

## Mineral security through landuse planning – Case study of rock aggregates in Eastern Selangor

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**Abstract:** There is a need to ensure long-term security for the supply of rock aggregates in Selangor, in view of the impending implementation of the Selangor Policy on Environmentally Sensitive Areas (ESAs). Preliminary findings from a case study of rock aggregates in Eastern Selangor reveal that six quarries and 66% of new aggregate resources in the state are located in highly sensitive ESAs, which are categorised as “no go areas” for quarrying. At least ten quarries and another 26% of new resources are located in ESAs of medium and low sensitivity, which are areas of “controlled development” requiring special circumstances and very strict conditions for quarrying. Only 8% of the new resources identified are actually available for exploitation in the future. Aggregate landbanks and buffer zones should be delineated and gazetted in local development plans and efforts should be made to thoroughly investigate potential resources outside of the ESAs. This effort should be augmented by the promotion of recycled concrete aggregates to maintain aggregate security and ensure sustainable development.

**Abstrak-** Pelaksanaan Dasar Kawasan Sensitif Alam Sekitar (KSAS) Selangor dijangka menjejaskan jaminan bekalan batuan agregat di negeri tersebut. Hasil awalan kajian kes di bahagian timur Selangor mendapati bahawa terdapat enam kuari dan 66% daripada sumber aggregate baru yang bertapak di KSAS berkesensitifan tinggi yang melarang kegiatan pengkuarian. Hampir 10 kuari dan 26% daripada sumber aggregate baru pula bertapak di KSAS berkesensitifan sederhana dan rendah yang merupakan kawasan pembangunan terkawal di mana kebenaran khas diperlukan untuk kegiatan pengkuarian dan syaratnya amat ketat. Hanya 8% daripada sumber aggregate baru yang telah dikenalpasti boleh dieksploitasi di masa depan. Tabung tanah dan zon penampungan aggregate perlu dikenalpasti dan digazetkan dalam pelan pembangunan tempatan manakala usaha perlu ditingkatkan bagi merisik potensi sumber tersebut di luar KSAS. Selain itu, penggunaan agregat konkrit terkitar perlu dipromosikan bagi menjamin bekalan aggregate dan pembangunan mampan.

### INTRODUCTION

Mineral security relates to the supply of minerals with respect to its availability and production, which are influenced by economic, social and environmental elements as well as political stability (Pereira *et al.*, 2006). This definition is broader than the traditional narrow perspective of security that relates to simple economic supply and demand closely related to political standpoints (Ray, 1984; Anderson, 1988; Harker and Lutz, 1990; Humphreys, 1995). Mineral security is particularly important to bulk commodities such as aggregates and sand, which are intricately associated with economic, social and environmental elements throughout their life cycle, from extraction, production, and utilisation to final disposal. For example, construction aggregate resources may be sterilised due to urban expansion, resulting in a shortage of such materials. This situation could be further compounded by closure of quarries in urban areas due to health, safety and environmental considerations. Similarly, banning of sand dredging along coastal areas due to environmental considerations could threaten the continuous availability of sand if such areas are the primary resource for sand.

The construction industry is the main consumer of

aggregates and sand and given the importance of the industry to the development of the country, any shortage in the supply of this commodity gives rise to serious concerns, not only among industry players but also the government sector. Shortages inevitably result in increased costs to the industry, which then translates down to the consumer, and these are primarily the government who outsource infrastructure projects and house buyers. Security of supply should be ensured and any future threat to the supply of such resources should be identified so that some form of government intervention can be taken to alleviate the situation.

This paper articulates the need to ensure long-term security for the supply of rock aggregates in Selangor, in view of the impending implementation of the Selangor Policy on Environmentally Sensitive Areas (ESAs). It is based on a case study of the highlands of Eastern Selangor, which encompasses the districts of Hulu Selangor, Gombak, Hulu Langat and Petaling. The paper commences with a brief outline of ESAs and its implementation using the landuse planning system. This is followed by a short description of rock aggregate quarries and resources in Eastern Selangor as well as the ESAs and landuse pressures therein. The final section touches on challenges in ensuring aggregates security to ensure sustainable development in the state.

