

"Sustainable reclamation scheme for bauxite mines by implementing GIS tools"

A. Argyriou, A. Adam*, D. Papakonstantinou
and K. Cassios

* Assistant Professor, School of Mining and Metallurgical
Engineering, NTUA

CONTENTS OF THE PRESENTATION



- Aim of the study
- Study Area
- Criteria for the selection of disposal sites- Methodology employed
- GIS Analysis
- Conclusions-Proposals for further study

1. AIM OF THE STUDY



To examine the potential use of old surface bauxite mines in Fokis and Fthiotis Prefecture, Region of Central Greece, as disposal sites suitable to receive the urban waste produced in the neighbouring communities.

Multicriteria Analysis and GIS Tools used to examine this alternative scheme.

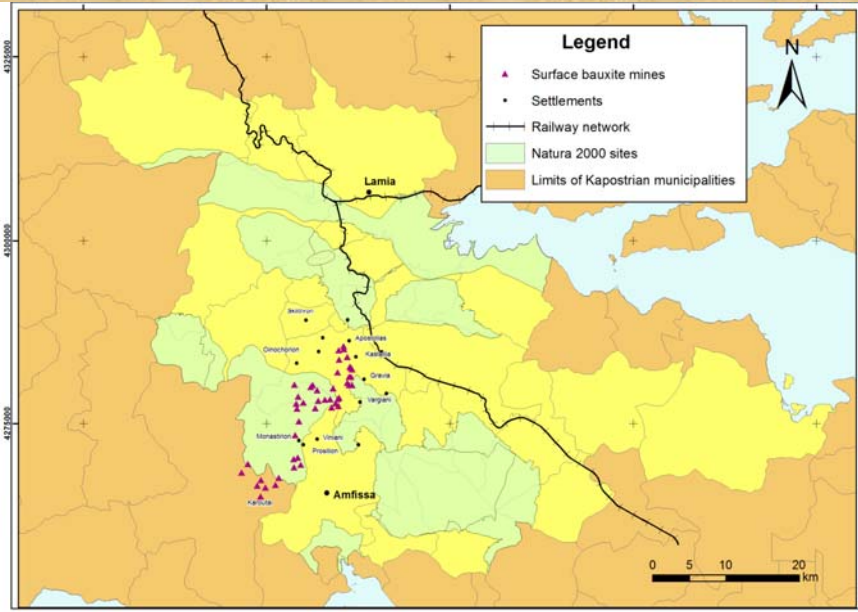
1. AIM OF THE STUDY, cont.



Feature of the proposed scheme consist the potential transportation of urban wastes collected from the communities with the Tithorea - Lianokladi section of the national railway line, scheduled to be inactivated in 2016.

