BREEAM®IN USE

COMPLIANCE REPORT

RSL 01, RSL 03, LUE 02

LUE 03 Y LUE 04

"PORTO TOWER STUDENT RESIDENCE" PORTO (PORTUGAL)

Version	**1**
Date	**05/05/2025**
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4. RSL.03 NATURAL HAZARD RISK ASSESSMENT

According to the BREEAM® ES In-Use International Commercial V6 Manual for non-residential buildings, the natural hazards to be considered are "those natural processes or phenomena occurring in the biosphere or Earth's crust that may result in a natural disaster." The following are included:

· Flooding

· Natural disasters of geological origin, such as volcanic eruptions, earthquakes, landslides, tsunamis, and seaquakes.

· Natural disasters of climatic or meteorological origin, such as droughts, avalanches, waves and swell, windstorms (including cyclones, hurricanes, tornadoes, tropical storms, and typhoons).

· Wildfires.

4.1 Flooding.

Flood risk has already been analyzed and developed in the compliance report for criterion RSL 01. The conclusion, after reviewing the project, plans, calculations, applicable regulations, technical documents, historical analysis, geology, and geomorphology—and considering all potential sources of flooding—is that the site is located in an area not affected by flooding, even for return periods of at least 500 years. Therefore, this risk does not exist for the site.

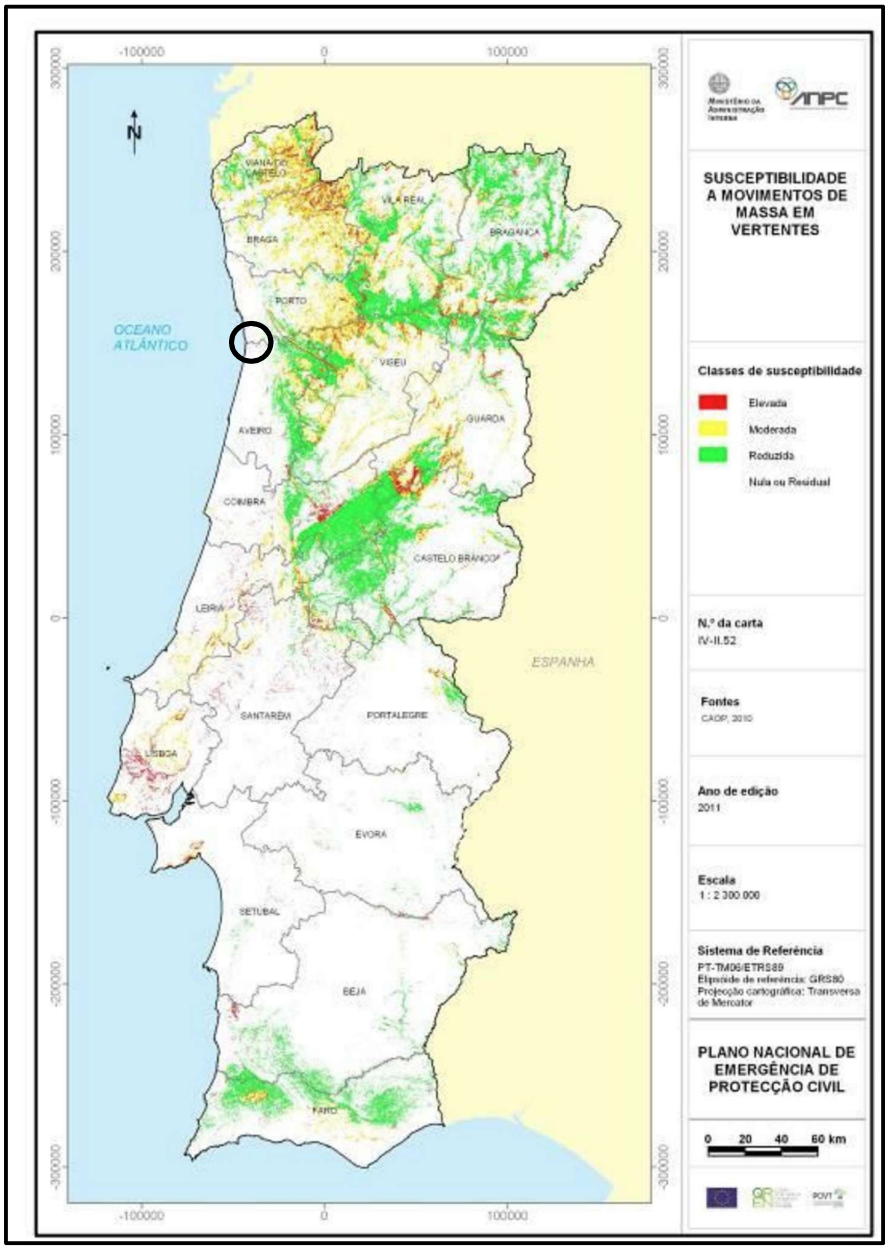
4.2 Natural disasters of geological origin

Volcanic Risk.