## LANDUSE PLANNING AND ENVIRONMENTALLY SENSITIVE AREAS

Land is a scarce commodity in Selangor and increasingly the emphasis is to ensure optimum use of land. Landuse planning is now more challenging in the state, requiring comprehensive information and approaches to ensure the best use of each parcel of land. As a result, the demand for geological information specifically for the planning process has changed over time (Pereira and Komoo, 2006). The need for comprehensive geological information in preparing development strategies was highlighted in a landmark study funded by the Selangor State Government in 1999 (GoS, 1999). The study introduced the concept of Integrated Environmentally Sensitive Areas (ESAs), which was the basis for the Selangor Policy on ESAs, officially launched on 5 June 1999.

The Policy takes into account the importance of an area from the perspective of the implementing government agencies and the perspective of its major function in terms of providing life support systems, heritage value as well as risk associated with hazards. Three groups of ESAs are identified. These are ESAs of Heritage Value, ESAs Associated with Hazards and ESAs that are important for Life Support Systems (GoS, 1999; Komoo, 1998). ESAs of Heritage Value include historical or archaeological sites, areas with high biological and geological diversity, unique landscapes and sites of importance for education and research, among others. ESAs Associated with Hazards encompasses areas with problematic ground conditions for infrastructure development, areas that are prone to flooding, landslides, subsidence and erosions as well as sites that have been polluted by anthropogenic activities. Examples of ESAs that are important as Life Support Systems include catchment areas, land used for food production, pastures for grazing, building material for shelter provision, energy resources, parks and recreational areas. As Selangor is a developing state, the classification of an area under this category is subject to trade-offs that are very much guided by development priorities in conjunction with stakeholder consultation. Any identification of ESAs should be within the framework of natural heritage value, risk associated with various hazards and its value as a life support system. Using this approach, an ESA is categorised based on the perspective of its value and its function in the overall ecosystem.

The State of Selangor is implementing the Policy on ESAs in two stages (GoS 1999, 2003). The first stage involves the implementation of Sectoral ESA in the short-term. Each agency is to identify ESAs that are relevant to their sector, which could then be gazetted or managed based on the degree of sensitivity, which would be determined. In the long-term, the State would develop and implement the concept of Integrated ESA to resolve the overlapping sectoral ESA problem and accommodate the dynamic nature of ESA, as a tool to operationalise

sustainable development. The State has commissioned all Local Authorities to identify ESAs and incorporate these into the landuse planning system i.e. in the review of development plans as well as in the planning permission process. Areas that are defined as highly sensitive zones will be categorised as “no go areas” for development while zones that are of medium and low sensitivity would be categorised as areas of “controlled development”. The Institute for Environment and Development (LESTARI) is currently providing technical assistance to the State Government of Selangor, through the Selangor Town and Country Planning Department (JPBD Selangor) in defining the zones of sensitivity for the highlands within the state.

## THE EASTERN SELANGOR AREA

Eastern Selangor encompasses five local administrative zones. These are the Hulu Selangor, Gombak, Hulu Langat and Petaling Districts in the state of Selangor as well as the Federal Territories of Kuala Lumpur, which is not part of the study. The Selangor Highlands, defined in this study as the zone that exceeds the 100 m contour line, is located in Eastern Selangor. The Highlands extends from the northern part of the state, bordering the state of Perak, to the south at the border of the state of Negeri Sembilan. It is demarcated in the east by the Titiwangsa Range and the state of Pahang. In terms of landuse, nearly three quarters of the area is covered by forests and agricultural land while the remaining quarter

