suggestions for case examples of best practice/standards regarding the environment and sustainability in the use of materials or processes in infrastructure.

[17] Thomas E. Glavinich, *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction,* 2008
[18] http://sd.defra.gov.uk/advice/public/buying/
[19] http://sd.defra.gov.uk/advice/public/buying/

Mechanisms for the ongoing monitoring and evaluation of environmental and sustainability impacts

The assessment and monitoring of the impacts of an infrastructure project during its operation and disposal should be an ongoing, iterative process to accommodate variations in its function, new standards or best practice, improved knowledge and its contribution to changing policy objectives. The structures to ensure this should be designed and implemented during the design phase to ensure appropriate accountability throughout the project lifecycle.

An **environmental management system** (EMS) is a framework which allows an organisation to routinely monitor its environmental performance and improve and control it. Through an EMS, aspects of an economic activity that impact on the environment can be identified and plans to manage and mitigate them can be put in place. It leads to the adoption of an environmental policy which commonly includes commitments to reduce waste, pollution, energy and resource use, sets objectives and targets and reviews a company's environmental performance[20].

The principal elements of an EMS include:

- An environmental policy, which formally outlines a organisation's commitments to environmental management;
- Identification of significant environmental impacts – for example energy consumption, emissions to air, water pollution, waste, water consumption, resource consumption;
- Setting measurable objectives and targets – e.g. a commitment to reduce environmental impact, accompanied by quantified targets in all significant impact areas such as emissions to air etc.;
- Internal reporting and management review of environmental performance and the performance of the EMS more generally; and
- Internal auditing – which includes internal audits and site audits, where appropriate.

An effective EMS as applied to the operation of infrastructure will encourage an organisation to[21]:

- Ensure all operations have procedures to minimise their environmental impacts;
- Identify opportunities to reduce waste, including raw materials, utility use and waste disposal costs;

[20] http://www.businesslink.gov.uk/bdotg/action/layer?r.i=1079422712&r.l1=1079068363&r.l2=1086021875&r.l3=1079422683&r.s=sc&r.t=RESOURCES&topicId=1079422683

[21] http://envirowise.wrap.org.uk/uk/Topics-and-Issues/EMS.html

- Define environmental responsibilities for all staff;
- Helps to ensure compliance with environmental legislation;
- Record environmental performance against set targets;
- Provide a clear audit trail through which performance can be monitored and rectified where it is falling below set levels.

Part 4: How SAIs can audit the environmental and sustainability impacts of infrastructure

This part will include a summary of how SAIs can audit environmental and sustainability impacts of infrastructure projects in their audits. It will include case studies to illustrate the breath and scope of audits of environmental and sustainability impacts of infrastructure projects. The selection will highlight three broad types of approach to such audits:

1. Audits of policy level governance tools across projects
2. Audits focussing specifically on the environmental/sustainability aspects of a project/series of projects
3. Inclusion of environmental/sustainability assessments within a wider audit topic.

Appendix

Case studies available to date

BRAZIL	
The Name of the Audit	**Audit on the Process of Environmental Impact Assessment of Public Works in Brazil.**
Publication Information:	July 2009; Brazilian Court of Audit, Judgment N° 2.212/2009 – Plenary; available in Portuguese at www.tcu.gov.br
The national audit objectives Provide an analysis of the federal environmental licensing process and environmental impact assessment of public works audited by the TCU to the National Congress, through Fiscobras 2009.	
The scope of the audit Process of environmental licensing and environmental impact assessment of large infrastructural projects and the activities of the oil sector and gas in the continental platform subject to review by the Court, under the responsibility of the Brazilian Institute of Environment and Renewable Natural Resources - IBAMA, not including the other activities that cause significant environmental impact licensed by the institute. Audit period covered: the period from 2004 to 2009.	
The environmental and sustainability issues within scope of the audit Question 1 – Does the Department of Environmental Licensing of IBAMA perform a continuous assessment of environmental impacts for each project? Question 2 – Does the system of process management of Environmental Impact Assessment carried out by IBAMA use criteria and indicators that characterize the actual and potential benefits from this process? Question 3 – Are the steps involved in the Assessment of Environmental Impacts standardized in order to unite its analysis?	
Conclusions relating to audit findings environmental and key recommendations The audit team found that the procedure for Assessment of Environmental Impacts carried out by IBAMA is very focused on the examination of formal requirements and less attention is given to the environmental and social effects of a given project or the effectiveness of the adopted mitigation measures. The follow-up phase of the environmental impacts assessment by IBAMA is not sufficiently accurate considering the importance and the resources spent in the licensing process. This indicates a concern with the formal aspects of the process at the expense of their ultimate goal. It was observed that great attention is devoted to the IBAMA's analysis of the Environmental Impact Assessment (EIA) and the requirement that the project incorporates an extensive program to mitigate impacts, however, once the project is approved, IBAMA has little ability to verify that it was actually implemented in accordance with the prescribed and if mitigation measures achieved their goals of environmental protection. The lack of standardization in the process of the federal EIA contributes significantly to the generation of poor quality´s EIAs. Without knowing what items are essential, the entrepreneurs eventually develop incomplete and deficient EIAs, due to lack of technical manuals and formal methodologies, indicators and	

criteria for evaluating these studies for each type of work.