Porto is an area with no volcanic risk because it sits in a geologically stable region, far from tectonic plate boundaries where volcanoes typically form. Mainland Portugal, including Porto, is on the Eurasian Plate, without hotspots or active faults that could cause volcanic activity. The geological history of the region shows no evidence of recent volcanism, reinforcing its safety regarding this type of hazard.

Landslides.

The limited slopes around the residence and the high cohesion and strength of the geological substrate (granite) minimize and effectively nullify the risk of erosion and landslides near the residence.



Landslide Susceptibility Map.

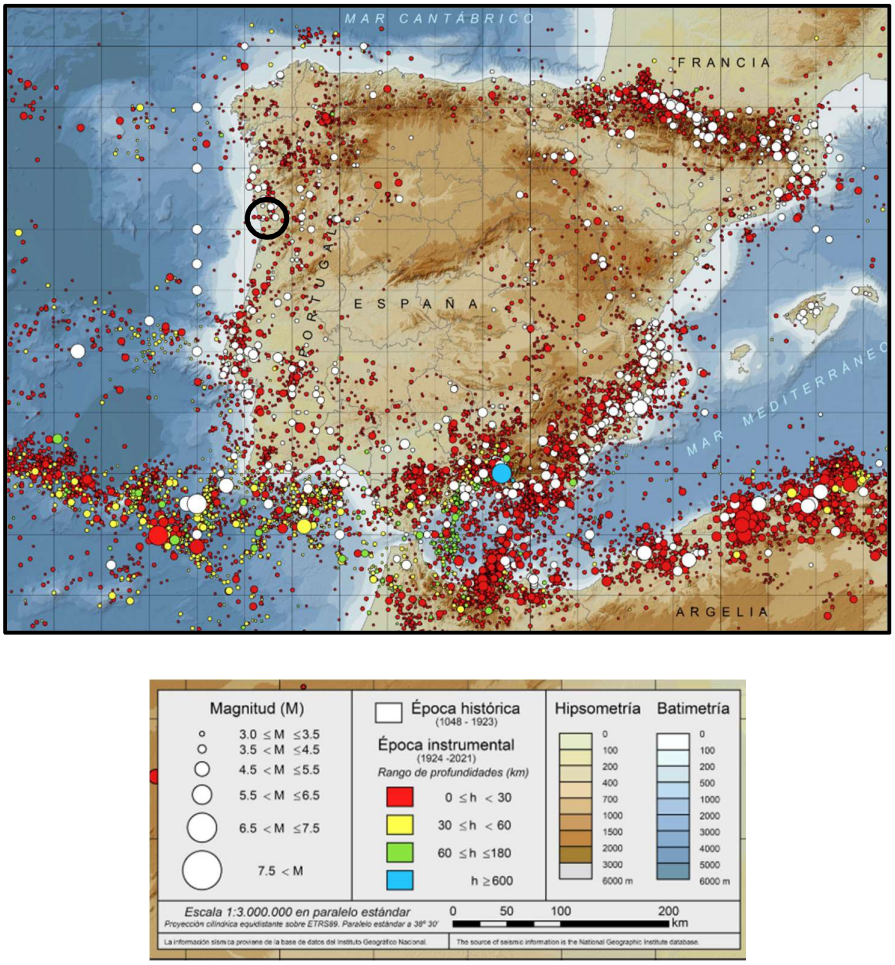
Source: Plano Nacional de Emergência de Proteção Civil – ANPC, 2013

Tsunamis and seaquakes.

