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# **DEVISING STRATEGIES FOR RECLAMATION OF DERELICT SITES DUE TO MINING OF RESIDUAL SOIL (“SAIBRO”) AT UBATUBA, NORTH COAST OF SÃO PAULO STATE, BRAZIL: THE VIEWS AND ROLES OF THE STAKEHOLDERS**

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## **ABSTRACT**

Between the late 60's and early 90's intensive exploitation of residual soil for civil construction took place in the municipality of Ubatuba, North Coast of São Paulo State. Tropical climatic conditions associated with a hilly landscape bordered by the Atlantic Ocean gave rise to thick (10-30m) weathering profiles derived from Precambrian granitic-gneissic rocks. Exploitation of large volumes of this material required only very simple technology, which on the other hand has caused highly adverse environmental impacts, such as deforestation, soil erosion, land instability hazards, scenic deterioration, pollution and disturbance of local water flow regime. This paper deals with the devising of strategies thus identifying stakeholders and describing their roles both on the dereliction and reclamation processes related with residual soil exploitation. The evaluation approach focused on the analysis of the regulatory framework and its practical implications and issues in terms of licensing for mining operations, commercialization of construction materials, and the relations of such mining activities with regional and urban planning. A survey of stakeholder

viewpoints was successfully achieved through a two-day workshop. The attendance included decision-makers, officials and representatives of governmental and regulatory bodies (Federal, State and Municipal), environmental research institutions, private miners (entrepreneurs) and consultants, public attorney, and NGOs. The outcomes have indicated that State and local authorities properly managed to stop illegal exploitation of residual soil in the early 90's. However no land reclamation was undertaken until present. One of the main problems would be related with the procedures for mining and environmental licensing that were considered to be too complex and long (usually involving up to seven decisional instances and 2,5 years in average). Other key issues and needs identified included: a) organization of a database in a Geographic Information System; b) formulation of a Regional Mining Directive Plan consonant with the other Management Plans; c) regulation of land ownership; d) regulatory framework able to reconcile development and preservation so that to prevent illegal mining; e) development of integrated models for reclamation taking comprehensive consideration to aggregate production, reduction of risks and land recovering.

## INTRODUCTION

Between the late 60's and early 90's intensive exploitation of residual soil for civil construction took place in the municipality of Ubatuba, North Coast of São Paulo State (figure 1). Exploitation of large volumes of this material required only very simple technology, which on the other hand has caused highly adverse environmental impacts, such as deforestation, soil erosion, land instability hazards, scenic deterioration, pollution and disturbance of local water flow regime (Chiodi *et al.* 1982, Campos & Bitar 1984, Bitar *et al.* 1985, Campos *et al.* 1986, São Paulo 1989, Braga *et al.* 1991, Silva 1995, Silva & Martins 1997).

The material was widely used for civil construction, particularly road surfacing and fill for housing and commercial building. There was a general expectation that mining activities could be carried out in “less predatory” ways after 1976, when São Paulo State legislation on the prevention and control of environmental pollution (Law 997 from May, 31, 1976 and its regulatory Decree 8468 from September, 8, 1976) was put in force. However, only by the early 90's, State and local authorities properly managed to stop non-licensed exploitation of residual soil. Even though no land reclamation was undertaken until present so that there are nearly a hundred of unsightly sites at Ubatuba municipality, among them nearly sixty can be considered as derelict sites.

The derelict sites entail at least three undesirable consequences: a) depreciation of landscape patrimony of a region with touristic vocation; b) rise of geological-hydrological hazards; and c) constraints for development of economic activities of mining.

This paper deals with the devising of public policies and strategies thus identifying stakeholders and describing their roles both in the dereliction and reclamation processes related with residual soil exploitation. It is suggested that the problem should be managed through the development and implementation of models for reclamation able to take comprehensive consideration to aggregate production, reduction of hazards and land recovering.

The evaluation approach has focused on the following topics: 1) description of the problem using the PES method (Situational Strategic Planning); 2) analysis of the regulatory framework and its practical implications in terms of licensing for mining operations and commerce of construction materials; and 3) the relations of such mining activities with regional and urban planning.