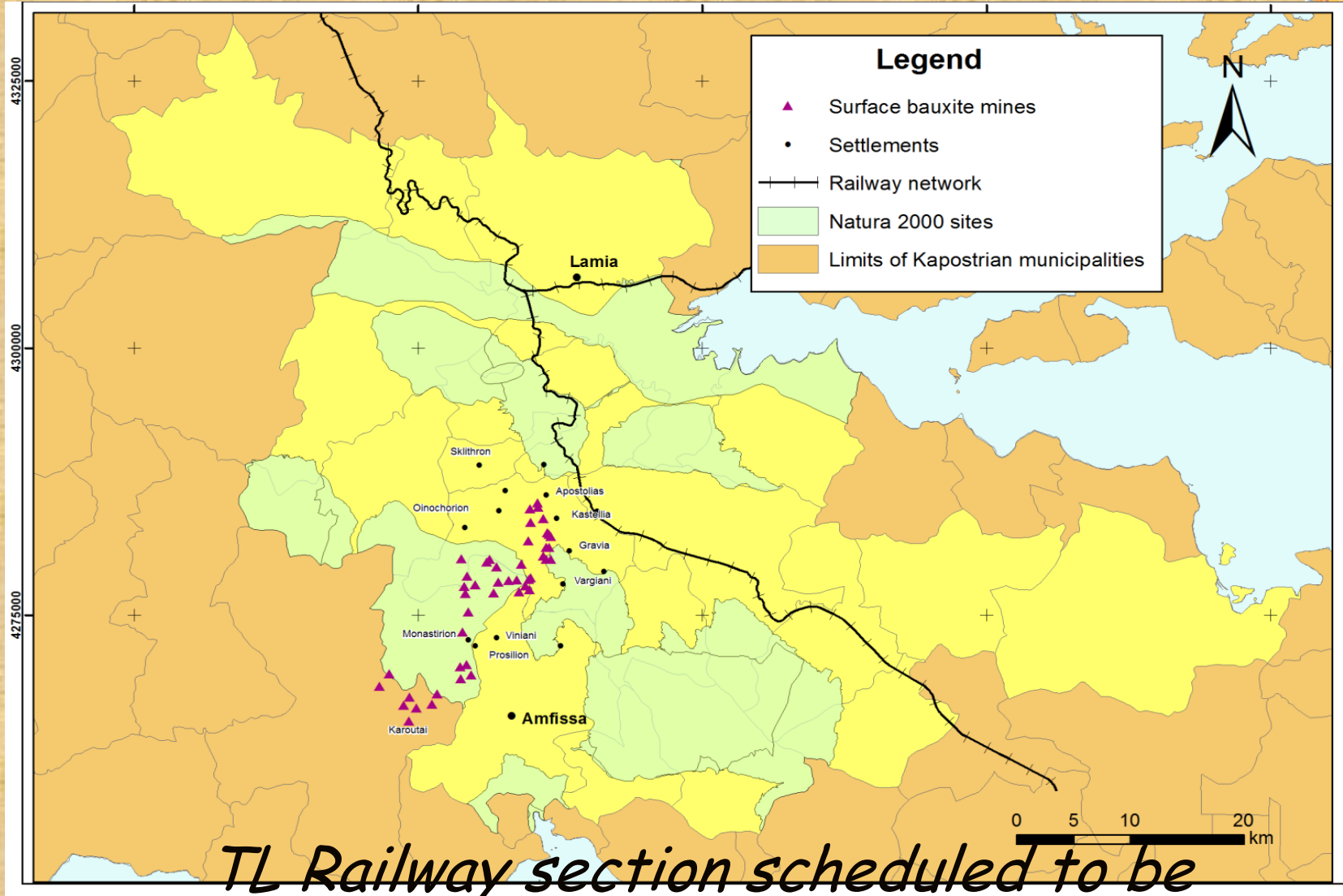


2. STUDY AREA



- ✓ located in the Region of Central Greece,
- ✓ extends around the Fokida, Fthiotida and Viotia Prefect.,
- ✓ Covers area of 5500 Km²
- ✓ Boundaries set taking into account (a) the location of the **old S&B bauxite mines** of Giona and (b) their proximity to the **Tithorea-Lianokladi (TL) railway section**, 69 Km long crossing the Fthiotida Prefecture.

2. STUDY AREA



*TL Railway section scheduled to be
inactivated in 2016*

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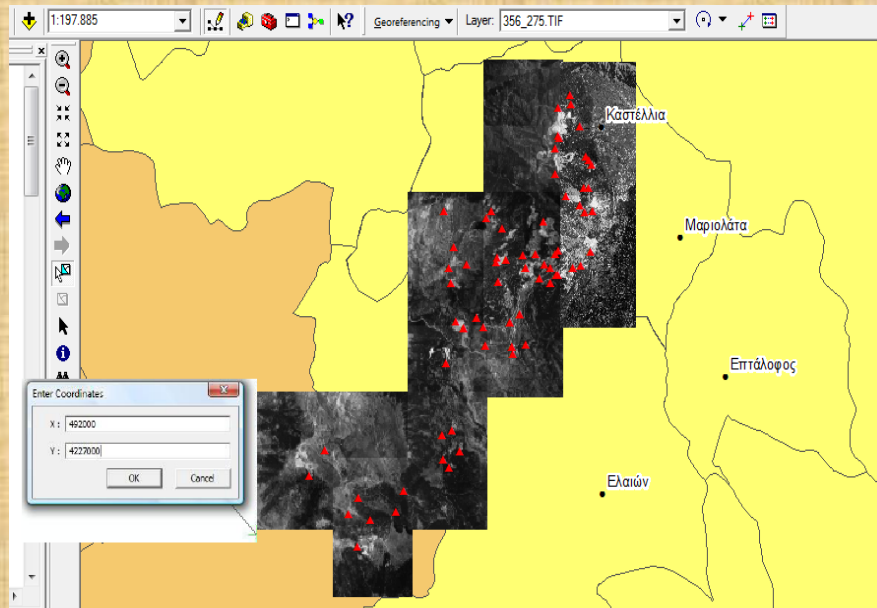
A. Adam

