ECOSUN

REPORT ON:

ESKOM KENDAL WETLAND DELINIATION SOIL SURVEY

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EXECUTIVE SUMMARY

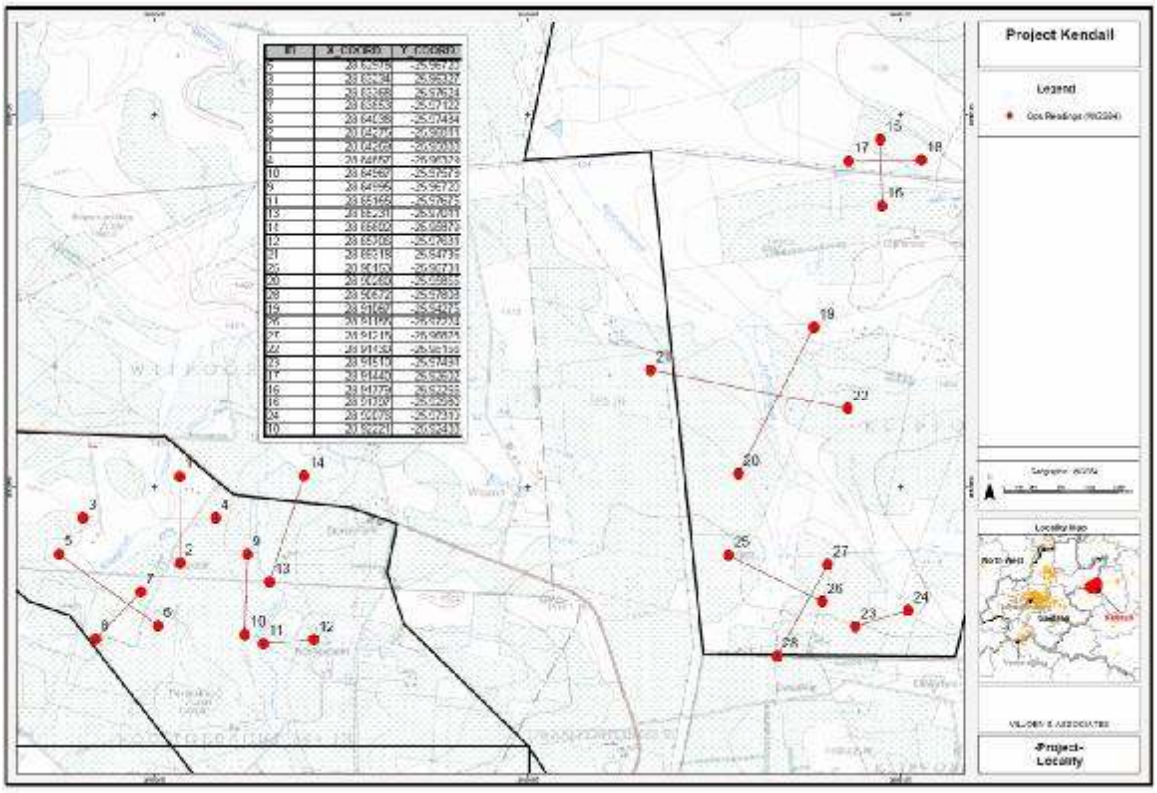


Figure 1. Eskom Kendal soil types and wetland areas associated with Katspruit soils.

Dr. J. Rall of Ecosun requested during September 2006 a wetland delineation soil survey (**Figure 1**) near Kendal Powerstation in Mpumalanga, with the primary objective to identify wetland soils on predetermined transects across potential wetland areas.

From the assessment it is conclusive the wetland areas are associated with one distintive soil type identified according to the South African Taxonomic Soil Classification System, *i.e.* Katspruit soil characterised by gley mottling anaerobic soil conditions. Demarcation of the wetland boundaries were conducted through identification of Hutton and Mispah soils characterised by low clay content well drained and aerated profiles.

ESKOM KENDAL WETLAND DELINIATION SOIL SURVEY

1 GENERAL PRINCIPALS

Before undertaking a wetland delineation it is important that the following general principles are understood:

- A wetland is defined as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (*Water Act 36 of 1998*).

- A wetland is therefore defined in terms of hydrology (*flooded or saturated soils*), plants (*adapted to saturated soils*) and soil (*saturated*).

- Much of South Africa has a very variable climate so that in some years the wetland is much wetter than in others. This is particularly noticeable at the outer boundary areas of the wetland. Thus, unless long term data are available, the direct presence of water is often an unreliable indicator of wetland conditions, particularly for wetlands in arid and semi-arid regions.

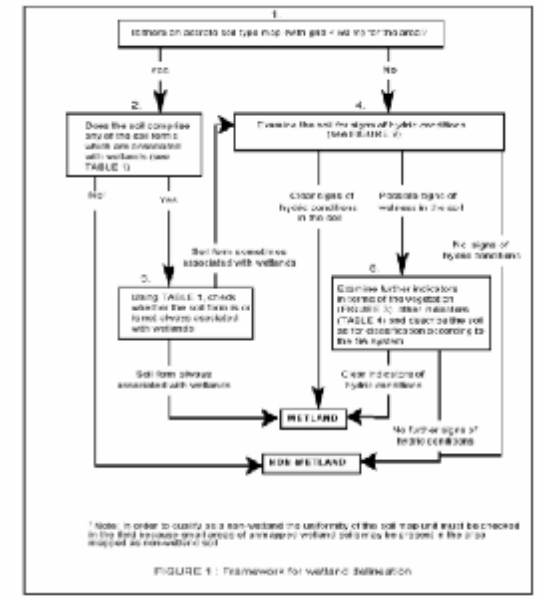
- Although data are often not available to describe the hydrology of a wetland directly, this can be reliably done in an indirect way using soil morphology or vegetation. Prolonged saturation of soil has a characteristic effect on soil morphology, affecting soil matrix chroma and mottling in particular.

