UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

United Nations Educational, Scientific and Cultural Organization

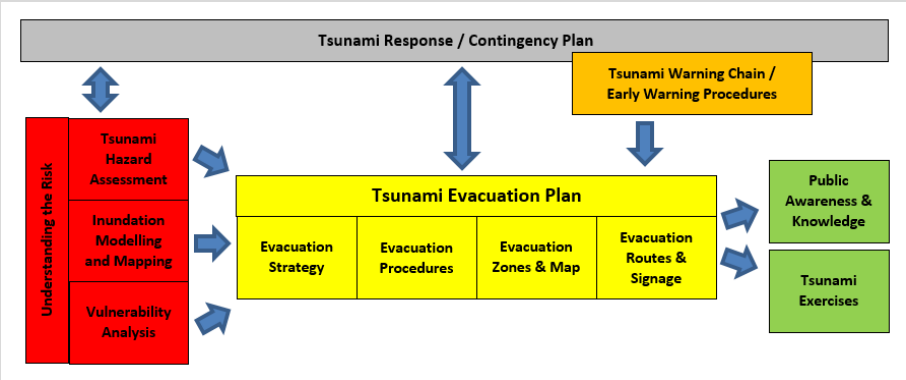
Intergovernmental Oceanographic Commission

Annex 10.1:

Tsunami Evacuation Planning

Information Package

TTF-31 Project
"Strengthening tsunami early warning in the North West Indian Ocean region through regional cooperation"



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About this document

This “Information Package” provides an overview on existing approaches, standards, methodologies and best practices for Tsunami Evacuation Planning (TEP). The document is deliberately kept general, limited to essential aspects, and builds upon tried and tested approaches. An attempt was made to derive a generally applicable framework from identified guidebooks which have been developed by various institutions over the years. It also shows how this framework fits into the TsunamiReady initiative.

The documentation is an output of the TTF 31 - Project “Strengthening tsunami early warning in the North West Indian Ocean region through regional cooperation” funded by the Economic and Social Commission for Asia and the Pacific (ESCAP) and implemented by UNESCO.

The “Information Package” is intended as an **internal working document** to serve as a reference for the national country teams from India, Iran, Oman, Pakistan and UAE, as well as for the TTF-31 Project Team for further activities to share experiences and to strengthen capacities for TEP in the Makran Region.

Content

1. Background

The TTF-Project supports partner countries in the NWIO to strengthen capacities for Tsunami Evacuation Planning (TEP) with a two-step approach to be implemented during Phase-2b and Phase-2c as follows:

Objectives

- **Phase-2b**: Gap analysis and development of guidance on tsunami evacuation planning in the NWIO region
- **Phase-2c**: Training in development of tsunami evacuation plans to facilitate effective community responses to the threat from near-field tsunamis.

Project Phase-2b:

Performance Indicator

- National policy, guidelines, and support mechanism established for tsunami evacuation planning (in each of the participating countries)

Output

- Information package on existing approaches, standards, methodologies and best practices for tsunami evacuation planning as well as tailored recommendations for the NWIO countries including concrete steps for the development of context-specific policies, standards and approaches

Approach

At the regional level, the project will provide information on existing approaches, standards, methodologies and best practices for tsunami evacuation planning. To facilitate joint learning and national implementation, the project will support the establishment of national working groups on evacuation planning and conduct participatory capacity and gap analysis in each of the five countries. It will then provide recommendations for the NWIO countries about what fits best and how to proceed regarding the development of a set of individual national policies, standards and approaches for evacuation planning.

Outlook Project Phase-2c:

In Phase 2c (subject to funding), the project intend to support training for selected staff from partner institutions of the NWIO countries to build a pool of national experts, who will facilitate and assist evacuation processes in the selected coastal pilot areas. The training will provide a methodology for the planning process, information on technical aspects like the development of evacuation strategies, zoning, map design and evacuation procedures, as well as facilitation on techniques to assure a participatory and consultative approach at community level.

Further on, the project will provide backstopping during the evacuation planning processes in pilot communities to strengthen capacities of the facilitators, to assure quality in the processes and outputs, as well as to obtain feedback for possible adaptations of the methodology based on local experiences and requirements. The developed evacuation plans and procedures for the identified pilot areas in all five countries within this initiative shall be tested during a future tsunami drill. Learning from the planning processes in these pilot areas will be brought into the National Working Groups responsible for the development of policies and standards.

2. Clarification on Important Terms and Concepts

Evacuation

The UNDRR defines “evacuation” as a process moving people and assets temporarily to safer places before, during or after the occurrence of a hazardous event in order to protect them.

A distinction must be made between a fast-onset / rapid evacuation processes which shall enable people in risk areas to escape the impact of tsunami waves and more long term evacuation processes which provides shelter for displaced people after a tsunami impact (Figure 1). The approach to be followed in the TTF-Project relates exclusively to the first one.

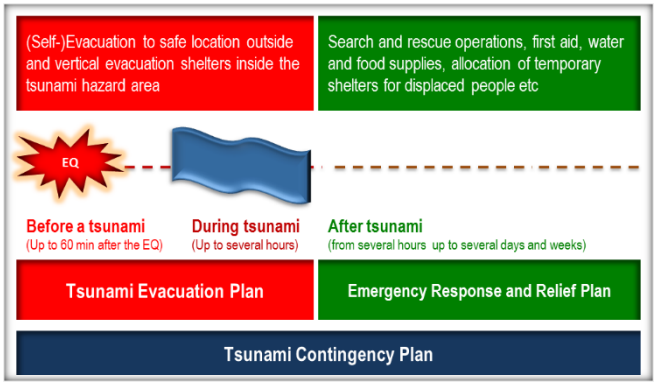


Figure 1: Tsunami evacuation planning prepares for evacuation before and during a tsunami (GITEWS 2010)

Evacuation Plan / Planning

According to UNDRR, “evacuation plans” refer to the arrangements established in advance to enable the moving of people and assets temporarily to safer places before, during or after the occurrence of a hazardous event. Evacuation plans may include plans for return of evacuees and options to shelter in place.

Tsunami evacuation planning is a key element of local tsunami preparedness. It is closely linked to local risk analysis including knowledge of tsunami sources, arrival times and inundation zones as well as local tsunami response plans and early warning arrangements. All these elements must be well aligned and consistent with each other. In any case, one of the basic requirement for evacuation planning is a sound understanding of tsunami threat and the areas on land which might be impacted.

