7 PROJECT ALTERNATIVES

7.1 Introduction

In terms of the EIA Regulations published in Government Notice R543 of 2 August 2010 in terms of Section 24 of the National Environmental Management Act (Act No. 107 of 1998), feasible and reasonable alternatives have to be considered within the Environmental Scoping Study, including the 'No Go' option. All identified, feasible and reasonable alternatives are required to be identified in terms of social, biophysical, economic and technical factors.

A key challenge of the EIA process is the consideration of alternatives[1]. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- incrementally different (modifications) alternatives to the Project; and
- fundamentally (totally) different alternatives to the Project.

Fundamentally different alternatives are usually assessed at a strategic level, and EIA practitioners recognise the limitations of project-specific EIAs to address fundamentally different alternatives.

7.2 The 'no go' alternative

The 'no go' alternative is the option of <u>not</u> proceeding with the continuous ashing project at Tutuka Power Station.

Eskom's core business is the generation, transmission and distribution of electricity throughout South Africa. Electricity by its nature cannot be stored and must be used as it is generated. Therefore electricity is generated according to supply-demand requirements. The reliable provision of electricity by Eskom is critical to industrial development and poverty alleviation in the country.

Tutuka Power Station envisages the continuation of dry ash disposal over Eskom owned land, ideally, which was purchased before the commencement of environmental laws, the Environment Conservation Act, in particular. As part of its planning processes, Eskom developed designs which were approved internally, during this time. With the promulgation of the environmental laws, and the National Environmental Management

[1] In terms of the EIA Regulations published in Government Notice R543 of 2 August 2010 in terms of Section 24 (5) of the National Environmental Management Act (Act No. 107 of 1998), the definition of "alternatives" in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity which may include alternatives to: (a) the property on which or location where it is proposed to undertake the activity; (b) the type of activity to be undertaken; (c) the design or layout of the activity; (d) the technology to be used in the activity; (e) the operational aspects of the activity and (f) the option of not implementing the activity.

Waste Act, Act 59 of 2008, in particular, Eskom would like to align its continued ashing activities with the requirements of the waste licensing processes.

The need for this project is to allow Tutuka Power Station to continue ashing in an environmentally responsible and legally compliant manner for the duration of the operating life of the power station.

In the event that the continuous ashing project does not proceed either the power station will run out of land to legally dispose of its ash and the power station will ultimately be required to close down, which would contribute negatively to the provision of reliable base load power to the national grid, and the country's plans.

Even though the no-go alternative is considered to be unfeasible, the 'no go' alternative will, still be investigated further in the EIA phase as an alternative as required by the EIA Regulations.

7.3 Technical Alternatives

The coal-fired power generation process results in large quantities of ash, which is disposed of in an ash disposal facility. Generally, Eskom has access to, and uses, coal of a low grade (called middlings coal) which produces a larger mass of ash during combustion. Over time, the quality of the coal provided to Eskom has degraded, due to higher ash quantities in the coal. The Tutuka Power Station utilises a dry ashing disposal method.

The waste product is deposited onto the disposal site by means of a stacker, which handles some 85% of the total ash whilst the remaining 15% is placed by a standby spreader system.

As the ash disposal progresses from west to east, the two extendible conveyors will be extended to its final lengths of 4 000 m each. The ash disposal facility is built out in two layers. The front stack is deposited by the stacker and spreader to a height of approximately 45 m. The ash is bulldozed out to a slope of 1:3 for dust suppression and rehabilitation purposes. The stacker then moves around the head – end of the shiftable conveyor to dump another 20 m high back stack. The total ash dump height is then approximately 65 m.

As the ash disposal advances, the topsoil is stripped ahead of the activities and is taken by truck and placed on top of the final ash disposal facility height. Grass is then planted in this top soil.

The existing ash disposal facility has the required dirty and clean water channels and the clean storm water flows to the north and south clean water dams. The dirty water flows to the south settling dam and then to the south dirty water dam.