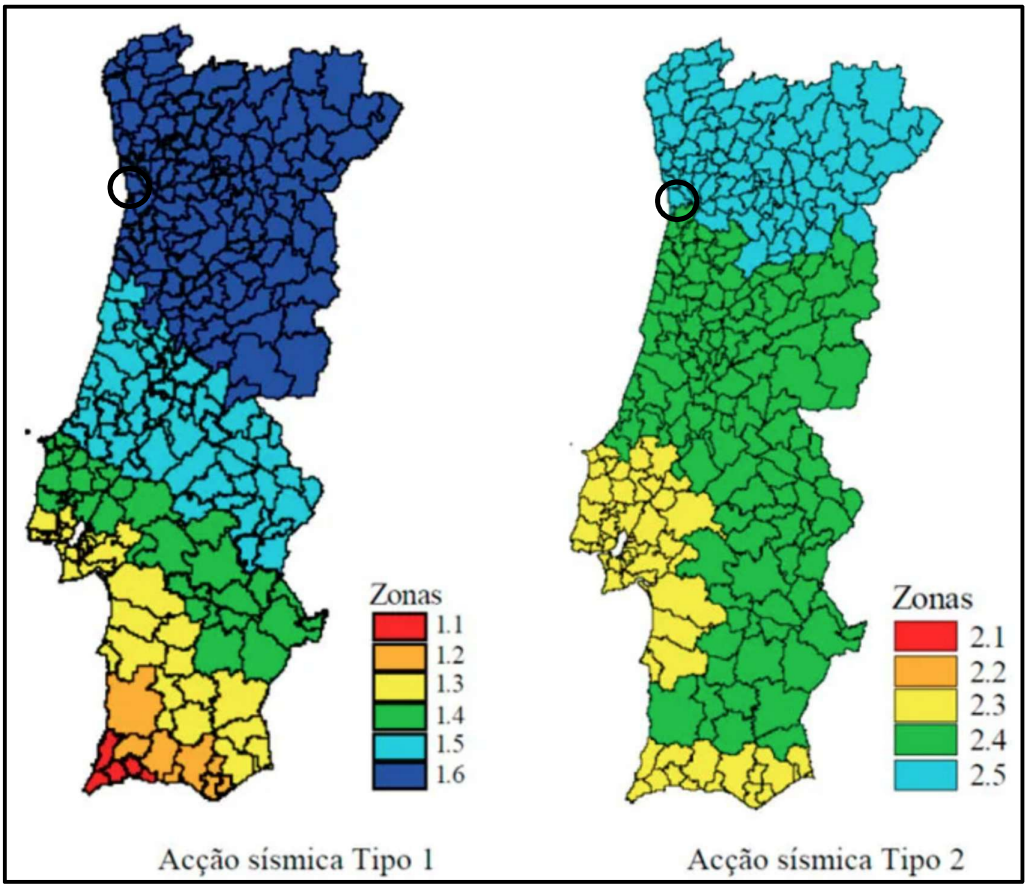
The risk from these natural hazards is null, given that the residence is located over 100 meters above sea level.

Seismic risk.

The seismicity in the Porto area is low, both for type 1 and type 2 earthquakes. Type 1 earthquakes, which are large-magnitude earthquakes generated in subduction zones and characterized by low-frequency, long-duration waves, present a very low reference seismic acceleration in this region, implying a very low structural risk. Type 2 earthquakes, which are shallower, lower-magnitude earthquakes but with high-frequency waves, also show limited hazard in Porto, with predicted accelerations that do not require special structural design measures beyond the usual standards.