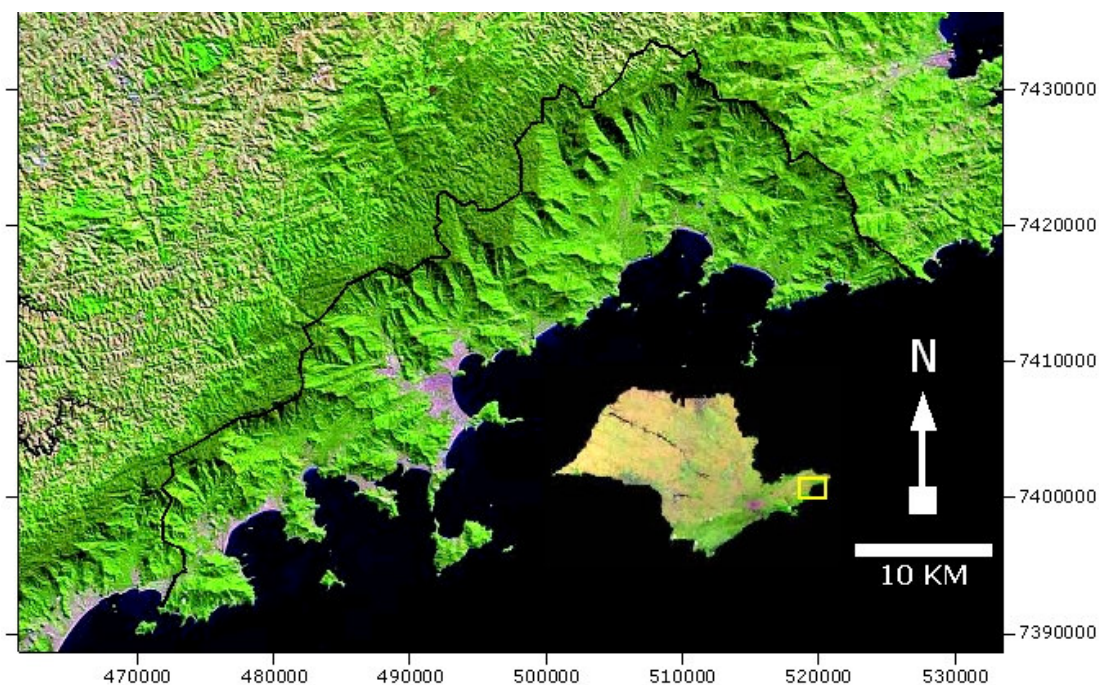


Figure 1. Localization of Ubatuba municipality showing main relief features. Landsat 7 image satellite ETM. UTM projection, 23 zone, SAD 69 datum.

## METHODOLOGY

The study methods included: a) target literature review and survey of previous work; b) problem processing following the PES method (Matus 1996, Huertas 1997); c) regulatory framework analysis; d) examination of official records and proceedings for environmental licensing for mining activities at the local office of the State Environment Agency (CETESB); e) on-line survey of official records and proceedings for mining permit at National Department of Mineral Production (DNPM) website; f) direct discussion with the stakeholders in a two-day workshop and in some previous interviews and meetings. The attendance included decision-makers, officials and representatives of governmental and regulatory bodies (Federal, State and Municipal), environmental research institutions, private miners (entrepreneurs) and consultants, public attorney, and NGO's.

A number of studies about mining activities in the region of Ubatuba have been conducted since the 70's. Amongst these studies it is worth highlighting Silva *et al.* (1977), Chiodi *et al.* (1982), Campos & Bitar (1984), Bitar *et al.* (1985), Campos *et al.* (1986), which have been carried out on behalf of the former São Paulo State Seashore Development Agency (SUDELPA). Other key previous studies include São Paulo (1989) and Braga *et al.* (1991), under the auspices of the Serra do Mar Hazard Mapping Programme (São Paulo 1988), and more recently Ferreira (2003, 2004) has issued a review, update and systematization of these previous works.

The PES method (Matus 1996, Huertas 1997) was the tool used for problem processing and description. The problem itself, its causes, consequences and quantitative indicators were defined. A general scheme about the PES method is presented in Table 1.

Table 1. Generic situational flow chart of the PES method (Matus 1996, Huertas 1997).