Due to the fact that Tutuka Power Station utilises dry ashing disposal method, it stands to reason that in order to continue ashing a dry ashing method should still be utilised.

A further technical alternative to limit the need for ash disposal facilities includes the use of higher grade coal which may reduce the amount of ash produced in the power generation process. The power station was originally designed for 35 years and now its life time is extended to 60 years. The boilers are designed to use lower grade coal and the boiler plant would require a redesign for higher grade coal. In order for this alternative to be implemented would require the complete redesign and reconstruction of the power station. The combination of the costs involved in the reconstruction of the power station as well as the higher price of the higher grade coal would have a knock on effect in terms of the country’s electricity prices. Therefore, this alternative is therefore not considered feasible.

7.4 Location Alternatives

Tutuka Power Station is located approximately 25 km north-north-east (NNE) of Standerton in the Mpumalanga Province. The power station falls within the Lekwa Local Municipality which falls within the Gert Sibande District Municipality.

The proposed continuous development is an ash disposal facility with the following specifications:

- Capacity of airspace of 353,1 million m^3 (Existing and remaining); and
- Ground footprint of 2 500 Ha (Existing & Remaining ash disposal facility & pollution control canals)

Figure 7.1 below illustrates the ash disposal facility layout as currently constructed (blue) and outlines the footprint of the proposed future extent of the facility (orange), which is also the Eskom land identified and purchased for ashing.

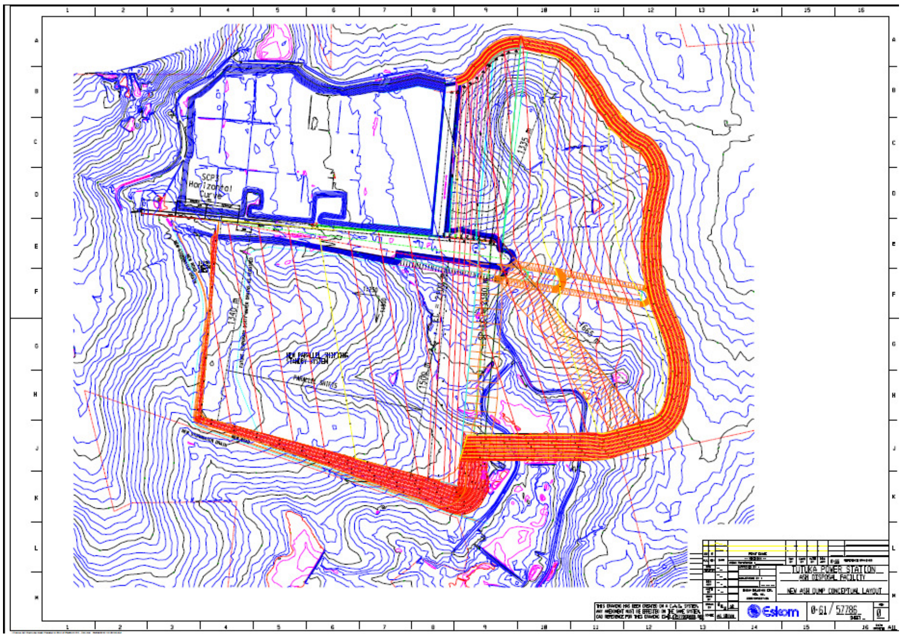

Figure 7.1: The ash disposal facility layout as currently constructed and the footprint of the proposed future extent of the facility

The particular area required for the continuous ashing facility is approximately 759ha, which is located on the eastern and southern portion of the existing Tutuka Power Station ash disposal facility.

However, in order to allow for a robust environmental process, while taking Eskom's proposed site into consideration, all land within a radius of 8 km was assessed in order to identify potential alternatives sites should any sensitive environmental aspects limit the suitability of Eskom's proposed site/land. The Tutuka Continuous Ashing EIA study area is therefore located within an 8 km radius around the source of ash at Tutuka Power Station (**Figure 7.2**).