2. STUDY AREA

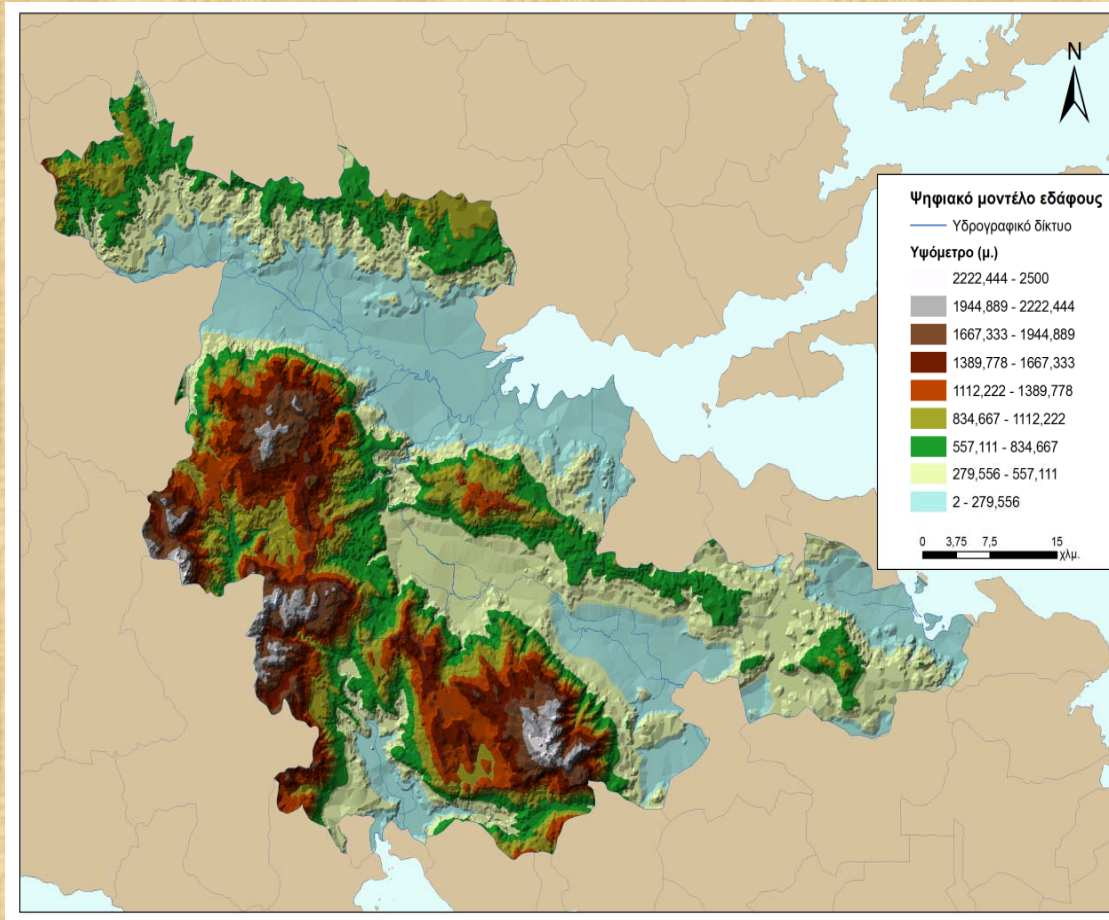
Bauxite Mines before
and after reclamation