<i>Problem definition and situational appraisal by an unique stakeholder</i>			
CAUSES			RESULTS
RULES	ACCUMULATIONS	FLows	INDICATORS
- formal rules	- how the institutions work	- acts and operations	- clear quantitative indexes to measure the evolution of the problem
- practical rules	- organizative systems	- routines	
- regulatory framework	- institutional culture	- daly procedures	
	- methods of work		
	- technologies		
	- administrative and cognitive powers		

The approach has included an analysis of the complex regulatory framework at three levels: federal, state and local. The main pieces of legislation related with environmental and mining licensing for a region such as Ubatuba to which approximately 70% of municipal territory corresponds with a nature and wildlife reserve is presented in Table 2.

Proceedings on the environment licensing of mining activities were the basis for the analysis of a reasonable range of problems. Such proceedings provide useful information such as identification of permit holders (and applicants), geographic coordinates of site location, geological and geotechnical data, environmental impact assessments and so forth. Twenty-two out from a total number of fifty proceedings for environment licensing of mineral exploitation- comprising the four municipalities of the State North Coast (Ubatuba, Caraguatatuba, Ilhabela and São Sebastião) - were analysed in order to obtain a better statistic sampling.

The approach taken also included an on-line survey of mining permit records databank which comprises two main components: tabular and spatial. The tabular data component provides information about the applicant (permit holder), location, type of mineral resource to be exploited, area dimensions, and record log of each procedural step from application to issue of permit, including dates, procedure description, decisions made and so on. The spatial data component includes full georeferencing of the polygons requested for mineral exploited and any protection buffer zones.

The workshop gathered the main stakeholders involved in the mining of residual soil divided into five thematic panels (see Table 3). The goals set up for the workshop were the following: a) to introduce the project to stakeholders and community; b) to seek information and available data not yet considered by the project team; c) to conduct a survey of stakeholders views and interests; and d) to convey these different views and interests in a discussion that ultimate aim was to come up with the identification of main issues and common viewpoints as well as early suggestions for the build-up of a strategy or policy for reclamation of derelict sites.

Table 2. Main regulatory framework related with mining activity at Ubatuba.

<b>FEDERAL</b>
Federal Constitution: Article 176 (claims that mineral resources are considered to be property of the Federal Government) and Article 225 (states the common right of a healthy environment);
Decree-Law 227, from 02/28/1967, Mining Code and its supplementary regulations and modifications through the following instruments: Federal Law 6403, from 12/15/1976; Federal Law 6567, from 24-09-1978; Federal Law 7085, from 12/21/1982; Federal Law 7805, from 07/18/1989; Federal Law 8901, from 06/30/1994; Federal Law 8982, from 01/24/1995; Federal Law 9314, from 11/14/1996; Federal Law 9827, from 08/27/1999; Federal Decree 62934, from 07/02/1968; Federal Decree 98812, from 01/09/1990; Federal Decree 3358, from 02/02/2000).
Federal Law 4771, from 09/15/1965: establishes the Forestry Management Code of Practice;
Federal Law 6938, from 08/31/1981: sets up the milestone for the Nacional Policy on the Environment;
Federal Law 7754, from 04/14/1989: deals with the protection of forests close to river springs;
Federal Law 9605, from 02/12/1998: establishes administrative and criminal penalties to acts or activities that harm the environment;
Federal Decree 750, from 02/10/1993: deals with the suppression of vegetation on the Atlantic Forest.
Resolutions of the National Environment Council (CONAMA), in special: Resolution 01, from 01/23/1986; Resolutions 09, 10 and 13, from 12/06/1990; 10, from 10/01/1993; Resolutions 302 and 303, from 03/20/2002;
Regulatory Issues of the Ministry of Mining and Enegy (MME) and of the National Departament of Mineral Production (DNPM), in special Issue MME 23, from 02/03/2000 and Issue DNPM 01, from 02/22/2001.
<b>STATE</b>
São Paulo State Law 997, from 05/31/1976: sets up the principles for the environmental pollution control;
São Paulo StateLaw 9509, from 03/20/1997: establishes the São Paulo State Environmental Policy;
Resolutions of the State Secretary for the Environment, in special: Resolution 18, from 10/23/1989; Resolution 26, from 08/30/1993; Resolution 42, from 12/29/1994; Resolutions 03 and 04, from 01/22/1999; Resolutions 04 and 21, from 11/21/2001.
<b>MUNICIPAL</b>
Ubatuba Municipal Law 711, from 02/14/1984: Urban and Structural Plan of the municipality.

