

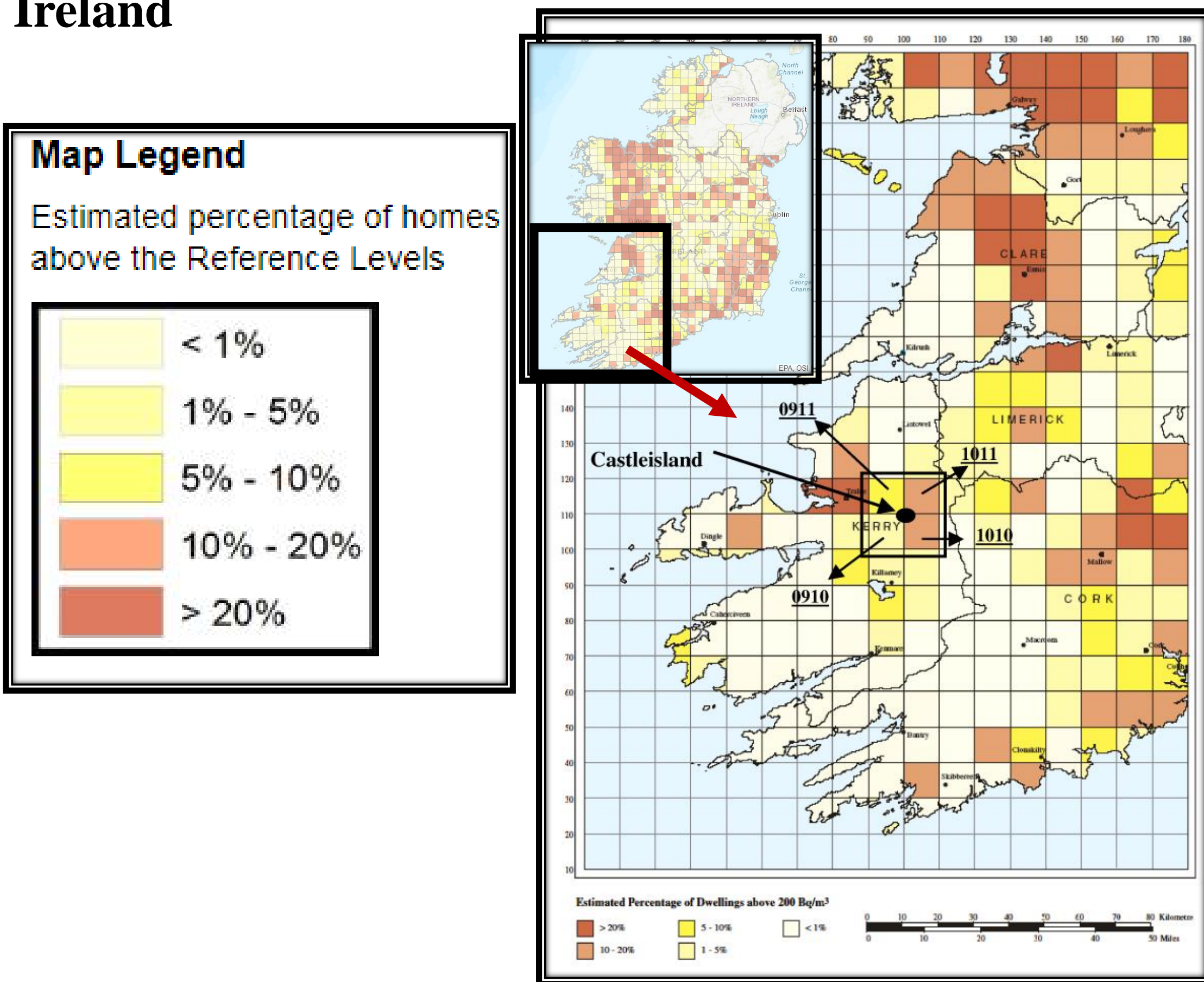
# Using geogenic radon potential to assess designation of radon priority areas in Ireland