Source: S&B S.A



2. STUDY AREA



Digital Terrain Model

Features of the Study area

- ✓ Mountaineous
- ✓ Main geological formations; flysch, hard compact limestone, igneous rocks and quaternary deposits, bauxite deposits
- ✓ Natura site closer to the mines examined, Mount Giona GR2450002

2. STUDY AREA



Demographical Data, 2001 Census

Viotia Prefecture, 1 Municipality in the study area

Fthiotida Prefecture, 10 Municipalities examined in the study area

Fokis Prefecture, 5 Municipalities examined in the study area

Total population of the area examined, almost 131.000 inhabitants.

Waste produced per capita per year in Greece 400-500 kg/y, (Eurostat 2007). Organic circa 45%, Recycling : 20%.

Brallos Railway station selected as Reference Point for the collection of wastes and transport by trucks to the old Mines sites.



3. CRITERIA FOR SELECTION OF WASTE DISPOSAL SITES



Based on Prevailing legislation, Reported studies, Best Available international practice, criteria used to evaluate/select sites appropriate for waste disposal relate to **functionality, land use, environmental protection and costs, i.e**

- Storage Capacity
- Distance from settlements, ecologically sensitive areas, archeological sites, water bodies, main infrastructure
- Distance from the waste generation sources
- Hydrogeology, topography, climate, seismicity
- Social Acceptance

Appropriate measures envisioned to seal the disposal site from the Downstream environment as dictated by relevant legislation

3. CRITERIA FOR SELECTION OF DISPOSAL SITES



In the present study the aim is not to select the most suitable undisturbed site to create a new waste disposal facility, but to identify with a multicriteria analysis existing old mine voids that could be used as waste disposal facilities, and subsequently reclaimed.

Criteria used:

Geological-Hydrogeological,
Spatial,
Environmental,
Economic

each represented as a layer in a GIS environment. Buffer mapping according to specific criterion(a) suggests exclusion zones.

4. GIS ANALYSIS



Criteria	
Geological & Hydrogeological Criteria	
-Not located in a seismically active area	All mines examined Zone 2, ✓
-Distance from the main river network >100m	All mines examined ✓
-Low Permeability formations	When not met to be Mitigated with low permeability geological or synthetic barriers
Spatial Criteria	
-Exclusion zone from settlements 250m	All mines examined ✓
- Not close to archeological sites	All mines examined ✓
-Away from lakes,>300m, highways, >300m, airports >3000m	All mines examined ✓

