

# **Report on disaster proneness of Pulingome and Thirumeni Villages**

(Reference: Submission to the Principal Secretary, Revenue and Disaster Management by Kottathalachy Hill Eco-Protection Council and direction by Principal Secretary to Head, HVRA Cell for urgent enquiry and report dated 3 May 2012)

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## **Prelude**

Kottathalachy hill, located in survey no. 119/1 of Pulingome village, Taliparamba taluk, Kannur district was declared as an Ecologically Fragile Land (Kerala Gazette dated 19 Sep 2006 No. 3 EFL 1-134/2006) in the year 2006. Figure 1 shows the location map of Kottathalachy hill. In May 2012, Kottathalachy Hill Eco-Protection Council placed a request before the Principal Secretary, Dept. of Revenue and Disaster Management, Govt. of Kerala to declare the villages of Pulingome and Thirumeni within which Kottathalachy hill is located, as Disaster Affected.

## **Immediate reason for the request by the Kottathalachy Hill Eco-Protection Council**

The council in its appeal to the Principal Secretary states the following:

*“Before three years a group of people from afar bought the land under the pretext that it may be used for tourism and related purpose. They also mislead the people saying that these acres of land are for large scale agriculture and cultivation. The innocent agricultural people sold the fertile land when they were offered an incredible price for it. At present this businessmen have accumulated around 65 acres of agricultural land. Actually they bought the land, the central part of the Kottathalachy hill for the purpose of quarrying, mining and stone crusher”.*

Further they have requested:

*“Since our villages are affected by piping and it is located in the environmentally sensitive area please declare that these villages (Thirumeni and Pulingome) are disaster prone and only ecofriendly projects should be allowed. An integral and all encompassed study on the environmental impact should be executed by the concerned experts before issuing the licenses required.”*

This request was also based on an investigation report submitted by Mr. G. Sankar, Scientist F, CESS, Thiruvananthapuram regarding the wide spread presence of ‘soil pipes’ in these villages and the conclusion in the report regarding possibility of land subsidence due to soil piping

Based on the request submitted by the Kottathalachy Hill Eco-Protection Council, the Principal Secretary, Revenue and Disaster Management ordered Head, HVRA Cell on 3 May 2012 to investigate the matter and report to the government.

## **The investigation**

A team was constituted to investigate the situation in the Thirumeni and Pulingome villages. The team members were Shri. G. Sankar, Principal Investigator, HVRA Cell (Scientist F, CESS), Dr. Sekhar L. Kuriakose, Associate Professor, DMC & Head (Scientist), HVRA Cell, Mr. Eldhose Kuriakose, Technical Assistant, CESS and Mr. Binoy P. Johny, Field Assistant, HVRA Cell. The team conducted a detailed investigation of the said villages between 21<sup>st</sup> and 26<sup>th</sup> May 2012. Findings of the team are given below.