Meabh Hughes<sup>1\*</sup>, Quentin Crowley<sup>1,2</sup> \*mhughes5@tcd.ie

<sup>1</sup>Department of Geology, Trinity College, Dublin, Ireland

<sup>2</sup>Centre for the Environment, Trinity College, Dublin, Ireland

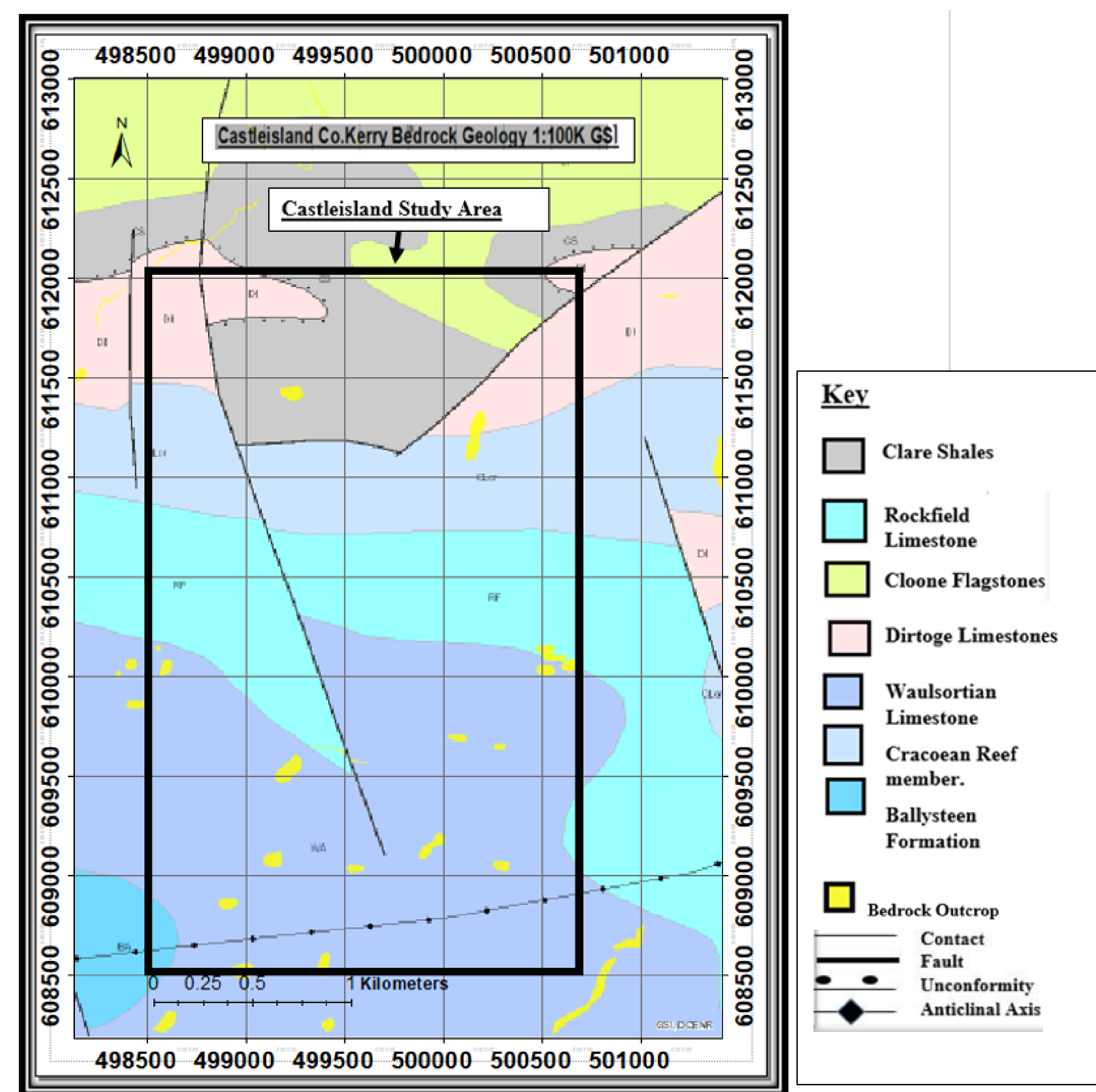
**Fig. 1** Current legislative radon hazard map for Ireland



RPII 2002. Organeau et al., 2007. The above map highlights the radon risk and location of Castleisland in relation to the South-west of Ireland.