In principle, tsunami evacuation planning is part of local response or contingency plans (Fig. 1). Nevertheless, it can be designed and carried out as a separate process, if properly aligned. The scope of evacuation planning processes may vary according to the local framework conditions.

Evacuation Map / Mapping

Evacuation mapping is part of evacuation planning. The Tsunami Glossary describes the term of “Evacuation map” as a drawing or representation that outlines danger zones and designates limits beyond which people must be evacuated to avoid harm from tsunami waves. Evacuation routes are sometimes designated to ensure the efficient movement of people out of the evacuation zone to evacuation shelters.

The development of a tsunami evacuation map is an important step and at the same time an outcome of the tsunami evacuation planning process. A good tsunami evacuation map on the other hand is an important tool and reference to build public tsunami awareness and knowledge.

Evacuation Zone

The Term “evacuation zone” is used and understood in different ways, which unfortunately leads frequently to confusion among stakeholder involved in evacuation planning.

On one hand, the term is used to describe the affected areas by tsunamis and which need to be evacuated (Tsunami Glossary, GITEWS Guidebook, New Zealand Guideline on tsunami evacuation zones). The same understanding is shared in the IOC Manuals and Guides 76, which describes evacuation zones as regions that cover all areas up to the maximum expected inundation limit.

On the other hand, the same term is described in the Glossary of IOC Manuals and Guides 82 as a pre-identified region determined to be a safe distance away from locations vulnerable to tsunami impact areas. The ISO 20712 standard for tsunami signage uses the term “evacuation area” as a location of a safe place for evacuation in the event of a tsunami. Other terms used to describe areas where people should evacuate to, are “evacuation sites” or “assembly areas”.

Most of the examples from international practice illustrated in the IOC Manuals and Guides 82 use the term “evacuation zone” as an equivalent to “hazard zone” and hence the area to be evacuated. The same applies for one of the main platforms (tsunamizone.org) for tsunami preparedness in the United States.

Given that the term “evacuation zone” is predominantly used in the sense of describing the area to be evacuated, it is recommended to apply it in this sense in the context of the TTF project as well.

Self-evacuation

Self-evacuation means that the vulnerable population decides on its own to leave the area at risk upon natural warning signs or a tsunami alert without waiting for an official evacuation call. This approach should always be strongly encouraged as an essential part of the evacuation strategy in the case of near-field tsunamis. Tsunami evacuation maps and plans should guide people in this process.

Tsunami Response

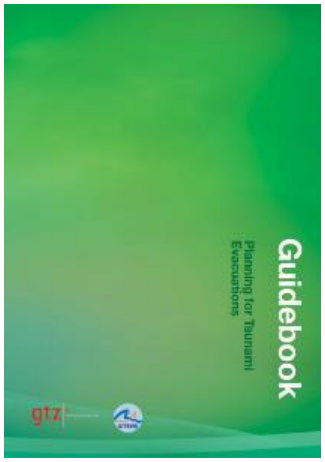
According to the IOC Manuals and Guides 82, “tsunami response” refers to actions to be taken in **response to the threat of tsunami impact** that limits effects and saves life. Tsunami response plans typically assign roles and responsibilities and may include evacuation procedures, shelter in place criteria, personnel lists and contact information.

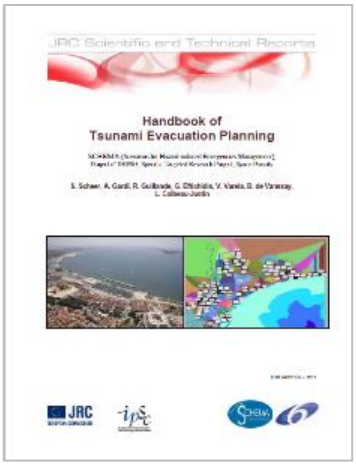
This, however, differs from the UNDRR definition of “response” that has a broader focus and includes actions taken not only directly before or during but also immediately after a disaster has occurred in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. In the disaster management community the focus of response is often mainly on actions after a disaster and predominantly focused on immediate and short-term needs. It is therefore sometimes called disaster relief.

3. Existing Approaches for Tsunami Evacuation Planning

So far, only three **comprehensive manuals and guidelines for tsunami evacuation planning** have been identified that appear to be appropriate for the advisory process in the TTF Project. These include the IOC Manuals and Guides 82 as well as Guidebooks developed by GITEWS and JRC.

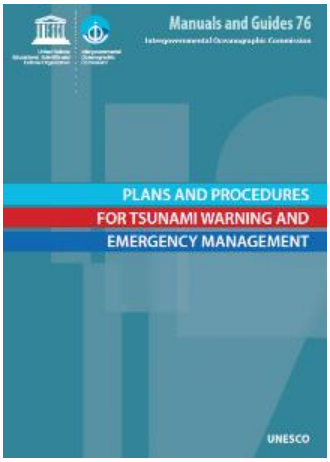
- Intergovernmental Oceanographic Commission - Manuals and Guides 82: Preparing for Community Tsunami Evacuations - From Inundation to Evacuation Maps, Response Plans, and Exercises (UNESCO 2020)
- Planning for Tsunami Evacuations – A Guidebook for Local Authorities and other Stakeholders in Indonesian Communities (GITEWS, 2010)
- Handbook of Tsunami Evacuation Planning (JRC, 2011)





The IOC Manuals and Guides 76 has been identified as another relevant reference as it provides guidance to strengthen **tsunami warning and emergency responses** through the development of tsunami warning and emergency response plans and standard operating procedures (SOPs) for their warning and emergency management authorities. Evacuation is considered as a key element of tsunami emergency response planning. The document includes some brief guidelines on evacuation planning (Annex B4).

- Intergovernmental Oceanographic Commission - Manuals and Guides 76: Plans and Procedures for Tsunami Warning and Emergency Management (UNESCO 2017)



Besides these documents there are numerous guides and documents which deal with

(1) **specific aspects of evacuation planning** like inundation zones, evacuation routes, shelter areas and vertical evacuation buildings as well as the design of evacuation maps and signage and public awareness campaigns
(2) **Sector specific approaches** as evacuation planning in hotels, schools or health facilities. Recently guidelines for tsunami evacuations during COVID-19 have been published.

The IOC Manual 82 provides a good selection of specialized documents, references and examples at the end of each of their four programme modules and in Annex III.