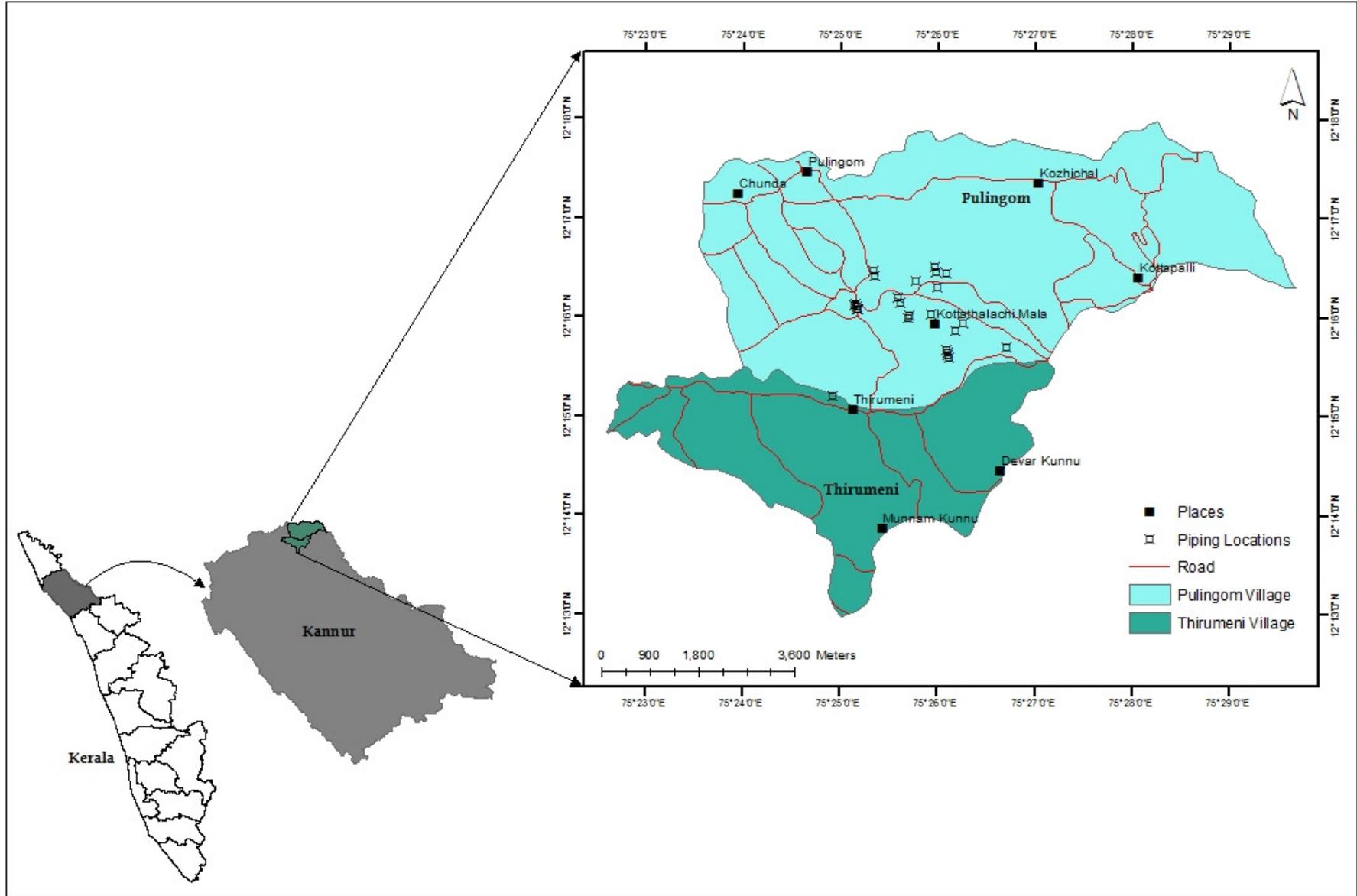


Figure 1: Location map of Kottathalachi hill

## 1. Introduction

Kottathalachy hill is situated in the border of Kerala and Karnataka in the villages of Pulingome and Thirumeni, Thaliparamba taluk, Kannur district (cf. Figure 1). The hill is 809 m above MSL. The hill top and immediate surrounding areas are ecologically fragile and was declared as an Ecologically Fragile Land (Kerala Gazette dated 19 Sep 2006 No. 3 EFL 1-134/2006) in the year 2006. The approach road to the hill top is via Cherupuzha town. The hill top is also a pilgrim center of the



*Figure 2: Panoramic view of the valley of Kottathalachy hill*

Christian community. Figure 2 shows a panoramic view of the Kottathalachy hill. The affected locality is situated in the highland region with elevations reaching up to 801m in the Kottanthalachi mala. Average slope of the hill is roughly 30° with many parts of the hill being near vertical. Soil thickness is about 7 m on an average with rocky exposures present in the most areas. The Kottathachi mala is characterized by radial drainage indicating its shape. Many lower order streams originate from this hill. ‘Thirumeni chal’ a third order stream and its tributaries drain through the locality. Charnockite rocks dominates Precambrian crystalline basement of the area. The overburden material above the basement is clay rich loamy soil.

### 1.1 Available literature

Two study reports are available regarding the environmental sensitivity of Kottathalachy hill, they being the study report on ‘Investigation of the land subsidence in Chattivayal locality of Cherupuzha grama panchayath, Taliparamba taluk, Kannu district’ from CESS in the year 2005 and an ‘Environmental Impact Assessment of Kottathalachy hill area’ by CARITAS India in the year 2011.

#### 1.1.1 Extracts from the report of CESS

*Land disturbances in the form of subsidence occurred in the Chattivayal ward of the Cherupuzha Panchayat at about 12 noon, on September 9, 2005. The incident happened in the land belonging to Mr. Chamakkala C.T Joseph. The subsided area is located very close to the house of Ms. Lisi Francis. As the extent of the subsidence was not clear, fearing danger, the family of Ms. Lisi Francis was shifted from this locality. In order to get an expert opinion on the matter, District Collector, Kannur requested*

CESS, Thiruvananthapuram to study the phenomenon in order to assess the vulnerability of the house under reference. Mr. G. Sankar, Scientist along with Mr. Sachit Mohan, Project Scientist investigated the site. The field investigation was assisted by Mr. K.R. Jagadish, Asst. Geologist, Mining and Geology, Kannur and Mr. M.K Rajan, Village Officer, Thirumeni.