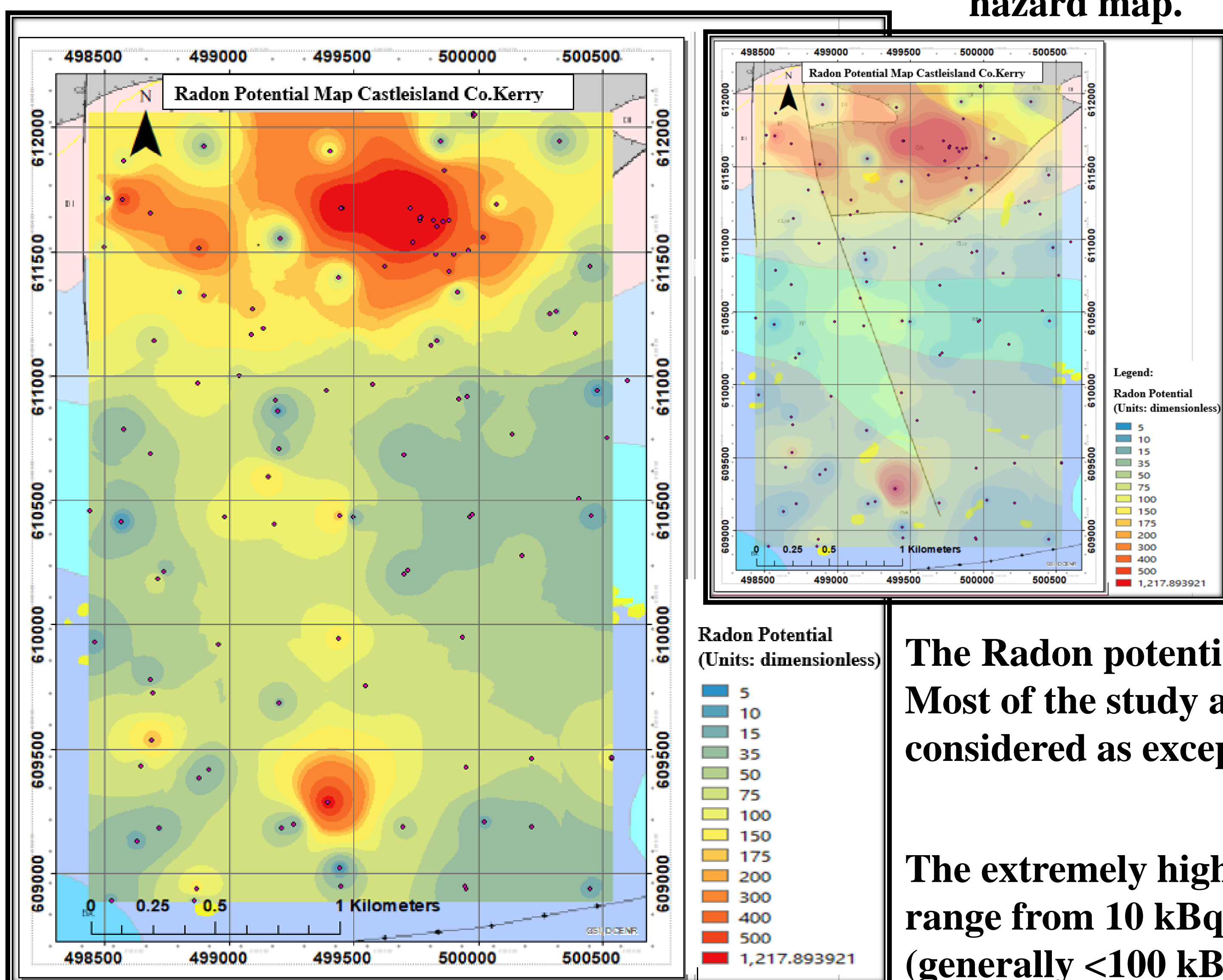
The Radiological Protective Institute of Ireland (RPII since joined with EPA) has produced a national radon hazard map (**figure 1**) exclusively based on indoor radon measurements grouped in 10x10km grids. The scale shows % of homes likely to exceed the 200 Bq/m<sup>3</sup> reference level. Grids where  $\geq 10\%$  of homes are estimated to exceed the reference level are designated as *high radon areas*. This study focuses in the area of Castleisland in the South West of Ireland, which according to the legislative map is not a high radon area, even though an exceptionally high indoor radon value of 49,000 Bq/m<sup>3</sup> was found there. This research investigates the use of in-situ Radon Potential (RP) measurements to assess the existing national legislative radon hazard map.