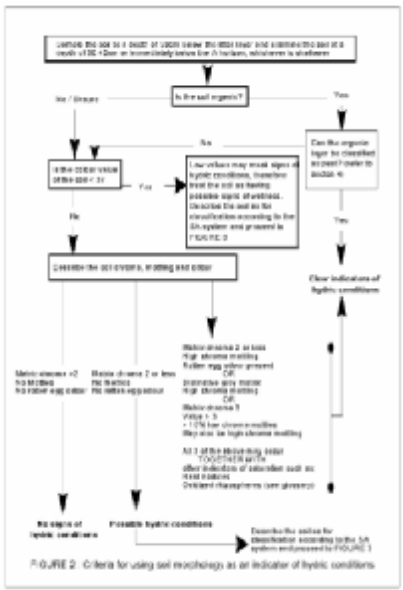
- Because of a wetland's transitional nature, as one moves from outside into a wetland, the hydrology, soils and vegetation generally change gradually along a continuum of increasing wetness. Thus, the boundary of the wetland is often not clearly apparent in the field and must be identified and placed across what is often a gradually changing gradient. While it is recognized that this boundary may be a human construct, it is necessary from a management and legal point of view and can be undertaken on the basis of scientifically defensible criteria.

- The gradual change in the vegetation along a wetland boundary gradient means that the outer parts of the wetland often have a mixture of species that occur widely outside of wetlands (*e.g. ngongoni* grass [*Aristida junciformis*] and rooigras [*Themeda triandra*]) and species specifically adapted to saturated soil conditions and confined to wetlands (*e.g.* the sedge *Pycreus macranthus*).

- In the Water Act definition of wetlands, "normal circumstances" refers to that which would be present without human modifications. Such modifications may

include, for example: (a) the drying out of a wetland with artificial drains or (b) the removal of the natural vegetation through cultivation. In the case of drying out of the wetland, it is important to note that even if the characteristic wetland vegetation is lost, the soil retains, for decades at least, indications of the hydric conditions under which it was formed. Upon artificial drying out of a wetland, the vegetation tends to change more rapidly than soil morphology in response to the altered hydrology.





Figures 2 & 3. Framework for wetland delineation and criteria using soil morphology as indication of hydromorphic soil conditions.

Figures 2 & 3 show a framework for wetland delineation and criteria using soil morphology to identify wetland soils, summarised in **Table 1**.

TABLE 1. SOIL FORMS ASSOCIATED WITH WETLANDS

Soil forms always associated with wetlands				
Champagne	Katspruit	Willowbrook	Rensburg	
Soil forms sometimes associated with wetlands				
Inhoek	Longlands	Wasbank	Lamotte	Estcourt
Klapmuts	Tukulu	Cartref	Fernwood	Westleigh
Dresden	Avalon	Pinedene	Glencoe	Bainsvlei
Bloemdal	Witfontein	Sterkspruit	Sepane	Valsrivier
Dundee				

2 TERMS OF REFERENCE

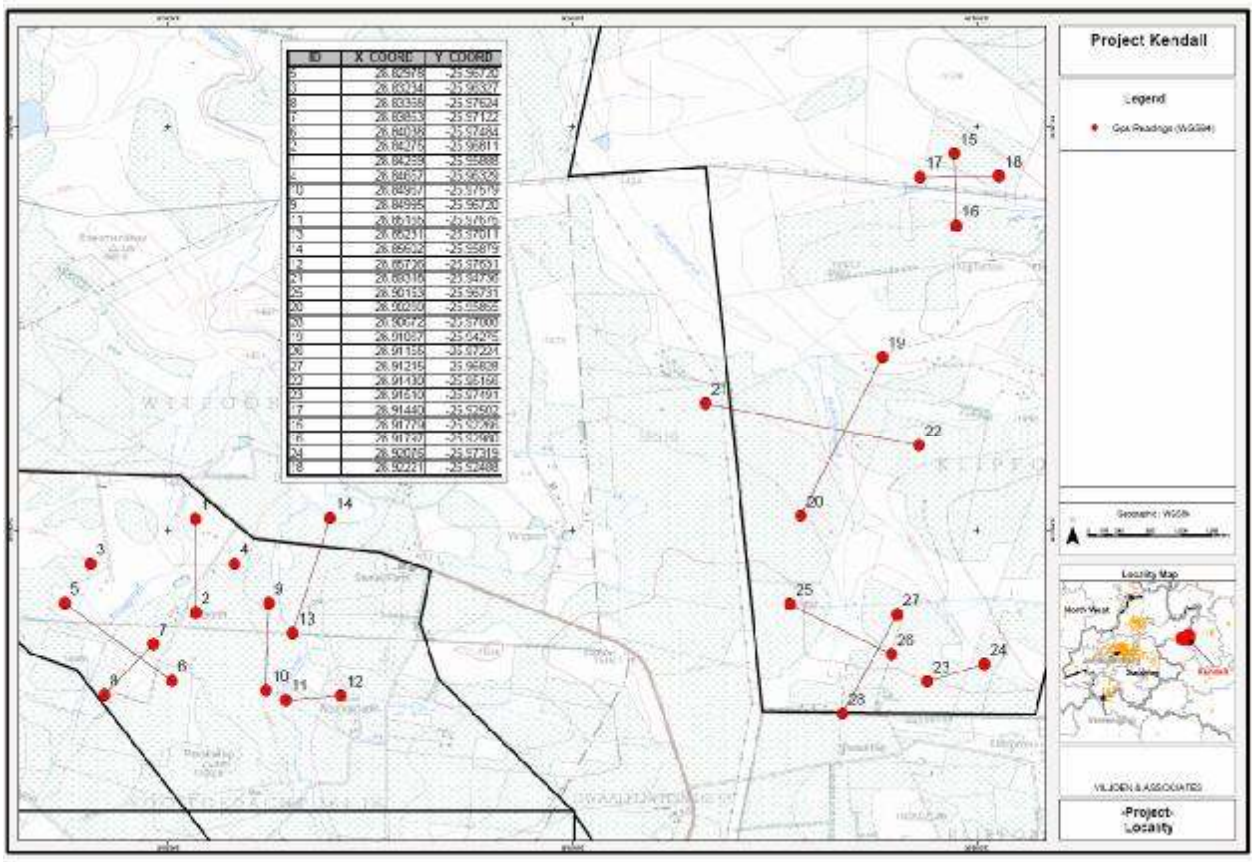


Figure 4. Eskom Kendal area of investigation.