4. GIS ANALYSIS



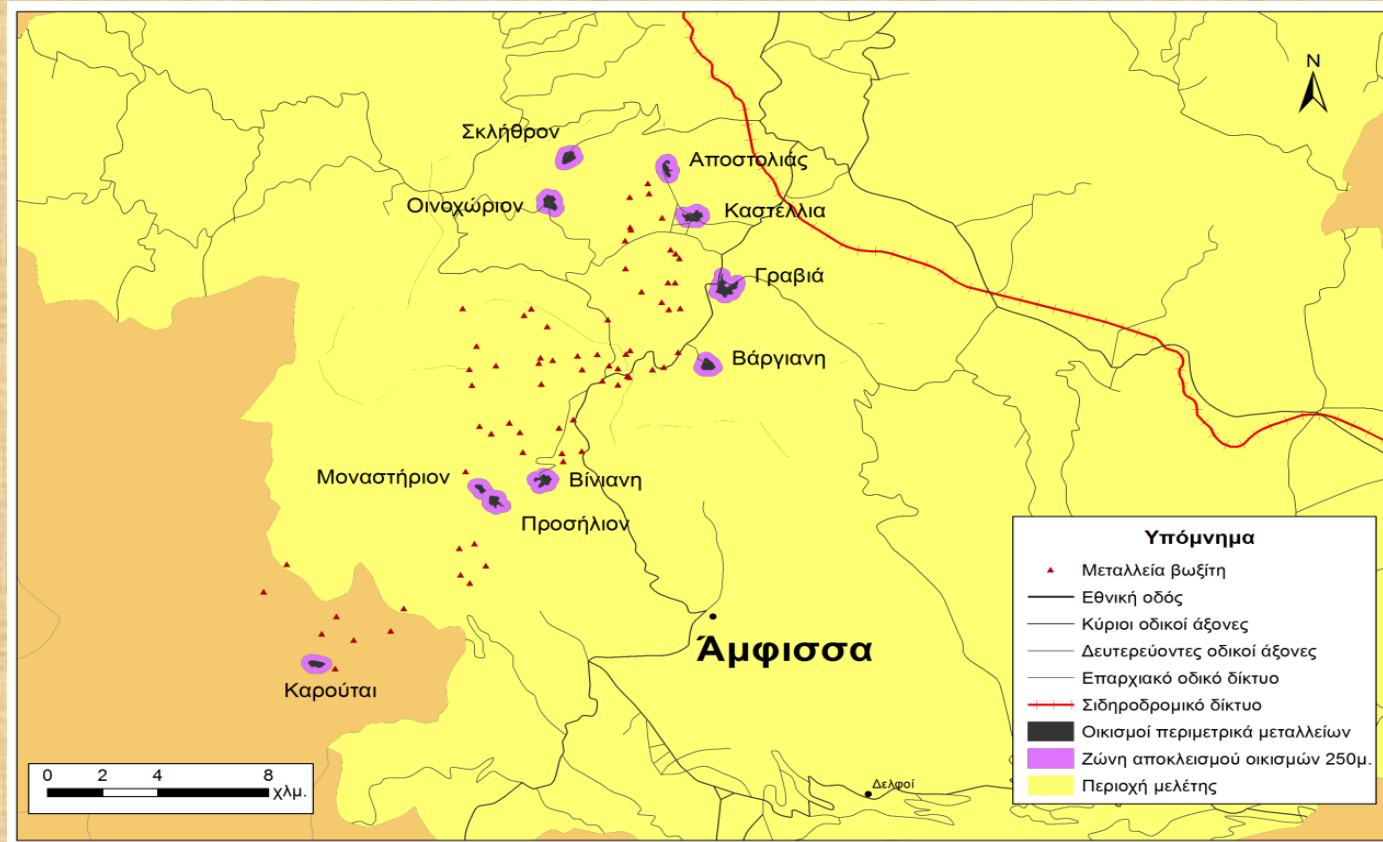
Criteria	
Environmental Criteria	
-Not located in an environmentally sensitive area	Buffer zone to exclude mines in Natura sites
-Only surface mines were considered for evaluation	Surface mines examined ✓
-Limited visibility from settlements	Of Relative importance , surface mines already present in the area
Economic Criteria	
- Distance, < 20Km from the Brallos Station	All Mines examined ✓
- Not applied to already restored mines	Restored mines not examined
- Operational road network	All mines examined ✓