## RESULTS AND DISCUSSION

Table 3 presents the stakeholders identified and their interests and roles in the problem (site dereliction and reclamation). These are grouped into five subjects according to workshop thematic panels as discussed below. The outcomes of problem processing screened in causes at three main clusters (rules, accumulations and flows) and consequences with quantitative indicators of the problem are displayed in Figure 2.

### *Regional and Local Management Plans*

The establishment of regional planning and management plans for the region is very recent. The Economic-Ecological Zoning (EEZ) was approved in December 2003 and discussions on the Watershed Management Plan have not yet been concluded though an Assessment Report

dated of 2000 was produced by the Steering Committee. Currently, two other key instruments are under construction: the Serra do Mar State Park Management Plan and the São Paulo State Coastal Management Plan.



Table 3. The main stakeholders and their roles on the problem of dereliction and reclamation of mined sites (to be continued).

<i>SUBJECT</i>	<i>STAKEHOLDER</i>	<i>INTEREST/ROLE</i>
REGIO- NAL AND LOCAL MANAGE- MENT PLANS	State Environmental Planning Department (CPLEA)	Responsible for co-ordination and implementation of Economic Ecological Zoning and Coastal Management Plan.
	Northshore Watershed Committee	Decision-making board responsible for water resources management (catchment, supply, distribution, sewage systems, funding to projects and structures).
	Mayoralty	Through its Secretary of Urban Planning is responsible for the implementation and management of the Municipal Structural Plan and local directives on urban land use.
	City Council	Responsible for the build-up of local legislation on land use and developments.
	State Forest Institute	The IF is responsible for the administration of State Nature and Wildlife Reserves. Therefore IF is in charge of the devising and implementation of the Serra do Mar State Park Management Plan.
ENVIRON- MENT AND MINING LICEN- SING AND CONTROL	National Department for Mineral Production (DNPM)	The DNPM is the ultimate responsible for the issuing of permits mineral exploration and exploitation. It also records the environmental license issued by the Mayoralty in the case of mineral exploitation of raw construction materials.
	State Environment Agency (CETESB)	Responsible for enforcement of environmental legislation and regulations on pollution control. Its role includes licensing for installation and operation of any activities liable to cause environmental damage, application of penalties and legal embargo.
	State Natural Resources Protection Department (DEPRN)	The DEPRN recommendations are a key part of the environmental licensing procedures. It analyses environmental impact assessments and reports with reference to wildlife and natural resources to be protected.
	State Forest Institute (IF)	The IF is responsible for State Park administration and advises the environmental licensing process with reference to any land use and economic activity within and around (10-km buffer protection zone) nature and wildlife reserve.
	State Council for Cultural, Historical and Archaeological Heritage (CONDEPHAAT)	The CONDEPHAAT provides advice in the environmental licensing process with reference to any land use and economic activity at the surroundings (up to 300 meters) of sites of cultural and historical interest. For instance, the whole Serra do Mar Mountain Range (and not only the State Park) is considered to be a site of interest.
	State Environmental Police	Responsible for police actions with reference to enforcement environmental legislation and control.
	Mayoralty	Through its Secretary of Environment is responsible for the issuing of specific licenses required in the environmental and mining permitting processes.

Table 3. The main stakeholders and their roles on the problem of dereliction and reclamation of mined sites (continuation).

<i>SUBJECT</i>	<i>STAKEHOLDER</i>	<i>INTEREST/ROLE</i>
SOCIAL-ECONOMIC CHAIN	Miners (and Private Sector)	Investments for mineral exploitation and appropriate commercialisation of raw materials such as fine aggregate, earth, clay, sand. Also investments for redevelopment of disused of quarried/mined sites (e.g. estate market)
	Consultants	Provision of services and technical advice to miners (and entrepreneurs)
	Mayoralty	Through its Secretary of Public Services and Structure is responsible for the maintenance of streets and local roads. Also potential consumer of raw constructions materials such as fine aggregates, earth, clay, sand etc.
RISK MANAGEMENT	State Civil Defense (CEDEC)	Responsible for monitoring and control of hazards and prevention and response to natural disasters including landslides associated with abandoned mined sites. CEDEC implements and manages the State Civil Defence Plan
	Mayoralty	Municipal Civil Defence Commission is responsible for the implementation of Civil Defence Plan at local level
RECLAMATION OF DERELICT SITES	Public Attorney	Enforces compliance for socio-economic well-being and for the protection of natural resources and non-specific environmental assets properties, and goods; wide jurisdictional power to legally request land restoration-reclamation
	State Environmental Organisations (e.g. CETESB, DEPRN, IF, Geological Institute)	Responsible for a wide course of actions regarding (State) public authorities role in the environmental management, pollution prevention and control, protection of natural resources
	Land Owner's	To add value to properties and to propose alternatives to solve legal dispute
	Non-Governmental Organizations	To defend interests of civil society about environment protection and to propose problem-solving alternatives
	Mayoralty	Incentives to best practice and fund raising to land reclamation. Add value to land considering natural resource assets (such as landscaping). Rational economic activity in the municipality.