The poor quality of EIAs generates a lack of assuredness to IBAMA's analysts that, as a precaution, require a greater number of environmental constraints to supply the deficiencies presented in the studies and avoid problems that could arise because of incomplete studies.

The consequence of this increase in the number of constraints is an addition in the time to grant the environmental license, because IBAMA has more difficulty in monitoring the implementation of a large volume of conditions and the entrepreneur to serve them fully, and also an increase in costs of entrepreneurs to fulfil them.

Thus, there is a vicious cycle, which results in the issuance of environmental licenses by IBAMA without effective guarantee that the actual environmental impacts caused by project have been avoided, minimized or compensated.

The SAI recommended to IBAMA

Develop standards and specific rules for the procedures and technical criteria and methodology adopted in the federal EIA process, by types of work;

Post on the website of the organization, documents relating to conclusive technical reports on the environmental feasibility of projects, licenses prior to installation and operation, to the Environmental Impact Studies and Environmental Impact Reports and other documents relevant to the EIA process for projects under its responsibility;

Establish a systematic monitoring of environmental conditions to ensure the effectiveness of its compliance for the purpose of the issuance of operating license;

Study the feasibility of creating a consolidated report for evaluation (ex post) of mitigated and unmitigated impacts, good practices observed and the environmental benefits of the process of environmental impact assessment, based on the environmental performance of the enterprises authorized by IBAMA;

Develop a program to improve the quality of Environmental Impact Assessment - EIAs submitted by the entrepreneur in order to correct the deficiencies described in the study of the Federal Public Prosecutors Office, 2004;

Developing indicators of environmental impacts and risks and with benefits for each type of work, incorporate them into the computerized system of Environmental Licensing - Sislic to generate management reports and plans for the monitoring of environmental impacts and benefits for each project based on such indicators;

Develop methodology for provision of environmental constraints and limitations of these classification criteria with regard to priority, the relevance and risk, based on the goals and targets to be achieved in licensing, according to the type of work;

Improve Sislic (Information System of the federal environmental licensing) for the generation of management information and control of the EIA process for projects under its responsibility;

Encourage the practice of special institutional commissions for monitoring environmental impacts with representatives of the organized society;

BRAZIL	
The Name of the Audit	**Evaluation of environmental monitoring carried out by TCU in the federal public works infrastructure.**
Publication Information:	May, 2010; Brazilian Court of Audit, Judgment N° 968/2010 – Plenary; available in Portuguese at www.tcu.gov.br

The national audit objectives

Forward details to the National Congress regarding the execution of the works covered by the Federal Budget. This inspection program is under the Supervision of Public Works of the TCU - Fiscobras, which among other aspects, analyses the compliance of environmental permit in each audited work.
Thus, it is aimed to analyse the ascertained environmental issues in the Supervision of Federal Public Works for Infrastructure, for the period from 2004 to 2009 in order to contribute to the development of compliance assessment of the environmental licensing.

The scope of the audit

The scope of this paper is the environmental situation of federal public enterprises verified in the inspections of Fiscobras under the responsibility of the Court of Audit

The public works of greater importance audited by the TCU are usually those that cause significant environmental impact on national or regional levels, and a federal body, the Brazilian Institute of Environment and Renewable Natural Resources – IBAMA, is responsible to issue the environmental license.

Audit period covered: the period from 2004 to 2009.

The environmental and sustainability issues within scope of the audit

Step 1 - Preparation of items to be added to the environmental analysis already conducted in each work, so as to deepen the compliance assessment of the environmental licensing process conducted by TCU.

Step 2 - Review the history of major environmental issues already observed in the audits of Fiscobras from previous years to allow visualization tendency and a range of environmental issues relating to major projects financed with federal funds.

Tries to get answers for the following questions:

1 - Is there a tendency for greater attention to environmental requirements in the federal public works?

2 - What are the most frequent irregularities in the works audited by the TCU during the Fiscobras?

3 - Does any federal government agency or entity stand out in the number of environmental findings?

Conclusions relating to audit findings environmental and key recommendations

While environmental monitoring is not the main focus of control, under the Program for Inspection of Public Works of the TCU - Fiscobras, it was possible to increase it from a more thorough evaluation of compliance in the process of environmental licensing.

Were incorporated into the standard array of new Fiscalis Execution Works required information, sources of information, audit techniques, possible new findings, procedures and criteria for the audit, with the main aim of raising awareness of the auditor on the case for effective control over environmental management. It is expected also, a significant increase in the control benefits arising from the increased effort to improve environmental management.

Regarding the evolution of the frequency of environmental findings, it is emphasized that the analysis is not possible to conclude by observing a trend of increased environmental legislation, however it signals a decrease in the occurrence of environmental findings. Such considerations allow us to infer that there are signs of improvement in environmental treatment by federal works, but this conclusion can only be proven with the results of coming years.

