4 GREEN GUIDE TO

STRATEGIC SITE SELECTION AND DEVELOPMENT

GREEN RECOVERY AND RECONSTRUCTION: TRAINING TOOLKIT FOR HUMANITARIAN AID

The Green Recovery and Reconstruction Toolkit (GRRT) is dedicated to the resilient spirit of people around the world who are recovering from disasters. We hope that the GRRT has successfully drawn upon your experiences in order to ensure a safe and sustainable future for us all.

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Charles Kelly, Consultant

A NOTE TO USERS: The Green Recovery and Reconstruction Toolkit (GRRT) is a training program designed to increase awareness and knowledge of environmentally sustainable disaster recovery and reconstruction approaches. Each GRRT module package consists of (1) training materials for a workshop, (2) a trainer's guide, (3) slides, and (4) a technical content paper that provides background information for the training. This is the technical content paper that accompanies the one-day training session on integrating environmentally sustainable approaches into site selection and development.

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MODULE 4: GREEN GUIDE TO STRATEGIC SITE SELECTION AND DEVELOPMENT

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1 INTRODUCTION

1.1 Module Objectives

This module describes the principles of strategic, environmentally sustainable site selection and development for post-disaster humanitarian aid projects. It presents a detailed set of guidelines and checklists as well as a post-disaster recovery time line. The time line includes strategic action points for ensuring that the long-term health and security of people and communities recovering from disaster have been factored into site selection and development.

Specific learning objectives for this module are as follows:

1. Understand the principles of environmentally sustainable site selection and development.
2. Conduct an assessment of post-disaster site selection, design, and adaptation to address environmental conditions in order to protect people and communities.
3. Identify strategic points of entry in the post-disaster recovery and reconstruction cycle to promote environmentally sustainable site selection and development.

1.2 The Green Recovery and Reconstruction Toolkit

This is Module 4 in a series of ten modules comprising the Green Recovery and Reconstruction Toolkit (GRRT). Collectively, the GRRT modules provide information and guidelines to improve project outcomes for people and communities recovering from disaster by minimizing harm to the environment, and taking advantage of opportunities to improve the environment. Module 1 provides a brief introduction to the concept of green recovery and reconstruction to help make communities stronger and more resilient to future disasters by integrating environmental issues into the recovery process. GRRT Module 2 provides guidance on how project design, monitoring, and evaluation can better incorporate and address environmental issues within the typical project cycle. GRRT Module 3 builds upon Module 2, focusing specifically on assessment tools that can be used to determine the environmental impact of humanitarian projects regardless of the type of project or sector. GRRT Modules 4, 5, and 6 pertain specifically to building construction, with Module 4 focusing on site planning and development, Module 5 on building materials and the supply chain, and Module 6 on building design and construction management. GRRT Modules 7 through 10 provide sector-specific information to complement Modules 2 and 3, including livelihoods, disaster risk reduction, water and sanitation, and greening organizational operations.

1.3 Intended Audience

Module 4 is intended to support the training of physical planners, shelter and other construction professionals, and program and project managers in the field or at headquarters. It also supports project designers and environmental specialists involved in site selection and the planning and implementing of post-disaster construction of shelter or other buildings for disaster survivors. The trainees are expected to have familiarity with the basic procedures normally used in a shelter construction project and with the green recovery and reconstruction introductory concepts. This background can come from other modules in the GRRT or from other professional experience. The staff of local and national government agencies involved in the design, review, and implementation of recovery and reconstruction projects would also benefit from the training.

1.4 Module Key Concepts

This module builds on four key concepts:

1. Site selection and development involves a wide range of actions with social, environmental, and economic dimensions. These can result in a wide range of impacts, all of which play a role in the long-term health and security of people and communities recovering from disaster.
2. By following the Guidelines for Sustainable Post-Disaster Site Selection and Development (see Section 4), project planners can improve project outcomes by taking steps to protect people and their environment.
3. *Strategic* selection at key intervention points is important because the shelter site selection and development process involves decision making that spans a variety of sectors and time lines, from the earliest phase of post-disaster damage assessments and the location of temporary camps to longer-term reconstruction planning on a regional scale.
4. Considering environmental sustainability in site selection and development helps achieve the "do no harm" concept and will improve the lives of resettled individuals and their communities.

1.5 Module Assumptions

This training module assumes that participants are generally familiar with the project management cycle for humanitarian aid or development projects as well as the larger context of the post-disaster recovery and reconstruction process from immediate relief to longer-term reconstruction. This module focuses on the selection and development of shelter sites (emergency, transitional, and permanent) following a disaster. The term shelter site includes the housing, basic services (e.g., water, fuel, sewage), access infrastructure (e.g., roads, paths, bridges, etc.), and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities). The principles of this module can be applied to either an urban or rural area. The guidance provided in this module is applicable regardless of the economic or social status of a disaster-affected population.

1.6 Key Module Definitions

The following are key terms used in this module. A full list of terms is contained in the Glossary.

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

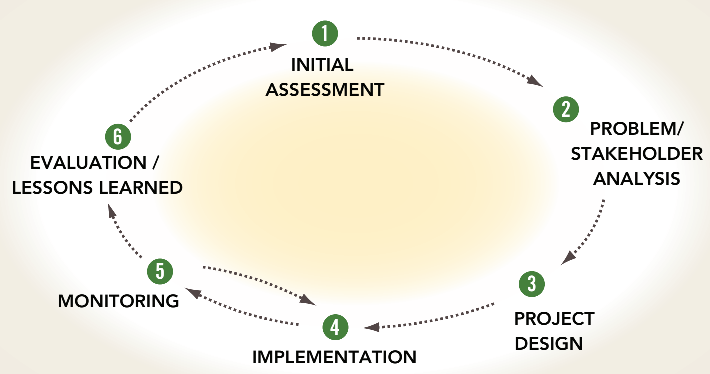
Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site development includes the physical process of construction at a building site, as well as environmental improvements such as the addition of home gardens and live fencing (e.g., fencing made out of live shrub cuttings) shown in this picture of housing built after the 2004 Indian Ocean tsunami in Aceh, Indonesia.
© Daniel Cima/American Red Cross

2 PROJECT CYCLE AND STRATEGIC SITE SELECTION AND DEVELOPMENT

In planning and carrying out disaster response activities, many humanitarian agencies follow a standard project management cycle, as shown in Figure 1.

FIGURE 1: STANDARD PROJECT MANAGEMENT CYCLE



Throughout the project cycle there are numerous opportunities for introducing and reinforcing the principles of Strategic Site Selection and Development as shown on the next page in Figure 2.

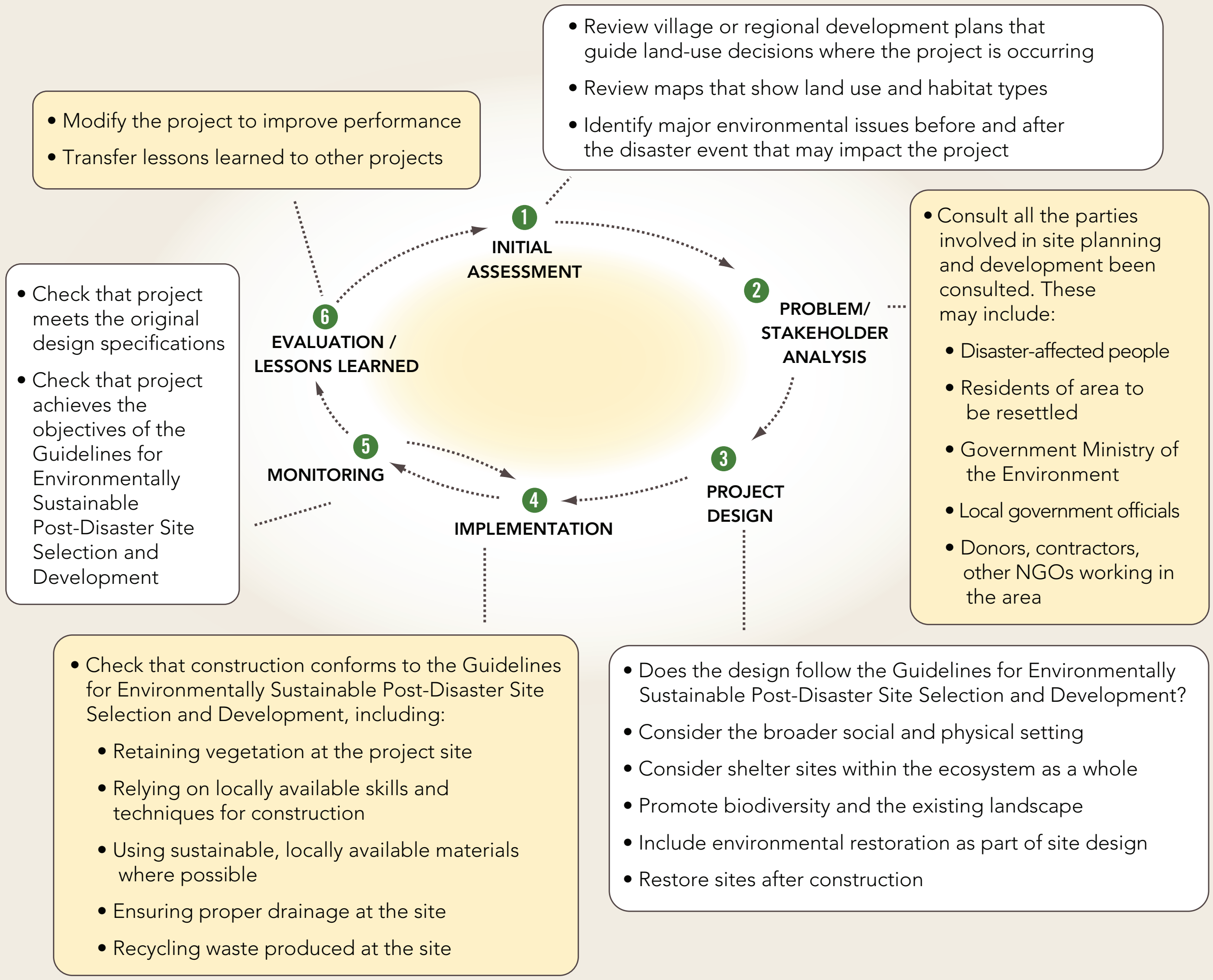
A full set of Guidelines for Sustainable Post-Disaster Site Selection and Development are included in Section 4. The Guidelines include a checklist to help project planners verify whether key elements contributing to sustainability have been identified and addressed in the site selection and development process.

At the initial assessment phase, it is important to find out whether the project area has any **preexisting village plans or regional development plans** that set forth the vision for future land-use planning. In most cases, these plans are the products of consultation with communities and with local, provincial, and national governments as well as with private-sector entities within the project area.

Even if the disaster event has dramatically altered the future course of development, these preexisting plans can give a good indication of community values, goals, and objectives with respect to land development. They can also be used as a source of information for the major types of industries (existing and planned) in the project area, the resources available (e.g., water, timber, agricultural resources), and areas of special (e.g., cultural) significance.

During the Problem/Stakeholder Analysis phase, it is important to engage all the relevant stakeholders to better understand the environmental context and the major actors in the project area. These stakeholders should be able to identify the major environmental issues that existed before and after the disaster, as well as provide some foresight into how the reconstruction process may impact different resources, such as the demand for raw materials for construction.

FIGURE 2: PROJECT CYCLE WITH OPPORTUNITIES FOR INTRODUCING PRINCIPLES OF STRATEGIC SITE SELECTION AND DEVELOPMENT



During the Project Design and Implementation phases, it is crucial that the Guidelines for Environmentally Sustainable Post-Disaster Site Selection and Development are reviewed and incorporated into project design and implementation.

During the Monitoring Phase, the project should be reviewed to ensure that it meets the original specifications of the design and that the implementation process conforms to the Guidelines. Any problems identified in the Monitoring Phase should be addressed as soon as possible. The results of the Monitoring Phase should also inform the Evaluation Phase in order to identify modifications needed to improve project performance. For example, solid waste management may be an issue not initially identified. If significant waste problems are detected, these should be addressed as soon as possible. If the correction is beyond the scope of the current project, it should be addressed during the evaluation phase when follow-up needs are identified. Development of specific indicators in the project logframe and/or Monitoring and Evaluation plan that relate to the Guidelines helps to ensure that the project achieves its sustainability objectives.

3 STRATEGIC SITE SELECTION AND DEVELOPMENT

Site selection and development involves a wide range of actions with social, environmental, and economic dimensions. These can result in a wide range of impacts, all of which play a role in the long-term health and security of people and communities recovering from disaster. The long-term impacts of site selection and development decisions need to be defined, considered, and addressed. Likewise, any opportunities that improve the overall well-being of disaster survivors beyond pre-disaster conditions should be maximized wherever possible.

The focus of this module is on ***strategic*** site selection and development. Strategic thinking is important because the shelter site selection and development process involves decision making that spans a variety of sectors and time lines, from the earliest phase of post-disaster damage assessments to the location of temporary camps to longer-term reconstruction planning on a regional scale. Addressing site selection and development issues solely within the context of an individual shelter project (e.g., the construction of 10 homes) is not sufficient to properly protect people and their environment; many of the aspects of site selection and development are interrelated and need to be addressed in a holistic manner across a range of site development activities, a process most effectively done from a strategic perspective. (NOTE: A full set of Guidelines for Sustainable Post-Disaster Site Selection and Development is included in Section 4.)

The period of recovery and reconstruction following a disaster represents an important opportunity to rebuild communities in ways that reduce disaster risks and increase sustainability for people and the environment. For instance, some communities affected by Hurricane Mitch in Honduras were relocated away from flood zones, and the site development incorporated park areas and open space that improved the quality of the local environment. Unfortunately, other communities in the same area could not be relocated away from flood areas, and continue to suffer repeated flooding.

The selection and development of resettlement sites following disaster often does not consider the full range of impacts on the environment, and does not take into account the concept of sustainability. Where resettlement sites do not take into account long-term sustainability, residents can experience the following problems:

- Increased impacts from hazards (e.g., flooding, landslides) that were not present or not as severe as they were before resettlement
- Living conditions actually worse than those that existed before resettlement
- Long-term environmental degradation (e.g., erosion, deforestation) due to insufficient consideration of local environmental resources will result in further damage to land, agricultural livelihoods, and safety and security.
- Increased air and water pollution will impact the health, welfare, and livelihoods of resettled and neighboring communities

Post-disaster housing reconstruction project built in flood plain in Aceh, Indonesia.
© Jonathan Randall/WWF

CASE STUDY: ACEH, INDONESIA
POST-TSUNAMI HOUSING PROJECT

These houses in Aceh Besar District, Sumatra, Indonesia, were built after the 2004 Indian Ocean tsunami. In the background is a newly constructed seawall that was built as a coastal barrier to protect residents from future tsunamis and storm surges. Unfortunately, the site plan and design for the housing project overlooked the fact that a significant quantity of freshwater flows from inland areas toward the ocean during periods of heavy rainfall and becomes trapped by the seawall before it is released into the ocean. As shown in the picture, the recurring floods have damaged the newly constructed shelter, water and sanitation systems, and roads, and have affected residents' health and quality of life. As a short-term fix, a costly drainage system was installed. To prevent these types of problems and added costs in the future, project planners need to ensure that there is coordinated planning among a range of stakeholders beyond the immediate project area. Planners must pay particular attention to the broader environmental context.