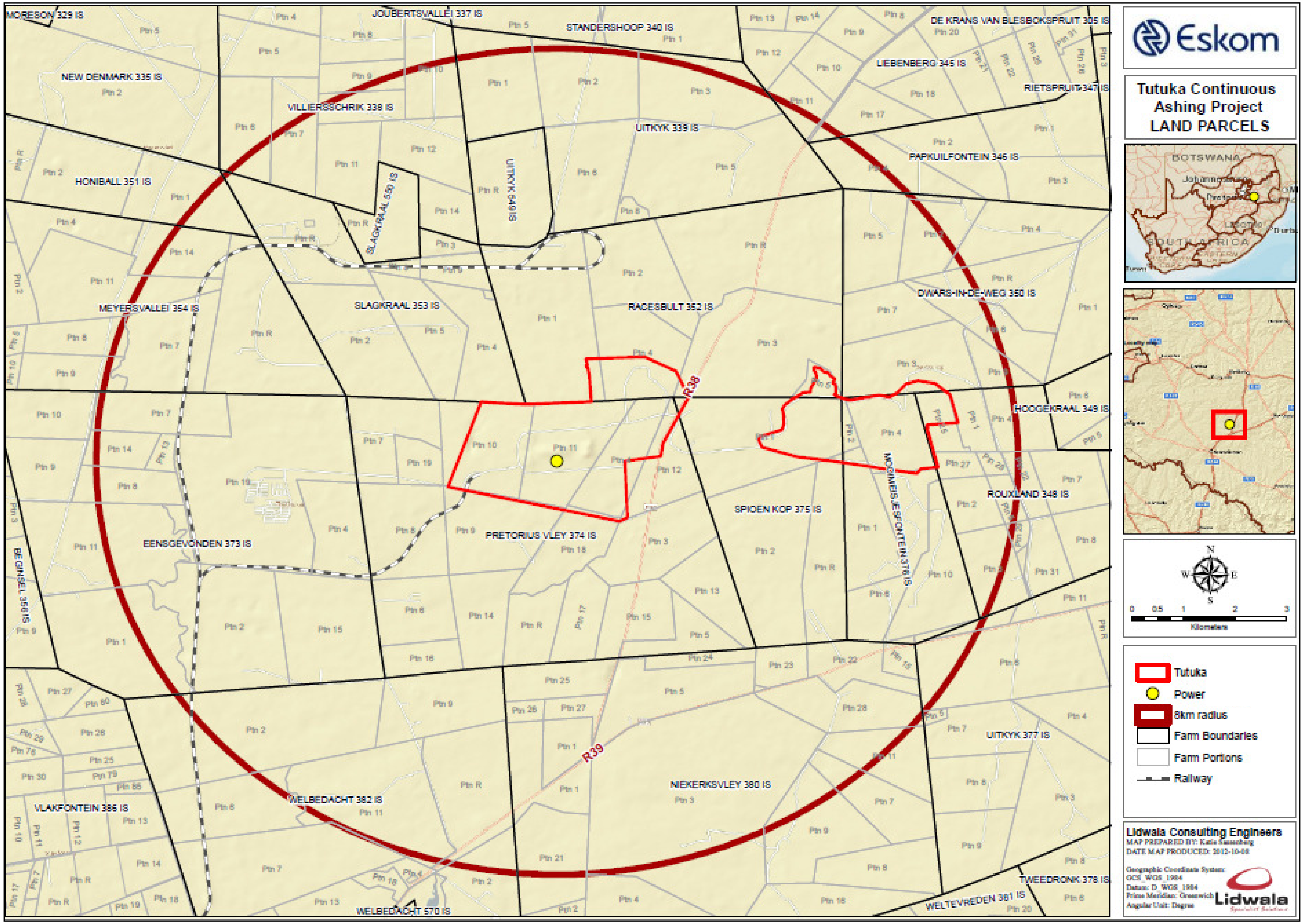

Figure 7.2: Proposed Study Area within which potential alternative sites were to be identified

7.4.1 Screening Analysis and Methodology

A screening study was initiated in order to assess where potential alternative sites are located within the study area that would be suitable for use for the proposed continuous ashing project. The study area was demarcated using an 8 km radius around Tutuka Power Station.