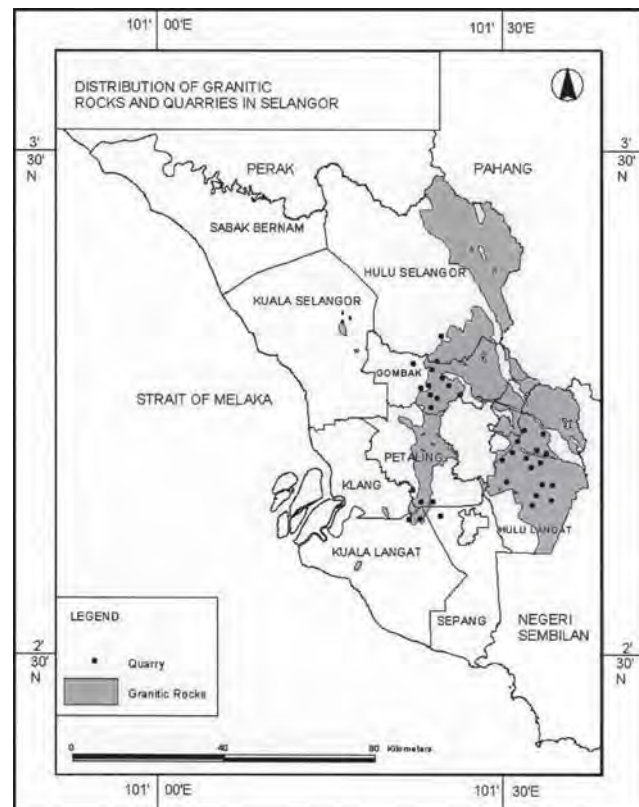


Figure 1: Distribution of granitic rocks and quarries in Selangor (Source: DMG, 2002).

Table 1: The 2001 production of rock aggregates and estimates of reserves and resources (in million tonnes, Mt) in Eastern Selangor (Source: DMG, 2002).

District	No. of Quarries	Annual Production (Mt)	Reserves (Mt)	Resources (Mt)	Resource Location
Hulu Langat	15	12.12	267	150	Hulu Langat Forest Reserve
Gombak	11	7.92	320	230	Bukit Lagong and Ulu Gombak Forest Reserves
Hulu Selangor	1	0.24	5	190	Other landuse and Bukit Gading Forest Reserve
Petaling	1	3.24	9	None	None

is built-up with housing, institutional and commercial centres as well as transportation, infrastructure and utilities.

## QUARRIES AND AGGREGATE RESOURCES

Granitic rocks, covering 22% of the total surface area, are the major source of aggregates in Selangor (Figure 1). About 98% of the rocks are located in Eastern Selangor. Granitic rocks underlie 75% of the Hulu Langat District, 55% of Gombak District, 33% of Hulu Selangor District and 31% of Petaling District.

There are 31 quarries extracting granitic rocks in Selangor and 28 of these are located in the Hulu Langat, Gombak, Hulu Selangor and Petaling Districts (Table 1). The consumers of the rock aggregates in Eastern Selangor are generally located within a radius of 20 km of the quarries. The total annual production of quarries in Eastern Selangor was about 24 Mt in 2001 but this dropped to about 11 Mt in 2005 (DMG, 2006). The total reserves of the quarries are estimated at 600 Mt with an average lifespan of 25 years but almost 30% of this total is below ground level (DMG, 2002).

In terms of resources, 170 Mt is estimated to be adjacent to quarries and this reportedly has a lifespan of about 25 years. In addition, 400 Mt are estimated from new areas in Eastern Selangor, with a lifespan of 23 years if extracted in the future (DMG, 2002). The new resource areas identified in Eastern Selangor are meant to meet the needs of the entire state in the future.