3.1 Disaster Cycle Time Line and Strategic Action Points

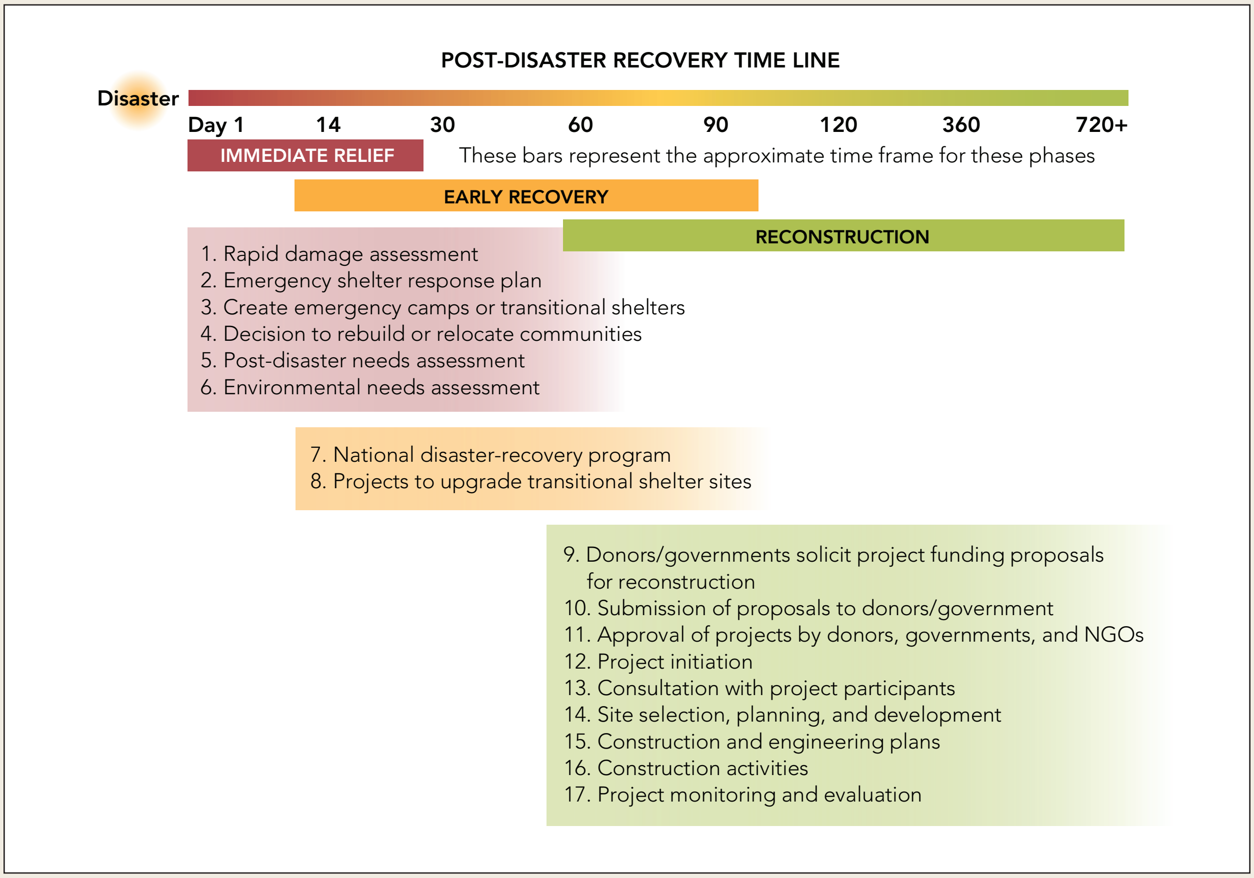
The recovery and reconstruction period after a disaster is not a one-time event; rather, it is a dynamic long-term process that represents an opportunity for planners to design strong communities, reduce the risks to and vulnerabilities of beneficiary populations, and enhance environmental sustainability. As such, the intervention points for strategic site selection and development occur at various stages during the recovery cycle.

The **Site Selection and Development Time Line – Recommended Actions & References** table (Annex 2) sets out key points on the "disaster to recovery" time line in order to provide opportunities for environment-focused actions to promote safer shelter sites for people and communities. The table includes a description of the environmental considerations at each intervention point and also lists key reference literature. The concept of sustainable reconstruction used here includes the management of natural hazards by site planners of natural hazards in order to limit the impacts on rebuilt or new communities.

The term "shelter sites" includes:

- Temporary shelter sites (e.g., camps and transitional shelter)
- Sites newly constructed after a disaster (e.g., relocated communities)
- Sites where shelter and shelter-related infrastructure are reconstructed after a disaster at or near their original location (e.g., rebuilt communities)

The focus of the table is on the construction of physical infrastructure. It is expected that standard participatory approaches will be used in the reconstruction process. The following diagram summarizes the key intervention points for addressing sustainable site selection and development. See Annex 2 for additional information.



Decisions about the siting and development of emergency, transitional, and permanent building sites begin within days of the disaster and continue for months. The decision-making process involves multiple actors working for multiple organizations. This can lead to coordination problems.

While early decisions are often strategic (e.g., "flood communities will be moved to safer locations"), subsequent decisions become increasingly site specific. At each decision point, different strategies and approaches are needed to ensure that decisions and actions support a sustainable recovery outcome.

The sequence of actions taken as the effort moves from disaster relief to recovery is influenced by a range of factors including the nature of the disaster, the level of assistance provided, and physical access. The Site Selection and Development Time Line is based on a rapid-onset event, such as a cyclone or earthquake, and needs to be adapted to the local context.

3.2 Planning for the Future

Many disaster survivors will have few assets in the immediate aftermath of disaster. However, site plans should anticipate that the site residents will replace lost assets over time, and the site will eventually experience normal growth.

As a result, all sites should be designed and constructed to allow space for future expansion without a reduction in the availability or value of environmental resources for site residents. This anticipation of future expansion can include plans for such things as:

- An expansion in the number of houses, and in house size and population
- Increased demand for fuel, water, and energy
- Increased waste water and garbage generation
- Expansion of and increase in commercial activities
- Increased demand for education and other social facilities
- Increased traffic volume and overall number of vehicles (e.g., road size and safety)
- Increased runoff and erosion potential due to an increase in impermeable surfaces

Sustainable site selection and development should specifically avoid underestimating the physical space and environmental requirements of a community, which can lead to overcrowding as more and more disaster survivors are settled on a limited number of shelter sites.

3.3 Maps as Tools

Maps are key tools in the selection and development of a new shelter site. Maps of appropriate scales can be used to:

1. Identify possible site locations, applying criteria such as elevation, slope, aspect (the direction the site faces), distance from roads and towns, proximity to natural resources, distance from rivers and other water supplies, risk to environmentally unique locations (e.g., parks or reserves), and distance from industrial or mining sites.
2. Design the actual layout of the site, taking into consideration guidance on matching the physical layout of the site with the infrastructure to be constructed.
3. Develop plans for the use of natural resources within or near the site as the site is developed (e.g., sourcing of sand and gravel) and once the site is occupied.
4. Help new residents and visitors find homes and services within the site.

Mapping can be done with various degrees of sophistication, from simple community-drawn diagrams on flip-chart paper to a detailed presentation of complex data using a geographic information system (GIS). The choice of the most appropriate and efficient mapping tools for use in shelter site selection and development depends on several factors, including:

- The physical size of the site
- The number of sites to be developed

- The complexity of the site development process and infrastructure to be built
- Available funds

In general, the more sites needed, the larger the sites, and the greater the complexity of infrastructure to be built on each site, the more sophistication in mapping technique is needed.

Most countries (at a national level and often at a local level) and almost all large-scale humanitarian operations, have the capacity to create maps. These capacities are often located in government agencies involved in planning, finance/taxes, environmental management, health and epidemiological surveillance, or public works. In some countries, the private sector can also be a good source of mapping capacities, with information available from surveyors, construction firms, computer services companies, and commercial delivery firms.

3.4 Stakeholders in Site Selection and Development

It is important to have a clear understanding of all the parties involved in the site selection and development process to ensure that there is proper coordination and consultation with the various stakeholders and a better understanding of the interconnections between and among sectors. The following are many of the parties that could be expected to be involved in site selection and development:

- The disaster-affected people to be resettled
- People living near the new site
- Local government officials involved in:
    - Selection
    - Construction permits and inspection
    - Public services, (e.g., health, education, water, sewage, garbage collection)
    - Environmental management
    - Finance
    - Security
- Regional and/or national government officials working in the areas of construction, selection, finance, the environment, and public services
- United Nation Clusters (e.g., Early Recovery or Shelter)
- Public and privately managed utilities (e.g., water, electricity)
- Donors funding the site development
- NGOs involved in the site development, including environmental NGOs (NGO staff may closely parallel the staff involved from local, regional, or national government)
- Contractors involved in all the construction activities at the site (the range and number of contractors will depend on the nature and scope of the site development work)
- Consulting firms providing design, selection, or architectural services, or conducting assessments (e.g., social, environmental) and monitoring and evaluating

- Local, regional, and national business persons interested in providing assistance to support reconstruction or interested in working under the recovery program
- Media representatives interested in documenting the recovery process
- Food sellers and other small-scale businesses that provide support to workers and site residents

CASE STUDY: XAAFUUN, SOMALIA, TSUNAMI (2004)

Reconstruction efforts in Xaafuun, Somalia, following the 2004 tsunami pinpoint the importance of environmentally appropriate site selection for a relocated community. Xaafuun is one of the few permanent fishing settlements on the northeastern Somalia coast, and oscillates between 250 and 600 families depending on the season. In the damaged settlement, houses had been built at sea level near the beach, and which had destabilized the fragile dune ecosystem of the area. Strong, sand-laden winds would regularly hit the village during the monsoon season, often burying structures and causing health problems, particularly for children, pregnant women, and the elderly.

To find a safe and environmentally sustainable site, a multidisciplinary team of urban planners, an economic development expert, and an environmental specialist collaborated to formulate the reconstruction plan. Key issues of sustainability included the potential for settlement expansion and construction in close proximity to both fishing and market locations. Protection from the elements was another important consideration, since Xaafuun is subject to strong winds and sand from the adjacent sand dune habitat. The team also looked at the suitability of a new site with regard to public infrastructure for water delivery systems, sanitation systems, and roadway access points.

The new location called for a carefully considered, integrated settlement layout with appropriate types of shelter, rather than a simple replication of what existed before. A preparatory sketch-plan discussed with all stakeholders allowed for swift land allocation to different agencies for immediate reconstruction activities. Meanwhile, a more detailed settlement layout was prepared by UN-HABITAT. A new mosque, a Koranic school, a meat market, a women's center, and a health center were built.

The town plan was based on the following principles:

1. Compact settlement: this mitigates the impact of Xaafuun's strong winds on living spaces and housing units, ensures cost efficiency by reducing the total service area, and reduces infringements on the sensitive dune habitat.
2. Public border: a public zone, comprising public spaces and public buildings, faces the sea, and acts as a buffer between the residential area and the dunes.
3. Main road: this serves as the backbone of the development and is linked with the main public facilities.
4. Economic development: next to the formal market structures and the sites along the sea for a small-scale fishing industry, spaces for spontaneous economic activities and social gatherings are created.

The Xaafuun case illustrates that without compromising humanitarian efforts to save lives, it is vital to introduce a development perspective in the early stages of the post-disaster situation, taking full advantage of the opportunities that might result from the disaster. The full case study is included as Annex 3.

Source: UN-HABITAT. 2006/2007. *Paving the Way for Sustainable Development in a Post Disaster Situation: the Case of the Tsunami-damaged Village of Xaafuun North Eastern Somalia.*

4 GUIDELINES FOR SUSTAINABLE POST-DISASTER SITE SELECTION AND DEVELOPMENT

The **Guidelines for Sustainable Post-Disaster Selection and Development** are designed to assist recovery program planners, recovery project managers, and on-site implementation staff in their efforts to do the following:

- Select, design, and develop sustainable post-disaster reconstruction operations.
- Work with affected communities in a collaborative approach to sustainable site design and construction.

A checklist covering key issues is included. This checklist can be expanded based on local environmental conditions and reconstruction requirements, and can serve as an aide-memoire in the choice of site selection and development planning. Material for this document has been adapted from Site Design (Chapter 5) in **Guiding Principles for Sustainable Design**[1] with a focus on making it relevant to post-disaster site selection and development.

The Guidelines are divided into two sections:

1. Basic Principles, providing five broad concepts on which to base environmentally sustainable site selection and development.
2. Site Selection and Design Considerations, identifying key sustainability issues to consider when selecting and designing a site or adapting an existing site for new construction.

This guidance takes the establishment of a new shelter site as a starting point for consideration of sustainable site selection and reconstruction requirements. However, the guidance can be used with on-site reconstruction as well. On-site reconstruction involves the planning of specific changes to a disaster-affected settlement so that the rebuilt infrastructure is more environmentally sustainable and less subject to disasters in the future. Since on-site reconstruction involves consideration of infrastructure, as well as social and cultural issues from before the disaster, the process of incorporating environmentally sustainable reconstruction is more challenging than it is for a site on which a settlement did not previously exist.

Reconstruction often proceeds without environmental concerns being addressed due to pressures from political authorities and from the disaster survivors themselves to rebuild quickly. This guidance is designed to be adaptive to the disaster-recovery situation. Users are urged to highlight the positive and immediate impacts that an environmentally sound sustainable site selection/development intervention can produce. Positive impacts include risk-reduction benefits of sustainable shelter, more cost-efficient use of local resources, and greater local ownership of project outcomes.

1 National Park Service. 1993. *Guiding Principles of Sustainable Design.*

4.1 Basic Principles

4.1.1 Recognize the context

Site selection and development should consider the broader social and physical setting of the proposed intervention. Site selection/development should be avoided where social conflict may arise between old and new residents, or where there will be conflicting or, eventually, excessive demands on natural resources. A "ridge to reef/valley" approach[2] should be used in assessing the environmental impacts of a proposed site on the larger environment around the site. Environmental impacts may include those of the livelihoods of the eventual residents on the environment and on downstream communities. An environmental impact screening/scoping is a good tool with which to consider the situational context.