#### **1.1.1.1 Major conclusions of the investigation**

- *The study conducted by CESS indicates that the deep hollow formed in the land of Mr. Chamakkala C.T. Joseph in Puligome Desom, Thirumeni village in Taliparamba taluk is due to a geological phenomenon called 'piping', a process of subsurface soil erosion along preferred channel.*
- *Once initiated they become cumulative with time, the conduits expand due to subsurface erosion leading to roof collapse and subsidence features on surface.*
- *The house belonging to Ms. Lisi Francis is located in a vulnerable area. It is found that the caving is taking place very near to the basement of the house. So it is found to be dangerous to dwell there.*
- *There are underground channel-ways in the form of pipes formed in this locality. These pipes have affected the ground water level in the area. As piping progresses subsidence may occur in future also.*
- *This survey infers that there may be couple of such underground cavities or pipes existing in the area. People may be advised to report if they hear sound of flowing water underground or see muddy water from the springs located down slope side.*
- *Further studies may be conducted to establish/confirm the path of the pipes so that people can avoid developmental activities there.*

#### **1.2 Extracts from the report of CARITAS India**

The EIA conducted by CARITAS states that the hills are prone to rockfall and landslides. The hill slope was affected by landslides in the year 2004, 2006 and 2010. The report also mentions that if quarrying is allowed and top soil is removed, it would affect the ground water table of the region.

#### **2. Hazard susceptibility of Thirumeni and Pulingome villages**

It was evident from the field work conducted by the team that the slopes of Kottathalchi hill has been affected by land degradation processes such as rock fall and debris flows since time immemorial. The presence of numerous cobbles and boulders entrapped in the B and C horizons of the soil, and the numerous loose boulders along the slopes of the hill are evidences of such events in the historic past.

Figure 3 shows a typical soil profile of the region. It is evident that these land degradation processes are active event today, given the occurrence of landslides in the years 2004, 2006 and 2010. The slope, rainfall conditions and anthropogenic activities prevalent in the area favors landslides and rock falls. Numerous loose boulders and large rock fragments were seen to be located precariously on the slopes of Kottathalachi hill. Such rocks and boulders which were found to be detached from the parent bed rock are susceptible to toppling if subjected to severe vibrations such as that resultant of quarry related blasting.

In addition to the above stated geo-hazards, the presence of soil pipes (tunnels due to natural subsurface erosion) makes the land further fragile. A total of 20 pipes and pipe outlets were marked and cataloged. Three pipes were investigated physically. It was evident from the investigation that many of these pipes are decades old in terms of their origin and existence. Investigations inside the pipes revealed that the baseline of the pipes is often bed rock. Figure 4 shows the locations of the investigated pipes overlaid on the digital elevation model; Figure 5 shows the locations of the pipes overlaid on the drainage map.

Water flow channels were observed inside the pipe. Evidences inside indicates that most pipes experiences pipe-full discharge during the peak seasons.

Indications of fluvial erosion such as water flow striations were evident on the side walls as well as the roof. As bed rock arrests down cutting, the investigated pipes were seen to be experiencing lateral erosion along the side walls. Presence of peat or peat like organic strata was found almost near the baseline on the side walls of the investigated pipes and this stratum was found to be bedding parallel to the slope. Some parts of the pipes were found to be stable. The walls and roofs of the stable segments were found to be made of saprolite. Major part of the investigated pipes was still experiencing lateral erosion. The relatively active parts of the pipes were found to be lined by thick soil strata that were being eroded. Loose soil blocks that got detached from the roof were found on the floor of the pipes.