During September 2006 Dr. J. Rall of Ecosun requested a proposal for a wetland delineation soil survey (**Figure 4**) near Kendal Powerstation in Mpumalanga.

3 INVESTIGATION OBJECTIVES

The primary objective of the investigation was interpreted as:

- Identification of wetland soils to delineate wetland areas on predetermined transects across potential wetland areas.

4 METHOD OF INVESTIGATION

In order to meet the objective of the investigation, the following scope of work was proposed:

4.1 Site Assessment:

- Undertake a preliminary delineation of wetland boundaries using an orthophoto or topocadastral map together with airphoto interpretation.

- Verify and adjust the preliminary delineation of the wetland using the following field verification:

    - Placement of lateral transects along the longitudinal length of the wetland. This spacing may need to vary depending on the complexity of the wetland. If a high level of accuracy is required in the delineation, and/or the wetland has been altered by artificial disturbance and land-use practices, then transects at more regular intervals may be required. Ensure that all transects are geographically referenced and marked on the orthophotos or topocadastral maps.

    - Start each transect well outside the perceived boundary of the wetland, and describe the soil at regular intervals along the transect.

    - Locate the point on the transect where the first clear signs of wetness are encountered. The boundary of the wetland may be unclear and it may be necessary to go back along the transect and take further samples.

    - Once the boundary has been determined continue with the transect through the wetland describing the soil at regular intervals. For each transect note the percentage distance occupied by the temporary, seasonal and permanent zones respectively. Finally, locate the far boundary of the wetland at the end of the transect using the same procedure employed to determine the initial boundary.

- When sampling the transects also take particular note of features not easily visible from the air- or orthophotos, including: artificial drains; localized features such as headcuts of erosion gullies and point sources of pollution. Mark the location of these features on the map.

- Once all transects have been completed, use topographic and soil features to establish lines connecting boundary points of the outer limits of the wetland and the zones within the wetland. This is best done from a vantage point (*e.g.* on a hill next to the wetland) with the aid of features visible on the orthophotos. Make any changes to the preliminary delineation on the map.

5 PROBLEM ANALYSES

5.1 South African Environmental Soil Legislation

The following section outlines a summary of the most recent South African Environmental Legislation that needs to be considered for any new development with reference to management of soil:

- *The law on Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal.*

- *The Bill of Rights states that environmental rights exist primarily to ensure good health and well being, and secondarily to protect the environment through reasonable legislation, ensuring the prevention of the degradation of resources.*

- *The Environmental right is furthered in the National Environmental Management Act (No. 107 of 1998), which prescribes three principles, namely the precautionary principle, the "polluter pays" principle and the preventive principle.*

- *It is stated in the above-mentioned Act that the individual/group responsible for the degradation/pollution of natural resources is required to rehabilitate the polluted source.*

- *Soils and land capability are protected under the National Environmental Management Act 107 of 1998, the Environmental Conservation Act 73 of 1989, the Minerals Act 50 of 1991 and the Conservation of Agricultural Resources Act 43 of 1983.*

- *The National Veld and Forest Fire Bill of 10 July 1998 and the Fertiliser, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947 can also be applicable in some cases.*

- *The National Environmental Management Act 107 of 1998 requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided be minimized and remedied.*

- *The Minerals Act of 1991 requires an EMPR, in which the soils and land capability be described.*

- *The Conservation of Agriculture Resources Act 43 of 1983 requires the protection of land against soil erosion and the prevention of water logging and salinisation of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and water courses are also addressed*