4.1.2 Treat ecosystems as interdependent and interconnected

Post-disaster shelter site development does not occur independently of the natural environment. The ecosystems surrounding a prospective site may serve to mitigate hazard impacts (e.g., forested slopes reducing flooding) and provide livelihood resources and public amenities. Waste generated at a new settlement site can create health and environmental problems in neighboring communities if not managed properly at the new site. Site development should complement and minimize damage to the ecosystems surrounding a site, and should integrate the physical development of the site into these ecosystems.

4.1.3 Promote existing landscapes

The site design and construction process should start with landscape mapping[3] prior to site clearance. The resulting data should be used to the extent possible to integrate site plans into the natural landscape rather than to re-engineer the natural landscape to fit the site and to maintain as much of the natural vegetation and habitats as possible. Maintaining existing vegetation will improve environmental conditions by, for example, providing shade to reduce solar heating, retaining access to indigenous sources of food and medicine, upholding soil stability, and providing more pleasant living conditions. Indigenous vegetation is also usually more resistant to local hazards and more resilient following disasters than is exotic vegetation.

4.1.4 Include environmental restoration as part of site design

For a variety of reasons, land with little economic or environmental value is often seen as the first option for post-disaster shelter reconstruction: Good land tends to go to the highest bidder, leaving the poorer, more vulnerable residents with the more hazard-prone sites. Proactive site development can re-house disaster survivors while restoring the environment of a degraded location. This outcome can be achieved through site design (e.g., establishing indigenous vegetation zones between houses), specific engineering interventions (e.g., water-retention areas supplying water to newly planted indigenous plants), and through social interventions (e.g., encouraging the resettled to plant trees or other vegetation near their homes, schools, and

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2 "Ridge to reef" refers to taking into consideration the environmental conditions from ridge-top to off-shore reef (or valley bottom) in planning sustainable interventions to limit negative environmental impacts. Specifically included in this approach is the impact of human occupation of a watershed, including use of forest resources, and farming, mining and other types of land use.

3 Landscape mapping is carried out to gain an understanding of the "lay of the land," such as natural drainage channels and preparing a vegetation and habitat inventory.

other community sites). Social engagement by the re-housed is important to this process, as they carry the responsibility for maintaining revegetated areas and managing these resources after the completion of any reconstruction project. It is worth noting that even already disturbed areas can still be used as migratory routes for certain types of wildlife, such as elephants, and steps should be taken to avoid siting shelter in these areas in order to reduce human-wildlife conflict.

4.1.5 Restore sites after construction

Whether from the increase in the number of people in a location or from the construction efforts associated with the building of houses, roads, and other infrastructure, resettlement can have profound, negative impacts on the environment. All site-related interventions should incorporate components to restore disturbed environments to pre-project conditions where possible.[4] These efforts should include areas from which natural resources have been extracted (e.g., borrow pits, logging sites) and the clearing and restoration of construction sites (e.g., restoring cement mixing areas, materials storage areas, vehicle maintenance yards). While a new shelter site does change the local environment, this change should be minimized by later restoration of the natural environment whenever possible.

Restoration should be a particular focus of on-site reconstruction. The changes to the physical infrastructure of a community following a disaster (e.g., destroyed buildings, roads, disrupted rivers, or access to new lands) provide an opportunity for organizations to work with the disaster survivors to establish improved environmental conditions during the reconstruction process. Such efforts can be as simple as planting trees, or as complex as reorganizing the layout of a community to improve air quality and drainage and create green spaces that can also serve as refuge points during floods. As well, the reconstruction process may provide opportunities for infrastructure improvement that can, if executed in a sustainable manner, have positive impacts on environmental conditions. Examples include replacing latrines with pipes and treatment sewage systems, and wells with piped water systems.

4.2 Site Selection and Design Considerations

Details complementing the strategic concepts presented above are presented in this section. This information can be used to define post-disaster resettlement options, plan for the establishment of a specific site, and review an existing shelter site in terms of rehabilitation or its evolution from a transitional shelter site to a permanent site.

Reference should also be made to local and national laws, regulations, and standards for site selection and development. Most locations have detailed laws and regulations about spatial planning, environmental impact, housing, and sanitary facilities, which lay out specific site selection and development requirements.

There are numerous factors to consider in selecting a site for the reconstruction of housing and related infrastructure following a disaster. While this document focuses on factors contributing to sustainability, other considerations, such as the availability of land, legal status of disaster-damaged communities, and the distance from the new site to sources for livelihoods, also play important roles in the selection process.

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4 This assumes, naturally, that pre-project conditions were environmentally acceptable and undisturbed by the disaster or human-made impacts.

Broadly, the sustainability component of the site selection and development process should focus on the selection of sites that will:

- Have the least negative impact on the environment
- Have the fewest possible threats from the environment
- Require the least extraction of natural resources for site preparation, construction, and operation
- Incorporate infrastructure and community-managed systems for minimizing and managing solid and liquid waste
- Offer the best quality of life for residents

These considerations are not absolutes. Every shelter site has some impact on the environment, and often compromise is needed to attain the best reasonable outcomes under competing demands and pressures to rebuild.

Ideally, post-disaster reconstruction efforts, including site selection and development and on-site reconstruction, should be integrated into the natural characteristics of the location where the site development is to take place rather than attempt to dramatically alter the existing physical environment. Realistically, all site development impacts the existing environment. The challenge is to minimize this impact to the greatest degree possible.

The following topics in this section are key attributes or considerations in site selection and development. Within the boxes are the summary recommendations for each topic.

4.2.1 Capacity

❑ The number of people at a new site will not result in resource requirements that unsustainably exploit locally available natural resources.

The number of people at a new site should not result in resource requirements that unsustainably exploit locally available natural resources, because this is likely to result in lack of access to vital resources in the future (e.g., overpumping of groundwater). As a rule of thumb, the per capita resource requirements of a new site will be as high as existed before the disaster, and may be higher if new housing, infrastructure (e.g., water, sewage), or livelihoods are introduced as part of the reconstruction process.[5] Planners should consider, as well, that some countries may have official criteria defining site capacity limits.

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5 See The Sphere Project's *Humanitarian Charter and Minimum Standards in Disaster Response* for further information on minimum space and resource requirements for emergency situations. While intended for emergency situations, this guidance may be useful in calculating the expected needs of a permament shelter site.

4.2.2 Density

- ❑ The density of habitation of the new site will not be greater than it was where the inhabitants lived before the disaster.
- ❑ The density of habitation of the site meets local regulations or international best practice.

By definition, increasing the density of inhabitation at the site reduces additional land needs, thereby reducing the immediate environmental "footprint" of the site. However, sufficient space needs to be available to allow residents to conduct their livelihoods and social activities, and to live with dignity. An approach to defining density limits is to consider the normal social and livelihood activities of a typical family in the disaster-affected area, and to plan for sufficient space for these activities.

In general the density of a site should be no greater than it was before the disaster and should include space for upgraded infrastructure (e.g., sewage system) and services (e.g., schools with sport fields) after a disaster. An appropriate density of inhabitants for a site will also depend on cultural considerations, a process requiring the participation of the intended residents of the site and the recognition of gender-based differences in the use of space. Some countries may have official criteria defining density limits. There may also be circumstances in which a higher density is preferable for a short period of time so that the safety of residents can be better ensured in areas where security is an issue.

4.2.3 Climate

- ❑ The site plan incorporates measures to address current climatic conditions.
- ❑ The potential for negative changes to local climate, such as changes in rainfall or frequency of severe storms, has been considered in the site plan.

Most new shelter sites will be in the same climatic zone as was the pre-disaster shelter. However, new shelter sites should consider the impact of potential future changes in climate, such as the need for increased drainage because of future increased rainfall), and incorporate features to enhance local climate conditions. (See **Vegetation** on the following page.)

BOX: CLIMATE CHANGE AND SITE SELECTION AND DEVELOPMENT

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as: "any change in climate over time, whether due to natural variability or as a result of human activity." Climate change refers in this section to the observed and projected increase in average global temperature as well as the associated impacts, including an increase in extreme weather events; melting of icebergs, glaciers, and permafrost; sea level rise; and changes in the timing and amount of rainfall. Climate variability is the change in weather that occurs over a matter of weeks, months, or, in some cases, a few years (e.g., El Nino). From the perspective of reducing vulnerability, it is unnecessary to separate "climate change" caused by humans from natural "climate variability."[1]

Site plans should anticipate climate change because of:

1. The short-term development of the site: Urban areas are usually warmer than rural areas; face a greater risk of flooding due to the larger areas of impermeable surfaces (e.g., roofs, roads); and suffer more air pollution, particularly from the concentration of vehicles, cooking, and commercial activities. These factors can create a microclimate more hazardous for the site inhabitants than would be the case in adjoining rural areas.
2. Long-term changes to weather patterns: These changes can exacerbate the local changes to climate induced by the development of the site and can increase disaster risks such as flooding.

Planning for the impact of climatic influences on the local environment should be based on an assessment of local hazards and identification of how these hazards can be addressed in both the short and long term. For instance, even with the same level of rainfall as before the reconstruction, site construction will increase the run-off at the site the impermeability effect noted above. The site should have a drainage system capable of handling larger flows than would be indicated simply by the amount of rainfall at the site.

If it is anticipated that future rainfall is likely to increase due to climate change, then the drainage system should be designed to handle even larger flows. Note, however, that for cost reasons, actual drainage structures (e.g., concrete gutters) will likely be built for flows anticipated over the short term (e.g., the next 10 years), with space made available for expanding structures if and when even larger flows become the norm.

1 Care International. 2009. *Climate Vulnerability and Capacity Analysis Handbook.*

4.2.4 Slope

❑ The slope of the land on the site does not exceed 5%.

Sloping land is very important for proper drainage, piped water, and sewage systems. However, it is preferred that new shelter sites be located on land with a slope of no more than 5%.[6] Where this is not possible, a combination of terraces, vegetation, and appropriately designed drainage systems should be installed to limit erosion. Steep slopes are also subject to landslides and slumping[7] and should be avoided measures to control these processes are very expensive and of limited reliability.

6 The Sphere Project. 2004. *Minimum Standards in Shelter, Settlement and Non-food Items.* Sphere Handbook. Geneva: Oxfam Publishing.

7 "Slumping" is a mass-wasting event that occurs when loosely consolidated materials or rock layers move a short distance down a slope.

4.2.5 Cultural significance

- ❑ The cultural, historical, political, and social significance of locations at or near the proposed site have been considered as part of the site selection and plan development process.

Inhabitants near a prospective settlement site and the prospective residents of the site should be consulted on whether the possible site has any cultural, historical, political, or social significance that could inhibit its use as a settlement. A culturally significant site may not be clearly marked to outsiders and may be significant for one group in an area but not for others. In some locations, areas of significant cultural importance are also areas of considerable biodiversity precisely because they are treated as special and not used in the same manner as the surrounding landscape.

4.2.6 Vegetation

- ❑ The retention of vegetation has been maximized in the site plan.
- ❑ Indigenous vegetation with economic value [such as fruit trees], is maintained or reintroduced at the site.
- ❑ The planting of nonnative plants has been avoided or minimized.

As much of the natural vegetation should be retained at a site as is possible. Additional vegetation should be added through gardens, tree planting in public areas and near schools and clinics, planting along water courses and in designated greenbelts, and planting as privacy buffers between houses and to separate housing from public areas.

Indigenous vegetation with economic value [such as fruit trees], should be planted where possible, with community-level agreement as to their ownership and use. The ownership of trees or vegetated areas and their produce – whether by individual, household, or community – should be decided through participatory discussions to avoid potential conflicts.

The use of nonnative plants that have the potential to invade agricultural and wildland areas should be avoided.

4.2.7 Hazards

- ❑ A hazards assessment for the site has been conducted and mitigation plans have been developed.
- ❑ The hazard assessment covers both natural and technological hazards.
- ❑ Mitigation plans incorporate structural (e.g., flood walls), nonstructural (e.g., warning systems), and ecological (e.g., maintenance of natural floodways) measures.

The safe management of natural hazards should be integral to a site development plan. Hazards from natural or technological sources (e.g., a toxic dump) should be indentified in the site selection process and in the associated environmental screening.

As it is not possible to avoid all hazards, a risk management strategy should be established as part of the development of the site. This strategy should include both structural measures (e.g., drainage canals in flood areas, adequate roof attachments in cyclone areas) and nonstructural measures (e.g., community-based warning systems, education) to minimize hazard impact. Planners should note that some countries may have official regulations relative to use of land subject to significant hazards, e.g., flood plains and areas subject to landslides or avalanches.

Site selection should take into account hazards, such as flooding and landslides, that might affect relocated populations. If it is not possible to avoid all hazards, a risk management strategy should be established as part of development of the site. After the 2005 Kashmir Earthquake in Pakistan, some temporary shelters were located in potentially unsafe areas as shown in this photo. Because many "temporary" shelters are used for many months or years beyond their intended use, it is important for project planners to choose sites carefully and consult with disaster-affected households about hazard risks.
© Karl Schuler / IUCN Pakistan

4.2.8 Construction methods and materials

- ❑ Construction methods minimize negative environmental impacts.
- ❑ Building designs reduce energy requirements for heating or cooling.
- ❑ Construction methods rely on locally available skills and competencies, and take into account the need to introduce new methods to reduce disaster risk or increase sustainability.
- ❑ Methods to reduce disaster impact are incorporated into site and building design.
- ❑ The use of locally available materials for construction does not place unsustainable demands on the local supplies of these materials.

A discussion of environmentally sustainable construction methods and materials can be found in GRRT Modules 5 and 6.

In general, construction methods that minimize impacts on the environment are preferred. These include, for example, those requiring minimal land clearance or those designed to reduce energy requirements for heating or cooling. Where possible, building methods, should be based on locally available skills and competencies, and minimize the need for imported labor and skills.

There is often an interest in rebuilding in the same style and manner as before a disaster. However, reconstructed buildings and infrastructure should be hazard resistant, and this may require the introduction of new building design characteristics, new building methods and new skills. Planners should note that some countries may have official regulations that determine how different types of housing and other infrastructure can be constructed.

There is often a preference given to the use of local materials in reconstruction for cultural, economic, and logistical reasons; relief aid spent locally helps the economy and reduces transport needs. However, the total demand on local resources should be assessed in the site-design phase to ensure that use of local resources does not lead to environmental damage from unsustainable resource extraction or processing. Post-disaster reconstruction efforts will use local resources such as sand, wood, stone, and gravel at a rate typically higher than that of the pre-disaster period as attempts are made to quickly reconstruct buildings and infrastructure that may have taken decades to construct. It is highly unlikely that such demands will be sustainable locally for any significant reconstruction effort. Risks from unsustainable resource extraction should not be displaced to other communities.