*Figure 3: Entrapped boulders and cobbles in the B & C horizons*

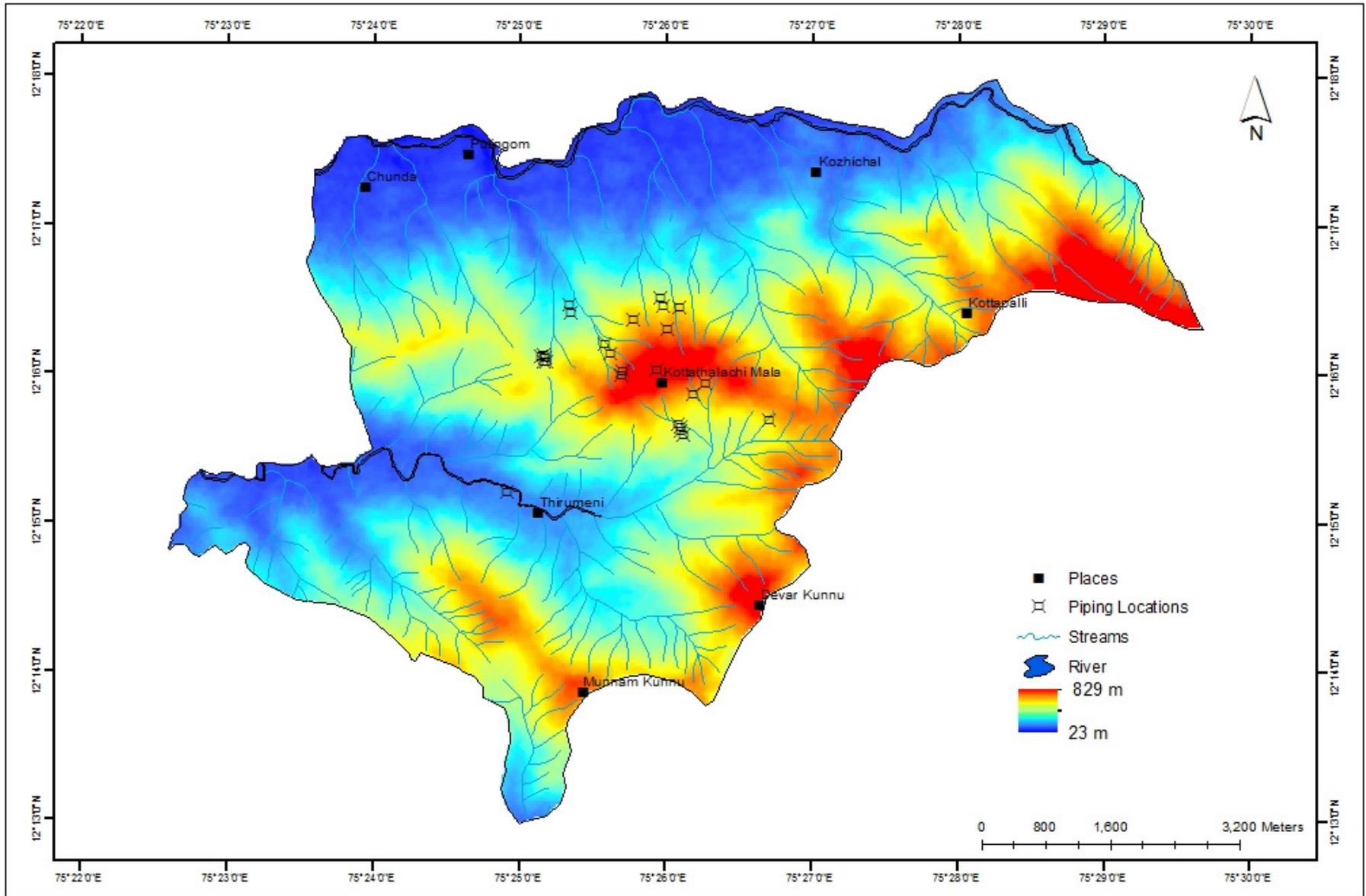


Figure 4: Locations of soil pipes cataloged, overlaid over the Digital Elevation Model