4. Comparison of Tsunami Evacuation Planning Guidebooks

IOC Manuals and Guides 82: Preparing for Community Tsunami Evacuations

The IOC Manuals and Guides 82 takes the broadest approach compared to the other identified guides. It includes modules on inundation and evacuation mapping, response planning, and exercises to prepare for community tsunami evacuations (Fig. 1).

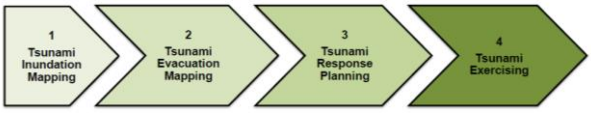


Figure 3: Modules for tsunami evacuation planning according to IOC Manual 82

- Module 1 describes the identification of inundation areas, including the identification of credible and/or worst-case scenarios that should be modelled.
- Module 2 describes the development of evacuation maps from inundation maps including how to choose evacuation zones and routes.
- Module 3 describes the development of Tsunami Response Plans and Standard Operating Procedures (SOPs) focusing on the community evacuations, but including the tsunami warning chain and the execution of evacuation during a warning.
- Module 4 describes the use of exercising to practice tsunami evacuations.

The four modules have been derived from the TEMPP (Tsunami Evacuation Maps, Plans and Procedures) training course which has been developed and implemented in the frame of ICG/PTWS since 2015. The guide has been designed to support the training of people who are responsible for the development and implementation of inundation and evacuation mapping, response planning, and exercises at the local level, can be used as part of the process to become UNESCO/IOC Tsunami Ready, or simply to enhance preparedness.

The guide contains a specific module on the development of **evacuation maps**, which is divided into 6 steps

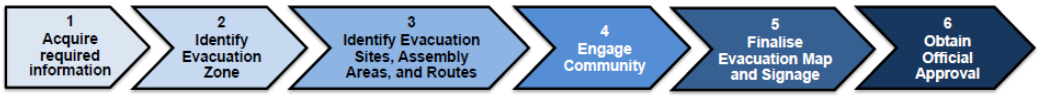


Figure 4: Steps for Module 2 – Evacuation Mapping according to IOC Manual 82

Module 3 focus provides guidance on the development of **tsunami response plans and standard operation procedures**. Tsunami Response Plans cover arrangements for warnings and evacuations, and public awareness. Concerning tsunami evacuation, a response plan includes information on evacuation map(s), evacuation routes, evacuation signage, evacuation thresholds & activation as well as the development of public awareness.

Figure 5: Steps for Module 3 – Tsunami Response Plan and SOPs according to IOC Manual 82

Module 4 provides guidance how to plan, conduct and evaluate **tsunami evacuation exercises**. It is considered as an important mechanism bringing planning to practice by testing the effectiveness of the evacuation plan and to promote public awareness and preparedness.

GITEWS: Planning for Tsunami Evacuations – A Guidebook for Local Authorities and other Stakeholders

The guidebook has been developed to support local authorities and other stakeholder in Indonesian communities in developing tailor-made tsunami evacuation plans. The methodology and contents of the guidebook are based on practical experiences in the GITEWS pilot areas acquired over a couple of years. Although the guidebook has been designed for the Indonesian context and the threat of near-field tsunamis, the methodology is transferable to other countries and can also support the design of evacuation plans for tsunamis that originate from a distant source (far-field tsunamis).

The guide starts with a chapter on important planning principles and assumptions followed by the description of a five-step approach to develop an evacuation plan (Figure 6).

Figure 6: The five steps towards a tsunami evacuation plan according to GITEWS 2010)

The guidebook defines evacuation planning as the process of designing strategies, procedures and maps that enable and encourage people to evacuate in a timely manner. The main results of the planning process are a tsunami evacuation plan and public evacuation maps. The evacuation plan is a document that includes a description of the local conditions, the evacuation strategy and procedures, evacuation maps, and recommendations for further steps that need to be taken into account to improve local preparedness.

Additionally, the guidebook includes a glossary of important terms and lists a set of reference documents.

JRC: Handbook of Tsunami Evacuation Planning

The JRC handbook aims at providing thorough and hands-on information and a fully-comprehensive methodology of tsunami evacuation plan generation. For this purpose, community-employed decision makers or similar stakeholders are supplied with a detailed guideline to implement a fully-fledged evacuation plan within three stages: set-up of valid first instance of evacuation plan, mid-term revision, and long-term revision and integration.

A tsunami evacuation plan is understood as part of a strategy including early warning, preparedness, and awareness. It is a plan that will be invoked if a tsunami alarm has been triggered. Hence a tsunami evacuation plan will affect a variety of preparedness measures to be activated in the case of tsunami alert. According to the guidebook, the purpose of a tsunami evacuation plan is to save the life of those persons that might be affected by the incoming tsunami waves. Primary aim of a tsunami evacuation plan should therefore be to guide all affected persons along the evacuation routes towards safe places in time.

The proposed methodology to develop a tsunami evacuation plan is using a fact-finding and analytical (risk) approach and is implemented in three iterative steps (Figure 7).

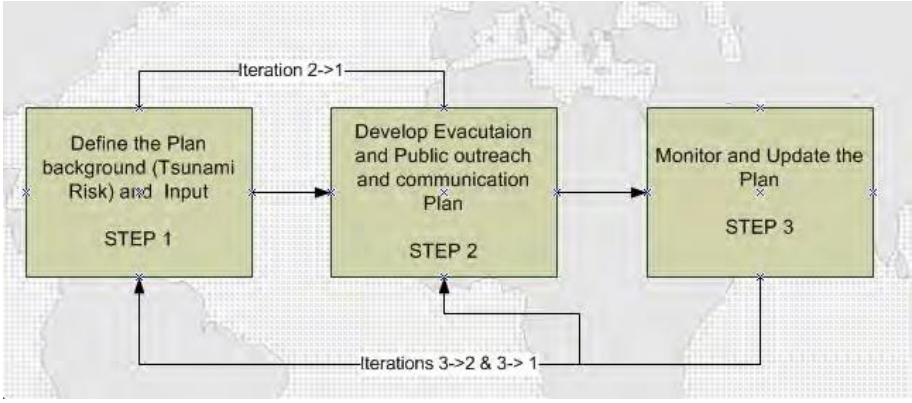


Figure 7: Three iterative steps to develop tsunami evacuation plan according to JRC (2011)

Step 1. **Risk and impact analysis for the definition of the plan background and input**. The outcome of this task will be the designation of a valid network of escape routes and safe locations to be used during a warning or an emergency for guiding the population at risk timely and safely.