## ESAs AND LANDUSE PRESSURES ON AGGREGATE RESOURCES

The Institute for Environment and Development (LESTARI) is currently defining the Environmentally Sensitive Areas (ESAs) in Eastern Selangor. The results indicate that large tracts of land, which are underlain by granitic rocks in Hulu Selangor, Gombak, Hulu Langat and Petaling Districts, are environmentally sensitive (Table 2). ESAs that are classified as being highly sensitive are categorised as “no go areas” for quarrying. Zones that are of medium and low sensitivity are categorised as areas of “controlled development”, where quarrying activities will be allowed under special circumstances, with very strict conditions.

About 67% of the areas underlain by granitic rocks in the Hulu Langat District have been identified as ESAs. Of

this area, 21% are classified as being highly sensitive where quarrying will not be permitted. Preliminary results indicate that all the quarries in the Hulu Langat District are located in zones of medium and low sensitivity, which would be categorised as areas of “controlled development” in the future. The resources identified by the Minerals and Geoscience Department Malaysia are also located in zones of medium and low sensitivity. Thus, future exploitation of resources in the Hulu Langat Forest Reserve would be under special circumstances and with more stringent conditions than those presently imposed. Currently, quarries are located in agricultural and unused land. It is anticipated that much of the resources near the quarries may be sterilised by built-up areas unless the resources are identified as an ESA for Life Support Systems and earmarked in the development plan as an aggregate landbank for future use.

About 85% of the areas underlain by granitic rocks in Gombak District have been identified as highly sensitive zones where quarrying should not be permitted. There are no zones of medium and low sensitivity over the granitic rocks here. Preliminary results indicate that six of the eleven quarries operating in Gombak District are located in the Bukit Lagong Forest Reserve, which will now be classified as being highly sensitive and a “no go area” for quarrying. Furthermore, future resources have been identified in both Bukit Lagong and Ulu Gombak Forest Reserves, which are classified as being highly sensitive zones. The Selangor State Government, in conjunction with the Minerals and Geoscience Department, will have to review this matter urgently, in view of the fact that the Department has identified this area as a major supplier for rock aggregates in the future, to sustain development in the state.

About 98% of Hulu Selangor District that is underlain by granite has been identified as ESAs. Of this amount, 88% is classified as highly sensitive zones where quarrying is not to be permitted. About 10% of the ESAs are of medium and low sensitivity. There is already one quarry operating in this zone with an estimated life span of 20 years (DMG 2002). New resources have been identified by the Minerals and Geoscience Department Malaysia in the Bukit Gading Forest Reserve and other non-forest landuse categories. The Bukit Gading Forest Reserve will soon be classified as being highly sensitive and a “no go area” for quarrying. The other areas with potential resources are located in zones of medium or low sensitivity, which would be categorised as areas of “controlled development”

Table 2: Percentage of sensitive zones in areas underlain by granite.

Districts	Total Granite Areas (ha)	High Sensitivity (%)	Medium Sensitivity (%)	Low Sensitivity (%)	Others (%)
Hulu Langat	62,647	21	43	3	33
Gombak	34,576	75	10	0	15
Hulu Selangor	58,155	88	9	1	2
Petaling	15,526	0	0	16	84

in the future. Future exploitation in these areas would be under special circumstances and with stringent conditions. The resources here need to be identified as an ESA for Life Support Systems and ear-marked in the development plan as an aggregate landbank to support the development plans of the state of Selangor.

Only 16% of the Petaling District that is underlain by granite, has been identified as ESAs and classified as a low sensitivity zone. There is currently one quarry operating there with an anticipated life span of 3 years (DMG, 2002). However, due to the expansion of built-up areas, resources in this District have been sterilised.

## CHALLENGES IN ENSURING AGGREGATES SECURITY

There are currently six quarries operating in the highly sensitive environmental zones, which are categorised as “no go areas” for quarrying in Eastern Selangor under the Selangor Policy on ESAs. At least ten quarries are operating in zones that are of medium and low sensitivity, which are areas of “controlled development”. These operations should be monitored carefully by the Department of Environment Selangor, in conjunction with the Minerals and Geoscience Department of Selangor, in order to ensure that they comply with all existing environmental standards. In the future, when the Selangor Policy is fully implemented, whereby quarry operations will not be considered in highly sensitive environmental zones. In addition, stringent guidelines would be formulated and imposed on any new operations in areas of medium and low sensitivity.