5.2 Wetland Deleniation

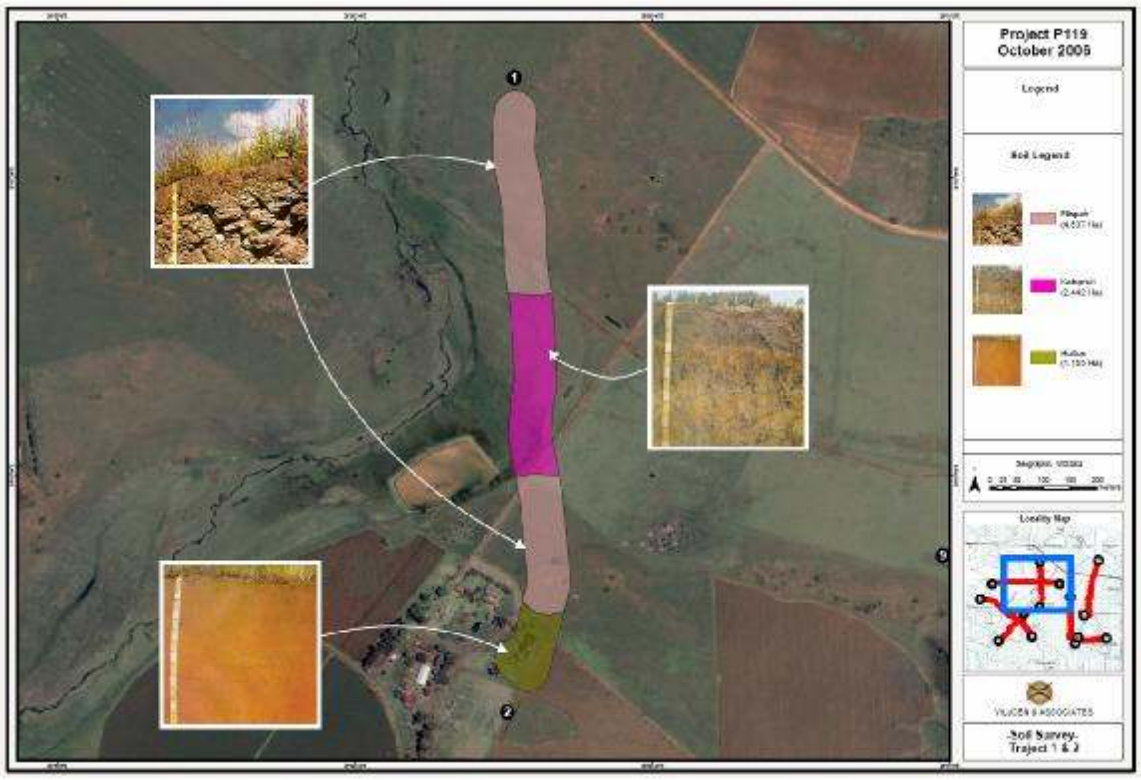


Figure 5. Transect 1 & 2 soil types.

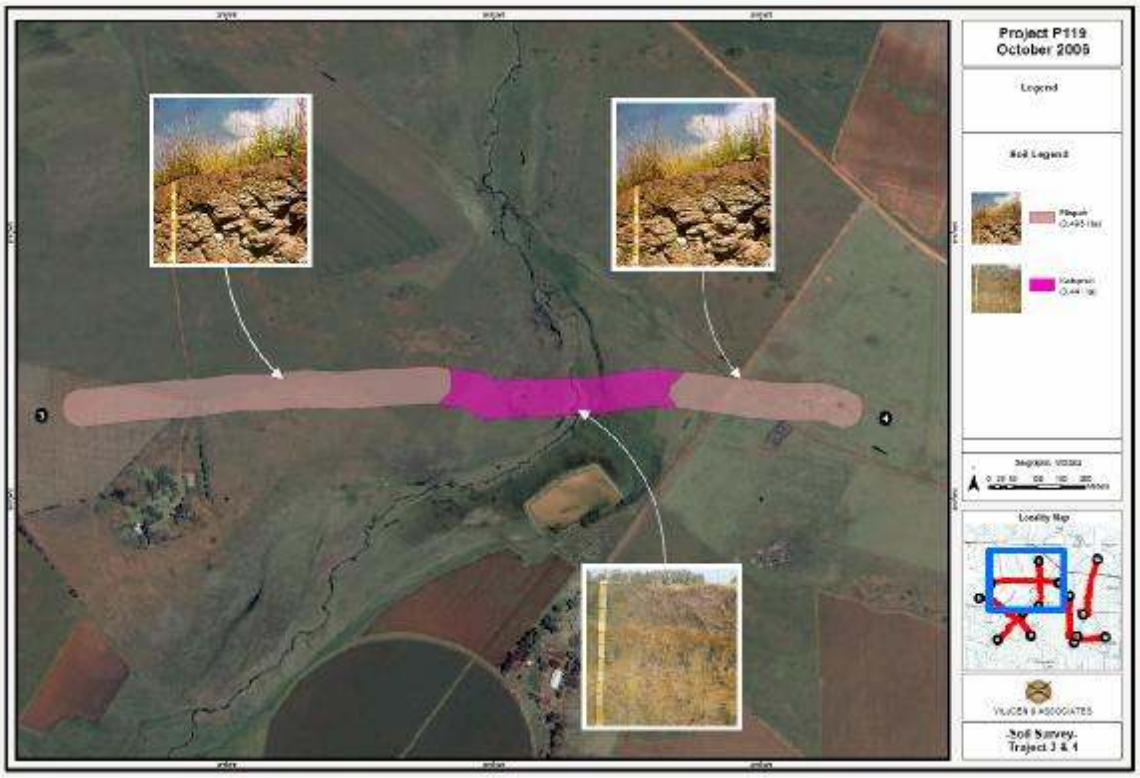


Figure 6. Transect 3 & 4 soil types.

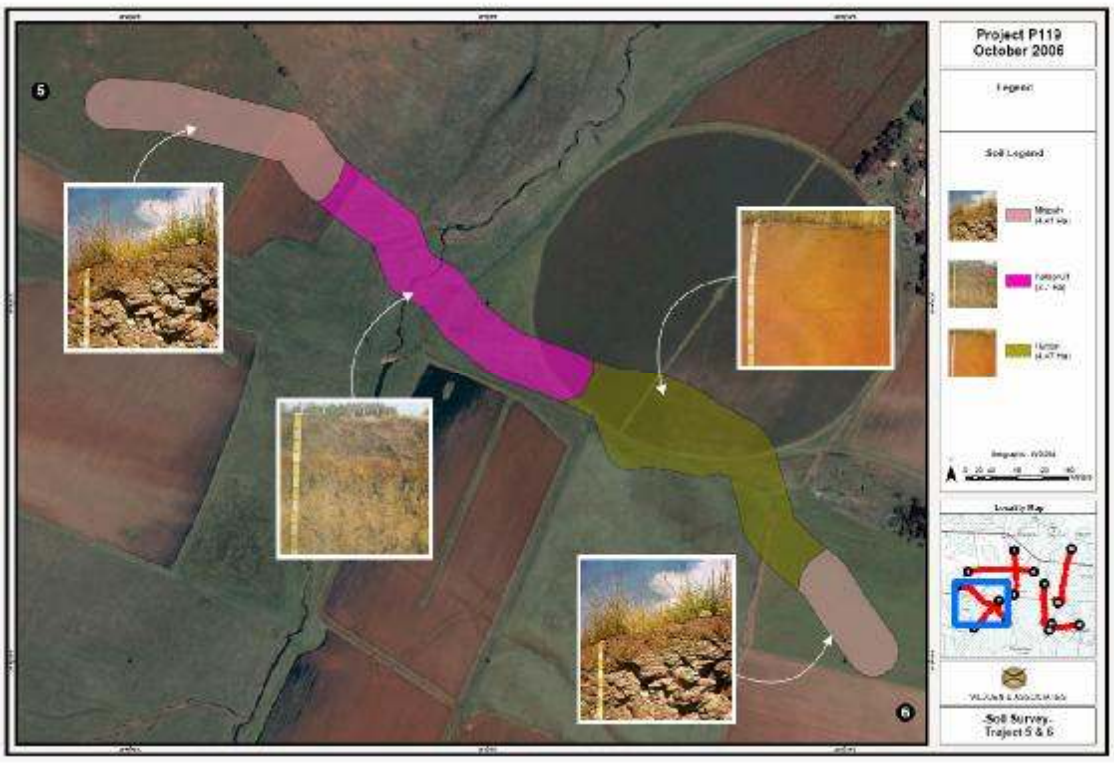


Figure 7. Transect 5 & 6.soil types.