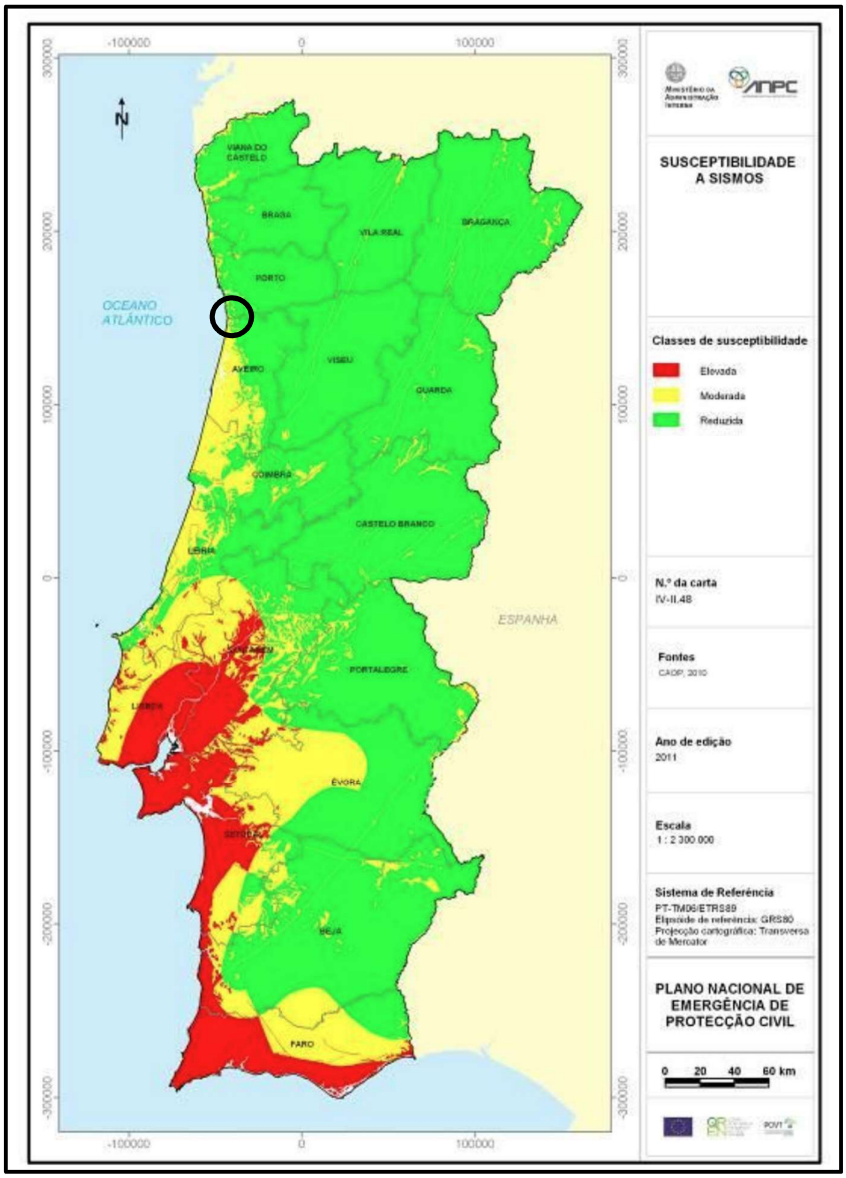


Seismicity of the Iberian Peninsula and surrounding areas. Source: Instituto Geográfico Nacional, Spain



Seismic zoning of Portugal according to Eurocode 8 (NP EN 1998-1).

Source: National Annex of Portugal (NP EN 1998-1)



Earthquake susceptibility map.

Source: Plano Nacional de Emergência e Proteção Civil – ANPC, 2013

Considering that the seismic risk is low and that both the design and construction of the building are recent, fully complying with the most demanding structural standards including Eurocodes related to seismic resistance, the probability of this risk materializing is low or null.

4.3 Natural disasters of meteorological (climatic) Origin

To define the fundamental components of climate risk, the definitions provided by the Intergovernmental Panel on Climate Change (IPCC) are used, as detailed below:

- **Risk:** The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as the probability of the occurrence of hazardous events or trends multiplied by the impacts if those events or trends occur. Risks result from the interaction of vulnerability, exposure, and hazard.

- **Vulnerability:** The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

- **Exposure:** The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.

- **Hazard:** The potential occurrence of a physical event, or trend of such events, of natural or human origin, or a physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.

Avalanches.