**Fig. 2** Bedrock geology (1:100K Geological Survey Ireland) of the study area in SW Ireland.



Sourced from GSI online data viewer. The projected coordinate system used is ITM.

Geologically, the study area is composed of two main Quaternary sediment types; till derived from Namurian sandstones and shales in the north and till derived from limestones in the remainder of the area. The underlying bedrock geology (**figure 2**) consists of Carboniferous siltstones (Cloone Flagstones) and Namurian shales in the north of the study area. The remaining of the study area is composed of various Carboniferous limestones (un-bedded, bedded, bioclastic, argillaceous).

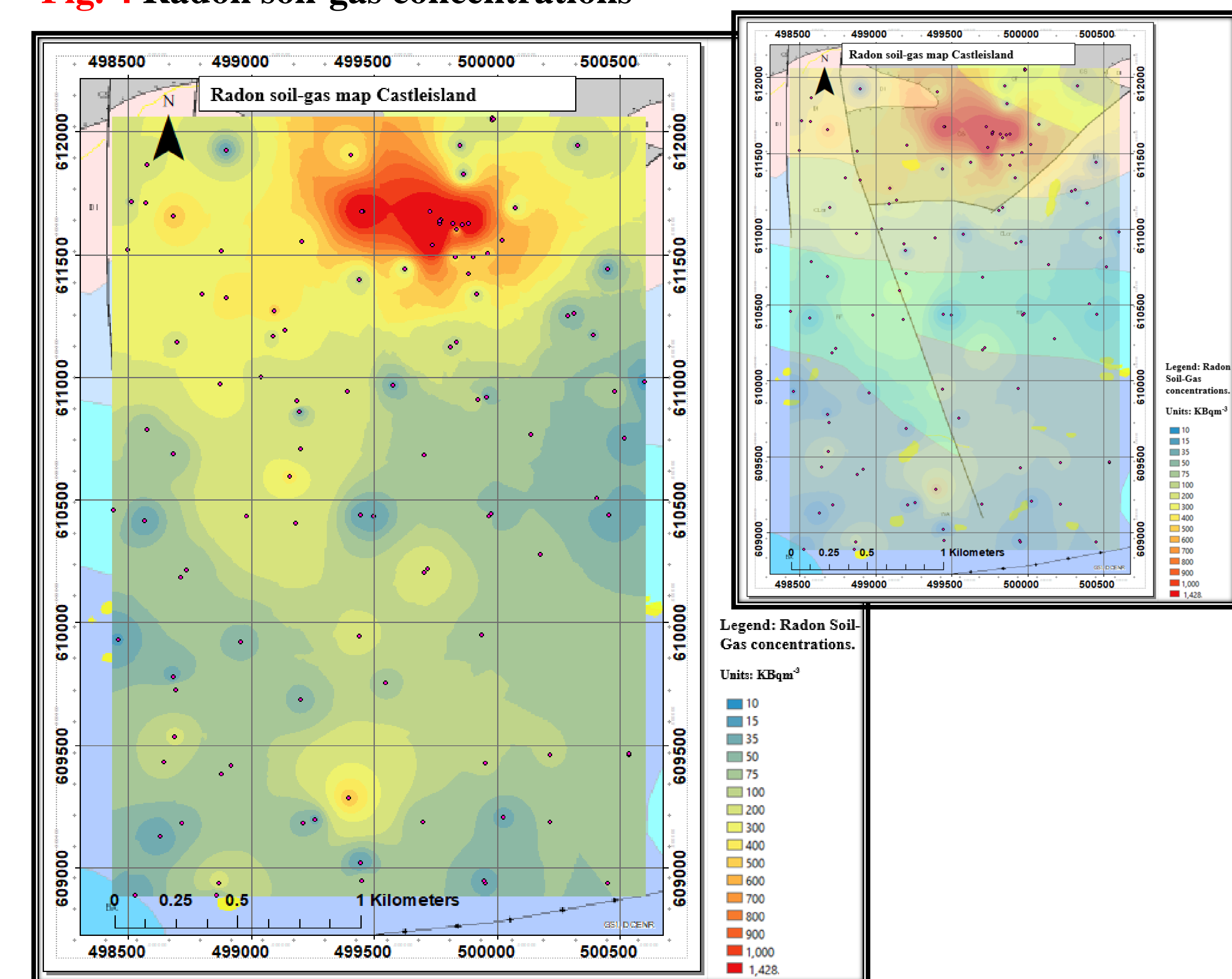


The radon potential map of Castleisland Co. Kerry made using the IDW kriging function in ARC GIS. Radon potential index values range from 5 to over 1200.