Step 2. **Evacuation plan production and implementation**. The outcome of this task is that of producing and communicating a tsunami evacuation plan in which the escape routes, assembly points, safe locations and the emergency shelters will be clearly marked. The implementation of an evacuation plan foresees also that the meaning of evacuation is incorporated by the potentially affected population through training exercises and by the public administrations through the definition of tasks and allocation of resources in order to keep a valid evacuation plan “alive”.

Step 3. **Evacuation plan deployment, monitor and update**. This step includes the integration with an early warning system and other (multi-hazard) emergency plans. A feasibility and acceptance review shall ensure the validation of the plan regarding practical applicability. Long term maintenance includes the revision of an existing tsunami evacuation plan and its current implementation.

The guidebook further includes a section on sociologic aspects of hazard acceptance and evacuation based on experiences from a test site at Setúbal /Portugal as well as a chapter on possible difficulties and limitations in the context of tsunami evacuation planning.

Common ground and differences

In principle, the conceptual approaches of the three guidelines regarding evacuation planning do not differ significantly. There is broad agreement in the **elements to be considered and their interdependencies**. This can be summarized and visualized as follows:

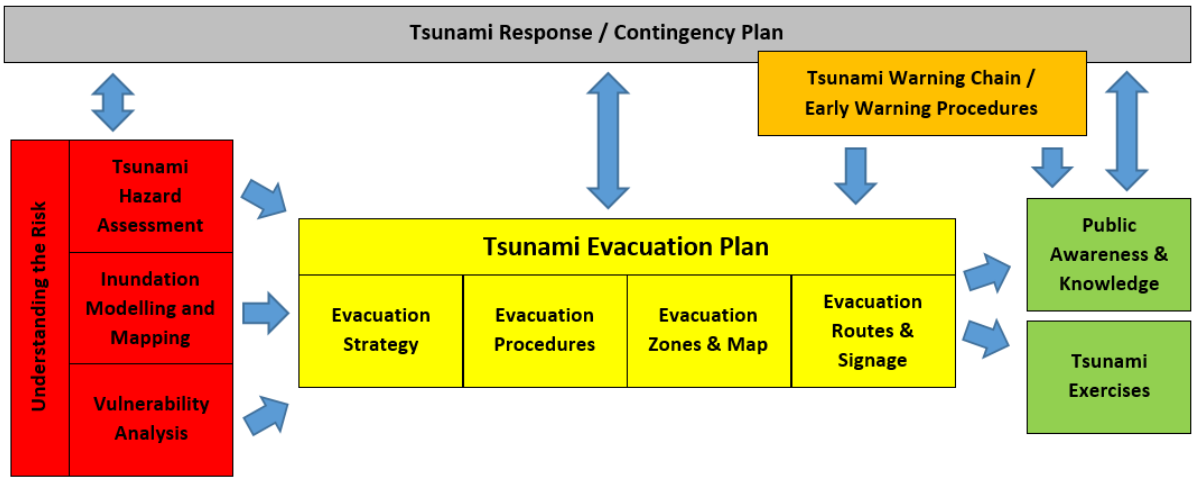


Figure 8: Key Elements of community tsunami preparedness and evacuation planning and their interrelationships (compiled by the author)

On the other hand, there are some slight differences in the **methodological approach for the design of an evacuation plan**, as well as the orientation of the guides in terms of supporting local stakeholders in carrying out the different steps of the planning process. Main differences in terms of the methodological approach are:

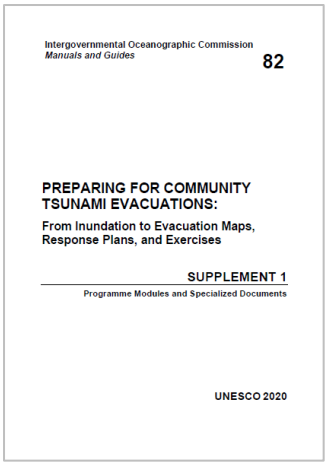
- The IOC Manual 82 provides for the production of an evacuation map as a first step, followed by the establishment of appropriate procedures within the framework of a response plan
- The JRC Manual also starts with the designation of a network of escape routes and safe locations. This includes the generation of evacuation simulation maps to determine feasible options to decide on horizontal and/or vertical shelter. This is considered an expert task. In the second step these findings will be integrated into an evacuation plan which will be communicated to the public by local authorities.
- The GITEWS guide proposes to agree first on an overall evacuation strategy which reflects the local conditions and available evacuation time. Such a strategy defines the modes of evacuation (horizontal and/or vertical evacuation, on foot or by vehicles) and an appropriate evacuation zoning concept including safe areas and evacuation routes. Subsequently an evacuation map and procedures are developed as part of an evacuation plan.

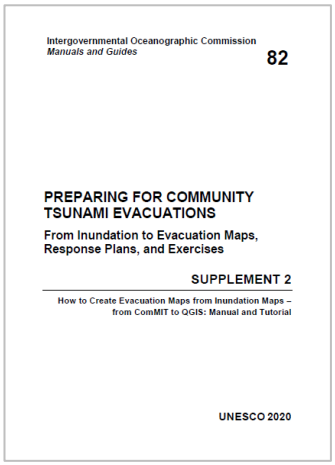
Basically, the differences are relatively small and the question of which of these approaches should be adopted is more a matter of framework conditions. Evacuation planning in rural areas with low population density is usually a straight forward and rather simple exercise, while the development of a suitable evacuation plan in urban environments with large inundation areas can be quite complex.

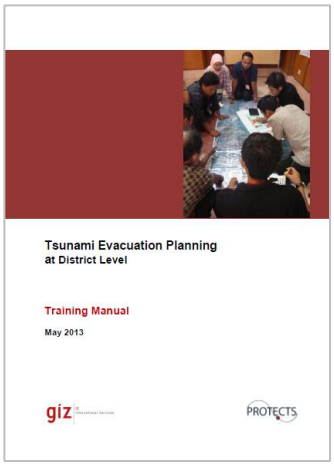
Of course, it is also a question of the available resources (human, financial, time), which decide how such a planning process can be designed. This includes the question of who develops the plan. A plan that is developed by local stakeholders largely on their own with some external guidance will follow a different approach than one that is designed with lots of expert support. In addition, it must always be taken into account to what extent there are already national standards and guidelines as well as support offers, which are to be taken into account when selecting the methodological approach.