Even with signs of improvement, despite the performance of the TCU and the greater demands of society for the observation of environmental aspects in the period 2004 to 2009, it was found to contain a significant proportion of projects financed with federal public funds that disrespect the environmental law.

The environmental findings indicated are for the most part, related to the lack of licensing or improper licensing. The audit also observed that more than half of the environmental findings is represented by the type "No environmental permit" (54.1%) and that approximately 1/3 of these findings come from deployment, duplication, restoration and maintenance of highways. Works of urban infrastructure, buildings and dams represents another 1/3.

The Index of Environmental Findings (IAA) was elaborated, which provides a preview of Budgetary Units (OU) more focused on work overseen by environmental findings. Thus, the National Department of Works Against Droughts (DNOCS) presented the highest IAA (43%), having been identified 22

environmental findings in 51 of its works inspected by the Fiscobras the period 2004 to 2009.

The Ministry of Education also stood out with 5 environmental findings in 13 works (38%). Of the construction like "dam / reservoir" and "bridges and flyovers" showed the worst results in relation to the Index of Environmental Findings with 50% and 35% respectively. This evidence shows that one in two dams and reservoirs was found to have some kind of environmental finding. In relation to bridges and flyovers, one-third showed some kind of environmental finding during Fiscobras' inspections between 2004 and 2009. Therefore, these works deserve a special attention of the Department of Works of the TCU in the next Fiscobras audits.

Despite being the Budget Unit with greater representation in the sample of Fiscobras between 2004 and 2009 (on average, 45% of the sample), the National Department of Transport Infrastructure - DNIT did not presented the worst performance against the Index of Environmental findings. Still, this federal agency manifested a high proportion of offenses related to the environment, in about 15 environmental findings for each of its 100 works inspected. In absolute terms, 43% of all types of environmental findings found in Fiscobras during the study period occurred in DNIT's works.

Adding to the evidence described, it was found that DNIT received fines totalling an amount of $ 8.6 million between 2005 and 2008, imposed by IBAMA for failure to fulfil standards of environmental licensing. Thus, DNIT was the federal entity that received the most fines, infraction notices, embargoes and other sanctions applied by IBAMA, resulting from noncompliance with the standards of environmental licensing in the mentioned period. It was concluded that it would be timely to carry out further work to assess the environmental management of public works in charge of DNIT.

It was further observed that the Brazilian Institute of Environment and Renewable Natural Resources - IBAMA does not have mechanisms to evaluate the effectiveness and quality of federal environmental licensing of public works. It was expected that the IBAMA presented a formal opinion on this matter, yet not even the meeting of individual perceptions of the license department´s staff showed consistent opinions.

Thus, it was not possible to gather robust information regarding the environmental situation of the works evaluated in the present audit and, either, to make any conclusions about the other public works licensed by IBAMA from the used sample.

For these reasons, it was concluded that the TCU has an important role as an inducer of the Brazilian environmental management´s improvement through the inclusion of environmental aspects in the inspections performed on the Fiscobras system and audits conducted within their court units.

The TCU decided to define systematic expansion and improvement of environmental aspects assessment under Fiscobras in the coming years, as well as in any audit that may contain object that somehow, cause environmental impacts.

BRAZIL	
The Name of the Audit	**Evaluation of the process of Environmental Impact Assessment in Federal Government´s infrastructure works - Case Study.**
Publication Information:	Not publicized
The national audit objectives An evaluation of the process of Environmental Impact Assessment - EIA in infrastructure works of the federal government, in view to identifying points that can be enhanced and contribute to improving the management of this process, in view of ensuring that environmental impacts are properly mitigated and / or compensated for during the installation and operation of projects and works, and the measures taken to mitigate them are the most effective and efficient.	
The scope of the audit The idea proposed in this study was to evaluate two large infrastructural projects with environmental	

permits issued by the Brazilian Institute of Environment and Renewable Natural Resources - IBAMA, the Highway BR 101 - Florianópolis (SC) section/ Osório (RS) and Transnordestina Railroad - Salgueiro (PE) section/ Missão Velha (CE).

Verification if the Basic Environmental Plan - PBAs and Environmental Impact Studies - EIS were effective in mitigating the impacts, in accordance with what was stated in conditions of environmental licensing.

Audit period covered: from 1997 to 2010.

The environmental and sustainability issues within scope of the audit

Were the measures implemented by entrepreneurs effective in mitigating the environmental impacts in accordance with which it was established under the conditions of the environmental licenses issued by IBAMA?

Did the environmental management of the entrepreneurs observe the principles and good international practices for monitoring during the process of environmental impact assessment?

Conclusions relating to audit findings environmental and key recommendations

The lack of an a posteriori evaluation of the EIA process does not permit it to identify what measures can be adopted to ensure that the objectives of the EIA are achieved with the least environmental impact and lowest cost.

Although the audit had analysed only two cases, it found that the process of IBAMA, the progress reports and other documents produced during the AIA process gather much information about the project and its impacts. The information is only useful if knowledge and expertise allow you to use it in a meaningful way. This study verified that information and knowledge generated in each case are used only for decisions regarding the case itself, with little effect on other activities of the EIA conducted by IBAMA.