Figure 8. Transect 7 & 8 soil types.

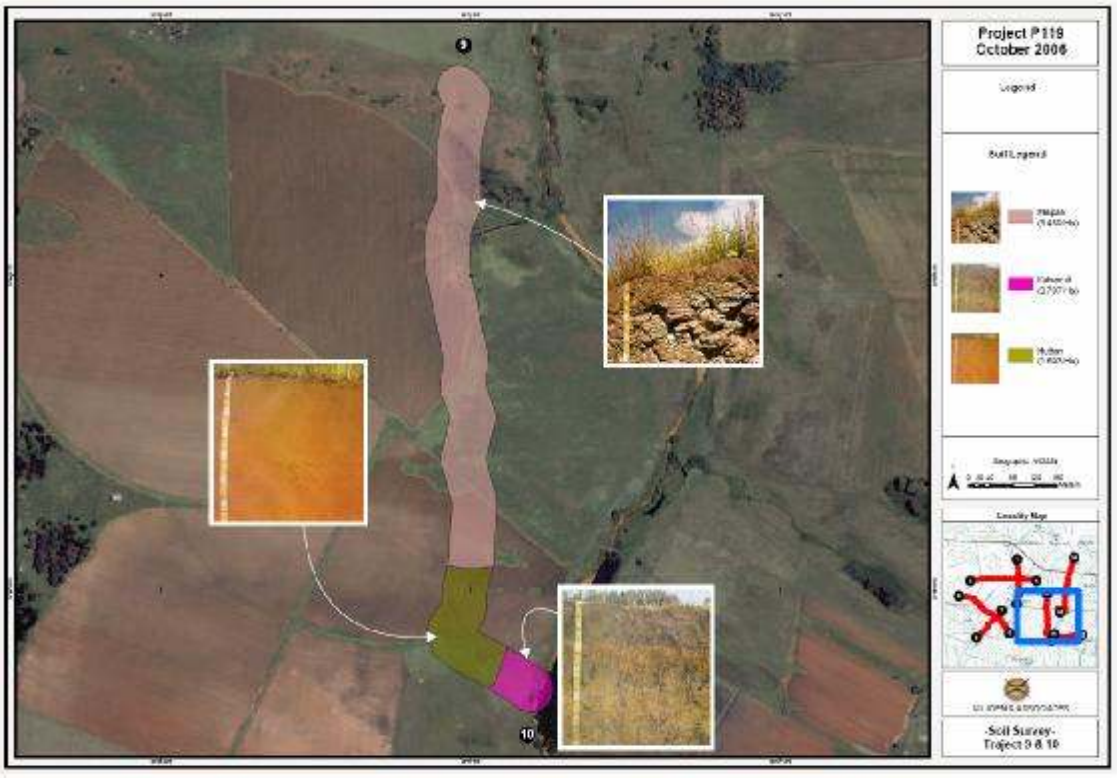


Figure 9. Transect 9 & 10 soil types.

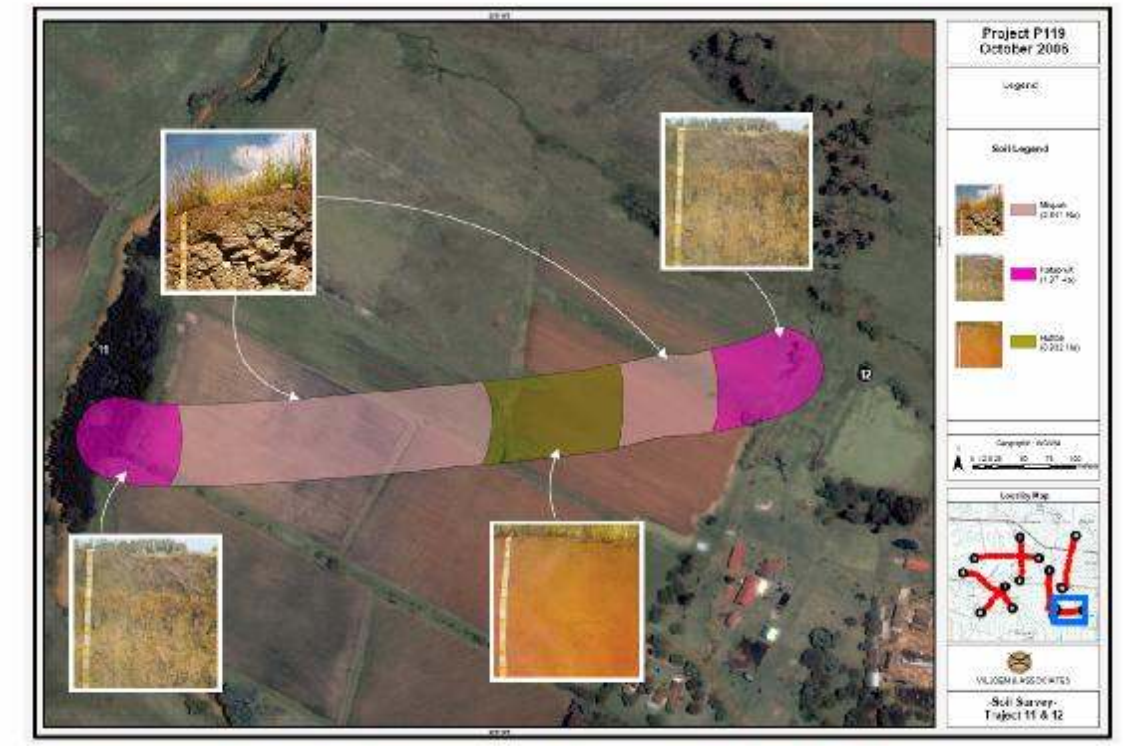


Figure 10. Transect 11 & 12 soil types.