5. Training Modules for Tsunami Evacuation Planning

Two of the guides, the IOC Manual 82 and the GITEWS Guidebook, are complemented by training modules.







IOC Manuals and Guides 82

The IOC Manual 82 is closely related to the **TEMPP training** course, which has been developed as a standardized course and process for the production of reliable and practical community-level tsunami evacuation maps. The technical and practical basis for the guide has been developed over the period 2015–2017 via a pilot course in Honduras.

The IOC Manual 82 consists of a guide and two supplementing documents. The guide presents a high-level summary of each programme module and the rationale behind them. Supplements contain additional detailed information, templates, reference to specialized documents, tutorials and best practice examples.

- Supplement 1: Programme Modules and Specialized Documents
- Supplement 2: How to Create Evacuation Maps from Inundation Maps – from ComMIT to QGIS: Manual and Tutorial

The TEMPP course consists of a linked **set of five 1-week training workshops**, each building upon the previous, that applied global standardized tools and methodologies on:

- Inundation Modelling and Inundation Map Development (TEMPP 1 and 2)
- Evacuation Map Development and Evacuation Planning (TEMPP 3)
- Tsunami Warning and Emergency Response Standard Operating Procedures (SOPs).
- (TEMPP 4)
- Conducting Community Tsunami Exercises (including evacuation) (TEMPP 5)

Target groups for the training modules are mainly staff from Disaster Management Agencies and other governmental institutions (local and national) and leaders from civil society organizations. The module on tsunami modelling has a different target group, which are physical scientists and oceanographers in governmental institutions and universities.

The most current versions of the Supplement to the Programme Modules and the Specialised Documents are available or can be download from the ITIC Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) website: http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=2166&Itemid=2640

PROTECTS training module “Tsunami Evacuation Planning at District Level”

This training module was developed under the PROTECTS project (the follow-up project to GITEWS) to address the training needs for professionals under the coordination of district/city or provincial disaster management agencies to facilitate tsunami evacuation planning in their areas. The training approach is based on the GITEWS Guidebook “Planning for Tsunami Evacuation”.

Training objective: develop capacities in tsunami evacuation planning by training professionals from local institutions who will become technical resource persons as well as facilitators in evacuation plan development processes at the district/city level.

The **5-day training** is designed in a way that it relates to specific local conditions and to be carried out preferably in preparation for an upcoming evacuation planning process. The topics covered by the training include basic concepts and principles of tsunami evacuation planning and follows a simple 5 steps approach as outlined in the related Guidebook “Planning for Tsunami Evacuation”. The training is “hands on” and participants are exercising the development of evacuation strategies and procedures based on real cases. It also addresses issues like the endorsement of evacuation plans and communicating them to the public. The learning experience is complemented by a follow up planning and supposed to lead to an action plan to help putting intended evacuation planning processes on track. Ideally, representatives of the respective local authorities should be present during the last training day to participate in the follow up planning.

The Training Module consists of the Training Manual and a set of supporting materials. The training Manual contains a training moderation plan and a list of supporting materials for trainers to conduct a tsunami evacuation planning training. The full set of supporting materials has been developed for training courses in Indonesia and is only available in Indonesian language.

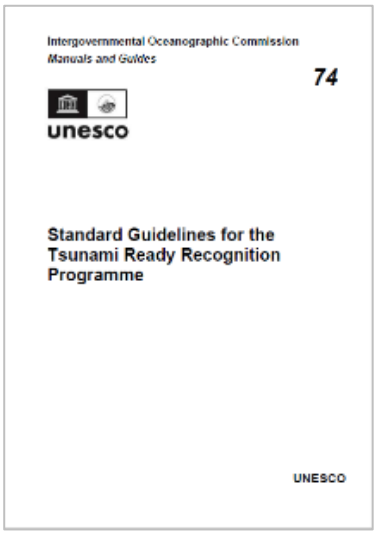
The **target groups** for the training are professionals with government, NGO or university background related to and/or assigned by local or provincial disaster management to advise and to facilitate local evacuation planning processes. Having, these individuals may be those who will play a key role in local working groups to strengthen tsunami preparedness

The training has been successfully applied in a number of provinces and districts in Java, Bali and Lombok in the frame of the PROTECTS project. Even though it was developed for the Indonesian context, the training approach is easily transferable to other countries with similar framework conditions.

6. Link to the Tsunami Ready Approach

Another important reference is the set of indicators applied in the **Tsunami Ready** initiative as documented in the Intergovernmental Oceanographic Commission - Manuals and Guides 74: Standard Guidelines for the Tsunami Ready Recognition Programme (UNESCO, 2022).

The Tsunami Ready Recognition Programme aims to build resilient communities through awareness and preparedness strategies that will protect life, livelihoods and property from tsunamis in different regions. The main goal of the programme is to improve coastal community preparedness for tsunamis and to minimize the loss of life, livelihoods and property. This is achieved through a collaborative effort to meet a standard level of tsunami preparedness through the fulfilment of a set of established indicators.



	TSUNAMI READY INDICATORS
I	**ASSESSMENT (ASSESS)**
1	**ASSESS-1**. Tsunami hazard zones are mapped and designated.
2	**ASSESS-2**. The number of people at risk in the tsunami hazard zone is estimated.
3	**ASSESS-3**. Economic, infrastructural, political, and social resources are identified.
II	**PREPAREDNESS (PREP)**
4	**PREP-1**. Easily understood tsunami evacuation maps are approved.
5	**PREP-2**. Tsunami information including signage is publicly displayed.
6	**PREP-3**. Outreach and public awareness and education resources are available and distributed.
7	**PREP-4**. Outreach or educational activities are held at least three times a year.
8	**PREP-5**: A community tsunami exercise is conducted at least every two years.
III	**RESPONSE (RESP)**
9	**RESP-1**. A community tsunami emergency response plan is approved.
10	**RESP-2**. The capacity to manage emergency response operations during a tsunami is in place.
11	**RESP-3**. Redundant and reliable means to timely receive 24-hour official tsunami alerts are in place.
12	**RESP-4**. Redundant and reliable means to timely disseminate 24-hour official tsunami alerts to the public are in place.