The technicians' rotation of Environmental Board Authorization of IBAMA, coupled with the lack of internal mechanisms for capturing the knowledge gained in the monitoring phase, provides a low capacity for organizational learning within the IBAMA.

There is no evaluation of effectiveness of the environmental programs implemented during the construction phase. Thus, there is no feedback that will allow future PBAs (Annual Basic Plan) and future EIAs incorporate what may have been successful or unsuccessful in the construction of transportation infrastructure works.

To IBAMA, the analysis of monitoring reports should not be limited to verification of compliance with the conditions of the environmental license, but include an assessment of the effectiveness of mitigation measures and of the environmental programs.

To do so, it would be interesting at the end of a work, lBAMA requested of the entrepreneur, a consolidated report on the implementation of environmental programs, in order to highlight experiences, good practices that could be replicated and programs whose results fell short of expected.

Based on information from the consolidated report and the experience of its own analysts, IBAMA would prepare a final technical report evaluating the effectiveness of the environmental programs and the results of environmental protection achieved, suggesting best practices, mitigation measures, monitoring strategies and procedures that can be adopted or adapted for future projects, including the preparation of future environmental impact studies.

IBAMA also should determine that the environmental program members of the PBAs have clearly defined goals and targets set properly, with measurable indicators that can be used to evaluate the effectiveness of each environmental program.

It was verified in this paper that the cost-effectiveness of environmental monitoring is a good thing and can bring significant benefits to the process.

On the other hand, the Court could address issues that currently are not adequately addressed in the EIA process and environmental licenses and that, however were not part of main objective of this audit, were also observed.

The first refers to the cumulative and synergistic impacts, whose analysis is required in accordance with

the law. In the case of railroad, there is a co-location of enterprises and, possibly, overlapping environmental programs developed by different entrepreneurs.

The other question refers to the involvement of other agencies in the process of environmental licensing, because there are no clear rules, with guidelines and regulations that guide the action of these agencies, which may hinder the progress, costs involved and the transparency of the process.

Country Name ESTONIA

The Name of the Audit: The state's actions in ensuring the sustainability of heating supply

Publication Information: full report available in English: www.riigikontroll.ee

The national audit objectives

Sixty percent of Estonia's population uses district heating: heat, which is generated in boiler plants or power stations and distributed to consumers via heat networks. The advantages of properly-working district heating systems are less air pollution in residential areas and the opportunity to save energy if power and heat cogeneration technology is used. District heating systems in Estonia were mostly designed and constructed decades ago to provide heat for large residential areas and industries whose consumption was greater than today.

The objective of the audit was to assess whether the state has organised the activities in the heating supply sector (first and foremost district heating) so as to ensure secure, reliable, effective and justified heating supply with spread risks and conforming to environmental requirements and the needs of consumers.

The scope of the audit

The audit analysed the activities of the Ministry of the Economic Affairs and Communications in regulating the field of monopolistic district heating, identifying the need for investments and support and organising price formation and monitoring.

The audit also analysed the activities of the Estonian Competition Authority in approving the price of district heating and organising monitoring, as well as the activities of the Environmental Investment Centre of the Ministry of Finance in assessing applications for support measures and adopting financing decisions.

The environmental and sustainability issues within scope of the audit

Due to a lack of investment over the years, the district heating systems are mostly deteriorating due to long time of utilization and have too much capacity for present-day consumption. According to good practice heat losses from an optimally-designed network in good working order should not exceed 10 percent. However, on average, 20 percent is lost in Estonian district heating system pipelines before the heat even reaches consumers. In the case of 18 percent of local municipalities, the loss is greater than 25 percent. As a result of poorly designed and managed infrastructure the residents have to pay for inefficiently produced and distributed heat; which is one reason why the heat price is high.

District heating companies are natural monopolies and therefore the price of heat is regulated by the state (Estonian Competition Authority). Price approval has to fulfil the aim of ensuring a sustainable supply of heat for consumers in the future. It means that the regulator has to assess the need for investments and calculate the necessary investments into the heat price.

Conclusions of the audit findings

In the opinion of the National Audit Office, the Ministry of Economic Affairs and Communications has paid insufficient attention to the sustainability of the nation's heating supplies:

- The state and many local authorities lack a broad understanding of their heating supply situation (i.e. length and condition of heat networks), and in particular of district heating. A national heating supply development plan has not been drafted.
- Many consumers are forced to use district heating even where it is more expensive and less efficient than other alternatives (such as local boiler plants, heating pumps etc.).

Conclusions relating to environmental and sustainability findings

- The manner in which prices are set has not been successful in ensuring a sustainable supply of heat for consumers in the future. Therefore it is not always guaranteed that the companies are investing in a way that will make production and distribution of district heating more efficient.
- It is not known how much money must be invested to renovate the district heating systems and whether district heating companies are willing and able to make such investment by themselves.
- The state has not developed principles on the basis of which state financial support could be given to the areas where district heating needs to be preserved but where currently it is in a poor condition.
- In the process of assessment of applications of The Environmental Investment Centre's 2009 support measure entitled 'More widespread use of renewable energy sources for the production of energy' very little attention was paid to the sustainability of district heating regions and projects. This might have led to the implementation of projects which are unable to support themselves in future.