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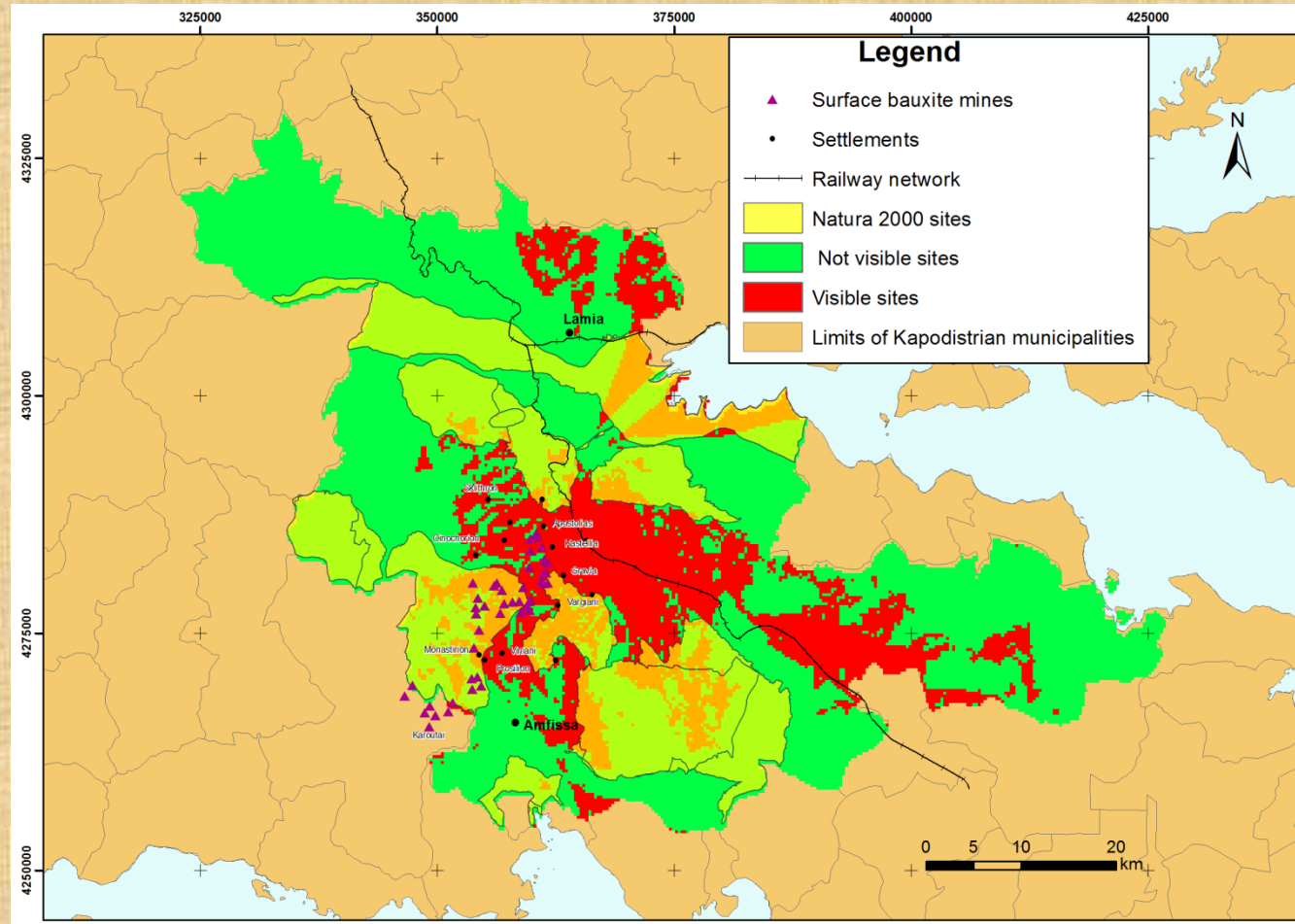
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4. GIS ANALYSIS, SPATIAL CRITERIA