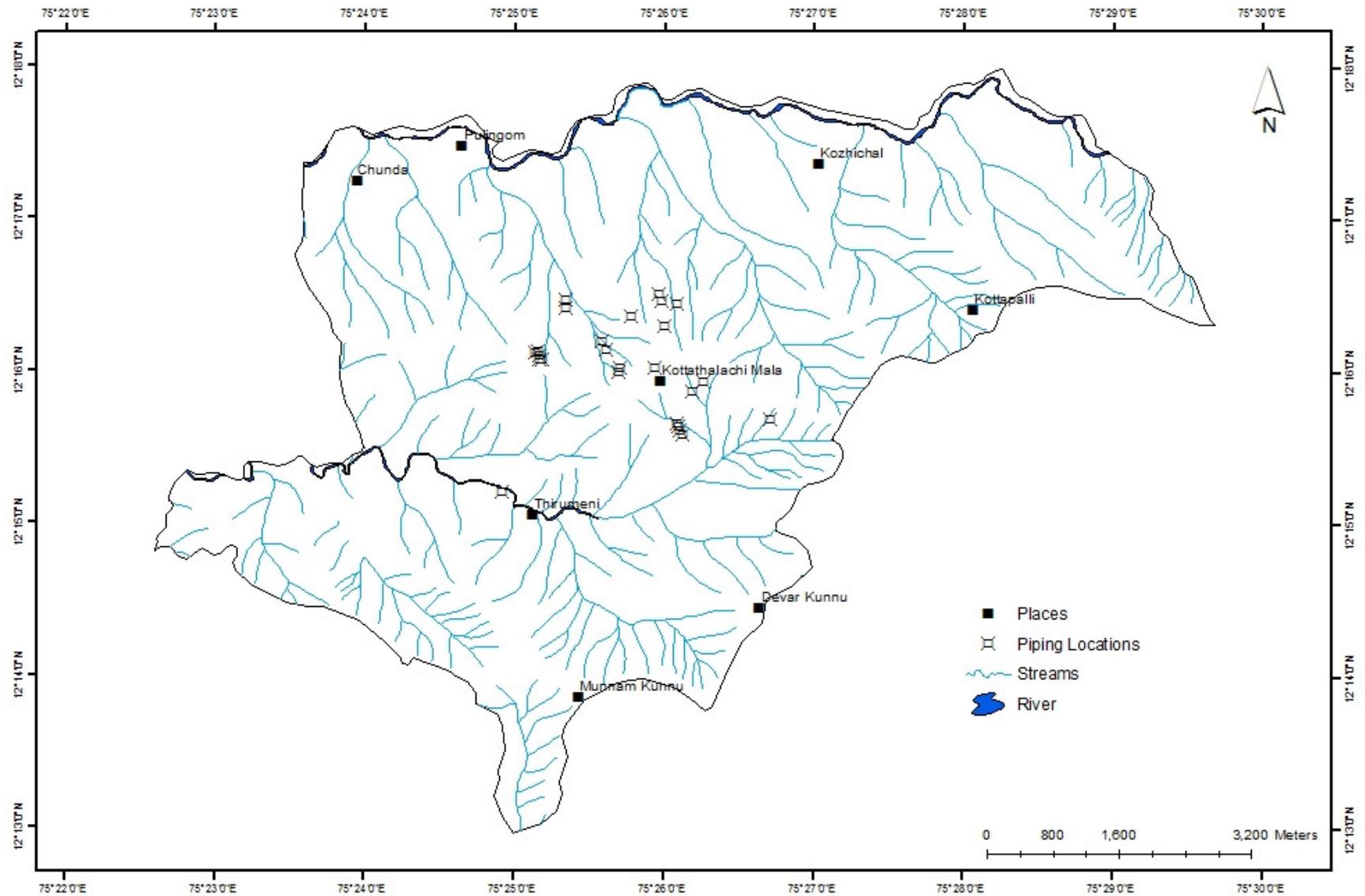


Figure 5: Locations of soil pipes cataloged, overlaid over the drainage network

The near original state of these soil blocks and the fact that the soil has not been washed off by running water indicates that they were recent in origin. This indicates that the processes which triggered piping are still active in the region and numerous undetected pipes may be present in the soil strata of the region. Table 1 shows the slope and elevation of the various pipe inlets and outlets cataloged during the site visit. From the table it is evident that pipes are located on steep slopes on altitudes above 150 m (cf. Figure 4). Figure 6 shows the sketch of an investigated soil pipe.