Responses of the government to the audit

The audit was presented in March 2011. The ministries and authorities admitted most of the problems related with heating supply in Estonia. Estonian Competition Authority agreed with the audit recommendations, but did not admit most of the problems related with the price regulation. However, the Authority has started to fix up their processes of price regulation.

In their responses to the audit recommendations, The Minister of Economic Affairs and Communications, The Minister of The Environment agreed with most of the recommendations that Estonian National Audit Office made.

The audit results were also presented in the Estonian Parliament.

Country Name ESTONIA

The Name of the Audit: Development of waste water treatment in rural areas with the support of the Cohesion Fund's projects

Publication Information: summary available in English: www.riigikontroll.ee

The national audit objectives

In order to protect public health and fulfil the environmental requirements of the European Union, Estonia had to improve the treatment quality of both drinking and waste water and achieve an ecologically sound state in its bodies of water by the end of 2010.

The National Audit Office examined the work of state agencies and local authorities in launching the first water management projects financed through the Cohesion Fund during the 2004-2006 programme period of the European Union.

The scope of the audit

The audit covered 63 local authorities and 7 regions of water companies. Three projects (the Western islands, the Matsalu ecological reserve and the Emajõgi and Võhandu Rivers) were audited in terms of the success of their preparation and instigation and financial sustainability of the water management systems developed as a result.

The environmental and sustainability issues within scope of the audit

In Estonia no significant investments had been made in improving the water management infrastructure in rural settlements over dozen years contrary to the larger cities. The majority of rural treatment facilities were unable to cope with waste water treatment and needed to be modernised or replaced. Waste water was leaking into the ground due to depreciated sewage pipelines. The exposure of groundwater and surface water to untreated waste water is potential hazard of spreading diseases among the population and the suffocation of bodies of water due to excessive concentration of nutrients. Properly organised waste water treatment was needed for preventing such problems.

Financial sustainability of water infrastructure development projects was considered a crucial success factor. The amortisation time for pipelines is 30 years after what they need to be recovered. So the water price has to cover management costs and ensure funds for future renovation works.

Conclusions of the audit findings

Conclusions relating to environmental and sustainability findings

According to the National Audit Office, Estonia was unable to ensure sufficient waste water treatment in all settlements by 2010. Waste water treatment supported through the Cohesion Fund's projects had not been organised in a sustainable way, with the price of water and sewerage not incorporating all costs and there being lingering uncertainty regarding the future administration of new structures.

- Too little funding was planned for the improvement of water management systems. According to the calculations of the Ministry of the Environment, 18 billion kroons was needed to bring waste water management in all settlements into conformity with European Union regulations between 2007 and 2013, but only 12 billion kroons was planned for the development of water management and waste treatment in that period (including Cohesion Fund and state and local government funding). Furthermore, projects from the second Cohesion Fund programme period could not be possibly completed in time to fulfil the obligations of the European Union's urban waste water directive by 2010.
- There were problems with the involvement of local authorities in instigating projects. If a local authority had no interest whatsoever in participating in a project, the Ministry of the Environment currently had no power to oblige them to do so. Several local authorities were unable to take part in projects as their ability to cofinance them (including through loans) was restricted. Some local authorities were poorly prepared for their involvement in projects, lacking, amongst other things, a public water supply and sewerage system development plan.
- There were shortcomings in both the financial analysis of projects and their technological solutions. Ineffectual applications and confusion in assessing environmental impact led to delays in launching projects: the reviewing of applications by the European Commission took longer and additional terms and conditions were placed upon funding decisions which the state would have had to fulfil before the allocation of funds. The main causes of the shortcomings that were identified were the demanding timeframe of the European Union's budgetary process in launching projects and the lack of the necessary preliminary studies. In the view of the National Audit Office more thorough assessment of the applications would have helped to avoid a number of those shortcomings.
- The sharp rise in building costs caused by the delays in the projects had further

increased the need for additional state financing. During the project duration, the cost of building tenders for the environmental sector had gone up by an average of 1.8 times. For example, the tenders received in response to the design and construction procurement in September 2006 exceeded the project budget by more than double. It was calculated that an additional 2 billion kroons would be needed between 2008 and 2011 to compensate for the increased cost of the six Cohesion Fund projects. As this amount could not have been covered either by increasing the contribution of local authorities or from the budget of the Environmental Investment Centre, the projects had to be supported through the state budget.

- The organisation of waste water treatment in rural areas with the support of Cohesion Fund projects was not going to guarantee the sustainability of the sector, as not all costs had been taken into consideration in determining the price of water and sewerage services. As a result, the revenue earned from these rates was not going to be sufficient for renovation and modernisation in the future – neither for those structures that existed prior to the Cohesion Fund project, nor the new constructions. Thus a situation could arise where the state would have to cover the cost of exchanging old and damaged equipment, since local authorities and water companies would not have generated enough money to do this themselves.