Figure 10: Set of Tsunami Ready Indicator (UNESCO 2022)

The set of Tsunami Ready indicators links seamlessly and fully into the outlined scheme (Figure 8) of community tsunami preparedness and evacuation planning elements (Figure 11).

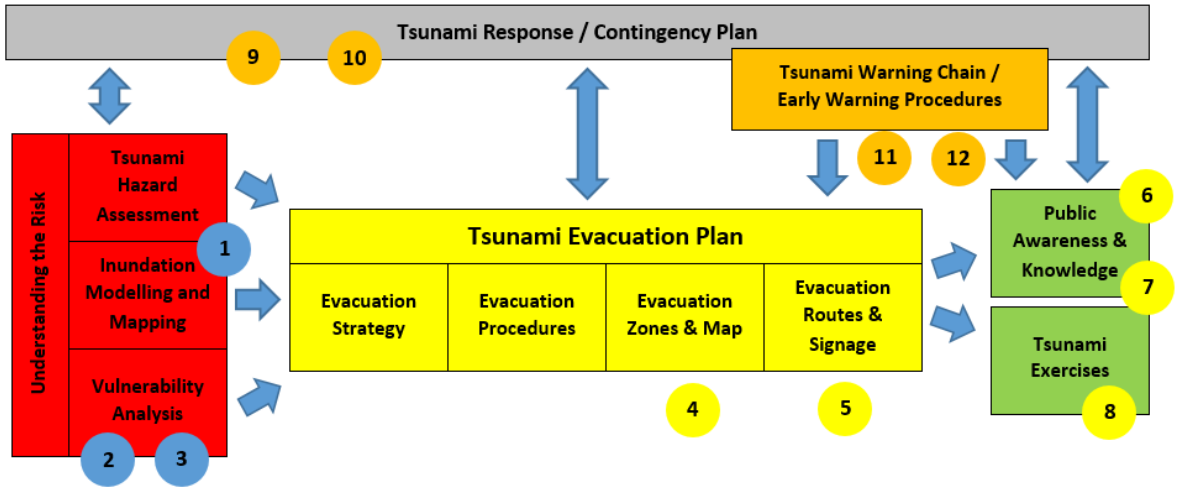


Figure 11: Key elements of tsunami evacuation planning and their relationships with the Tsunami Ready Indicators (see numbering in figure 10 / compiled by author)

7. Good Practices

Tsunami Evacuation Planning Process

Tsunami evacuation planning is ideally done in an integrated manner that ensures its practical implementation and is linked to other elements of local tsunami preparedness such as tsunami response planning and early warning systems, and fits into preparedness programs such as the Tsunami Readiness Initiative. It should be emphasized that evacuation planning is not a one-time planning process, but one that needs to be reviewed regularly and updated as needed.

Drawing from the three guides, it is possible to delineate a generally applicable **planning cycle** for evacuation planning:

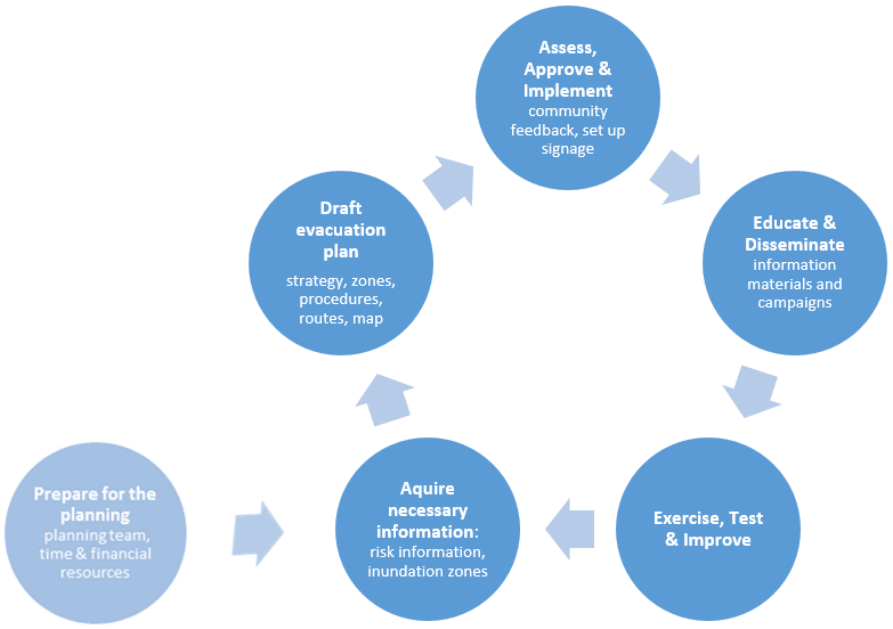


Figure 12: Outline of a generic tsunami evacuation planning cycle (compiled by the author)

There are a number of issues that require special attention when organizing the planning process:

- Evacuation planning for administrative units like districts, cities or villages are responsibility of public institutions. Be sure to clarify on **mandates, roles** and **responsibilities** of the relevant stakeholder. Any plan should get **official approval** before disseminating it to the public.
- Check for national **policies** and **guidelines** on tsunami evacuation planning to assure that your efforts will be in line with existing requirements.
- **Involve local stakeholder from different backgrounds** (public, private, NGO, community) in the evacuation planning process. This will not only lead to more realistic planning results and ownership, but will also provide for a good **opportunity to develop capacities** at the local level on tsunami preparedness.
- Make sure that the planning team has the required **human** and **financial resources** to steer and conduct the planning process in an appropriate way. Involve external support for facilitation and technical guidance as needed.

Tsunami Evacuation Strategies

Communities may face different types of tsunami threats (near-field, far-field, seismic induced or non-seismic induced tsunamis) and have different environmental and settlement conditions which need to be considered when developing tsunami evacuation plans and maps. A densely populated city in a low lying coastal area face different challenges in this regards compared to a rural community with hilly hinterland. Therefore, a good understanding of these framework conditions is necessary in order to develop conclusions for an appropriate evacuation strategy.

The development of a locally suitable tsunami evacuation strategy requires the consideration of several aspects like the available evacuation time, the size of the area and the number of people to be evacuated and the possibilities of reaching safe ground in time. Local tsunami evacuation strategies may differ in terms of evacuation modes (horizontal or vertical evacuation strategies), the number of evacuation zones (usually one or two zones), the triggering of the evacuation process and whether to evacuate on foot or using vehicles (Figure 13).