4.2.9 Drainage

- ❑ The drainage plan is based on projected maximum daily precipitation as well as consideration of future climate impacts.
- ❑ Raised areas that can provide safety from possible floods have been established for humans, their possessions, and domestic animals.
- ❑ The permeability (i.e., ability of the soil to absorb water) of the site is maximized to reduce runoff.
- ❑ Unpaved areas are established to reduce flooding and to increase soil absorption of water.
- ❑ Warning systems are established for potential flood events.

The increased impermeability created by roofs, compacted roads, and other surfaces in a site may lead to locally severe flooding even where such flooding was not previously a problem. As a result, even moderate rainfall can lead to considerable damage to site infrastructure and lead to the concomitant loss of lives or property. Project design should account for local rainfall patterns and project impacts from climate change.

A sustainable site should have a drainage plan designed for the maximum expected level of precipitation. Provisions should also be made for safe sites (e.g., raised areas normally used for sports or similar space-extensive activities) where inhabitants can gather with essential possessions if heavy rainfall threatens to cause local flooding. Similar areas for livestock may be needed if animal husbandry is practiced at the household level.

By maximizing the permeable areas of a site, planners can reduce the potential for heavy runoff due to rains. This can be accomplished by increasing vegetative areas and trapping water from roof runoff for household use. Areas paved with bricks with open areas to allow water to drain can help reduce runoff.

Retention areas should be created where drains and slopes are expected to concentrate runoff, to avoid down-slope flooding and increase aquifer recharge. These retention areas can be used as gardens, recreation areas (such as sports fields), open spaces, or woodlots.

In addition to adapting project designs for local rainfall patterns and impacts from climate change, project planners may also consider establishing warning systems in order to minimize flood hazard risks to life and well-being.

4.2.10 Livelihoods

- ❑ The new site is close to the location of normal livelihood activities, and enables residents to pursue these activities without significant additional cost or difficulty when compared to the precrisis situation.
- ❑ Adequate space has been provided for livelihood activities at the household and community levels.
- ❑ Markets include sufficient water supplies and space and facilities for adequate sanitation and the handling of waste.
- ❑ Waste from markets and other commercial sites is recycled.
- ❑ Composting is used to add value to organic waste.
- ❑ There is adequate space between the location of economic activities and living and social areas, such as schools to decrease the impact of noise, air, and water pollution.
- ❑ All markets have adequate water supply, drainage, and waste-handling facilities.

A new shelter site should be in proximity to where residents previously pursued their occupations and secured their livelihoods.[8] Sites distant from locations where livelihoods are secured tend to be abandoned or only partially used by the intended residents: If they cannot pursue a living, they will not be able to afford to live at the site.

The spatial layout of a shelter site should also include sufficient space for household-level livelihoods such as weaving and food preparation, and for commercial enterprises such as furniture production, shops, and stores. Sufficient space should be allocated to avoid noise, water, and air pollution from commercial enterprises that could affect residential areas, schools, clinics, and other public locations.

Space for markets, live-stock handling facilities, and slaughterhouses should be included in a site plan. Markets should be sized appropriately in accordance with local consumer demand based on pre-disaster needs. Larger markets, livestock handling facilities, and slaughterhouses should be located away from housing and public services such as schools and clinics.

All markets should have adequate water supply, drainage, and waste-handling facilities. Specific attention should be given to the waste management needs of areas handling livestock, as well as to the impact of abattoirs and fish processing sites, which can produce considerable manure, offal, and water pollution. Some waste can be recycled for commercial uses such as fertilizer, but will pose considerable health and environmental risks if not managed properly.

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8 Livelihoods assessments are often conducted following major disasters and can be a source of information on livelihood needs in a new settlement; this information is generally complemented by participant discussions.

4.2.11 Utilities (water, energy, waste)

- ❑ Sufficient space is available for water, energy, and solid and liquid waste utility services.
- ❑ The growth of demand for water, energy, and solid and liquid waste utility services is incorporated into site plans.
- ❑ Utility networks are easily accessible and, where appropriate, integrated into green spaces.
- ❑ Storage areas for wood, coal, or other similar energy sources are available and limit fire hazards and the impact of pollution.
- ❑ Rainwater harvesting is used to reduce demand on surface or groundwater resources.
- ❑ Grey water is recycled where possible.
- ❑ Low-volume toilets are used where appropriate.
- ❑ Flow-limiting faucets are used for communal water sources (e.g., stand pipes).
- ❑ Environmentally beneficial and appropriate technologies (e.g., solar panels, solar cookers) are used to limit demand from other sources of energy.
- ❑ Solar cookers/water heaters and/or fuel-efficient stoves are used to reduce the demand for carbon-based fuels for cooking and heating.
- ❑ The types of toilets used reduce sewage production (e.g., composting toilets) and groundwater pollution (e.g., use of closed-box septic tanks).
- ❑ Sewage collected through septic system cleaning (e.g., pumping of latrines) or through piped systems receives tertiary treatment.
- ❑ All solid organic matter collected through sewage systems is composted and reused to improve soil quality (e.g., in agriculture, to support tree planting, or to restore areas of natural vegetation).
- ❑ Solid waste is recycled and organic waste composted and used to improve soil quality.
- ❑ The area allocated to landfills meets the expected future waste outputs of the site and is designed to meet appropriate sanitation and pollution-control standards.
- ❑ The need for landfill space or waste incineration is reduced through the practice of recycling, including composting for commercial or communal uses.
- ❑ Local laws, international standards, and best practices are followed in the development of waste management systems.
- ❑ Pricing is used to reduce resource demand, taking into account basic rights to water and local expectations of entitlements to water and energy resources.

Sufficient space should be provided for water, energy, and solid and liquid waste utility services, with the potential growth of the site taken into consideration. Utility networks should be easily accessible and can be integrated into green spaces where appropriate. If wood or coal or other sources of energy will be used in the site for cooking or heating, then storage areas outside the main part of the site should be identified and developed to limit pollution and fire hazards.

Consideration should be given to the provision of water, energy, and sewage services from nonconventional/ noncentralized sources. In the case of water, rainwater harvesting, low-volume toilets, or flow-limiting faucets can be used to reduce demand on surface or groundwater sources. In the case of energy, solar panels, solar cookers, fuel-efficient stoves, and similar appropriate technologies can reduce the demand from conventional energy sources.

A variety of latrine types can be used to reduce the need for sewage collection and the risk of groundwater pollution. With a piped sewage system, tertiary treatment in a conventional sewage treatment plant can reduce downstream pollution and produce fertilizer for agriculture and other uses. In the case of solid waste, commercial or social (e.g., school) recycling can reduce the volume and limit spatial and environmental impacts of landfill disposal.

Local environmental NGOs and universities may be good sources of information on recycling options and the reuse of grey water. Technical specialists should be consulted about optimal sustainable solutions to the management of liquid waste.

Local laws and conditions will determine whether landfills or incineration are optimal for solid waste disposal. Incineration, correctly done, is generally more demanding from a technological perspective, while landfills require more land and long-term, ongoing management. The parameters for the environmentally sound management of either option are well established.

Consideration should also be given to service pricing to reduce resource demand, particularly in the case of water and energy. As access to water and energy can be considered an entitlement in some societies, pricing regimes may need to be based on free access to a minimum level of service, such as a fixed number of liters of water per day, with charges applied to quantities used above the minimum level.

4.2.12 Site access

- ❑ The site is not physically isolated from road networks, towns, and markets.
- ❑ There are adequate roads and access within the site.
- ❑ Roads/paths within the site follow the contours of the site where possible, and steep roads/paths are avoided.
- ❑ Crossings of water courses are designed for maximum flows, and include pedestrian passages for use during periods of high water.
- ❑ Road surfaces limit dust and water erosion.
- ❑ Roads have adequate drainage to prevent flooding and surface erosion.
- ❑ Space is provided along roads for pedestrian traffic and for bicycles and motorbikes or carts, where these are a major means of transportation.
- ❑ Vegetation, indigenous if possible, is used to stabilize slopes and road shoulders.

A new settlement site should not be physically isolated from road networks, towns, and markets, and should have easy internal access to all parts of the site. Steep roads should be avoided. Where possible, roads should follow the contours of the site. Aligning roads along contours is helpful for disabled persons.

Road surfaces should be paved with stone, cement, or asphalt to limit dust and water erosion; stone is preferred for paving if sufficient quantities are available locally, so that water can be absorbed by the underlying soil. All roads should have adequate drainage systems to prevent flooding and surface erosion.

Vegetation, indigenous if possible, should be used to stabilize slopes and road shoulders. Runoff can be channeled to retention areas that can be used to water vegetated areas within the site.

Where a settlement reconstruction site is located close to a navigable body of water, space should be allocated for the on-land storage of boats and related equipment. Any docks and boat launch/recovery areas should be located away from sensitive marine habitats.

4.2.13 Public space lighting

- ❑ Public lighting is designed to minimize energy and maintenance requirements.

The lighting of public spaces within a new settlement site is often both a security and economic requirement. This lighting should be designed to minimize energy requirements through, for example, the use of energy-efficient bulbs, and to be as maintenance free as possible. While solar panels may seem to be an ideal solution for public lighting, consideration should be given to medium- and long-term maintenance, and to the threat of theft, as solar lighting systems may be of considerable value relative to local incomes.

4.2.14 Household-level agriculture

- ❑ Space is provided for kitchen gardens or small truck farms (as per local custom).
- ❑ Rainwater and/or grey water are used for household-level agriculture.
- ❑ Kitchen and other organic waste are recycled as compost or, in the case of food waste, as animal feed.
- ❑ Waste from household livestock is properly managed, including composting, and odors, as well as air and water pollution, are limited to the extent possible.

Market and kitchen gardens are often a key element of livelihood and food security strategies and need to be planned as part of new settlement sites. To minimize demands on primary water resources such as piped water or household wells, rainwater should be captured for garden watering. Grey water should also be recycled where this is practical. Shower water, for example, can be used to water banana trees and other similar vegetation.

Kitchen and other organic waste can be recycled as compost or, in the case of food waste, used as animal feed.

Where livestock is kept in or near housing units, provision should be made for waste management, including composting, and to limit odors, as well as air and water pollution.

4.2.15 Wildlife

- ❑ The impact of the site on wildlife populations has been assessed.
- ❑ The potential for conflict between wildlife and livestock has been assessed and addressed.
- ❑ The site is not in a wildlife transit corridor.

The presence of wildlife should be assessed as part of the site selection process. The potential for wildlife-human and wildlife-livestock problems should be discussed with the potential site residents and neighboring communities. Specific attention is needed to avoid placing a new settlement site in a wildlife migration corridor; the potential for wildlife-human conflict should be discussed with environmental professionals.

4.2.16 Pest management

- ❑ Pest breeding sites have been limited in the location and design of the site.
- ❑ The need for chemical pest control has been limited through site design and location.

Pests, such as flies, mosquitoes, and rodents, pose serious health problems. Sites should be planned to limit potential pest breeding sites such as stagnant water, areas of scrub land, or unmanaged vegetation, and to include building styles that do not encourage rodents to live in or near human habitation. While chemical methods such as pesticide spraying are appropriate for controlling some pests, these efforts should be complemented by environmental modification, site design, and communal activities such as clean-up campaigns to reduce the opportunities for pest populations to develop.

4.2.17 Wind

- ❑ Wind directions, including seasonal variations, have been plotted for the site.
- ❑ Roads and building direction take into account prevailing winds to provide good ventilation for the site.
- ❑ Doors and windows are positioned to limit the impact of winds considered unpleasant.
- ❑ Roads are designed to break the flow of the wind.
- ❑ In areas of potentially high winds (from thunderstorms, monsoon fronts, etc.) or heavy snow, roof slopes are 1:4 unless other structural measures are taken to limit the potential for wind or snow damage.

The siting of the building should reflect consideration of the local wind conditions. Proper siting can enhance passive cooling and heating of the building which will be more comfortable for building occupants. Adapting site designs for wind conditions can also reduce demand for fuel, lowering costs for building occupants.

4.2.18 Sun

- ❑ The sun track across the site has been plotted.
- ❑ Buildings are oriented to limit or promote solar heating as needed.
- ❑ Building design incorporates the need for shade to offset roof heating
- ❑ Options for solar water heaters have been investigated and heaters used where appropriate.

The siting of the building should reflect consideration of the sun track across the site. Similar to designing for wind, a site design for the sun track can enhance passive heating of the building which will be more comfortable for building occupants. Adapting site designs for sun conditions can also reduce demand for fuel, lowering costs for building occupants. In areas with high amounts of regular sunlight, project planners may consider promoting solar water heaters and other solar-based technologies.

4.2.19 Rainfall

- ❑ Precipitation data is used in the design of roads, housing, and drainage.
- ❑ Rainwater catchment systems at the household or community level are based on precipitation data and the seasonality of rainfall.
- ❑ In areas of heavy rainfall, vegetation is used to slow runoff and is complemented by retention ponds.

Precipitation data should be used in the design of roads, housing, and drainage. Rainwater catchment systems at the household or community level should be based on precipitation data and the seasonality of rainfall. Early-season rains collected through gutters and barrels may be able to provide sufficient water for a family for several weeks when other sources are under severe stress. Where rainfall can be heavy, vegetation should be used to slow runoff and be complemented by retention ponds (which can themselves be used for aquaculture.)

4.2.20 Topography

- ❑ The settlement is designed to match the existing topography; the location and orientation of roads, housing blocks, and community structures have been adjusted to fit the form of the land.
- ❑ Discussions on the disadvantage of a block-grid approach to site selection have taken place, and alternatives developed as financially and socially feasible.

Ideally, a new settlement site should be designed to match the existing topography, with the location and orientation of roads, housing blocks, and community structures adjusted to fit the form of the land. However, there is usually a considerable push to make post-disaster settlement sites as economically and spatially efficient as possible, leading to a grid layout and minimal consideration of topography. In advocating for a site layout that blends with the existing topography to the best degree possible, planners should highlight the problems inherent in a grid approach, which include the likelihood of increased erosion, increased construction costs (from placing a flat layout on an uneven surface), and poor social cohesion among eventual residents.

4.2.21 Geology/soils

- ❑ The permeability, structure, and composition of the soil and geology of the site have been assessed.
- ❑ The site does not include rocky areas and is not located on rocky terrain.
- ❑ The site plan should consider the permeability of the soil and geology of a site, and, in particular, the following elements:
  - Liquid waste disposal
  - Revegetation
  - Drainage
  - High ground water

The geology of a site is a significant factor in the cost of constructing a post-disaster shelter site. Rock or rocky terrain is more expensive and difficult to build on and can pose major problems in assuring adequate water supplies (e.g., it is very difficult to bury pipes or dig wells), drainage (e.g., in terms of water supply ditches), and livelihood activities (e.g., it is difficult to develope and maintain kitchen gardens).