At local level, the Municipal Land Use Law dates from 1984 whilst the Municipal Directive and Structural Plan dates from 1996. They both need to be updated in order to comply with new federal legislation on urban land use (The Statute of the Cities - Federal Law 10.257, from July 10, 2001). In this context, early developments of such planning instruments have all taken some consideration to the issues related to mining activities nearby urban areas or in environmentally protected zones. However few practical measures and actions have been taken or implemented up to date.

In the Economic-Ecological Zoning there is a statutory requirement for a Regional Directive Plan for mining and mineral exploitation. However, discussions for the devising of such Plan remain to be started. The Watershed Management Plan Bill includes short and mid-term goals relative to mining activity such as: organization of an updated databank of all mined sites; reclamation of derelict sites; measures for compliance of currently non-

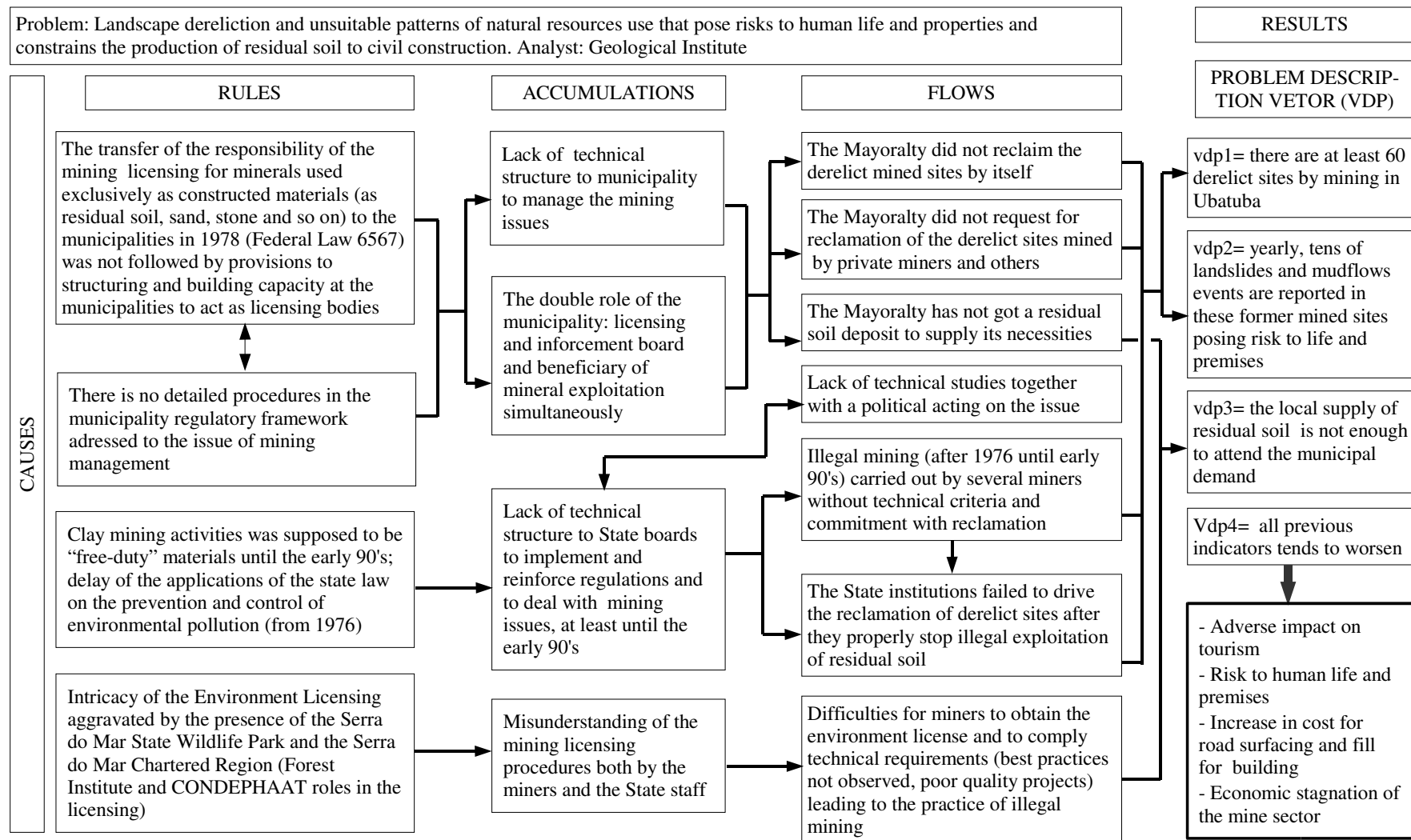


Figure 2. Application of the explanatory step of PES method (situational flow chart) on the derelicted sites by mining in Ubatuba.

licensed mining activities to stated standards; enhanced control of mining operations; and devising of a Regional Directive Plan for mining and mineral exploitation conforming to water resources management as well. Particular consideration should also be taken to mineral exploitation in the Serra do Mar State Park Management Plan as a significant number of mining sites are located within the buffer protection zone (10 km contiguous to park boundaries).

Even the Municipal Directive and Structural Plan points out the following matters: a) lack of appropriate policies for the mineral exploitation sector; b) occurrence of long-term inappropriate practices; and c) precarious control exerted by the municipal administrative level (see also Figure 2). The Plan requires land reclamation and suitable control of mining activities in the municipality. In addition, the Municipal Land Use Law states that any application, project or engineering works that requires removal of soil cover (of any thickness) should: 1) not involve land with slope steepness greater than 25 degrees or that can be seen from the beaches and from the main roads; 2) submit a vegetation recovering plan for the area to be affected; and 3) indicate the amount of the material to be exploited (and removed) and a completion deadline for such work.