■ **Evacuation time:**	the time that people have to reach a safe location
■ **Evacuation zone(s) and safe areas:**	the zone(s) that people need to leave and the areas that are safe from tsunami inundation
■ **Modes of evacuation:**	horizontal and vertical evacuation, evacuation on foot, by motorbike or car
■ **Evacuation routes:**	the paths that lead to safe locations
■ **When to (self-)evacuate:**	the trigger for evacuation

Figure 13: Issues to be considered when defining a locally adapted tsunami evacuation strategy (GITEWS, 2010)

Tsunami Evacuation Procedures

Ultimately, the established tsunami evacuation strategy must be translated into brief and concise instructions for local evacuation procedures. These instructions complement the map section, which indicate evacuation zones, routes and safe areas (Figure 14). Procedures can be displayed in different languages if necessary.

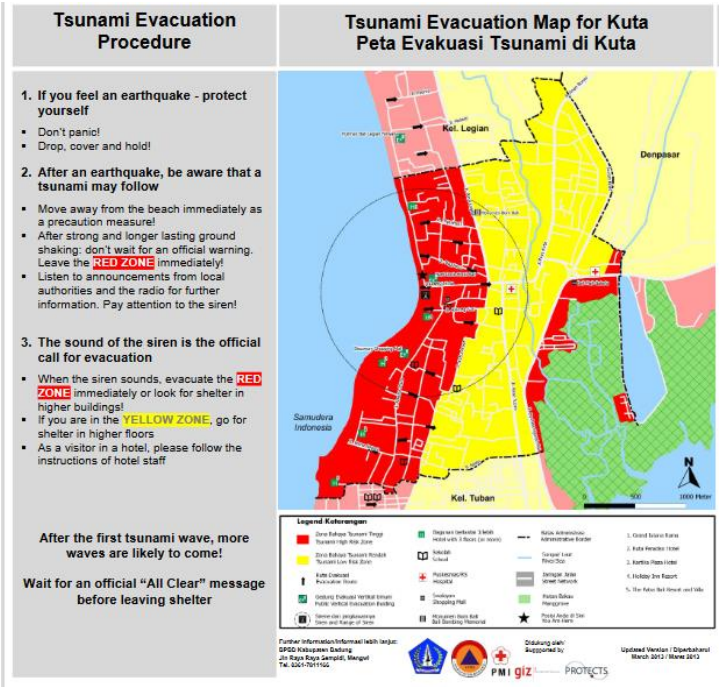


Figure 14: Tsunami evacuation procedures and map. Example from Kuta in Bali / Indonesia (PROTECTS, 2013)

Tsunami Evacuation Maps

Defining **minimum requirements** and **standards** is considered good practice to develop consistent and reliable tsunami evacuation maps, thereby avoiding public confusion and misconceptions about tsunami evacuation maps. There are a number of guidelines available which have been developed by different countries and projects.

In any case, tsunami evacuation maps must delineate zones that should be evacuated in the event of a tsunami and should reference technical documentation on how the map was made and its intended use. Figure 15 provides an example of the **basic contents** to be displayed in an evacuation map (NTHMP, 2011).

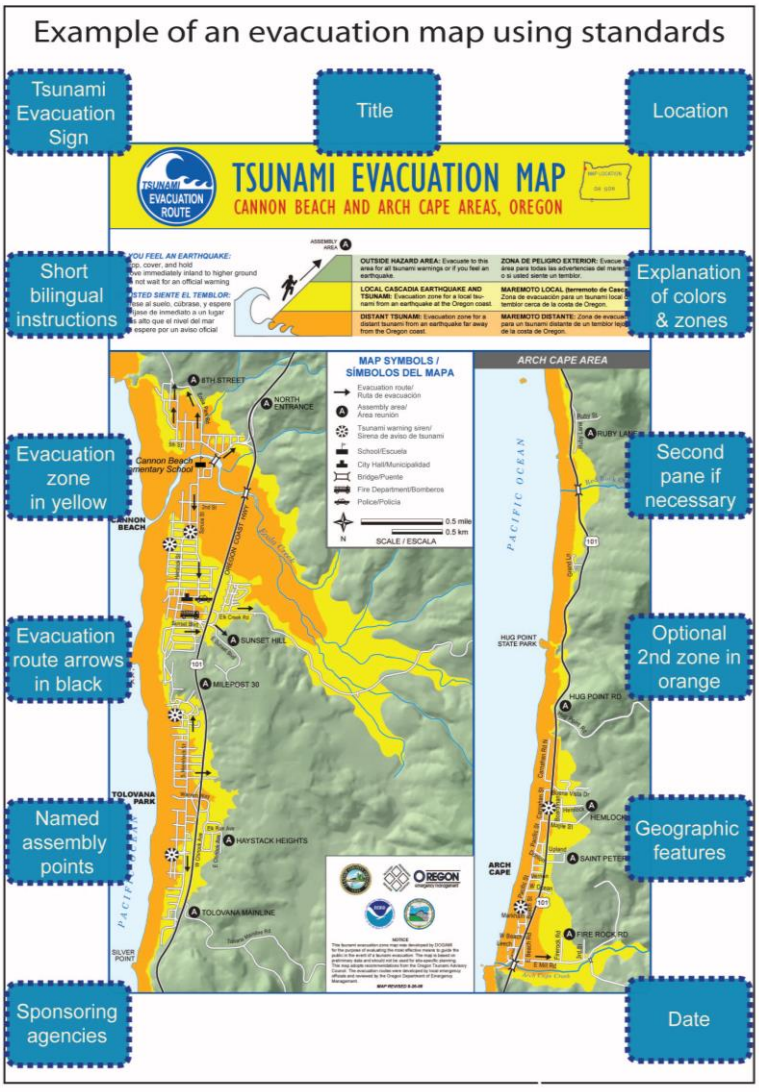


Figure 15: Example of a standard for basic map content to be displayed in tsunami evacuation maps (NTHMP, 2011)

Other standards might refer to symbols, colour codes, base maps to be used, scale, legends, logos and the overall layout of an evacuation map.

It is strongly recommended that TTF project partner countries consider developing their own standards for the design and layout of tsunami evacuation maps. These standards should be consistent with evacuation map standards already developed for other hazards (e.g. floods) in the respective country, if available and feasible. In addition, consideration should be given to whether regional standardization might make sense.