The permeability, structure, and composition of the soil and geology below the site should be assessed early in the site selection process. Permeability is a key factor in determining the options for:

- Liquid waste disposal, e.g., soak pit latrines in high clay soils will not operate properly.

- Vegetation, e.g., rocky soils will need more organic matter to support vegetation.
- Drainage, e.g., sandy soils drain better and faster than clay soils, thus requiring less in the way of drainage systems and reducing the likelihood of standing water for extended periods of time.

On the other hand, areas with high permeability and high ground water levels can lead to excessive moisture in homes, posing environmental health problems.

The geological setting of a building site will also affect how susceptible a building will be to earthquake and landslide hazards. Local hazard maps should be consulted to ensure that building designs and construction techniques address geological hazards.

4.2.22 Aquatic ecosystem

- ❑ The sustainable use of aquatic ecosystems has been incorporated into the site selection.
- ❑ The risk of pollution of aquatic ecosystems from the site has been limited.

The presence of aquatic ecosystems – lakes, rivers, estuaries, wetlands, seas – at or near a site is a mixed blessing. Aquatic ecosystems present considerable options for livelihoods such as fishing, harvesting of aquatic vegetation, and gardening opportunities.

However, siting of settlements near aquatic ecosystems can also lead to excessive exploitation of aquatic resources as well as to increased pollution, as aquatic areas are generally downhill from the settlement site. Plans for the management of the aquatic ecosystems should be developed as part of the site development plan and developed in detail with the site residents in the early stages of the site development.

4.2.23 Vegetation

Vegetation should be retained to the greatest degree possible during site development. Where clearing is necessary, trees should be retained as a priority and trees with economic or food value should be accorded top priority. In most cases, a slight realignment of buildings on a case-by-case basis can result in the retention of a considerable number of trees on a site.

4.2.24 Visual characteristics

- ❑ The visual characteristics – *the look* – of the site have been considered in the site selection and development plans.
- ❑ Landscaping has been provided to improve the visual characteristics of the site.

Post-disaster settlement reconstruction focuses on returning affected populations to normal living conditions as quickly as possible. The fast pace of reconstruction often leaves little time to consider how the resulting settlement will actually appear.

Landscaping considerations should be incorporated into site layout plans prior to the site clearance process.

Leaving trees and planting new trees, creating vegetation buffer zones, and other forms of simple landscaping will improve the visual characteristics and the environmental conditions of the site, and will help improve the psychological health of and "sense of place" for disaster survivors.

These **Guidelines** do not provide comprehensive coverage of all aspects of site selection and development. Other subjects and key references that should be consulted in the selection and development process include:

- **Planning the rebuilding process: See Guidelines for Planning the Rebuilding Process – Resource Pack** published by Intermediate Technology Development Group – South Asia.
- **Rebuilding shelter:**
    - *After the Tsunami: Sustainable building guidelines for South-East Asia,* published by UNEP, contains guidance on rebuilding shelter as well as a "Project environmental review record" to track and note measures to address environmental issues related to rebuilding. www.preventionweb.net
    - *Home Again: A handbook for reconstructing housing and communities after disaster* (World Bank, in press), which provides general and sector-specific information on successful re-housing following disasters, with a limited section on environmental issues.
- **Environmental impact assessments:** (which should be completed for each reconstruction project and should incorporate a review of site-related environmental impacts). See materials available from the International Association for Impact Assessment. www.iaia.org.
- **Land use planning:** See *Guidelines for Land-Use Planning.* www.fao.org
- **Upgrading of transitional shelter to permanent shelter:** See *Emergency Shelter Environmental Impact Assessment and Action Checklist Identifying Critical Environmental Considerations in Shelter Site Selection, Construction, Management and Decommissioning* by ProAct Network and CARE International. www.proact.org

This list is not comprehensive. Specific site selection and reconstruction guidance is often developed following major disasters and is available from local or national government sources.

Useful background information on post-disaster shelter and site selection can also be accessed through the Shelter Centre (www.sheltercentre.org). Although much of the literature to date refers to emergency and transitional shelter and not specifically to sustainable site selection, this disaster-focused literature can often provide useful contextual guidance.

5 RELATED STANDARDS

5.1 SPHERE Standards

By addressing strategic site selection and development as described in this module, project planners can achieve consistency with the Humanitarian Charter and Minimum Standards in Disaster Response (SPHERE).[9] Relevant standards include:

- **Shelter and settlement standard 4: design.** The design of the shelter is acceptable to the affected population and provides sufficient thermal comfort, fresh air, and protection from the climate to ensure residents dignity, health, safety, and well-being.
- **Shelter and settlement standard 5: construction.** The construction approach is in accordance with safe local building practices and maximizes local livelihood opportunities.
- **Shelter and settlement standard 6: environmental impact.** The adverse impact on the environment is minimized by the settling of the disaster-affected households, the material sourcing, and construction techniques used.

5.2 Local and National Standards

Typically, local or national laws define the relevant standards (e.g., population density in resettlement sites) related to shelter and urban infrastructure. These laws and regulations may at times be modified or ignored in specific post-disaster reconstruction assistance. Nonetheless, it is important to acknowledge that such standards were established for a reason, that is, to reduce the risk of future disasters to communities, and ensure that a site's carrying capacity is not exceeded. Every effort should, therefore, be made to follow the standard.

It is often the case that normal environmental review procedures, which are now relatively standard worldwide, will be lowered or waived because of a perceived need to complete the reconstruction process as quickly as possible. In the absence of local or national requirements for environmental review, project planners can follow the guidelines used in this module.

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9 The Sphere Project. 2004. Minimum Standards in Shelter, Settlement and Non-food Items. Sphere Handbook. Geneva: Oxfam Publishing. *Note: a revised version of the handbook will be published in 2011.*

ANNEX 1: ADDITIONAL RESOURCES

The following organizations and publications provide a variety of tools, resources, and information that elaborate on the concepts presented in this module.

Organizations

Shelter Centre: Non-government organization supporting the humanitarian community in post-conflict and disaster shelter and housing. Provides guidelines and other resources for emergency and transitional shelter. *www.sheltercentre.org*

World Bank: Global financial institution involved in post-disaster reconstruction, often with a focus on longer term recovery. *www.worldbank.org*

UNEP's Post Conflict and Disaster Management Branch: Branch of UNEP providing post-crisis environmental assessment, disaster risk reduction and other green reconstruction information. *www.unep.org/conflictsanddisasters*

Swiss Resource Centre and Consultancies for Development: Swiss Non-government organization working in the fields of development and humanitarian aid. Provides resources on sustainable building and livelihoods. *www.skat.ch*

World Wildlife Fund (WWF): Non-government organization offering a broad array of resources on environmental issues. National level WWF offices can provide insight into environmental issues at a local level. *www.wwf.org*

Publications

FAO. 1996. *Guidelines for Land-Use Planning.*

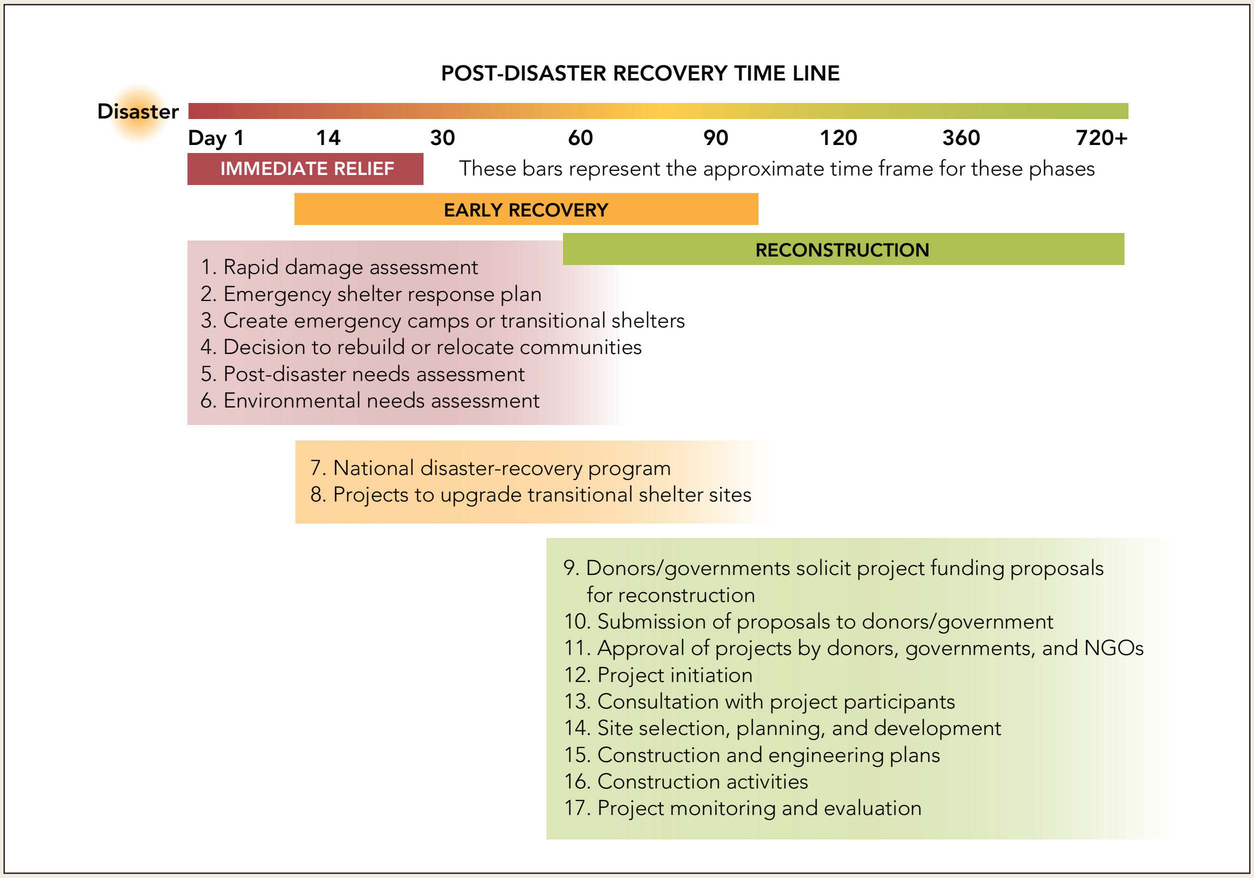
Intermediate Technology Group- South Asia. 2004. *Guidelines for Planning the Rebuilding Process- Resource Pack.*

Kelly, C. 2005. *Checklist-Based Guide to Identifying Critical Environmental Considerations in Emergency Shelter Site Selection, Construction, Management and Decommissioning.* Benfield Hazard Research Centre/CARE.

National Park Service. 1993. *Guiding Principles of Sustainable Design.*

United Nations Environment Programme (UNEP) and Swiss Resource and Consultancies for Development (SKAT). 2007. *After the Tsunami: Sustainable Building Guidelines.*

ANNEX 2: SITE SELECTION AND DEVELOPMENT TIME LINE – RECOMMENDED ACTIONS AND REFERENCES



Immediate Relief (approx. 1 to 30 days after disaster)

Early Recovery (approx. 10 to 120 days after disaster)

Reconstruction (approx. 60 to 720+ days after disaster)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
1	**RAPID DAMAGE ASSESSMENT**	A. Review scale of damage, which can be an early indicator of future demand for reconstruction resources. B. Research the causes of damage agents and specific hazard locations, which can indicate whether settlements are in hazardous areas and may need to be moved or adapted in the future. C. Identify whether relocation will be necessary, because this will have significant impact on spatial planning and site selection in the future. D. Determine if disaster debris can be used as construction materials. E. Begin planning for proper disposal of disaster debris to mitigate negative environmental impacts.	As a rule of thumb, post-disaster reconstruction attempts to replace damaged infrastructure that was built over the course of 20 or more years in one or two years. This rapid rate of reconstruction places considerable demands on local resources, such as sand, rocks, wood, and water. Damage agents that indicate a hazardous location include flooding, landslides, rockslides, sea surge, and subsidence following an earthquake. Disaster survivors often use debris for immediate shelter construction. A debris management program is required following a disaster. The plan should include a sustainable disposal component and will generally include labor-intensive public works.	The Inter-Agency Standing Committee (IASC) **INITIAL RAPID ASSESSMENT (IRA): FIELD ASSESSMENT FORM** can be found at groups.google.com/group/globalwashimtools. Shelter Cluster guidance on assessments is provided in **Guidelines for Assessment in Emergencies** (www.humanitarianreform.org/). See Appendix 1 – *Shelter, Settlement and Non-Food Items Initial Needs Assessment Checklist*, Shelter, Settlement and Non-Food Items Chapter, **Humanitarian Charter and Minimum Standards for Disaster Response**. A **Rapid Environmental Impact Assessment in Disasters** (REA) process can also be used early after a disaster to identify critical environmental issues, but the REA does not focus specifically on site-related issues. (AVAILABLE FROM www.reliefweb.org). Information on debris management is available from Disaster Waste Recovery (www.disasterwaste.org/). A **Quick Guide: Post-Disaster Debris Management** is available from ProAct Network ((www.proactnetwork.org).

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
2	EMERGENCY SHELTER RESPONSE PLAN	A. Review the items being selected for use in shelter kits to ensure that they do not result in excessive demand on local resources. B. If the affected population is being relocated, consider and address the environmental impacts and hazards associated with new settlement sites. C. If formal emergency camps are being set up, specific site selection criteria are required to minimize the environmental impact of camps. D. Seek opportunities for recycling or reuse in permanent sites of materials used in the establishment of camps or transitional sites. E. Research the number of disaster survivors living with host families, at or near previous camps, or in camps. Monitor the environmental demands of survivors living under these different conditions. F. Determine how long people will need to remain outside normal shelter and without normal services, so that you can address cumulative demands for resources (e.g., water, food, fuel).	Kits provided without frames (e.g., metal or wood poles) can require users to collect frame materials from the local environment, with possible local environmental damage. The planned use of shelter kits should be reviewed to identify potential impacts on the local environment. The materials used to construct camps or transitional shelter sites can provide significant assets to occupants. Enabling the occupants to take these assets to their permanent shelter sites allows the recycling of these resources and reduces demand for additional assets to expand new housing or to support livelihood activities. Even short-term relocation can have negative impacts on the environment if adequate preparations are not made to minimize or mitigate these impacts. Environmental impacts can come from the creation of a camp (e.g., removing all vegetation from a site) and from the presence of residents (e.g., demand for water and shelter materials from scarce resources, the sustainable disposal of solid and liquid waste). In general, survivors living in camps place a greater immediate demand on environmental resources than do survivors living at or near previous homes or with host families, since they do not have access to the natural resources they normally use and need to exploit new resource sites to live and rebuild. Disaster survivors living with host families are less obvious than those living in camps or near former homes, but	See The Shelter Centre (www.sheltercentre.org) for extensive information on shelter options and site selection for camps and emergency and transitional shelter sites. Most core literature and reports on post-disaster shelter site development are available through the Centre's library (www.sheltercentre.org/library).