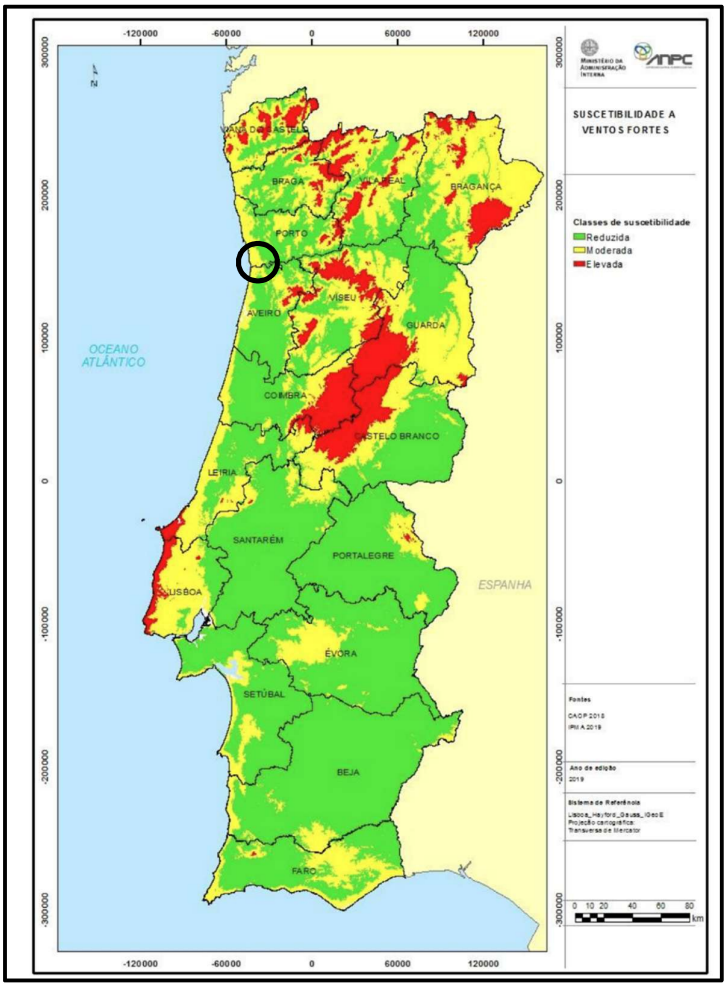
There is no risk, as Porto is not a region where snowfall occurs.

Waves and swell

No risk exists because the residence is located more than 100 meters above sea level.

Cyclones (including cyclones, hurricanes, tornadoes, tropical storms, and typhoons) and strong winds

The flood risk associated with extreme rainfall that cyclones may produce has been analyzed in RSL 01. Regarding the risk of strong winds, the site has a moderate risk of strong winds, so it is necessary to analyze vulnerability, exposure, and hazard.



Strong Winds Susceptibility Map.

Source: Instituto Português do Mar e da Atmosfera, 2019

Vulnerability is very low or null, considering that both the design and construction of the building are recent and comply with the strictest structural regulations, including Eurocodes related to wind resistance.