Tsunami Evacuation Signage

Evacuation signage plays an important role in providing guidance to people in risk areas during an emergency as they indicate escape routes and safe areas. They are also permanent reminders and help build and sustain tsunami awareness and preparedness. Evacuation signs that indicate evacuation routes need to be quickly recognizable and easy to understand by local residents, as well people who are not familiar with the area. This is the reason why national or international standards are considered necessary.

In 2008, the International Organization for Standardization (ISO) approved international signage for tsunami hazard zones, evacuation areas and evacuation buildings. ISO 20712 on water safety signs and beach safety flags provides guidance on safety signs that provide information about aquatic hazards and the action necessary to avoid those hazards, including signage for tsunami hazard areas. It includes signage for tsunami hazard zones, evacuation areas and buildings (Figure 16a) as well as directional signs to show the evacuation route the closest safe area or evacuation building (Figure 16b).

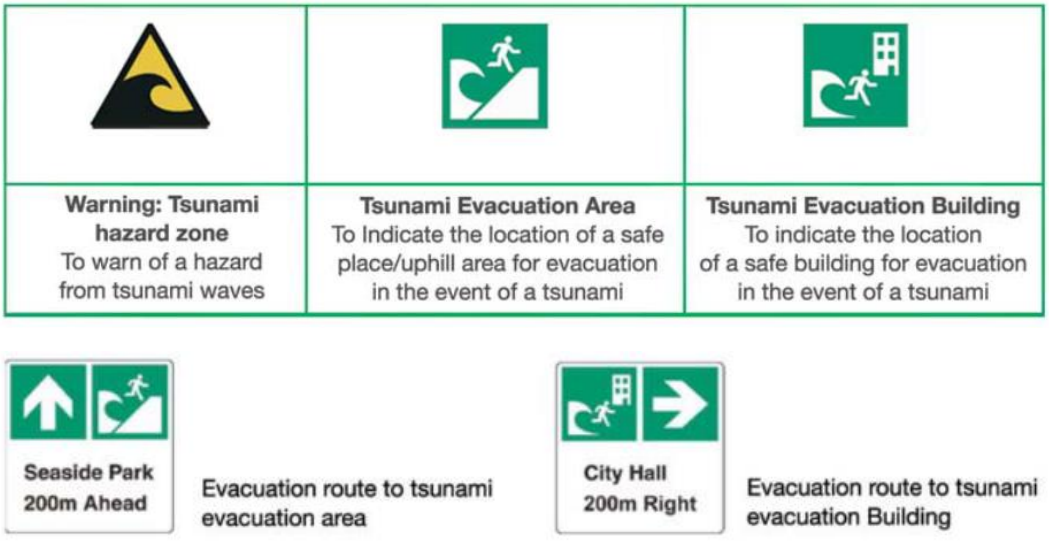


Figure 16a / b: Tsunami evacuation signage in line with ISO 20712 (ITIC Website, GITEWS 2010)

Besides the ISO Standard, many countries have developed and deployed their own approaches or standards for tsunami evacuation signage, which are depicted through a variety of symbols, graphics, texts, sign shapes and colours (Figure 17).

Figure 17: Examples from tsunami evacuation signage in the USA, Puerto Rico, New Zealand and Indonesia (ITIC Website)

Same as for tsunami evacuation maps, it is strongly recommended that project partner countries consider developing their own standards for the design and layout of tsunami evacuation signage. Also here, consideration should be given to whether a regional standardization might make sense.

8. Resources

Tsunami Evacuation Guidebooks

IOC Manuals and Guides 82 “Preparing for Community Tsunami Evacuations: from inundation to evacuation maps, response plans and exercises” (UNESCO 2020): https://unesdoc.unesco.org/ark:/48223/pf0000373019

GITEWS Guidebook “Planning for tsunami evacuations” (GITEWS 2010): https://www.gitews.org/tsunami-kit/en/E4/tool/Guidebook%20Planning%20for%20Tsunami%20Evacuations.pdf

JRC Handbook for Tsunami Evacuation Planning (JRC 2011): https://publications.jrc.ec.europa.eu/repository/bitstream/JRC61202/lbna24707enc.pdf

IOC Manuals and Guides 76 “Plans and procedures for tsunami warning and emergency management” (UNESCO 2017): https://unesdoc.unesco.org/ark:/48223/pf0000256552?posInSet=3&queryId=71f19dfe-8bdd-4982-947f-2d4fb49a1d7d

Tsunami Evacuation Training Modules

Tsunami Evacuation Maps, Plans and Procedures (TEMPP): http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=2166&Itemid=2640.

GITEWS/PROTECTS training module “Tsunami Evacuation Planning at District Level” (PROTECTS 2013): https://www.gitews.org/tsunami-kit/en/E4/tool/Training%20Manual%20-%20Tsunami%20Evacuation%20Planning%20at%20District%20Level.pdf

Good Practices

https://www.civildefence.govt.nz/assets/Uploads/publications/dgl-08-16-Tsunami-Evacuation-Zones.pdf

NTHMP (2011): Guidelines and Best Practices for Tsunami Evacuation Mapping Guidelines https://nws.weather.gov/nthmp/documents/4evacuationmapsguidelines.pdf

ITIC - International Tsunami Signs - ISO-approved (2008): http://itic.ioc-unesco.org/index.php?option=com_content&view=article&id=1645&Itemid=2322

ITIC - Signs & Symbols: http://itic.ioc-unesco.org/index.php?option=com_content&view=category&id=1406&Itemid=2280

https://nws.weather.gov/nthmp/signs/signs.html

https://www.gitews.org/tsunami-kit/en/E4/info/Evacuation%20Signage.pdf

Other Related Online Resources

UNESCO/IOC Tsunami Ready Programme: http://itic.ioc-unesco.org/index.php?option=com_content&view=category&id=2234&Itemid=2758

IOC Manuals and Guides 74 “Standard Guidelines for the Tsunami Ready Recognition Programme” (UNESCO 2022): https://unesdoc.unesco.org/ark:/48223/pf0000381353

https://iotic.ioc-unesco.org/

http://itic.ioc-unesco.org/images/stories/about_tsunamis/tsunami_glossary/tsunami_glossary_en_v19.pdf

https://www.tsunamizone.org/

https://www.gitews.org/tsunami-kit/index_en.html