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
2	**EMERGENCY SHELTER RESPONSE PLAN**		can still impose unusual demands on the environment, such as the need for additional sand, wood, and other local resources for shelter reconstruction. The longer that individuals live with host families the greater the burden on existing systems (waste management, water demand, fuel [for cooking and heating], and resources), the greater the demand to expand existing shelter, and therefore the greater the potential impact on environmental resources. As a rule of thumb, the longer a displaced population is living in other than normal conditions, the more significant the demands and impacts on local resources, for instance from fuelwood collection, discharge of sewage, or livelihood activities (e.g., farming). While these demands may not be greater than under normal circumstances, they occur in a more concentrated manner than is the case under normal conditions. For example, populations displaced by disaster living in transitional shelter sites may not be able to travel far from the sites, and thus have to get food, fuel, and water from nearby forests, leading to local environmental damage. Such local damage was a major environmental problem arising from displaced Rwandan populations in western Tanzania. In some cases, this damage is transitory, with the environment recovering when the people leave, but in others it may be long term (e.g., the impact of refugees on national park areas in the eastern Democratic Republic of the Congo.)	

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
3	**CREATION OF EMERGENCY CAMPS OR TRANSITIONAL SHELTERS**	A. Ensure that specific camp or transitional site development plans conform to sustainable design criteria (see Guidelines in Module 4), including formal site assessments and site plans to minimize environmental impact. B. Materials used in emergency camps or transitional shelters should be chosen based on their ability to be reused for permanent shelter or recycled.	Environmental impacts can arise from the creation of a camp/transitional site (e.g., removing all vegetation from a site) and from the presence of residents (e.g., demand for water and shelter materials from scarce resources, the sustainable disposal of solid and liquid waste). A formal camp or transitional site requires an environment management plan covering site selection, construction, operation, and decommissioning.	UNHCR's **FRAME** toolkit can be used to assess the impact of camps and transitional shelter sites. FRAME is geared towards the identification and management of camp-related environmental issues. A copy of FRAME can be secured from www.unhcr.org. Additional information on camp creation, layout and management can be found in publications available from the Shelter Centre Library (www.sheltercentre.org/library). The library includes a wide range of reports, documents and manuals useful in camp development, site selection, shelter construction, and other reconstruction-related topics. The **Emergency Shelter Environmental Impact Assessment and Action Checklist** can be used to identify critical environmental issues for transitional shelter sites, temporary camps, or on-site reconstruction efforts. (Available from www.proactnetwork.org)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
4	**DECISION TO REBUILD OR RELOCATE COMMUNITIES**	A. Consider whether relocation is really necessary or if survivor housing can be reconstructed in the same location to streamline the reconstruction process and cause less disruption to people and the environment. B. Ensure that consultations with survivors are completed before a decision is announced.	Relocation will require greater environmental resources than rebuilding and may involve moving people to previously unsettled areas. A general decision to relocate disaster-affected populations is often made early in the disaster response and may be based on politics rather than on detailed assessments. Relocation of affected communities requires numerous steps involving multiple parties. Keeping affected communities in the same location reduces the number of steps to recovery, but may also raise issues about risk reduction, for instance in the case of flooding. Decisions to relocate all or part of an affected population may be driven by other considerations, such as long-term urban plans or the desire to remove squatters from inconvenient locations.	Background information on relocation is available in the book, **Home Again**, Global Facility for Disaster Reduction and Recovery, World Bank (draft) and in **Housing Reconstruction After Conflict and Disaster** (Sultan Barakat, Humanitarian Practice Network, Overseas Development Institute, 2003, //www.odihpn.org/documents/networkpaper043.pdf), which discusses relocation or on-site reconstruction and provides a summary list of considerations in selecting a site.

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
5	**POST-DISASTER NEEDS ASSESS-MENTS (PDNA) WRITTEN BY GOVERNMENT, UN, OR NGOS**	A. Ensure that PDNA includes a component on the environment and linkages with human welfare. B. If the PDNA includes options for on-site reconstruction or resettlement, make sure that these options are presented in consideration of environmental factors.	PDNAs are normally conducted jointly by the host government, UN system, and international financial institutions (IFIs). Sometimes NGOs are involved. The PDNA process is adapted to each disaster and involves sectoral assessments and a consolidated results statement. A PDNA can involve a socioeconomic and environmental impact assessment procedure developed by the Economic Community for Latin America and the Caribbean. This procedure focuses on setting the monetary value of damage as a basis for determining the level of post-disaster recovery funding needed. This assessment does not necessarily consider the costs of sustainable recovery or risk reduction.	**Early Recovery: Compilation of Tools and Resources** www.humanitarianreform.org/. PDNA Schematic and Outline www.undp.org/bcpr/ **Needs Assessment Framework** (includes general questions about the environment by sector and overall): www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=143 The Economic Community for Latin America and the Caribbean assessment process (**Handbook for Estimating the Socio-Economic and Environmental Effects of Disasters**) (also used by the World Bank and others) and a number of assessment reports can be accessed here: web.worldbank.org/ **Environmental Guidelines for Small Scale Activities in Africa**, (USAID, www.encapafrica.org/EGSSAA/EGGSSA-front-&-back-cover.pdf) provides a review of environmental considerations related to housing, as well as checklists to assess these impacts. These materials can be used in assessing possible project interventions.
6	**ENVIRONMENTAL NEEDS ASSESSMENT**	A. Make sure that the PDNA includes a companion "Environmental Needs Assessment" that covers environmental issues related to shelter, water, sanitation, waste management, energy, biodiversity, agriculture, livestock, and fisheries.	**The Environmental Needs Assessment in Post-Disaster Situations** includes checklists on shelter, water, sanitation, waste management, energy, biodiversity, agriculture, livestock, and fisheries that cover possible impacts arising from the disaster and recovery. Reference is made to camps but not specifically site selection or resettlement.	**Environmental Needs Assessment in Post-Disaster Situations** www.humanitarianreform.org/

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
7	**(NATIONAL) DISASTER RECOVERY PROGRAM** **[Provides a master plan for recovery, including whether new or existing settlement sites will be used, and how fast reconstruction will take place]**	A. The establishment of a National Disaster Recovery Program should be complemented with a Strategic Environmental Impact Assessment (SEA) that identifies major environmental issues related to on-site or new settlements, including mitigation measures.	The disaster recovery plan can be set out in a Common Humanitarian Assistance Program (CHAP), Consolidated Appeals Process (CAP), or Flash Appeal. For significant recovery needs, a Donor Conference is often held, with a formal recovery plan presented. Any of these documents should include a review of environmental issues, including whether reconstruction will be on-site, at new sites, or both, and should establish parameters for addressing the related environmental impacts.	For information on CHAPs, CAPs and Flash Appeals, see www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=143. On the **Needs Assessment Framework** (includes general questions about the environment by sector and overall) which is intended to provide the overall framework for information to be used in a CAP or other appeal, see: www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=143 Information on SEAs and disaster-related topics: **Tools for Mainstreaming Disaster Risk Reduction:** www.proventionconsortium.org/themes/default/pdfs/tools_for_mainstreaming_GN7.pdf. **Strategic Environmental Assessment (SEA) and Disaster Risk:** www.oecd.org/dataoecd/54/26/42201482.pdf See **After the Tsunami: Sustainable Building Guidelines for South-East Asia** on issues related to sustainable reconstruction (www.preventionweb.net/english/professional/publications/v.php?id=1594).
8	**PROJECTS TO UPGRADE TRANSITIONAL SHELTER SITES**	A. Review existing environment-related conditions on sites and identification of upgrades to improve environmental conditions. For example, proper disposal of waste, fuelwood collection near housing site, etc.	If there is an extended period between the establishment of transition sites and the completion of reconstruction, then further assistance is needed to maintain and upgrade transitional shelter sites	The **Emergency Shelter Environmental Impact Assessment and Action** Checklist can be used to identify critical environmental issues linked to the upgrading of transitional shelter sites, temporary camps, or on-site reconstruction efforts. (Available from www.proactnetwork.org)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
9	**DONORS/ GOVERNMENTS SOLICIT PROJECT FUNDING PROPOSALS FOR RECONSTRUCTION**	A. Many donors have statements of principles related to environmental impacts from reconstruction. These should be reviewed and incorporated into funding plans and proposals. B. Funding plans should also include the environmental issues developed in the Strategic Environmental Assessment for the disaster if one has been prepared.	Based on the (National) Disaster Recovery Program or other assessments, donors/ governments propose to fund a specific number or type of reconstruction, including whether efforts will focus on on-site or new-site construction.	Key literature and links to policy statements are usually available through a disaster-specific web site or through disaster-specific web sites developed by individual Clusters or the United Nations (e.g., www.Reliefweb.org, a disaster-specific Humanitarian Information Center web site, or an OCHA-managed country-specific web site).
10	**SUBMISSION OF PROPOSALS TO DONORS/ GOVERNMENTS**	A. Proposals should include details of how negative environmental impacts will be mitigated and environmental conditions will be monitored in the proposed project. B. The proposal should include details of interventions that increase environmental sustainability, such as bioremediation of waste, recycling programs, or environmental improvements.	Not all donors require environmental impact management plans, but good practice (and standards to the extent they apply to reconstruction) requires an environmental impact review of a proposed project.	Shelter, settlement and non-food items chapter, **Humanitarian Charter and Minimum Standards for Disaster Response** for guidance on minimum standards for settlements, including the need for environmental reviews. See chapters on *Introduction to Sustainable Reconstruction and Guidelines for Sustainable Reconstruction* on **After the Tsunami: Sustainable building guidelines for South-East Asia** on issues related to sustainable reconstruction (www.preventionweb.net/english/professional/publications/v.php?id=1594) for guidance on sustainability in designing projects. The document includes a project/program environment review checklist in Annex VIII. See the *Key Literature and Links* under the Project Monitoring Intervention Point below for indicators on sustainable recovery that should be considered in project design.

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
11	**APPROVAL OF PROJECTS BY DONORS, GOVERNMENTS, AND NGOS**	A. The approval document should state any specific measures needed to address identified environmental issues.	The approval process can include the waiving of specific rules and regulations related to environmental review procedures. However, the implementing organization still has an obligation not to cause avoidable environmental damage and hardship for disaster survivors.	Information on project approval may be available through a disaster-specific web site established by the disaster-affected country or the United Nations (e.g., Reliefweb, a disaster-specific Humanitarian Information Center web site, or an OCHA managed country-specific web site).
12	**PROJECT INITIATION**	A. Introductory meetings with beneficiaries and government officials should be held to review the terms and requirements of the project. Discussions should cover local environmental issues, hazards present at the site, and related issues such as land tenure and local availability of natural resources.	Local authorities and (environmental) NGOs may be aware of environmental issues at or near the site. Consultations with current or future occupants of a site may also identify environmental or related concerns. Possible source locations for natural resources to be used in construction should be identified and assessed. Local waste-disposal systems should be identified and assessed in terms of the additional load posed by the site(s).	See **Participation by Crisis-Affected Populations in Humanitarian Action. A Handbook for Practitioners** (ALNAP, www.alnap.org/publications/gs_handbook/gs_handbook.pdf). See the section on *Community Environmental Action Planning* in **FRAME** www.proactnetwork.org
13	**CONSULTATION WITH PROJECT PARTICIPANTS**	A. Efforts should be made to specifically solicit concerns about environmental issues from project participants, and obtain their agreement to the environment-linked activities of the project.	Participant consultations are an opportunity to identify how the project's environmental impact can be improved, to secure buy-in from participants to different approaches to managing environmental issues (e.g., bioremediation of waste water), and to identify areas of potential conflict over environmental resources needed for construction or livelihoods.	See the **Humanitarian Charter and Minimum Standards for Disaster Response** for guidance on minimum standards on participation. See **Participation by Crisis-Affected Populations in Humanitarian Action. A Handbook for Practitioners** (ALNAP, www.alnap.org/publications/gs_handbook/gs_handbook.pdf). See the section on *Community Environmental Action Planning* in **FRAME** (www.proactnetwork.org)

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
14	**SITE SELECTION AND DEVELOPMENT**	A. Site reviews should include a preliminary review of possible impacts of the site on future inhabitants and of the creation of the site on the environment. B. Site plans should address any physical hazards, minimize the loss of natural vegetation, and use the physical landscape to maximize living conditions (e.g., airflow, drainage).	Where sufficient data is available, geographic information systems (GIS) can be used to identify possible sites. However, all potential sites should be visited and local residents contacted about environmental and other site-related issues (e.g., ownership, hazards, and previous use).	General guidance on overall land use planning can be found in the FAO's **Guidelines for Land Use Planning** (www.fao.org:80/docrep/T0715E/t0715e00.HTM). See **Site Planning and Design,** Steven B. McBride, Professor of Landscape Architecture, West Virginia University (www.rri.wvu.edu/WebBook/McBride/main.html) for general guidance on site planning including ecological/sustainable site planning. Information on sustainable site development is available in **Guiding Principles for Sustainable Design,** National Park Service, Department of Interior, Leslie Starr Hart, December 15, 1994, Denver, Colorado, www.nps.gov/dsc/dsgncnstr/gpsd/toc.html or www.nps.gov/dsc/dsgncnstr/gpsd/ch5.html. See chapter on *Guidelines for Sustainable Reconstruction* in **After the Tsunami: Sustainable building guidelines for South-East Asia** on issues related to sustainable reconstruction (www.preventionweb.net/english/professional/publications/v.php?id=1594).
15	**CONSTRUCTION AND ENGINEERING PLANS**	A. Energy, and resource-efficient construction materials and methods should be incorporated into construction plans.	Particular attention should be given to the resources to be used in construction (e.g., sand, water) and whether different construction methods can reduce the demand for resources. The tendency to use locally available resources should be weighed against the potentially unsustainable demand for those local resources.	Chapter 3, *Construction*, **Environmental Guidelines for Small-Scale Activities in Africa**, (USAID, www.encapafrica.org/EGSSAA/EGGSSA-front-&-back-cover.pdf) provides a review of environmental considerations related to construction and provides information on likely environmental impacts and mitigation measures.