#### *Mining Permitting, Environmental Licensing and Control*

The environmental licensing for the exploitation of residual soil (for commercialization as aggregate and not only as borrowing material) was expected to be undertaken since the São Paulo State legislation on the prevention and control of environmental pollution (State Law 997 of May 31, 1976 and its regulatory Decree 8468 of September, 8, 1976) was put in force. However, ambiguity and misinterpretation of this legislation - due traditional ways of thinking that control should be exerted only on industrial sources of pollution and residual soils could be considered as “free minerals” – has led to a 15-years delay for practical enforcement of environmental licensing requirements. It was only by the early 1990's, supported by resolutions of CONAMA (National Council for the Environment) - Resolution 01-1986 and Resolution 10-1990), and probably influenced by public opinion (as indicated by workshop attendants), the State and local authorities managed to stop unlicensed exploitation of residual soil and formally request proper licensing for the new mining sites.

Furthermore, it was only in the 1990s by means of three resolutions dated of 1993, 1995 and 1999, the São Paulo State Secretariat for the Environment (SMA) started organizing its own procedures for licensing the exploitation of minerals to be used in civil construction. The 1999 Resolution is the regulation currently in force, but due to updating by now.

It is worth stressing the process of mining permitting and environmental licensing of mineral exploitation is definitely intricate at the Ubatuba region as it comprises at least seven jurisdictional levels (see Table 3). An examination of 22 proceedings at the local office of the State Environment Agency (CETESB) shows that only 50% of applications were successful in having a license for operations granted. It was observed that average time-spent from application to license grant was 2.5 years. The main problems identified were the following: a) bureaucracy and lack of standard mechanisms for the analysis of permit applications; b) insufficient technical staff in public organizations responsible for the analysis of permit applications; c) poor technical standards of projects presented in support to permit applications; and c) problems of land ownership frequently preclude processing of permit applications (most sites have no proper land documentation registered at public notary).