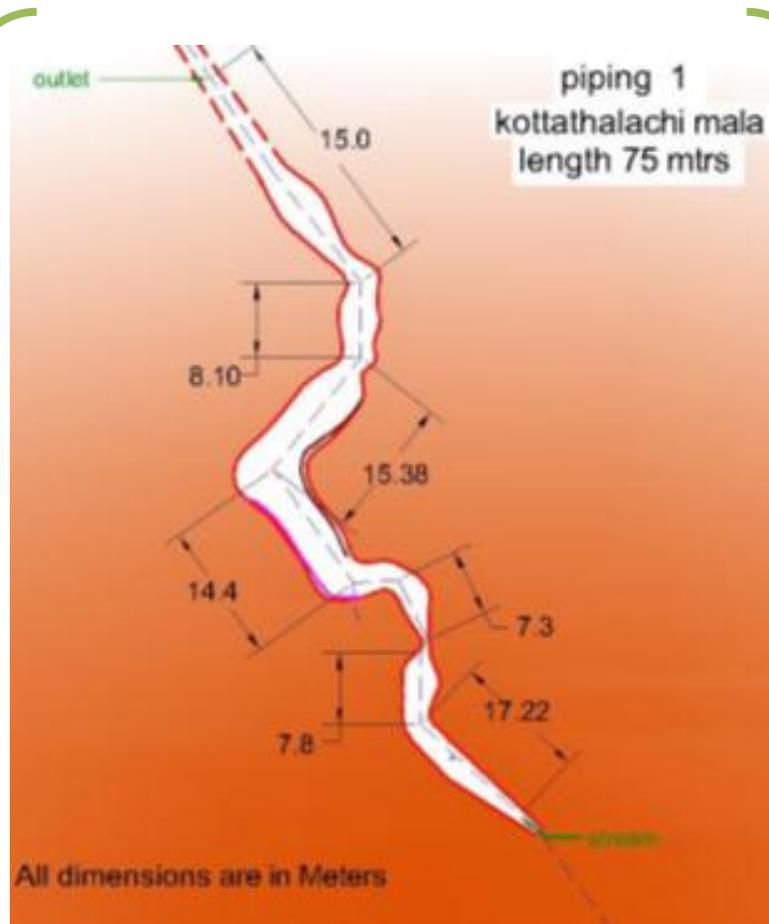


Figure 6: A sketch of an investigated soil pipe

The pipe inlets and outlets were in close proximity to the 1<sup>st</sup> order drainage channels in the region (cf. Figure 5) which is an indicator of the hydrological influence of these entities. The ground water level of the region also seems to be influenced by the presence of these pipes. It may be noted that such large soil pipes would collapse and result in significant loss of agricultural land if severe ground disturbances such as blasting, piling etc. and resultant ground vibrations propagate through them. The roofs and sidewalls of such pipes are unstable and the soil strata in the region do not seem to be possessing sufficient cohesion to withstand such vibrations. Figure 7 shows some photographs of the investigated soil pipes.

Further, based on the rainfall records in the current year (2012) it has been noted that Thirumeni and Pulingome are Moderately Drought (26-50% deficit of rainfall) affected (*Meteorological Drought Situation Assessment of Kerala, June-July 2012. Prepared by HVRA Cell, Dept. of Disaster Management, Govt. of Kerala*). Kottathalichi hill being the origin of 'Thirumeni chal' is a major source of fresh water for these villages.



Figure 7: A – Inlet of a pipe; B – 20 m inside a soil pipe; C – 45 m inside a soil; D – Inlet to another soil pipe

Any disturbance to its sedimentary strata and bed rock will result in the reduction of soil water and ground water storage respectively whereby the thriving agricultural richness of these villages will be negatively affected.

The ecological fragility of Taliparamba Taluk (cf. Figure 8) has been noted in the 'Report of the Western Ghats Ecology Expert Panel – Part 1, 2011' appointed by the Ministry of Environment and Forests, Govt. of India. The report, known as '*the Madhav Gadgil Committee Report*' identified Taliparamba taluk as 'Region of high sensitivity' and has classified it as Ecological Sensitive Zone 2 (*Appendix 3, Page 95, WGEEP Report 2011*). The WGEEP Report 2011 further states 'Change in land use is not permitted in ESZ 2 from forest to non-forest uses or agricultural to non-agricultural, except agriculture to forest (or tree crops) except when extension of existing village settlement areas to accommodate increase in population of local residents' (*Table 6, Page 41, WGEEP Report 2011*).

Further, in a report prepared by Centre for Earth Science Studies (CESS) in the year 2010, Thirumeni and Pulingome villages have been classified as highly landslide prone and lightning prone. Figure 9 shows the hazard susceptibility of Kannur district in which the villages Thirumeni and Pulingome are highlighted.

### **3. Conclusions and recommendations**

Based on the above stated facts, the following conclusions and recommendation are made by this expert team which visited these villages:

#### ***Conclusions***

1. The villages, Thirumeni and Pulingome of Taliparamba taluk are prone to natural hazards such as landslides, land subsidence due to soil piping, drought and lightning.
2. These villages are ecologically highly sensitive as evident from the WGEEP report.
3. Based on the field investigation and available literature it is evident that these villages are hazard prone.
4. The investigation team could not find immediate reasons for declaring these villages as 'Disaster Affected' under the available provisions of the Disaster Management Act 2005.
5. However, if major anthropogenic interventions such as quarrying, mining (including river sand mining), blasting, deep piling, ground water extraction for purposes other than local agriculture etc. are allowed, it would lead to a situation whereby the hazard probability in the area would substantially increase.