	INTERVENTION POINT	RECOMMENDED ACTION	NOTES	REFERENCES
16	CONSTRUCTION ACTIVITIES	A. The generation of air and water pollution, and waste should be minimized (see Module 3 on Sustainable Construction).	As a rule of thumb, self-built sites are less polluting and more efficient users of construction resources, with contractor-based construction posing the greatest risk of pollution and waste. However, a good environmental management plan covering construction activities can reduce pollution and waste regardless of the approach used.	See Chapter 3, *Construction*, **Environmental Guidelines for Small Scale Activities in Africa**, (USAID, www.encapafrica.org/EGSSAA/EGGSSA-front-&-back-cover.pdf).
17	PROJECT MONITORING AND EVALUATION	A. Monitoring should include environmental indicators (see Module 3 on M&E), a focus on limiting waste and pollution, and the perception of beneficiaries as to environmental issues. B. The success of the project in addressing environmental issues identified during project design and implementation should be evaluated, as should any lessons encountered.	The use of beneficiaries to monitor the environmental impacts of a project should be considered. This is most practical at on-site reconstruction, but can be integrated into a broader beneficiary monitoring to the development of new sites. A post-project evaluation is a good tool for identifying successful approaches to sustainable site selection and development. It also provides an opportunity for project beneficiaries to express their views on environmental aspects of the project and identify ways that sustainability can be improved in similar situations.	See the section on *Evaluation* in FRAME, www.proactnetwork.org. See **The Good Enough Guide: Impact Measurement and Accountability in Emergencies**, published by Oxfam, available at publications.oxfam.org.uk/oxfam/display.asp?isbn=0855985941 overall impact monitoring.

ANNEX 3: XAAFUUN CASE STUDY

URBAN PLANNING IN A STATE OF FLUX Series

paving the way for sustainable development in a post disaster situation

the case of the tsunami-damaged village of Xaafuun
North Eastern Somalia

This brochure examines the UN-HABITAT role in post-disaster situations from its perspective of *'Sustainable Relief and Reconstruction'** by illustrating the case of the Xaafuun town. Using its holistic approach to human settlements and its planning and design expertise combined with components involving physical construction, UN-HABITAT acts as a catalyst for framing emergency/early recovery interventions within a long-term development perspective. Disasters of the magnitude of tsunami provide a clean slate to radically rethink the set-up and improvement of human settlements.
In the case of Xaafuun, UN-HABITAT, in partnership with UNICEF, took the emergency as an opportunity to set the stage for the renewed sustainable development of the area.

TSUNAMI IN XAAFUUN
disaster or opportunity?

The small village of Xaafuun, located on a remote peninsula along the north-eastern coast of Somalia, was severely damaged by the tsunami in December 2004. While an estimated 30 people perished, the extent of the damage caused by this natural disaster cannot be compared with the catastrophic scale of the events in Asia. However, the impact of the tsunami was yet another blow to a marginalized area already stricken by years of drought and civil war. With this reality in mind, the international spotlight on the tsunami-affected areas provided an opportunity to tackle the multitude of problems faced by the Somali coastal region.

FROM EMERGENCY TOWARDS DEVELOPMENT
The role of UN-HABITAT

As frequently happens after a major disaster, numerous organizations 'flooded' the area with pledges for assistance. As the traditional community leaders had no formal institutional set-up and no expertise in planning or coordinating development, the initial interventions were ad hoc and randomly located within the sensitive, unstable dune ecosystem near the old settlement. UNICEF, present from the start, partnered with UN-HABITAT to look at safe and sustainable solutions for the relocation of the settlement and its future development.

URBAN PLANNING IN A STATE OF FLUX - Towards Sustainable Urbanization

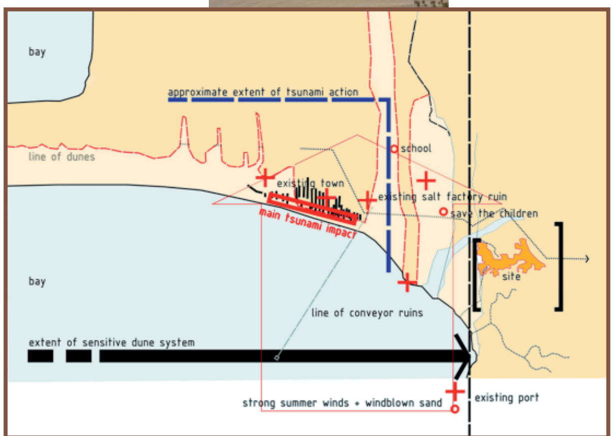
Urban planning was traditionally seen as a means to control and regulate the development of towns and cities. In the cities of the developing world, however, traditional planning approaches have failed to address the challenges of rapid urbanisation and the poverty, exclusion, informality and vulnerability it brings in its wake.
This series of brochures illustrates how UN-HABITAT has applied urban planning and design in a variety of ways, in very different contexts, to contribute towards sustainable human settlements development in general, as well as prevention, upgrading and integration of unplanned settlements, and the management of post-conflict and post-disaster situations, in particular. Each brochure introduces one thematic area or approach, and illustrates its impact on the built environment, and/or the planning legislation, policy and process. The specific context and programme within which the illustrated UN-HABITAT activities have been developed are mentioned at the end of each brochure, along with contact details for more information.

*see: *www.unhabitat.org/rdmu/* and *www.unhabitat.org/roaas/*

MOVING TO SAFER GROUND

finding sustainable space for development

The first step in the Xaafuun reconstruction process was to find a safe and environmentally sustainable site.



A multi-disciplinary team – comprised of urban planners, a local economic development expert (from ILO) and an environmental expert – recommended that the site be:

- Close to the sea and to different fishing locations (for economic sustainability);
- Protected from sand-laden winds and mobile sand dunes, and sufficiently elevated above sea level (for long-term environmental sustainability);
- Suitable for the cost-efficient establishment and operation of basic services (water, sanitation) and other public infrastructure;
- Easy to expand over time.

The final choice was agreed upon with the district authorities, the village elders and the women's representatives. It is not just land where people can settle safely, but it is a genuinely sustainable location, in other words a 'sustainable space'.

XAAFUUN VILLAGE

Xaafuun (pronounced ha-foon) is one of the few permanent fishing settlements on the north-eastern Somali coast, oscillating between 250 and 600 families, depending on the season.

In the damaged settlement, houses had been built at sea level near the beach, destabilizing the very fragile dune ecosystem of the area. Strong, sand-laden winds would regularly hit the village during the monsoon season, often burying structures and causing health problems, particularly for children, pregnant women and the elderly.

Fishery is the main source of income, but the rich marine resources are vastly under-exploited. The "industry" is very rudimentary: fish are sold directly to foreign boats lounging along the coast, and there is no internal market or fish processing business.

APPROPRIATE SETTLEMENT LAYOUT AND SHELTER TYPES

The new location called for a carefully considered, integrated settlement layout with appropriate types of shelter, rather than simply replicating what existed before. A preparatory sketch-plan discussed with all stakeholders allowed for swift land allocation to different agencies for immediate reconstruction activities. Meanwhile, a more detailed settlement layout was prepared by UN-HABITAT. A new mosque, a Koranic school, a meat market, a women's centre and a health centre have been built; the construction of additional public infrastructure continues. Such timely planning intervention has been vital, as organisations had a tendency to find the best 'spot' for their building without considerations for coherency and without consulting the other agencies. After this preparatory exercise, UN-HABITAT started the construction of the new houses.

The town plan is based on the following principles:

- Compact settlement: this mitigates the impact of Xaafuun's strong winds on living spaces and housing units. It also ensures the cost-efficient development and operation of basic services, reduces the extent of the area that needs to be protected against soil erosion, and controls infringements on the delicate coastal dune ecosystem.
- "Public border": a public zone, comprising public spaces and public buildings, faces the sea, acting as a buffer between the residential area and the dunes, as it was in the original settlement.

- Main road: this is the backbone of the settlement, as it is linked with the main public facilities and aligned with the access road to the settlement and previously built structures.
- Economic development: next to the formal market structures and the sites along the sea for a small-scale fishing industry, spaces for spontaneous economic activities and social gatherings are created.

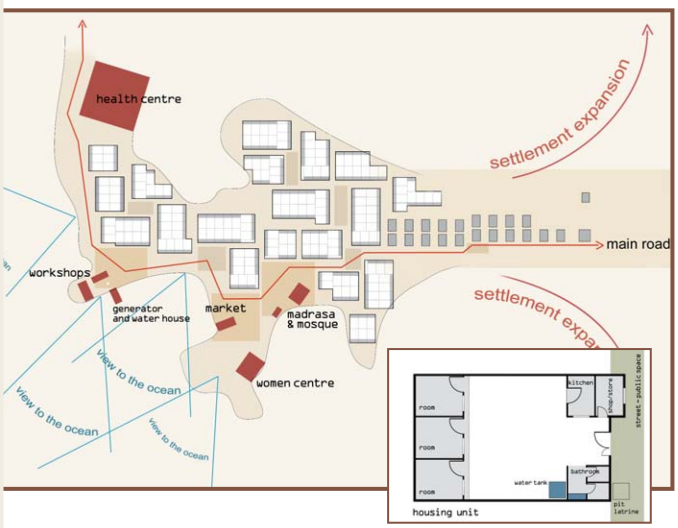
The design of the houses was based on environmental and cultural considerations, and the community made a final choice from three different types. The selected courtyard type was modelled on the most advanced houses in the old settlement, which had protected private spaces and room for expansion. Combining several units in blocks meanwhile increased compactness and cost-efficiency.

STATUS OF IMPLEMENTATION

As of April 2006, UN-HABITAT had built two construction workshops (to be converted into community centres on completion of the activities) and the first phase of 100 houses for the UNICEF-funded Xaafuun shelter reconstruction project. In total, it is anticipated that some 250 houses will be constructed under the presently available funding.

The buildings constructed by other agencies are in place and most of the public infrastructure has been finalized.

The remoteness of Xaafuun has presented a major access challenge. In addition, our participatory approach – adopted in the selection of the site, its layout and the design of the houses – has been time-consuming, but its benefits are clear. Houses built by another organization without proper community consultation, for instance, were not well received by the beneficiaries. Contracts are given to the community, organized through a newly created District Development Committee.



Xaafuun - *Workshops (above) and houses (below) constructed by UN-HABITAT*

CREATING SPACE FOR WOMEN AND CHILDREN

Both the settlement and individual houses were specifically designed to allow women to run economic activities from home. The basic house type has a room protruding into the street that can be used as a shop, small workshop or rental room. Small public areas around the settlement provide space for such things as playgrounds for children and water points, all in a safe environment. The women's centre is positioned close to the markets. A kindergarten and a primary school will be included in the settlement, and the first school built by UNICEF will be converted into a secondary school.

ROAD MAP FOR XAAFUUN: PLANNING THE WAY AHEAD

A lot more work remains to be done. While finalizing the 250 houses planned for 2006, suitable expansion areas will be designed. Xaafuun has attracted substantial investments that are turning a small fishing settlement into a potential pillar of coastal development. Links to the new fishing hubs need to be formalized alongside further investments being made in this sector. With the growth of the settlement, new problems of solid waste pollution and hygiene will have to be tackled. For this purpose, appropriate community-based solutions are being developed.

ENVIRONMENTAL REHABILITATION OF THE OLD SITE

Relocation of the settlement will allow the dismantling of the original settlement and environmental rehabilitation of the dunes. This has to be properly planned, to avoid the risk that the old settlement will continue to be used, especially by seasonal workers. District authorities have so far demonstrated a clear environmental consciousness – for instance, cutting of live wood has been forbidden. The construction materials of the old settlement can be re-used in the new settlement. Youth and women's groups have shown interest in re-planting the dunes to facilitate the disrupted ecosystem's natural rehabilitation.

SOME CONCLUDING THOUGHTS

The Xaafuun case described illustrates that without compromising humanitarian efforts to save lives, it is vital to introduce a development perspective in the early stages of a post-disaster situation, fully taking advantage of the opportunities that might result from a disaster. It furthermore illustrates that UN-HABITAT can make an important contribution to post-disaster contexts, using its holistic approach to human settlements and its specific expertise in environmentally sound planning and urban design. This is strengthened by the experience UN-HABITAT has gained over the years in the actual implementation of substantial infrastructure projects. Our approach highlights opportunities, but also enhances the capacity of the international community to efficiently coordinate interventions during early recovery , and shorten the period of crisis.

SUDP - urban development programme for the somali region

The SUDP is an umbrella programme for urban interventions in the Somali regions.
UN-HABITAT is the lead agency, and its partners are UNA, ILO, Novib and UNICEF, each of whom contribute in their field of specialization. The three main components addressed are (1) governance, including legal and institutional reforms, strengthening municipal governance and the role of civil society; (2) urban management, including strategic planning and development control, land management, municipal finance, delivery of basic services and local economic development; and (3) the implementation of local projects by local consortia, building on the two capacity-building elements already mentioned. The programme is funded by the European Commission, and co-funded by UNDP, Government of Italy, Government of Japan, UNICEF and DFID. The programme receives support from WFP through Food-For-Work schemes.

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The opinions in this document are those of the authors and do not necessarily reflect those of UN-HABITAT and of the SUDP partners.

GLOSSARY

The following is a comprehensive list of the key terms used throughout the Green Recovery and Reconstruction Toolkit. In some cases, the definitions have been adapted from the original source. If no source is given, this indicates that the module author developed a common definition for use in the toolkit.

Anaerobic Filter (or Biofilter): Filter system mainly used for treatment of secondary effluent from primary treatment chambers such as septic tanks. The anaerobic filter comprises a watertight tank containing a bed of submerged media, which acts as a support matrix for anaerobic biological activity. For humanitarian aid agencies, the prefabricated biofilters that combine primary and secondary treatment into one unit can provide a higher level of treatment than do traditional systems such as precast cylindrical septic tanks or soakage pit systems. Source: SANDEC. 2006. *Greywater Management in Low and Middle Income Countries.* Swiss Federal Institute of Aquatic Science and Technology. Switzerland.

Better Management Practices (BMPs): BMPs are flexible, field-tested, and cost-effective techniques that protect the environment by helping to measurably reduce major impacts of growing of commodities on the planet's water, air, soil, and biological diversity. They help producers make a profit in a sustainable way. BMPs have been developed for a wide range of activities, including fishing, farming, and forestry. Source: Clay, Jason. 2004. *World agriculture and the environment: a commodity-by-commodity guide to impacts and practices.* Island Press: Washington, DC.

Biodiversity: Biological diversity means the variability among living organisms from all sources, including inter alia, terrestrial, and marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Source: United Nations. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Carbon Footprint: The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product. For simplicity of reporting, the carbon footprint is often expressed in terms of the amount of carbon dioxide, or its equivalent of other greenhouse gases, emitted. Source: Carbon Trust. Carbon Footprinting. www.carbontrust.co.uk (Accessed on June 22, 2010)

Carbon Offset: A financial instrument aimed at a reduction in greenhouse gas emissions. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Source: World Bank. 2007. *State and Trends of the Carbon Market.* Washington, DC

Climate Change: The climate of a place or region is considered to have changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or the variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Construction: Construction is broadly defined as the process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and processing of raw materials, the manufacturing of construction materials and components, the construction project cycle from feasibility to deconstruction, and the management and operation of the built environment.