Responses of the government to the audit

Although the Minister of the Environment considered it important to compensate for the rise in the prices of water management caused by the rise in the construction prices, the Minister found it difficult to develop common principles for subsidising, because the capacity of the local authorities was very different.

The Minister of the Environment found that upon compensation of the rise in prices the capacity of the local authorities as well as that of the water companies had to be taken into account.

At the same time the Association of Estonian Cities considered it important to treat all local authorities equally upon covering the rise in construction prices.

The Minister of the Environment confirmed that a legislative amendment had been initiated to resolve the problems associated with the establishment of water prices.

The audit results were also presented in the Estonian Parliament.

The role of approving the price of water supply and sewerage services was transferred from local councils to Estonian Competition Authority in 2010 by amending relevant act accordingly.

As a result of economic decline the construction prices dropped also for water supply and sewage infrastructure development projects in 2009. Therefore, the financial constraints have ceased to be major constraint for development, but instead the setbacks occurring in the tendering process.
In 2010 environmental monitoring data allowed the Environmental Information Centre to conclude that the efficiency of wastewater treatment in Estonia had improved. Wastewater to be treated passed biological or more stringent treatment systems and the latter had brought about decrease in the pollution load for organic matter as well as for phosphorus and nitrogen.

Case Study Submission from United States Government Accountability Office

Most of GAO's infrastructure studies have focused on how well the nation meets the financial, safety, and reliability challenges currently facing American infrastructure. This work has primarily reported on the effectiveness of existing infrastructure and different ways to fund

infrastructure construction and maintenance; but with little direct focus on the associated environmental implications. One study recently initiated by our Physical Infrastructure team, however, is reviewing initiatives to improve the delivery of surface transportation projects, and does have a particular focus on the role of environmental reviews in federally-funded highway projects. This study, however, will not be completed until late 2012.

United States Government Accountability Office (GAO) *Clean Water Infrastructure: A Variety of Issues Need to Be Considered When Designing a Clean Water Trust Fund* GAO-09-657, May 29, 2009
GAO was asked to (1) obtain stakeholders' views on the issues that would need to be addressed in designing and establishing a clean water trust fund and (2) identify and describe potential options that could generate about $10 billion in revenue to support a clean water trust fund.
More than 220 million people in the United States are served by wastewater systems that are composed primarily of a network of sewer pipes and treatment plants that carry and treat wastewater before it is discharged into surface water. Many of these systems were constructed more than 50 years ago and are reaching the end of their useful lives. In addition to the deterioration in the condition of this infrastructure, some of these systems also lack the capacity to adequately treat increasingly large volumes of wastewater, particularly during periods of wet weather. As a result, these systems are releasing large quantities of untreated wastewater into surface waters, which can pose a threat to human and aquatic health. The Environmental Protection Agency (EPA) has estimated that a potential gap between future needs and current spending for wastewater infrastructure of $150 billion to $400 billion could occur over the next decade. A number of entities are involved in planning, financing, building, and operating this infrastructure. A variety of approaches have been proposed to help bridge a potential gap between projected future infrastructure needs and current levels of spending. For example, one approach would be to increase federal funding for the Clean Water State Revolving Fund (CWSRF) program, which is the largest source of federal assistance for wastewater infrastructure.
GAO did not make any recommendations. While this report identified a number of funding options, GAO did not endorse any option and did not have a position on whether or not a trust fund should be established.
GAO provided a draft of the report to EPA and the Internal Revenue Service for review and comment. Neither agency provided written comments. EPA provided technical comments, which were incorporated as appropriate.

United Kingdom **The Name of the Audit:** Building for the future: Sustainable construction and refurbishment on the government estate **Publication Information:** April 2007, available in English at www.nao.org.uk

The national audit objectives

To audit government performance in meeting targets to make their new buildings and major refurbishments more sustainable.

The scope of the audit

- the extent to which departments and agencies are meeting the standards set for sustainable construction and refurbishment on the government estate. This included a wide range of building types: offices, courts, laboratories, storage centres, vehicle testing centres, job centres, detention centres and others. Public buildings such as hospitals and schools, which fall outside the immediate control of departments and agencies, were excluded;

- how departments and agencies evaluate value for money when designing and specifying sustainable buildings; and

- whether buildings on the government estate which were designed to be sustainable have delivered the expected benefits.

We appointed engineering and management consultants to assist us in this work.

Conclusions of the audit findings

The government has set sustainability standards for the construction and refurbishment of buildings on the government estate, but these are not being met. Departments are failing to carry out environmental assessments and achieve the target ratings.

Various barriers are hindering progress towards more sustainable buildings. These include, in particular:

- the fragmentation of policy responsibility among government bodies for improving sustainable construction and the absence of a coherent approach to monitoring progress and ensuring compliance;
- the lack of sufficient knowledge and expertise in sustainable procurement among those departmental staff responsible for them;
- the widespread perception of a conflict between sustainability and value for money – partly because project teams are failing to assess the long-term costs and benefits of more sustainable approaches; and
- the failure to specify expected benefits and undertake rigorous reviews to evaluate performance against them and the consequent lack of robust data to inform business appraisals for new projects.