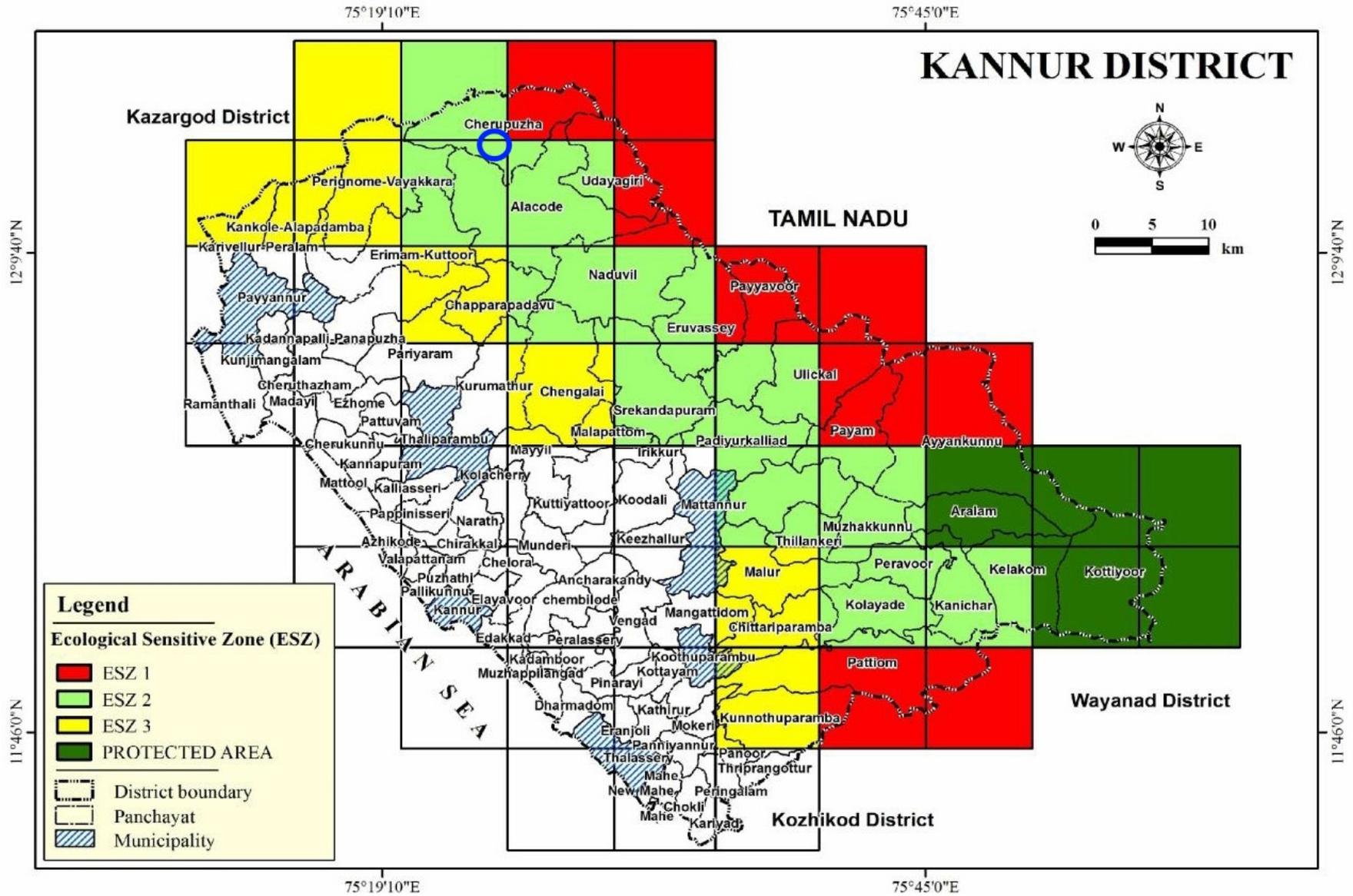
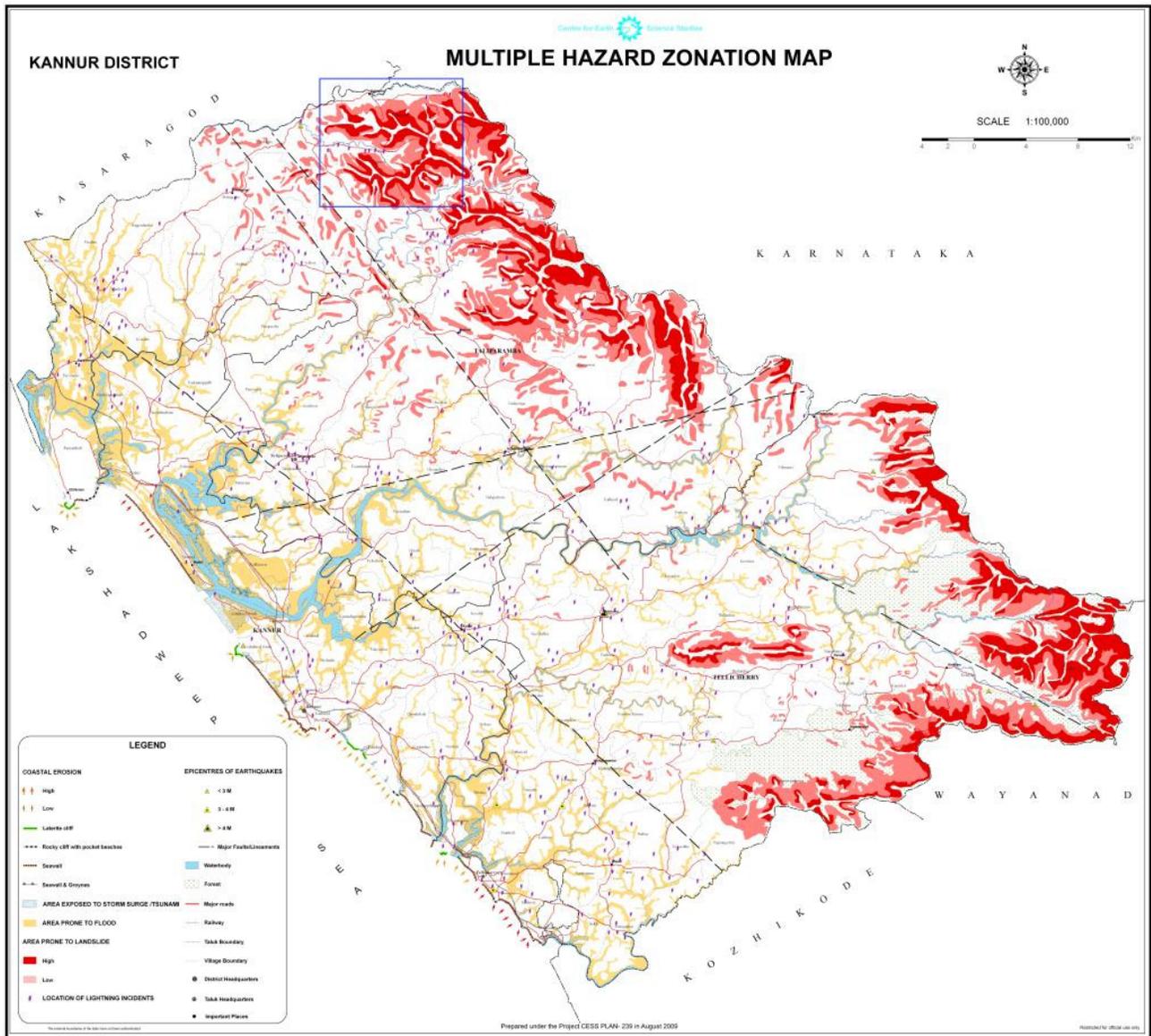