The Radon potential (RP) for the study area ranges from 5 to greater than 1200 (**figure 3**). Most of the study area consists of a radon potential higher than 35. RP values > 35 are considered as exceptionally high (Neznal et al. 2004).

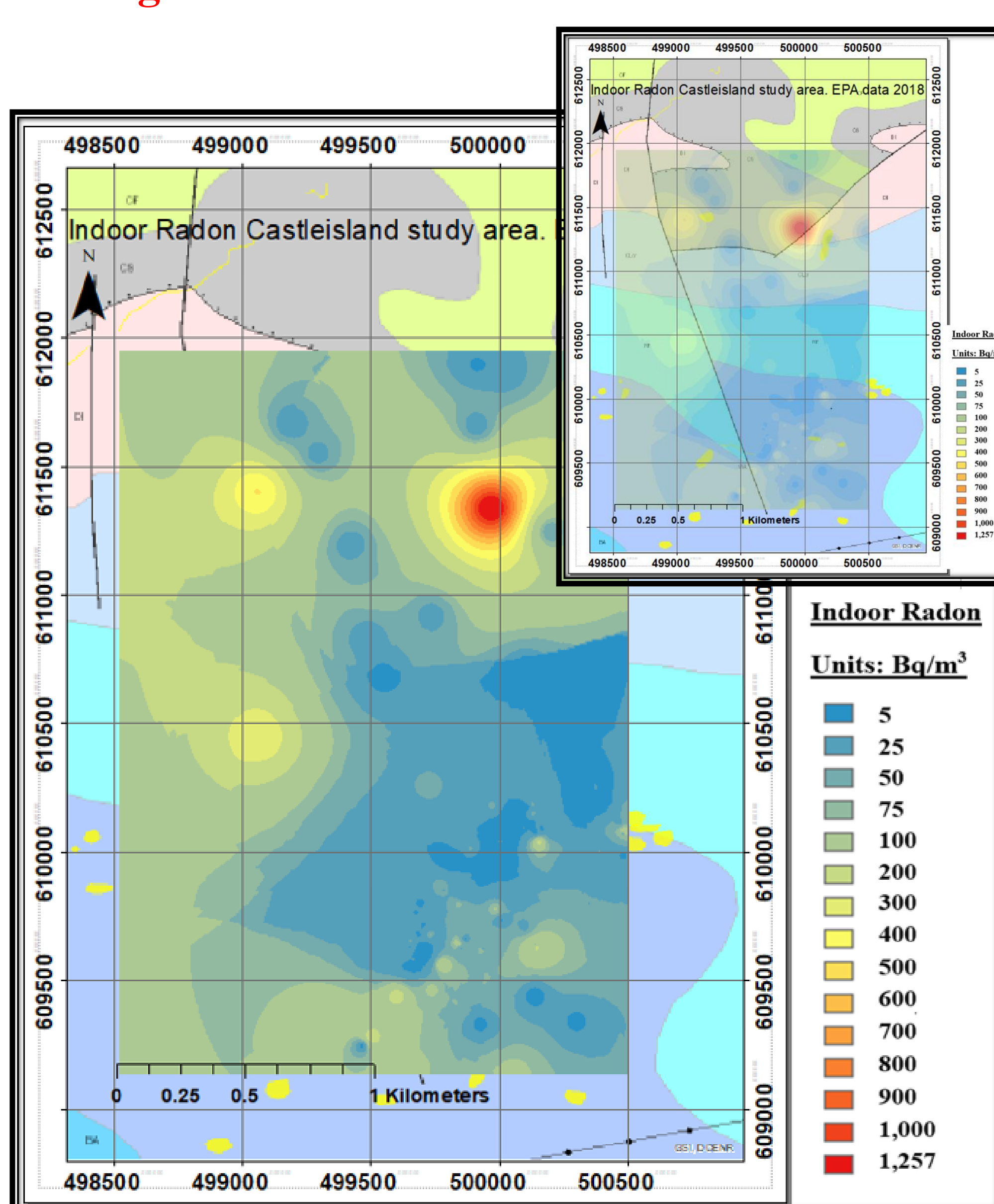
The extremely high radon potential may be explained by the high radon soil-gas concentrations which range from 10 kBq/m<sup>3</sup> to greater than 1400 kBq/m<sup>3</sup> (**figure 4**). The lowest radon soil-gas concentrations (generally <100 kBq/m<sup>3</sup>) are found overlaying Carboniferous limestones, whereas the anomalously high radon soil-gas measurements (mainly 300 to >1400 kBq/m<sup>3</sup>) are overlying Namurian shales.