The SAI's key recommendations:

The government should establish a clear understanding on the division of policy responsibilities for sustainable construction in the public sector, in such a way as to ensure clear accountability for this area of policy.

The government should specify their requirements for environmental performance in terms of outcome base performance targets – including carbon emissions and energy and water

The government needs to better monitor and report on progress to help understand and hold departments to account for environmental performance. Completed projects should be evaluated to assess whether they delivered the specified level of performance.

The government needs to take full account of the government's environmental targets - and the wider social and economic impacts which sustainable buildings can bring - when assessing value for money, with clearer guidance on the use of whole life costing.

Responses of the government to the audit

The government established the Centre of Expertise in Sustainable Procurement (CESP) in 2008 to provide leadership focusing on environmental sustainability across government.

The Name of the Audits:

- Preparations for the London 2012 Olympic and Paralympic Games - Risk assessment and management, February 2007
- Preparations for the London 2012 Olympic and Paralympic Games: Progress Report, June 2008, February 2010 and February 2011

Publication Information: All reports available in English at www.nao.org.uk

The national audit objectives

To audit the government's preparations for hosting the London 2012 Olympic and Paralympic Games.

The scope of the audit

It considers the progress that has been made since July 2005 when the International Olympic Committee chose London as the host city for 2012.

The environmental and sustainability issues within scope of the audit

It considers the risks, challenges and progress in relation to planning for a lasting legacy, the prospect of which formed a key element of the Olympic bid. The legacy is viewed in terms of the venues that will remain after 2012, the regeneration of the local area, and also the wider benefits that the Games are expected to bring to London and the UK more generally.

Environmental and Sustainability conclusions of the audit findings

February 2007

Work is ongoing to finalise proposals for the legacy use and ownership of the venues, and to develop plans for delivering and measuring the wider benefits of the Games, a key driver behind London's bid.

Key SAI recommendations

In relation to planning for a lasting legacy, recommended action required to manage risk:

- develop robust business plans for the Olympic venues with a clear focus on whole-life costs, to avoid the risk of facilities being under-used or unaffordable after the Games.
- agree who will be responsible for each facility during the transition phase after the Games, who will cover conversion and ongoing running costs, and who will own the legacy assets.
- beyond the venues, identifying the key legacy benefits that it is realistic to expect from the Games, and where possible quantifying these so that it will be clear whether they have been achieved.
- embed the development of delivery plans into normal business planning cycles.
- decide what benefits would be counted in any final reckoning of the costs and benefits of the Games, being clear about these throughout, and ensuring principles and processes are in place to support accurate reporting.
- ensure that in any final reckoning, costs and benefits are approached in the same way so that any assessment of wider benefits is not set against a narrow definition of cost.
- ensure the legacy proposals for the Olympic Park are integrated with the plans.

June 2008

The Olympic Delivery Authority has established a dedicated team to implement its sustainability strategy, and:

- has established quantified and measurable targets;

- provided guidance to project teams on how to incorporate sustainability into designs;
- requires every contractor to set out a plan for how it will minimize environmental impacts during
- construction, including with its own sub contractors, and subject to random audits by the Authority; and
- has developed a system for monitoring and managing the main suppliers' performance against targets for sustainable development, with the main suppliers in turn responsible for cascading sustainability targets down their supply chains.

The legacy requirements for the venues and infrastructure on the Olympic Park have not been finalised. The longer the legacy requirements remain unclear, the harder it will be to accommodate them in the design and construction of facilities, and the more likely it is that, through expediency, legacy objectives will be compromised by the need to deliver the Games on time.

Key SAI recommendations
In developing the evaluation framework for assessing the impact of the Games, the Government Olympic Executive should set baselines against which it will measure whether the expected legacy benefits are achieved. The framework should set out how the effects of the Games will be disentangled from the effects of, for example, other regeneration activities already taking place in East London.

February 2010
During 2009 the Olympic Park Legacy Company was formed to take responsibility for delivering a positive legacy from the Olympic Park. The Legacy Company is building its capacity and working with its founder members to resolve its financing.

Key SAI recommendations
The Legacy Company, with whom responsibility now rest, should set out a clear plan for mitigating the costs of maintaining assets after the Games. Securing long term legacy usage should remain the priority.

The Delivery Authority is a temporary organisation set up to deliver the Games, with assets and liabilities which will need to be managed beyond its lifetime. The Olympic Executive should finalise plans for post Games management of assets and liabilities, having regard to the need to avoid adverse impact on the Legacy Company's ability to fulfil its objectives.

February 2011
The Government Olympic Executive is accountable for the success of the legacy, but accountability for individual projects lies with a range of delivery bodies outside the direct control of the Executive. The Government has not yet estimated the net benefits it expects to accrue which can be directly attributed to the Games. The Olympic Executive is developing a framework for evaluating the legacy, as recommended by the Committee of Public Accounts in July 2008.

Key SAI recommendations
The Government Olympic Executive should set baselines against which it will measure whether the expected legacy benefits are achieved. The evaluation framework should set out how the effects of the Games will be separated out from business as usual activities.