Figure 8: ESZs in Kannur (Blue circle in the map indicates the relative location of Kottathalachi hill)  
 (Reference: Understanding WGEEP, Kerala State Biodiversity Board 2012)

#### **4. Recommendations**

1. Anthropogenic interventions such as quarrying, mining, blasting, deep piling and ground water extraction for purposes other than local agriculture should not be allowed in these two villages considering the possibility of rock fall, possibility of land subsidence due to soil pipe collapses and the possibility of hydrological and agricultural drought given any reduction in soil water storage and ground water storage.
2. Quarrying, mining and explosive licenses issued in these two villages must be revoked and no further mining and explosive licenses should be issued in these villages.
3. As recommended in the WGEEP report, agricultural land in these two villages should not be converted to non-agricultural land, except from agriculture to forest (or tree crops).
4. Public must be alerted that they should not construct houses without undertaking a thorough investigation to know if any sub-surface soil pipes exist at the sites proposed for construction.



Taluk	Natural hazards in Kannur district – Taluk wise											
	Flood		Landslide				Coastal erosion				Storm surge / Tsunami inundation	
	Area Km <sup>2</sup>	Area %	Area Km <sup>2</sup>	Area %	Area Km <sup>2</sup>	Area %	Length Km	Length %	Length Km	Length %	Area Km <sup>2</sup>	Area %
Taliparamba	116.4	8.8	81.0	6.1	152.2	11.5	2.6	29.2	3.8	8.9	22.5	5.2
Kannur	116.2	8.8	87.5	7.3	118.0	9.8	1.4	10.1	5.6	39.2	4.8	0.4
Thalassery	108.2	8.8	87.5	7.3	118.0	9.8	1.4	10.1	5.6	39.2	4.8	0.4
Total	339.2	11.4	168.7	5.7	272.6	9.2	17.4	26.6	9.3	14.3	31.1	1.0

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 Project Fellows : R Amburajan, S Sreejesh Kumar, R Sachin, Binoy P George, Bintha C Thomas, S Prayth, K Suryakala, B Praveen, TS Saji

Figure 9: Hazard zonation map prepared by CESS for Kannur district. In the blue box are Pulingome and Thirumeni villages