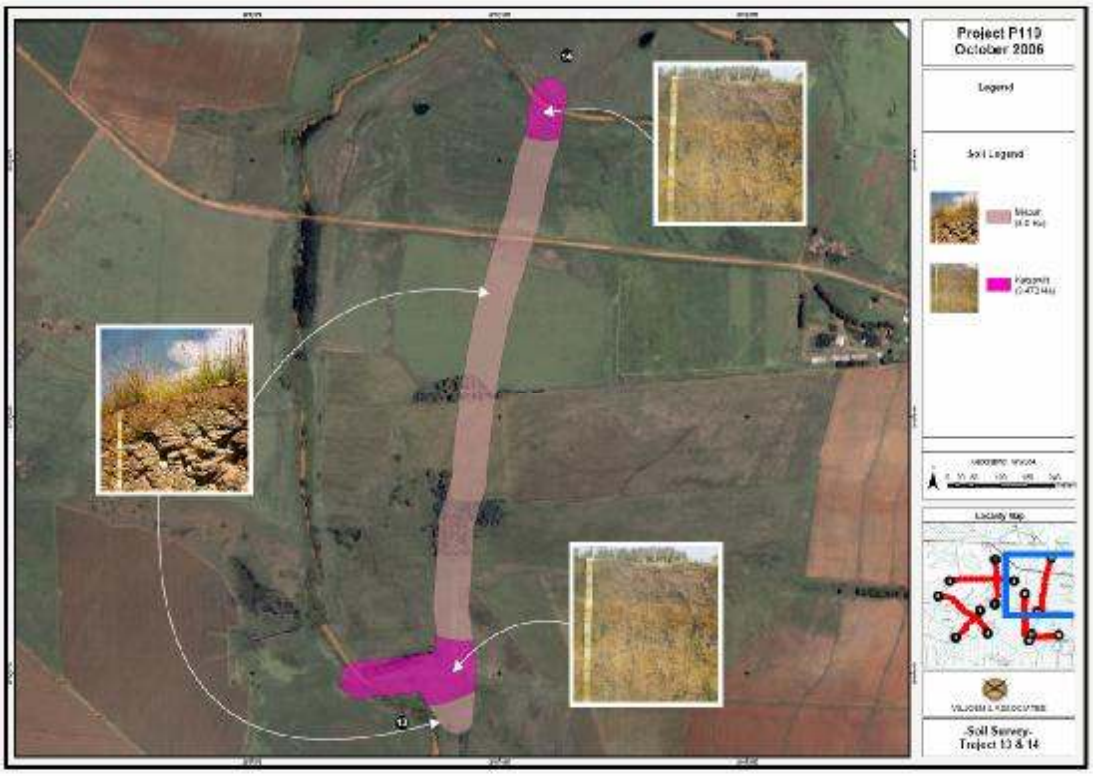


Figure 11. Transect 13 & 14 soil types.

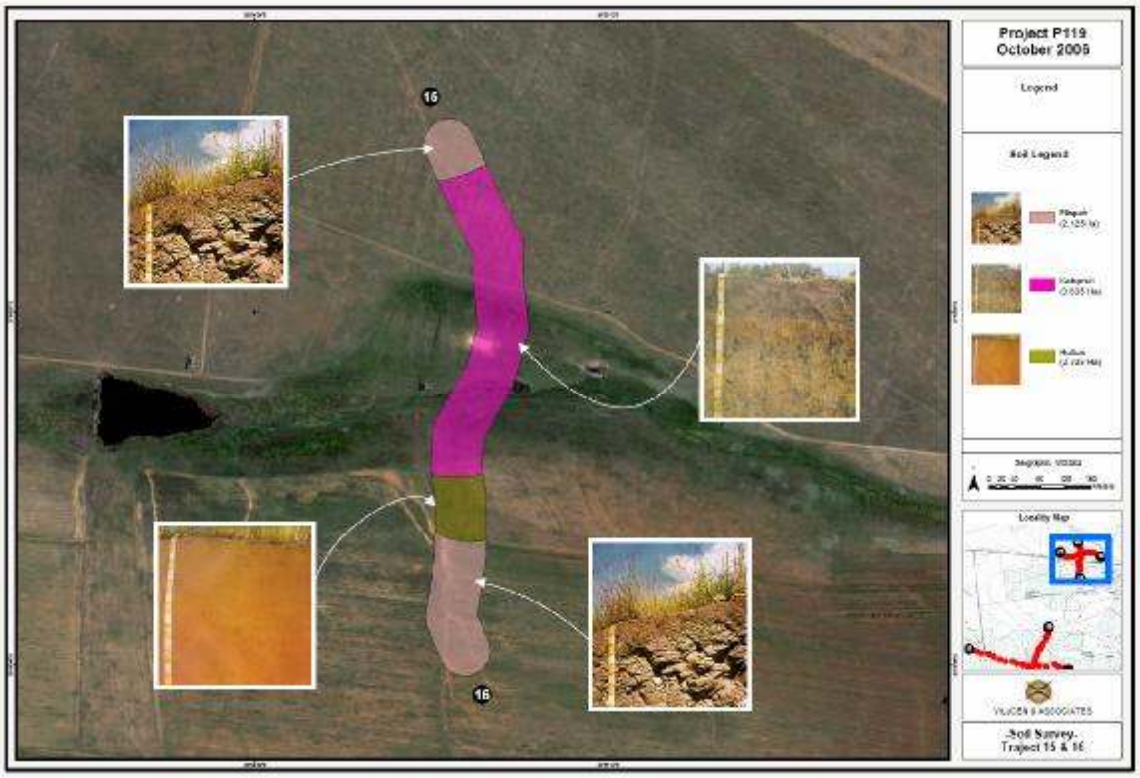


Figure 12. Transect 15 & 16 soil types.