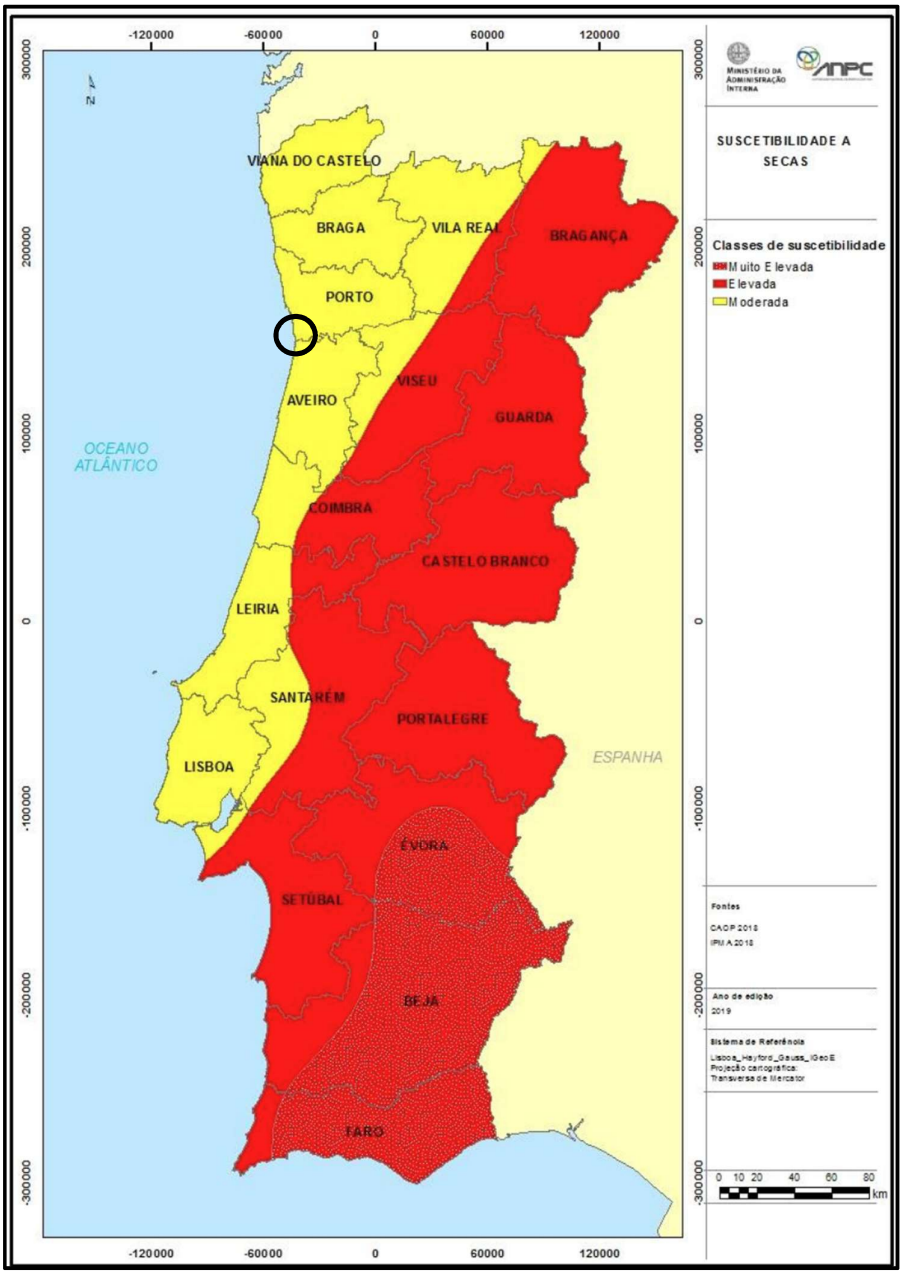
Droughts

Portugal has experienced several intense drought periods, with the most notable events occurring in 1994–1995 and 1990–1992.

Hydrological Year	Description
2017	100% of the territory was affected for several months.
2004–06	100% of the territory in meteorological drought for over 18 months.
1994–95	One of the most intense meteorological droughts of the 20th century; 100% of the territory in drought for over 12 months.
1990–92	Another of the most intense meteorological droughts of the 20th century; 100% of the territory in drought for over 18 months.

Main drought periods impacting public water supply. Source: National Emergency Plan – ANPC, 2012

The drought risk in northern Portugal is moderate, while it is high or very high in the south and interior regions.



Drought Susceptibility Map. Source: Instituto Português do Mar e da Atmosfera, 2019

According to climate projections, depending on different greenhouse gas emission scenarios and climate change, the drought risk in Portugal is expected to increase throughout the 21st century.

Based on the analyzed information, it is concluded that drought risk exists and, according to forecasts, is expected to rise. Therefore, it is appropriate to analyze whether this risk could constitute a "threat" as defined in the BREEAM Manual for the applicable criterion:

"A serious disruption of the functioning of a community or society, causing human losses and/or significant material, economic, or environmental losses that exceed the capacity of the affected community or society to cope using its own resources."

The factors for determining whether this risk could exceed the capacity of the community or society to manage it with their own resources are as follows:

- The drought risk in Portugal has been long analyzed and mitigated through measures to increase water storage, promote savings, and improve efficiency in water use.
- The reduction in precipitation estimated by climate models is not drastic and is a well-known situation.
- Portugal, and specifically the Douro basin, has an extensive network of reservoirs.
- In case of drought, there are established protocols to limit and reduce potential damage.
- The intended use of the building does not have high water consumption because of its nature (hospitality use).
- Water consumption is for essential and priority uses (such as sanitation). Considering that the first restrictions during a drought typically apply to agriculture and industry, the building's supply is ensured even in severe restriction scenarios.