The Government Olympic Executive should:
- estimate the net legacy benefits to the United Kingdom which can be directly attributed to the Games;
- satisfy itself as to progress; and
- set out how the Olympic legacy will be coordinated and monitored when the Olympic Executive is wound up after the Games.

The Olympic Park Legacy Company does not yet have a business plan agreed with the Treasury which matches objectives with funding. The absence of a business plan potentially undermines the optimal use of resources and the Legacy Company should conclude its

business plan by March 2011.

Responses of the government to the audit

Country Name **New Zealand**

The Name of the Audit: *Local authorities: planning to meet the forecast demand for drinking water*
Publication Information February 2010 - the report is available at www.oag.govt.nz

Introduction

Many parts of New Zealand are experiencing increasing demand for water, which puts pressure on water sources and the capacity of the infrastructure (that is, the pipes and water treatment plants). Local authorities are responsible for the supply of drinking water to New Zealand communities. Augmenting or replacing water supply infrastructure can be challenging for local authorities because it is expensive. It is important that local authorities ensure that they have considered and planned for the forecast demand for drinking water, so they can have adequate infrastructure and strategies in place to meet the needs of their community.

Audit objectives

The audit examined whether a representative sample of eight local authorities were effectively managing their supplies of drinking water to meet the likely future demand for it.

The scope of the audit

The audit looked at the forecasts the local authorities used to identify the likely future demand for drinking water, and the strategies they were using to make sure they could meet that demand.

Methodology

We reviewed documents and interviewed staff and councillors at each local authority to understand each local authority's:

- approach to forecasting the likely demand for drinking water;
- approach to developing strategies for managing drinking water;
- levels of service and how they affect forecasting and choice of strategies;
- approach to risk management and contingency planning;
- plans to implement the strategies through commitments in long term plans, annual plans, and other council planning documents;
- governance arrangements for the delivery of drinking water;
- asset information used to forecast the likely demand for drinking water and used to choose strategies;
- response to the meeting statutory requirements for drinking water quality;
- views on limitations, problems, or barriers to forecasting and to strategies to meet the forecast demand for water.

Overall results

Overall, we found that only two of the eight local authorities in our sample were managing their drinking water supplies effectively. Four local authorities were adequately managing their drinking water supplies, and adequately placed to meet the forecast demand for drinking water. Two local authorities were poorly placed to meet the forecast demand for drinking water.

All eight local authorities had identified their main challenges to meeting the forecast demand for drinking water. The most common challenges were:

- accessing new sources of water to increase the quantity of water available;
- meeting the drinking water standards for water quality;
- improving information available for forecasting, planning, and asset management;
- funding infrastructure upgrades; and
- improving the efficiency of their water supply systems.

Six local authorities used a demand forecasting method that would be considered the minimum in terms of industry standards. We considered this to be unsatisfactory, because it could result in infrastructure that is not the right size for their needs and therefore wastes public funds. It could also place unnecessary demands on scarce water resources.

The ability of some of the local authorities to prepare reliable forecasts for drinking water demand was limited by the quality of information they had, particularly about water use. Few of the eight local authorities explicitly addressed uncertainty in their forecasts. There were few examples of forecast verification or peer review.

The environmental and sustainability issues within scope of the audit

While most of the local authorities were clearly taking sustainable development into account, the actions they had chosen were partial rather than comprehensive. None of the local authorities had a fully integrated approach to dealing with sustainable development and supplying drinking water.

All eight local authorities had assessed what they need to do to meet the country's drinking water standards. Their assessments were behind the changes they were making and their increased capital expenditure for supplying drinking water. Five of the smaller local authorities need to upgrade their infrastructure, especially those that have previously received poor water quality grades.

Conclusions of the audit findings

We recommended that local authorities:

1. use accurate and up-to-date information to prepare water demand forecasts to reduce the risk of under- or over-investing in water supply infrastructure. In particular, this needs to include accurate and up-to-date information on water consumption;

2. verify the reliability of water demand forecasts to reduce the risk of under- or over-investing in water supply infrastructure.

3. improve the efficiency of drinking water supplies by minimising water that is unaccounted for, to reduce the demand on existing water sources and the risk of over-investing in water supply infrastructure;

4. participate in an independent benchmarking programme to measure progress to improve the efficiency with which they supply drinking water;

5. prepare comprehensive demand management plans that integrate a broad range of supply and demand strategies, to reduce the demand on existing water sources and the risk of over-investing in water supply infrastructure, and to benefit from cost

savings;

6. carry out rigorous evaluations of the costs and benefits of supply and demand strategy options, to choose the most cost-effective and sustainable options.

Conclusions relating to environmental and sustainability findings

We recommended that local authorities integrate sustainable development strategies into drinking water supply management as part of preparing comprehensive demand management plans.

Responses to the audit

We provided individual, detailed reports to each of the local authoriies that we audited. Several began making improvements as a result of those reports.

The report was well received by the wider local government sector and has been used by local authorities to improve their water supply management and future planning.

We will conduct a follow up in 2011/12.