**Fig. 4** Radon soil-gas concentrations



Inverse Distance Weighted (IDW) Map of soil-gas radon concentrations made using Arc GIS. The interpolated map is superimposed with zero transparency on the bedrock geology 1:100,000k GSI map of the Castleisland study area uploaded from Arc GIS online. The coordinate system used is Irish Time Mercator.

**Fig 5** EPA Indoor radon concentrations



Castleisland Indoor radon data provided by the EPA 2018 under a GDPR agreement. IDW map with 0% transparency, made using ARC GIS. Point locations removed under GDPR agreement.

The EPA indoor radon data ranges from 5 Bq/m<sup>3</sup> to over 1200 Bq/m<sup>3</sup> (**figure 5**). Approximately half of the study area is lower than the reference limit. Higher indoor radon values (>400 Bq/m<sup>3</sup>) occur near faults. The highest value (>1250 Bq/m<sup>3</sup>) occurs near a fault bordering the Namurian shales. Indoor radon data for the area does not include information on building characteristics, remediation or presence/absence of a radon barrier. **Indoor radon data are not available for entire area, so may not be representative. Soil-gas surveys are important for local scale designation of indoor radon hazard.**

## References:

- Environmental Protection Agency, 2018. - Indoor Radon Data provided under a GDPR agreement.
- Geological Survey Ireland, 2019. - Provided online geological data. Bedrock 100k (scale 1:100,000)
- Neznal, M., Matolin, M., Barnet, I., Mikšová, J., 2004: The new method for assessing the radon risk of building sites. *Prace Ceskeho Geologickeho Ustavu*. 7-47.
- Organeau, Catherine, Murphy, Patrick. 2007: The Castleisland Radon Survey - Follow-up to the discovery of a house with extremely high radon concentrations in County Kerry (SW Ireland). *Journal of radiological protection: official journal of the Society for Radiological Protection*. 27. 275-85. 10.1088/0952-4746/27/3/002.
- Fennell, S.G. Mackin, G.M. Madden, J.S. McGarry, A.T. Duffy, J.T. O'Colmáin, M. Colgan, P.A. Pollard, D., 2002: Radon in Dwellings The Irish National Radon Survey. Radiological Protection Institute of Ireland (RPII). Series/Report no. RPII 02/1