Source: du Plessis, Chrisna. 2002. *Agenda 21 for Sustainable Construction in Developing Countries.* Pretoria, South Africa: CSIR Building and Construction Technology.

Disaster: Serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow) and their cause (natural or man-made). Disasters occur when a natural or human-made hazard meets and adversely impacts vulnerable people, their communities, and/or their environment. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster preparedness: Activities designed to minimize loss of life and damage; organize the temporary removal of people and property from a threatened location; and facilitate timely and effective rescue, relief, and rehabilitation. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management*. 2nd Ed.

Disaster Risk: Potential disaster losses in lives, health status, livelihoods, assets, and services that could occur to a particular community or a society over some specified future time period. Risk can be expressed as a simple mathematical formula: Risk = Hazard X Vulnerability. This formula illustrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a population, the greater the risk. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Ecosystem: Dynamic complexes of plants, animals, and other living communities and the nonliving environment interacting as functional units. Humans are an integral part of ecosystems. Source: UN. Convention on Biological Diversity. www.cbd.int/convention/articles.shtml?a=cbd-02 (Accessed on June 18, 2010)

Ecosystem Services: The benefits that people and communities obtain from ecosystems. This definition is drawn from the Millennium Ecosystem Assessment. The benefits that ecosystems can provide include "regulating services" such as regulation of floods, drought, land degradation, and disease; "provisioning services" such as provision of food and water; "supporting services" such as help with soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious, and other nonmaterial benefits. Integrated management of land, water, and living resources that promotes conservation and sustainable use provides the basis for maintenance of ecosystem services, including those that contribute to the reduction of disaster risks. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Embodied Energy: The available energy that was used in the work of making a product. Embodied energy is an accounting methodology used to find the sum total of the energy necessary for an entire product life cycle. Source: Glavinich, Thomas. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* John Wiley & Sons, Inc: New Jersey.

Environment: The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation. Source: Adapted from: *Merriam Webster Dictionary, "Environment."* www.merriam-webster.com/netdict/environment (Accessed on June 15, 2010)

Environmental Impact Assessment: A tool used to identify the environmental, social, and economic impacts of a project prior to decision making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision makers. Source: International Association of Environmental Impact Assessment in cooperation with Institute of Environmental Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice.*

Green Construction: Green construction is planning and managing a construction project in accordance with the building design in order to minimize the impact of the construction process on the environment. This includes 1) improving the efficiency of the construction process; 2) conserving energy, water, and other resources during construction; and 3) minimizing the amount of construction waste. A "green building" is one that provides the specific building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after the structure's construction and specified service life. Source: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Green Purchasing: Green Purchasing is often referred to as environmentally preferable purchasing (EPP), and is the affirmative selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use, and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water and minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as biobased fuels and solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials, and biohazardous agents. Source: U.S. Environmental Protection Agency. 1999. Final Guidance on Environmentally Preferred Purchasing. *Federal Register*. Vol. 64 No. 161.

Greening: The process of transforming artifacts such as a space, a lifestyle, or a brand image into a more environmentally friendly version (i.e., "greening your home" or "greening your office"). The act of greening involves incorporating "green" products and processes into one's environment, such as the home, workplace, and general lifestyle. Source: Based on: Glavinich, T. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Hazard: A potentially damaging physical event, phenomenon, or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological, and biological) or induced by human processes (environmental degradation and technological hazards). Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Impact: Any effect caused by a proposed activity on the environment, including effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments, or other physical structures, or the interaction among those factors. It also includes effects on cultural heritage or socioeconomic conditions resulting from alterations to those factors. Source: United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context.* www.unece.org (Accessed June 22, 2010)

Indicator: A measurement of achievement or change for the specific objective. The change can be positive or negative, direct or indirect. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods used. The indicator may be qualitative or quantitative. Indicators are usually classified according to their level: *input* indicators (which measure the resources provided), *output* indicators (direct results), *outcome* indicators (benefits for the target group) and impact indicators (long-term consequences). Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services: Washington, DC and Baltimore, MD.

Integrated Water Resources Management: Systemic, participatory process for the sustainable development, allocation, and monitoring of water resource use in the context of social, economic, and environmental objectives. Source: Based on: Sustainable Development Policy Institute. Training Workshop on Integrated Water Resource Management. www.sdpi.org (Accessed June 22, 2010)

Life Cycle Assessment (LCA): A technique to assess the environmental aspects and potential impacts of a product, process, or service by compiling an inventory of relevant energy and material inputs and environmental releases; evaluating the potential environmental impacts associated with identified inputs and releases; and interpreting the results to help make a more informed decision. Source: Scientific Applications International Corporation. 2006. Life Cycle Assessment: Principle's and Practice. Report prepared for U.S. EPA.

Life Cycle Materials Management: Maximizing the productive use and reuse of a material throughout its life cycle in order to minimize the amount of materials involved and the associated environmental impacts.

Life Cycle of a Material: The various stages of a building material, from the extraction or harvesting of raw materials to their reuse, recycling, and disposal.

Livelihoods: A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and can maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. Source: DFID. 1999. *Sustainable Livelihoods Approach Guidance Sheets.* London: Department for International Development.

Logframe: Logical framework, or logframe, analysis is a popular tool for project design and management. Logframe analysis provides a structured logical approach to the determination of project priorities, design and budget and to the identification of related results and performance targets. It also provides an iterative management tool for project implementation, monitoring and evaluation. Logframe analysis begins with problem analysis followed by the determination of objectives, before moving on to identify project activities, related performance indicators and key assumptions and risks that could influence the project's success. Source: Provention Consortium. 2007. *Logical and Results Based Frameworks.* Tools for Mainstreaming Disaster Risk Reduction. Guidance Note 6. Geneva, Switzerland.

Primary Wastewater Treatment: Use of gravity to separate settleable and floatable materials from the wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press.

Project Design: An early stage of the project cycle in which a project's objectives and intended outcomes are described and the project's inputs and activities are identified.

Project Evaluation: Systematic and impartial examination of humanitarian action intended to draw lessons that improve policy and practice, and enhance accountability. Source: Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). Report Types. www.alnap.org (Accessed June 25, 2010)

Project Monitoring: A continuous and systematic process of recording, collecting, measuring, analyzing, and communicating information. Source: Chaplowe, Scott G. 2008. *Monitoring and Evaluation Planning.* American Red Cross/CRS M&E Module Series. American Red Cross and Catholic Relief Services : Washington, DC and Baltimore, MD.

Reconstruction: The actions taken to reestablish a community after a period of recovery subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state. Source: UNDP/UNDRO. 1992. *Overview of Disaster Management.* 2nd Ed.

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Recycle: Melting, crushing, or otherwise altering a component and separating it from the other materials with which it was originally produced. The component then reenters the manufacturing process as a raw material (e.g., discarded plastic bags reprocessed into plastic water bottles). Source: Based on: Glavinich, Thomas E. 2008. *Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Resilience: The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Response (also called Disaster Relief): The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Source: UN International Strategy for Disaster Reduction. Terminology of disaster risk reduction. www.unisdr.org/eng/terminology/terminology-2009-eng.html (Accessed on April 1, 2010)

Reuse: The reuse of an existing component in largely unchanged form and for a similar function (e.g., reusing ceramic roof tiles for a reconstructed house). Source: Based on: Glavinich, Thomas E. 2008. Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction. Hoboken, New Jersey: John Wiley & Sons, Inc.

Secondary Wastewater Treatment: Use of both biological (i.e., microorganisms) and physical (i.e., gravity) processes designed to remove biological oxygen demand (BOD) and total suspended solids (TSS) from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas*. Washington DC: National Academy Press.

Site Development: The physical process of construction at a building site. These construction-related activities include clearing land, mobilizing resources to be used in the physical infrastructure (including water), the fabrication of building components on site, and the process of assembling components and raw materials into the physical elements planned for the site. The site development process also includes the provision of access to basic amenities (e.g., water, sewage, fuel) as well as improvements to the environmental conditions of the site (e.g., through planting vegetation or other environment-focused actions).

Site Selection: The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site selection includes the housing, basic services (e.g., water, fuel, sewage, etc.), access infrastructure (e.g., roads, paths, bridges, etc.) and social and economic structures commonly used by site residents (e.g., schools, clinics, markets, transport facilities, etc.).

SMART Indicator: An indicator that meets the SMART criteria: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**ime-bound. Source: Based on: Doran, G. T. 1981. There's a S.M.A.R.T. way to write management›s goals and objectives. *Management Review:* 70, Issue 11.

Sustainable Construction: Sustainable construction goes beyond the definition of "green construction" and offers a more holistic approach to defining the interactions between construction and the environment. Sustainable construction means that the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure, and is also concerned with any building's final deconstruction and the management of the resultant waste. It is a holistic process aimed at restoring and maintaining harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity. Source: du Plessis, Chrisna. 2002. Agenda 21 for Sustainable Construction in Developing Countries. Pretoria, South Africa: CSIR Building and Construction Technology.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Source*:* World Commission on Environment and Development. 1987. *Report of the World Commission on Environment and Development: Our Common Future*. Document A/42/427. www.un-documents.net (Accessed June 22, 2010)

Tertiary Wastewater Treatment: Use of a wide variety of physical, biological, and chemical processes aimed at removing nitrogen and phosphorus from wastewater. Source: National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas.* Washington DC: National Academy Press. p. 58

Vulnerability. *Human* vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist, and recover from the impact of a hazard. *Structural or physical* vulnerability is the extent to which a structure or service is likely to be damaged or disrupted by a hazard event. *Community* vulnerability exists when the elements at risk are in the path or area of the hazard and are susceptible to damage by it. The losses caused by a hazard, such as a storm or earthquake, will be proportionally much greater for more vulnerable populations, e.g., those living in poverty, with weak structures, and without adequate coping strategies. Source: UNDHA. 1997. *Building Capacities for Risk Reduction.* 1st Ed.

Watershed: An area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers that become progressively larger as the water moves downstream, eventually reaching a water basin (i.e., lake, estuary, ocean). Source: Based on: Oregon Watershed Enhancement Board. 1999. *Oregon Watershed Assessment Manual.* www.oregon.gov Salem.

ACRONYMS

The following is a comprehensive list of the acronyms used throughout the Green Recovery and Reconstruction Toolkit.

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRA	Adventist Development and Relief Agency
AECB	Association for Environment Conscious Building
AJK	Azad Jammu Kashmir
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANSI	American National Standards Institute
BMPS	best management practices
BOD	biological oxygen demand
CAP	Consolidated Appeals Process
CEDRA	Climate Change and Environmental Degradation Risk and Adaptation Assessment
CFL	compact fluorescent lamp
CGIAR	Consultative Group on International Agricultural Research
CHAPS	Common Humanitarian Assistance Program
CIDEM	Centro de Investigación y Desarrollo de Estructuras y Materiales
CO	Country Office
CRISTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CRS	Catholic Relief Services
CVA	community vulnerability assessment
DFID	Department for International Development
DRR	disaster risk reduction
EAWAG	Swiss Federal Institute of Aquatic Science and Technology

ECB	Emergency Capacity Building Project
EE	embodied energy
EIA	environmental impact assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
EMP	environmental management plan
ENA	Environmental Needs Assessment in Post-Disaster Situations
ENCAP	Environmentally Sound Design and Management Capacity Building for Partners and Programs in Africa
EPP	environmentally preferable purchasing
ESR	Environmental Stewardship Review for Humanitarian Aid
FAO	Food and Agriculture Organization
FEAT	Flash Environmental Assessment Tool
FRAME	Framework for Assessing, Monitoring and Evaluating the Environment in Refuge Related Operations
FSC	Forest Stewardship Council
G2O2	Greening Organizational Operations
GBCI	Green Building Certification Institute
GBP	Green Building Programme
GIS	geographic information system
GRR	Green Recovery and Reconstruction
GRRT	Green Recovery and Reconstruction Toolkit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
HQ	headquarters
HVAC	heating, ventilation, and air conditioning
IAS	International Accreditation Service
IASC	Inter-Agency Standing Committee

IAIA	International Association for Impact Assessment
IBRD	International Bank for Reconstruction and Development
ICE	Inventory of Carbon and Energy
ICT	information and communication technology
IDA	International Development Association
IDP	internally displaced peoples
IDRC	International Development Research Centre
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IFMA	International Facilities Management Association
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRC	International Rescue Committee
ISAAC	Institute for Applied Sustainability to the Built Environment
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
IT	information technology
ITDG	Intermediate Technology Development Group
IUCN	International Union for the Conservation of Nature
ISWM	integrated solid waste management
IWA	International Water Association
IWMI	International Water Management Institute
IWRM	integrated water resource management
IWQA	International Water Quality Association
IWSA	International Water Supply Association

KW H	Kilowatt hour
LCA	life cycle assessment
LEDEG	Ladakh Ecological Development Group
LEED	Leadership in Energy & Environmental Design
M&E	monitoring and evaluation
MAC	Marine Aquarium Council
MDGS	Millennium Development Goals
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers
NGO	non-governmental organization
NSF-ERS	National Science Foundation - Engineering and Research Services
NWFP	North Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PMI	Indonesian Red Cross Society
PVC	Polyvinyl chloride
PV	photovoltaic
REA	Rapid Environmental Assessment
RIVM	Dutch National Institute for Public Health and the Environment
SC	sustainable construction
SCC	Standards Council of Canada
SEA	Strategic Environmental Impact Assessment
SIDA	Swedish International Development Agency

SKAT	Swiss Centre for Development Cooperation in Technology and Management
SL	sustainable livelihoods
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SODIS	solar water disinfection
TRP	Tsunami Recovery Program
TSS	total suspended solids
UN	United Nations
UNDHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Program
UNGM	United Nations Global Marketplace
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USAID-ESP	United States Agency for International Development- Environmental Services Program
VROM	Dutch Ministry of Spatial Planning, Housing and the Environment
WEDC	Water, Engineering, and Development Centre
WGBC	World Green Building Council
WHO	World Health Organization
WWF	World Wildlife Fund

Soon after the 2004 Indian Ocean tsunami, the American Red Cross and the World Wildlife Fund (WWF) formed an innovative, five-year partnership to help ensure that the recovery efforts of the American Red Cross did not have unintended negative effects on the environment. Combining the environmental expertise of WWF with the humanitarian aid expertise of the American Red Cross, the partnership has worked across the tsunami-affected region to make sure that recovery programs include environmentally sustainable considerations, which are critical to ensuring a long-lasting recovery for communities.

The Green Recovery and Reconstruction Toolkit has been informed by our experiences in this partnership as well as over 30 international authors and experts who have contributed to its content. WWF and the American Red Cross offer the knowledge captured here in the hopes that the humanitarian and environmental communities will continue to work together to effectively incorporate environmentally sustainable solutions into disaster recovery. The development and publication of the Green Recovery and Reconstruction Toolkit was made possible with support from the American Red Cross.