The Federal Law 6567 – 1978 has transferred jurisdiction to the municipality over mining permitting for minerals to be used exclusively as constructed materials. However, actual and current practice of local miners and entrepreneurs is to produce not more than a preliminary land use permit (issued by the Mayorality) at the beginning of the process, assuming this meet all requirements either for mining operations or for environmental licensing of these. After that, local authorities have no track record on further procedures for the issuing of mining and environmental permits. Two aspects should be highlighted here: 1) there is no formal or specific administrative structure to deal with the mining permit process at municipal level; 2) indeed, there is a conflict of interests since the municipality (through the Mayorality) is a major consumer of residual soil (earth) for road maintenance and other engineering works (see also Figure 2).

Matters related with the control of illegal mining operations include: a) easy access to sites and simple technology required for exploitation of residual soil deposits; b) lack of effective policies to promote good practice and legal exploitation; c) demand of material in the construction sector; d) negative perception of miners, entrepreneurs, and even sectors of the population in relation to the enforcement of environmental regulations (e.g. in relation to Environment Police actions); e) lack of integrated mechanisms of control (for instance, fiscal and environmental control are not implemented in conjunction).

#### *Social-Economic Chain related to Residual Soil Exploitation*

In 2004, there were only two exploitation pits of residual soil fully licensed for operations in Ubatuba. Pricing is significantly influenced by distance between the source (exploitation site) and the consumer. In 2004, prices were about R\$60,00 (Brazilian currency), in average, for a

lorry with approximately 5 m<sup>3</sup> load capacity. A summation of factors that include low value of such aggregate, simple technology required for exploitation, direct use in civil construction, and delay for proper consideration to potential adverse environmental impacts led to a sort of culture of “free exploitation” of residual soil that have lasted for years.

Others problems identified (by miners and private sector entrepreneurs) in the socio-economic chain include: a) unfair competition between legal and illegal miners (as the latter do not pay taxes and may not be liable for site reclamation unless legal action is taken for it) b) poor quality consultancy services that do not properly take into account considerable environment impacts caused by the residual soil exploitation; c) difficult to integrate the business viewpoints with the environmental awareness, particularly with reference to a relatively protected nature reserve region such as the North Coast of São Paulo State; d) lack of economic incentive mechanisms (or market self-regulation protocol) to replace traditional command-and-control approach, which is strongly dependent on course of action set by public authorities; e) enormous difficulties for the municipality to exert its legal right of charging miners with the Financial Contribution Over Mineral Exploitation (CFEM) (65% of CFEM must be destined to local authority in order to promote environmental site reclamation).

#### *Hazards associated with open pit mining sites*

A recent survey has accounted at least 32 hazardous sites - susceptible to landslides - in the municipality Ubatuba, nine of them in direct association with abandoned or unsightly mining sites (Silva 1995, Silva & Martins 1997, Ferreira 2004). Many of these abandoned mining sites have been used for informal housing at unsuitable ground conditions thus prone to landsliding hazards. Some of these have also potential for proliferation of health diseases (due to accumulation of water and refuse).

#### *Strategies for reclamation of derelict sites*

In face of so many abandoned or unsightly mining sites the role of the Public Attorney is relevant to identify legal liabilities and to compel land reclamation. On the other hand, legal contests tend to be time-consuming, and in some cases, due to long-term characteristics of mineral exploitation, it may not be easy to attribute liability for a specific environmental damage. Therefore, the main strategy envisaged is the development of integrated models for reclamation taking comprehensive consideration to aggregate production, reduction of risks and land recovering (Figure 3).