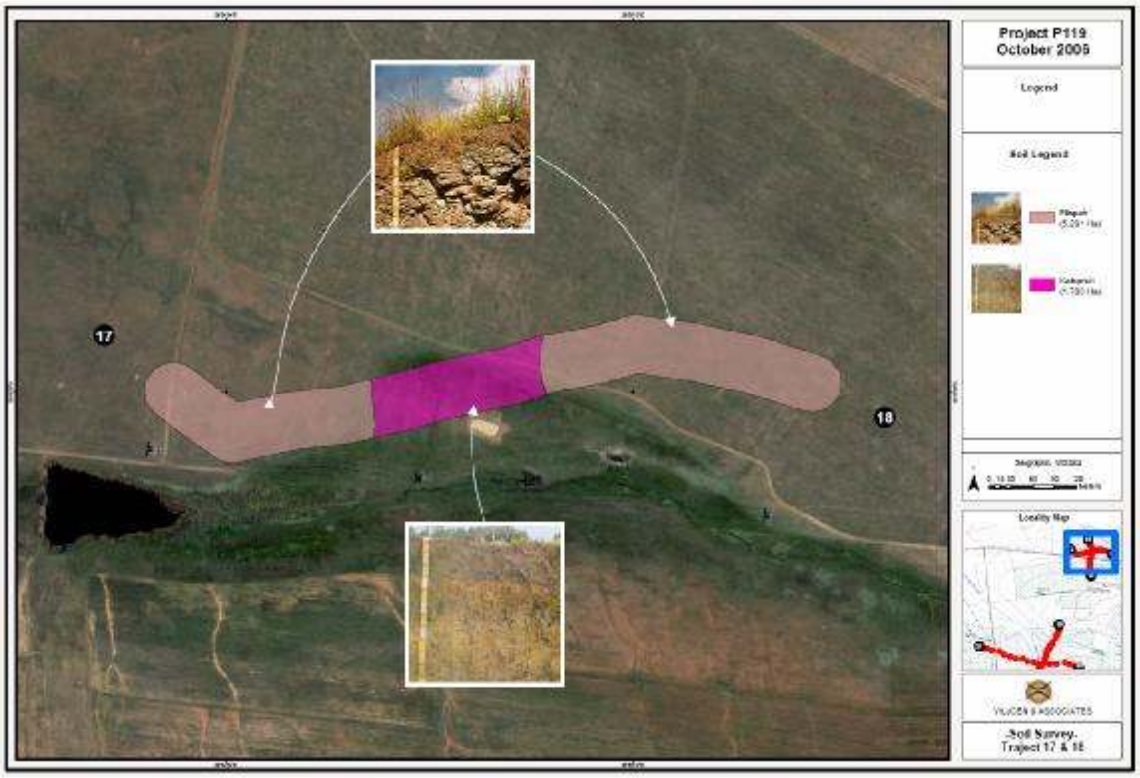


Figure 13. Transect 17 & 18 soil types.

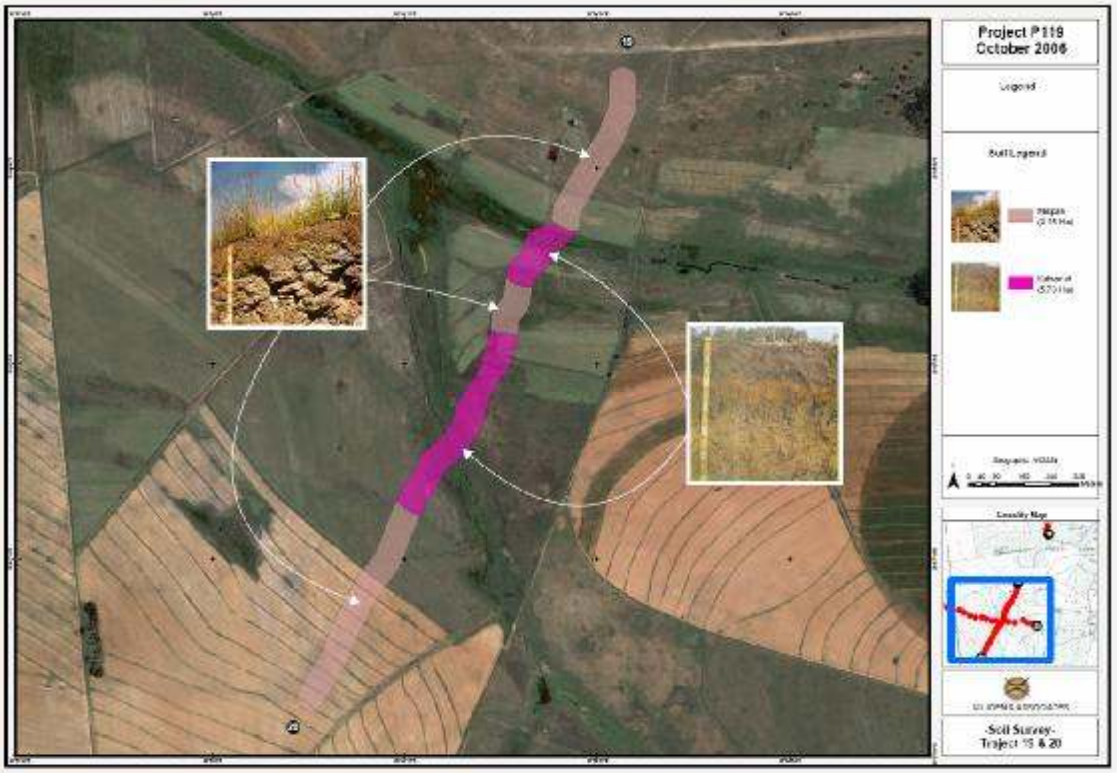


Figure 14. Transect 19 & 20 soil types.