In order to ensure that sites are identified in the most objective manner possible, a sensitivity mapping exercise was undertaken for the study area. The purpose of such an exercise was to identify suitable areas within the study area that could accommodate the proposed ash disposal facility and associated infrastructure and to pro-actively identify sensitive areas (i.e. fatal flaws) that should be avoided.

- ***Sensitivity Mapping***

The qualitative sensitivity mapping exercise divided the study area into three categories *viz.* lower, medium and higher sensitivity areas. A sensitivity map for the study area was requested from each of the following specialist fields:

Biophysical
- Biodiversity (fauna and flora)
- Surface Water
- Groundwater
- Avifauna
- Agricultural Potential

Social
- Social (including Visual and noise)
- Air Quality

Table 7.1 provides a description of the various categories used in the sensitivity mapping.

Table 7.1 Description of the various categories used in the sensitivity mapping

Study Component	Category	Description
Biophysical Components		
Fauna and Flora	Higher Sensitivity	Indigenous natural vegetation that comprehend for a combination of the following attributes: - The presence of plant species of conservation importance, particularly threatened categories (Critically Endangered, Endangered, Vulnerable); - Areas where 'threatened' plants are known to occur, or habitat that is highly suitable for the presence of these species; - Regional vegetation types that are included in the 'threatened' categories (Critically Endangered, Endangered, Vulnerable), particularly prime examples of these vegetation types; - Habitat types are protected by national or provincial legislation (Lake Areas Act, National Forest Act, draft Ecosystem List of NEMBA, Mountain Catchment Areas Act, Ridges Development Guideline, Integrated Coastal Zone Management Act, etc.); - Areas that have an intrinsic high floristic diversity (species richness, unique ecosystems), with particular reference to Centres of Endemism; These areas are also characterised by low transformation and habitat isolation levels and contribute significantly on a local and regional scale in the ecological functionality of nearby and dependent ecosystems, with particular reference to catchment areas, pollination and migration corridors, genetic resources. A major reason for the high conservation status of these areas is the low ability to respond to disturbances (low plasticity and elasticity characteristics)
	Medium Sensitivity	Indigenous natural habitat that comprehend habitat with a high diversity, but characterised by moderate to high levels of degradation, fragmentation and habitat isolation. This category also includes areas where flora species of conservation importance could potentially occur, but habitat is regarded marginal
	Lower Sensitivity	No natural habitat remaining; this category is represented by developed/ transformed areas, nodal and linear infrastructure, areas of agriculture or cultivation, areas where exotic species dominate exclusively, mining land (particularly surface mining), etc. The possibility of these areas reverting to a natural state is impossible, even with the application of detailed and expensive rehabilitation activities. Similarly, the likelihood of plant species of conservation importance occurring in these areas is regarded negligent
Surface Water	Higher Sensitivity	100 m zone from the edge of the permanent wet zone for valley bottom and pan systems.
	Medium Sensitivity	100 m buffer zone from the edge of the temporary zones, or the edge of the riparian zones.