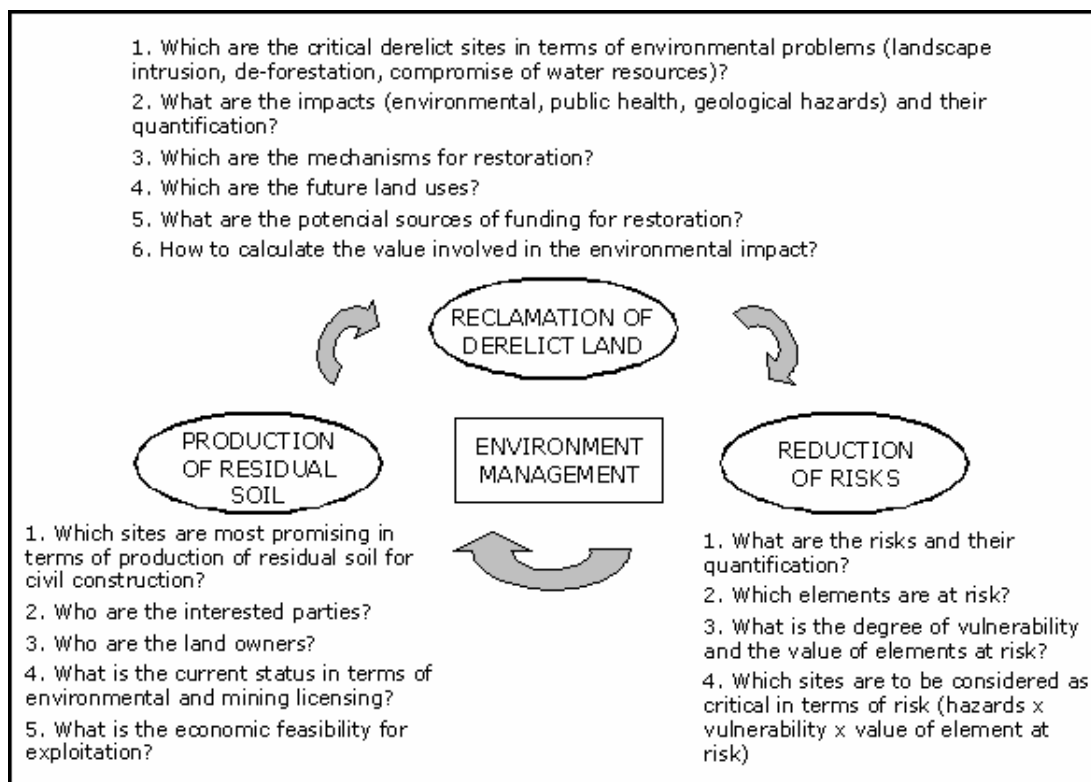


Figure 3. Integrated strategy for reclamation taking comprehensive consideration to aggregate production, reduction of risks and land recovering. Questions indicate the studies necessary to adopt the indicate strategy.

There are cases in which derelict sites may be subject to further exploitation and in-situ materials partially used for site reclamation. Other sites are suitable for redevelopments such as housing, commercial buildings and others facilities. Sites where hazards have been identified must firstly get through a land stabilization intervention in order to reduce the risks. Another category refers to sites located within or at the vicinities of the Serra do Mar State Park (Atlantic Forest Biome). These sites are regarded as of major aesthetic and ecological value.

The topics described and discussed above disclose the complexity of the problem, but also indicate a number of opportunities to meet financial resources for land reclamation and re-use of former quarried/mined sites. Potential sources of funding include private miners, private housing and estate development companies, and a variety of national and international environmental funds. Such approach requires a previous systematisation that involves: a) build-up of GIS (Geographic Information System) database; b) formulation of a Regional



Mining Directive Plan consonant with the Management Plans; c) better regulation of land ownership; d) regulatory framework able to reconcile development and preservation so that to prevent illegal mining.

## **CONCLUSIONS**

The regulatory framework concerning the control of environmental impacts due the mining of residual soils was consolidated as early as 1976. However only in the 1990's the State and local authorities managed to stop unlicensed exploitation of residual soil and formally request proper licensing for the new mining sites. Even though no land reclamation was undertaken until present so that there are nearly a hundred of unsightly sites at Ubatuba municipality. Nearly sixty of these sites can be considered as derelict. They entail at least, three undesirable consequences: a) depreciation of landscape patrimony of a region with touristic vocation; b) rise of geological-hydrological hazards; and c) restriction for development of economic activities of mining.

The main constraints to the problem are: a) the planning instruments of the region have all taken some consideration to the issues related to mining activities, however few practical measures and actions have been taken or implemented up to date; b) the process of mining permitting and environmental licensing of mineral exploitation is definitely intricate including problems such: bureaucracy and lack of standard mechanisms for the analysis of permit applications, insufficient technical staff in public organizations responsible for the analysis of permit applications, poor technical standards in the projects presented to support the licensing procedure; and problems with the land ownership that may preclude permit issue.

It is envisaged that the most efficient approach should involve the development of integrated models for reclamation taking comprehensive consideration to aggregate production, reduction of risks and land recovering.

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