Buffer Zone around settlements

4. GIS ANALYSIS, ENVIRONMENTAL CRITERIA



4. GIS ANALYSIS, SYNTHESIS OF CRITERIA

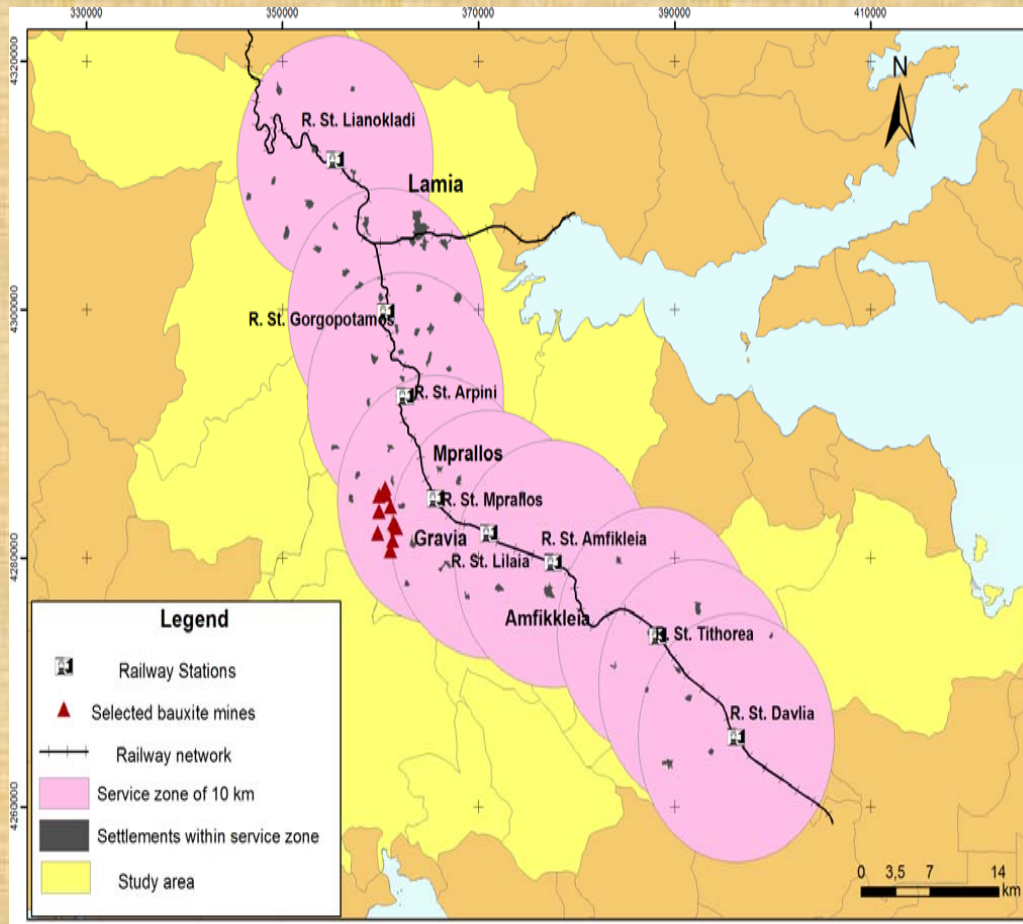


GIS application indicated 9 Mines as suitable for potential waste disposal, Cumulative capacity circa 9,5 Mm³

Evaluation: Serve Municipalities/Waste sources located in 5, 10, 20 Km zone around the Tithorea-Lianokladi railway section.

Radius from the railway section, km	No of settlements	Annual waste production, m ³ /y
5	46	64.000m ³ /y
10	56	246.000m ³ /y
20	97	333.000m ³ /y

4. GIS ANALYSIS, SYNTHESIS OF CRITERIA



5. CONCLUSIONS-PROPOSALS FOR FURTHER STUDY

The reclamation scheme proposed was developed in conceptual stage with the application of Multicriteria Analysis and GIS tools along two main sustainable development concepts

- Use of old bauxite mines, after sealing, as waste disposal areas- Backfilling of voids enhances mines reclamation
- Beneficial use of an existing planning infrastructure, scheduled to be inactivated in 2016

Additional potential benefit: Transfer of inert mine wastes back to railway stations for use at construction reducing the needs to operate new aggregate quarries

5. CONCLUSIONS-PROPOSALS FOR FURTHER STUDY, cont.

For the successful development and application of the proposed scheme, **a cost-benefit analysis in environmental economics terms** is needed taking into account:

- ✓ the current state regarding bauxite mining, closure and reclamation in the area, in cooperation with the mining companies
- ✓ Prevailing/evolving legislation regarding (a) the post-closure rehabilitation of old mines, (b) waste disposal, (c) use of inactivated railway infrastructure for the transport of solid wastes
- ✓ Social acceptance of stake holders

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Thank you for your attention

katadam@metal.ntua.gr