Study Component	Category	Description
	Lower Sensitivity	Higher lying areas, reflecting terrestrial soils and no obligate, facultative hydrophilic vegetation
Ground Water[2]	Higher Sensitivity	Lies within the 250 m river buffer zones, or falls on D3 aquifer type, or on Quaternary sediment.
	Lower Sensitivity	Areas falling outside of the 250 m buffer around surface water features, outside of mapped Quaternary sediment, and outside of the area classified as "D3" on the general hydrogeology map series (GRA1 data)
Avifauna	Higher Sensitivity	Wetlands, rivers and streams, farm dams, CWAC sites,
	Medium Sensitivity	Remaining cultivated lands and farm lands
	Lower Sensitivity	Built up areas, roads, mines, existing ash disposal facilities, railway lines and high voltage power lines
Agricultural Potential	Higher Sensitivity	High Agricultural Potential
	Medium Sensitivity	Medium Agricultural Potential
	Lower Sensitivity	Low Agricultural Potential
<u>Social Components</u>		
Social: Demographic	Higher Sensitivity	Displacement and resettlement of people are necessary.
	Medium Sensitivity	Visual, noise, air quality and traffic impacts on affected parties are acceptable during operation.
	Lower Sensitivity	No displacement and resettlement of people are necessary.
Social: Economic and Land use	Higher Sensitivity	Land use is affected in such a way that those who are dependent on the land to make a living are affected, and mitigation measures cannot neutralise the impacts. Good agricultural land is lost. Potential mining land is lost.
	Medium Sensitivity	Land use is affected in such a way that those who are dependent on the land to make a living are affected, but mitigation measures can neutralise the impacts. Land that was mined and which is stable, not potentially putting people's safety at risk.
	Lower Sensitivity	Land use activities can carry on, and people who are dependent on the land to make a living can carry on with their activities. Good agricultural land is not affected. Potential mining land is not affected.
Social: Noise impact	Higher Sensitivity	Closer than 4 km to urban areas and any informal settlement.
	Medium Sensitivity	Areas where construction is possible, as the Tutuka power station is already the centre of a noise degraded area.
	Lower Sensitivity	Area at or within an 8 km radius of the Tutuka Power Station. Subject to consideration of isolated noise sensitive sites.

[2] Depth of groundwater across the site is not known with accuracy, but is almost certainly shallower closer to surface water features - hence the higher sensitivity assigned to a 250 m buffer zone adjacent to surface water features. Permeability (rate at which water can "penetrate" ground) is covered by the DWA hydrogeological classification - essentially the same across the site ("D2"), except for the small area classified as "D3" - which has higher borehole yields and likely higher permeability, and has therefore been classified as medium sensitivity rather than lower sensitivity. The 250 m buffer is a horizontal distance, not a depth.

Study Component	Category	Description
Social: Visual Impact	Higher Sensitivity	Restricted location for the proposed development with highest visual sensitivity – no positive criteria and one or more restrictions (negative criteria).
	Medium Sensitivity	Acceptable or suitable location for the proposed development with neutral visual sensitivity – no positive criteria, but no restrictions (negative criteria) either.
	Lower Sensitivity	Preferred or ideal location for the proposed development with lowest visual sensitivity – complies with the positive criteria with no restrictions (negative criteria)
Air Quality	Higher Sensitivity	Zone containing potentially expanding and permanent residential settlements within the direction of the prevailing winds
	Medium Sensitivity	Zone with potentially sensitive receptors but out of the prevailing wind direction
	Lower Sensitivity	Zone within the expected exceedance area with no potentially sensitive receptors.

- ***GIS Layer Amalgamation and Sensitivity Indice Calculation***

In order to calculate a combined sensitivity rating for the study area, all the GIS layers received from each specialist area of study (e.g. ground water, biosensitivity etc) were combined to form one integrated layer (**Figure 7.3**). During this integration, string arrays were built containing information on the layer name, the assigned sensitivity rating for each particular area and the adjustment factor for the particular layer (**Figure 7.4**).

Three results (**Figure 7.4**) were then calculated from the integrated layer (**Figure 7.3**) by unnesting and summarising the string array data using the following logics:

- **maximum sensitivity wins:**
  The maximum sensitivity rating found in the array became the sensitivity index.
- **sum of all sensitivity ratings:**
  The sensitivity index was the sum of each sensitivity rating found in the array.
- **sum of all adjusted sensitivity ratings:**
  Each sensitivity rating found in the array was adjusted by the assigned adjustment factor for each particular layer. The sensitivity index was then the sum of these.

The presented maps were then created by reclassifying each logic result into five classes, namely:

- low sensitivity (green),
- low-medium sensitivity (light-green)
- medium sensitivity (yellow)
- medium-high (orange)
- high sensitivity (red).