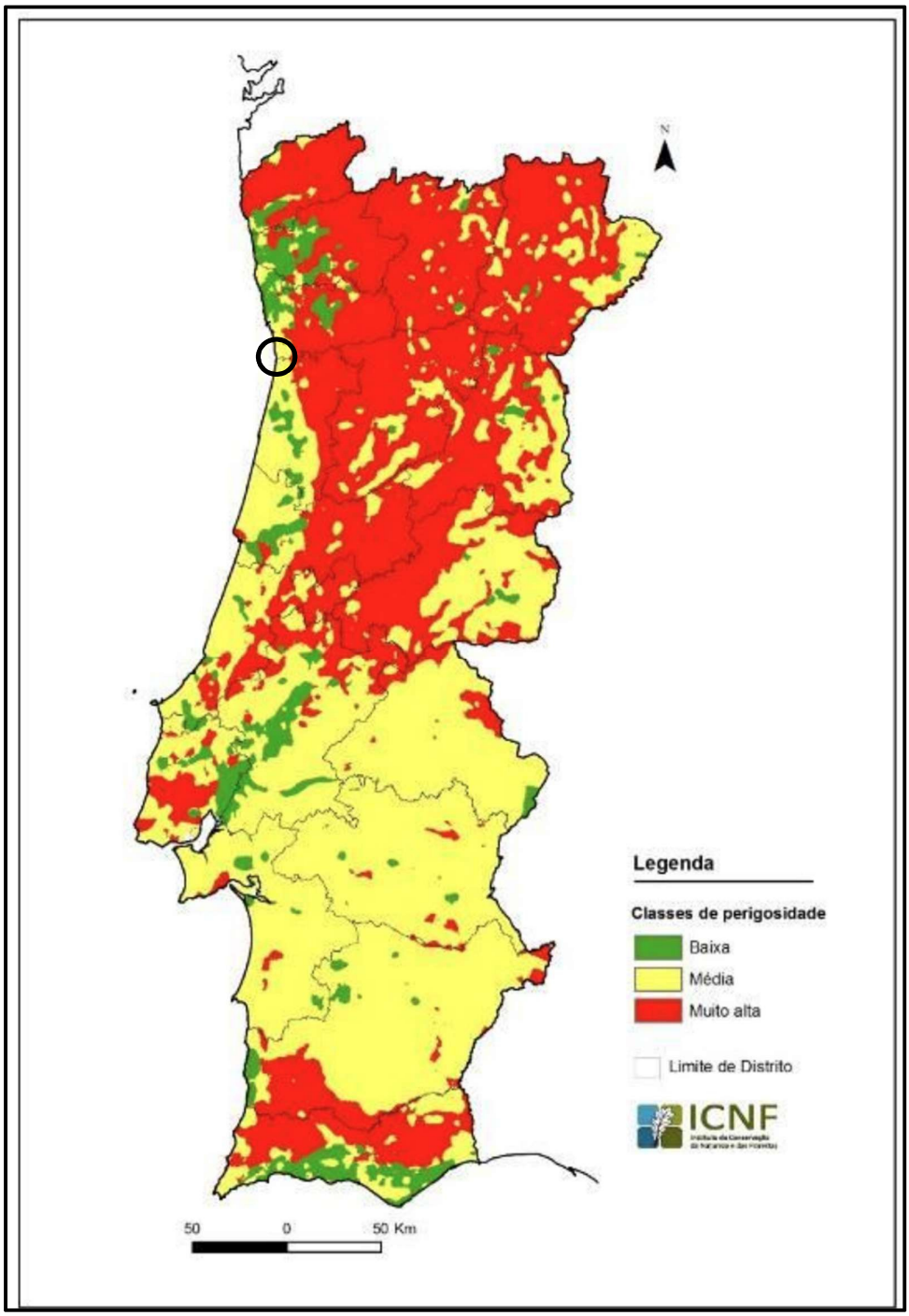
Therefore, it is unlikely that this risk could exceed the capacity of Portuguese institutions and society in Porto to prevent and address it using their own resources

4.4 Fire risk

The fire risk in the surroundings of the residence is conditioned by two key factors:

- The region's oceanic climate, which is characterized by high humidity. These conditions make it difficult for fires to spread because both the air and outdoor materials are less dry than in inland areas.

- The northern part of Porto is predominantly a consolidated urban environment with modern infrastructure, nearby emergency services, and strict building and fire safety regulations, which reduce the likelihood of severe incidents.



Wildfire Hazard Map. Source: Instituto da Conservação da Natureza e das Florestas, 2014

At the local scale, it is concluded that the absence of significant combustible material in the surroundings, the presence of various elements acting as firebreaks—such as Highway A20, roads, paths, and urban areas—and moderate slopes mean that the fire risk is low or null.

4.5 Conclusions – Compliance with RSL 03

The site presents a low incidence of natural hazards, with the only relevant risk being drought. However, due to the nature of the project—with low and priority water consumption—this is not expected to affect the project.

The building is in an area where there are no significant natural hazard risks; therefore, it qualifies for a rating of 4 credits under RSL 03