In terms of new rock resources, about 66% of the resources identified by the Minerals and Geoscience Department Malaysia in Eastern Selangor are located in ESAs of high sensitivity. The areas include Bukit Lagong and Ulu Gombak Forest Reserves in Gombak District and the Gading Forest Reserve in Hulu Selangor District. About 26% of the resources in Eastern Selangor are located in ESAs of medium and low sensitivity in the Hulu Langat Forest Reserve. The remaining 8% are of the resources identified in Eastern Selangor are located in non-ESAs. Thus, implementation of the Selangor Policy on Environmentally Sensitive Areas in Eastern Selangor will result in sterilisation of 66% of the resources currently located in ESAs of high sensitivity, as these will be “no go areas” for quarrying. This leaves only 34% of the resources that have been identified relatively available, of which only 8% is open for quarrying activities. As the new resource areas identified in Eastern Selangor are

meant to meet the upcoming needs of the entire state, its non-availability will hinder future supply of aggregates from that area and pose a threat to development in Selangor. The situation is compounded by the fact that 30% of the current total quarry reserve in the state is below ground level (i.e. below natural drainage level). It is highly unlikely that stakeholders, in particular the public, will relish the thought of creating new open pits in this highly urbanised state.

Local Authorities and other stakeholders should be convinced that new aggregate resources in ESAs of medium and low sensitivity serve a life support function in the form of provision of shelter and maintenance of built-up areas. Thus, new resources in the Hulu Langat Forest Reserve should be ear-marked in the development plan as an aggregate landbank for future use. Initially, the spatial extent of existing quarry reserves and resources that is relatively open for exploitation should be determined at the lot level and prioritised for Local Authorities and the Land and Mines Department, in conjunction with appropriate stakeholder consultation. An assessment of the extent of existing or committed development, and the nature and extent of any proposed development should also be conducted. The information and stakeholder participation will enable the delineation and gazettement of aggregate landbanks and buffer zones in local development plans, to prevent sterilisation of the reserves and resources.

In the meantime, efforts should also be made to thoroughly investigate other non-ESAs that are open for exploitation, to identify aggregate resources to support the state after the current reserves have diminished. These areas should be identified very quickly and ear-marked in the development plan as an aggregate landbank before it is sterilised by built-up development. In addition, a programme to promote recycled construction aggregates from construction and demolition waste should also be initiated. The life cycle of construction aggregates in Selangor should be investigated to promote the 4Rs i.e. reduce, reuse, recycle and recovery. Such measures will serve to maintain a balance in the supply and demand of rock aggregates, while reducing the need for new quarries and minimising the environmental impacts of operating ones.

## CONCLUSION

Mineral security in its broad definition has not been comprehensively studied in the country. This is particularly

true in the case of rock aggregates in Eastern Selangor, in the light of the impending implementation of the Selangor Policy on ESAs at the Local Authority level. Preliminary findings reveal that six quarries and 66% of new aggregate resources in the state are located in highly sensitive ESAs of Eastern Selangor, which are categorised as “no go areas” for quarrying. At least ten quarries and another 26% of new resources are located in ESAs of medium and low sensitivity, which are areas of “controlled development”. Only 8% of the new resources identified are actually available for exploitation in the future. Aggregate reserves and resources should be prioritised and delineated in local development plans as land banks to meet future aggregate demand for urban development. Efforts should also be made to thoroughly investigate other non-ESAs in Eastern Selangor, which is underlain by granite to identify aggregate resources to support the state after the current reserves have diminished. This should be augmented by promotion of recycled construction aggregates to maintain aggregate security and ensure sustainable development.

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