Finally, the reclassified layer was clipped with the pre-determined no-go areas layer (to remove them from consideration – **Figure 7.5**) and further clipped with the 8km radius study area buffer to remove any extraneous features.

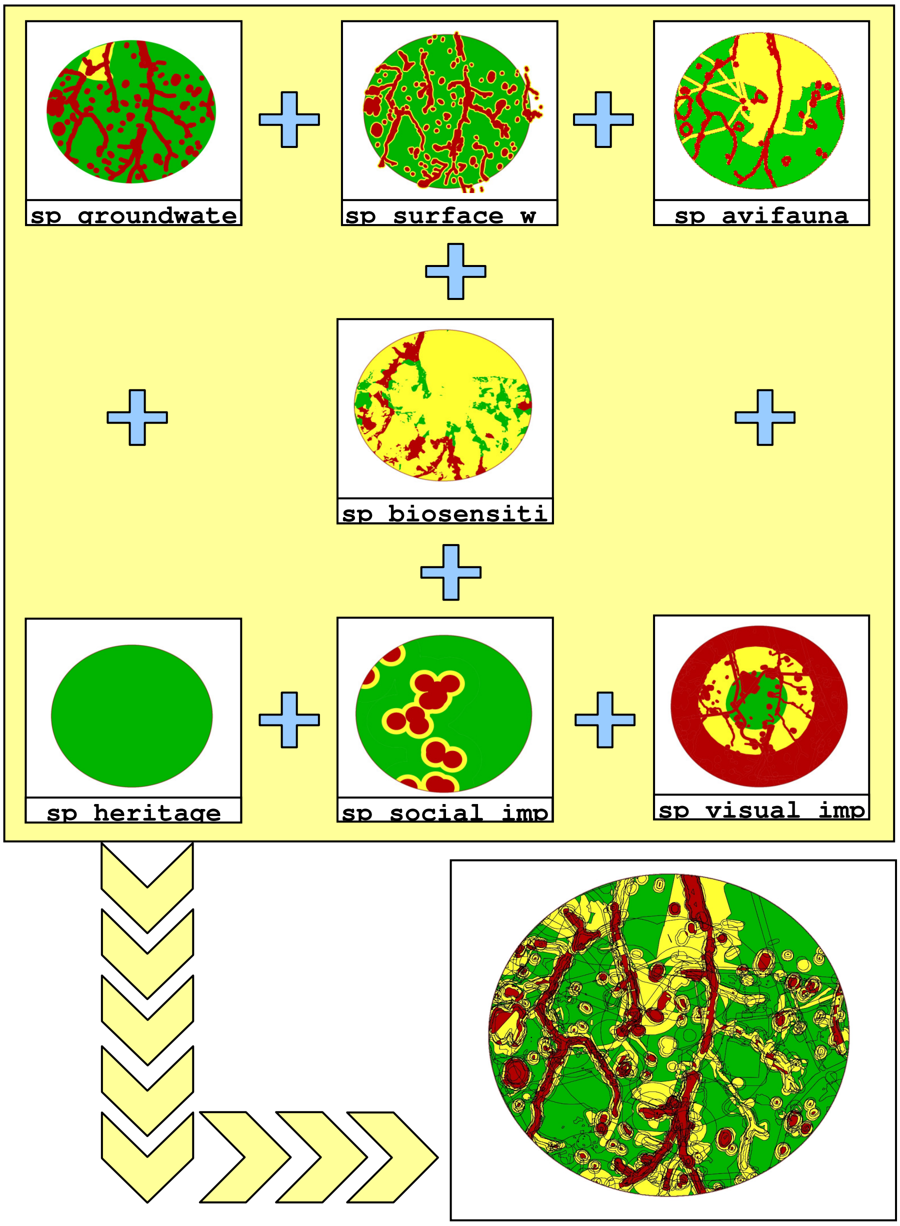

Figure 7.3: An example of typical layer integration process