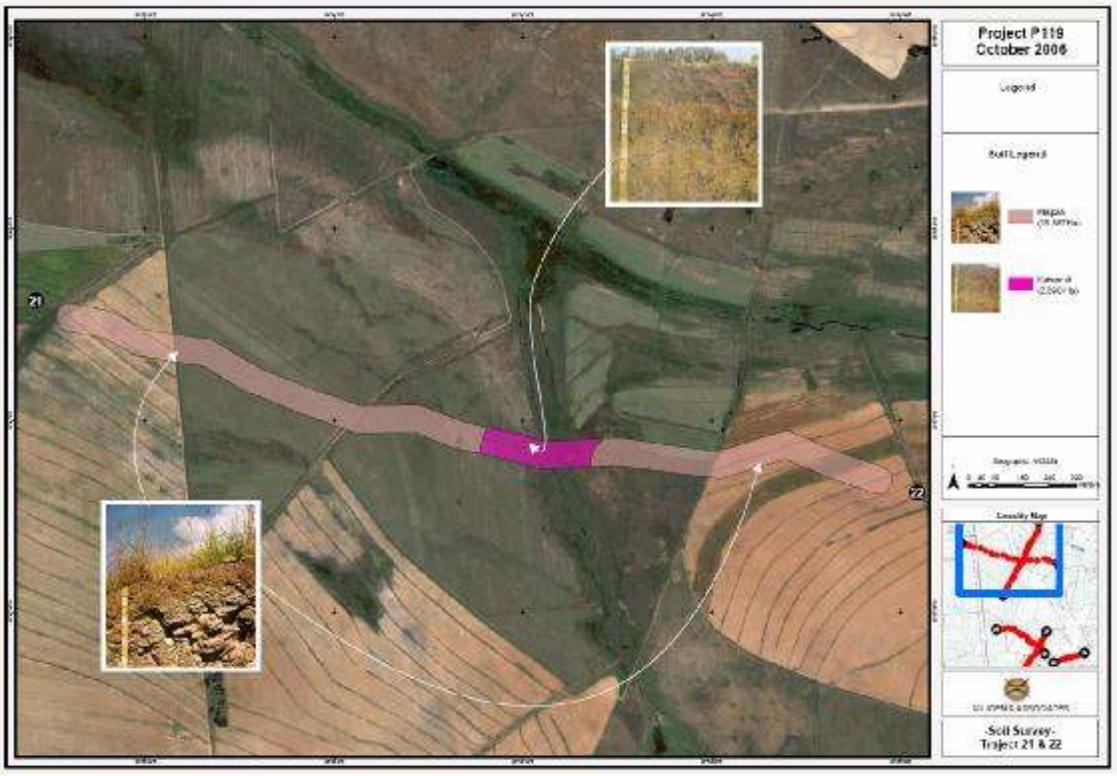


Figure 15. Transect 21 & 22 soil types.

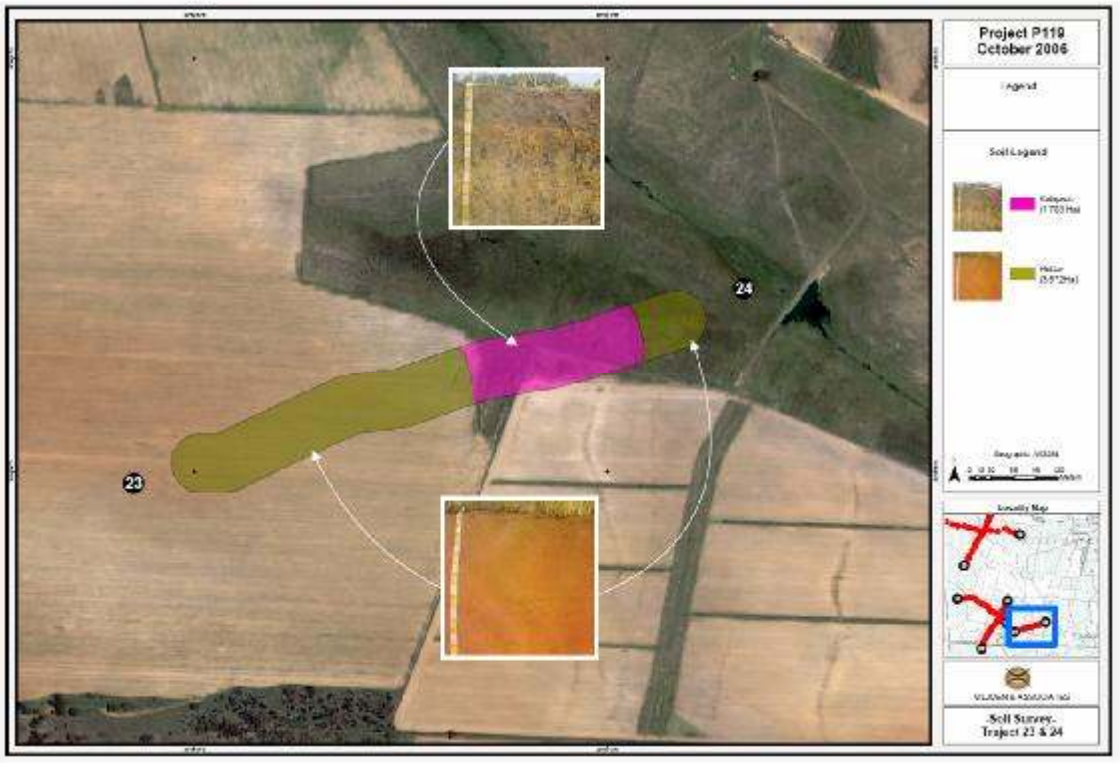


Figure 16. Transect 23 & 24 soil types.

Figure 17. Transect 25 & 26 soil types.

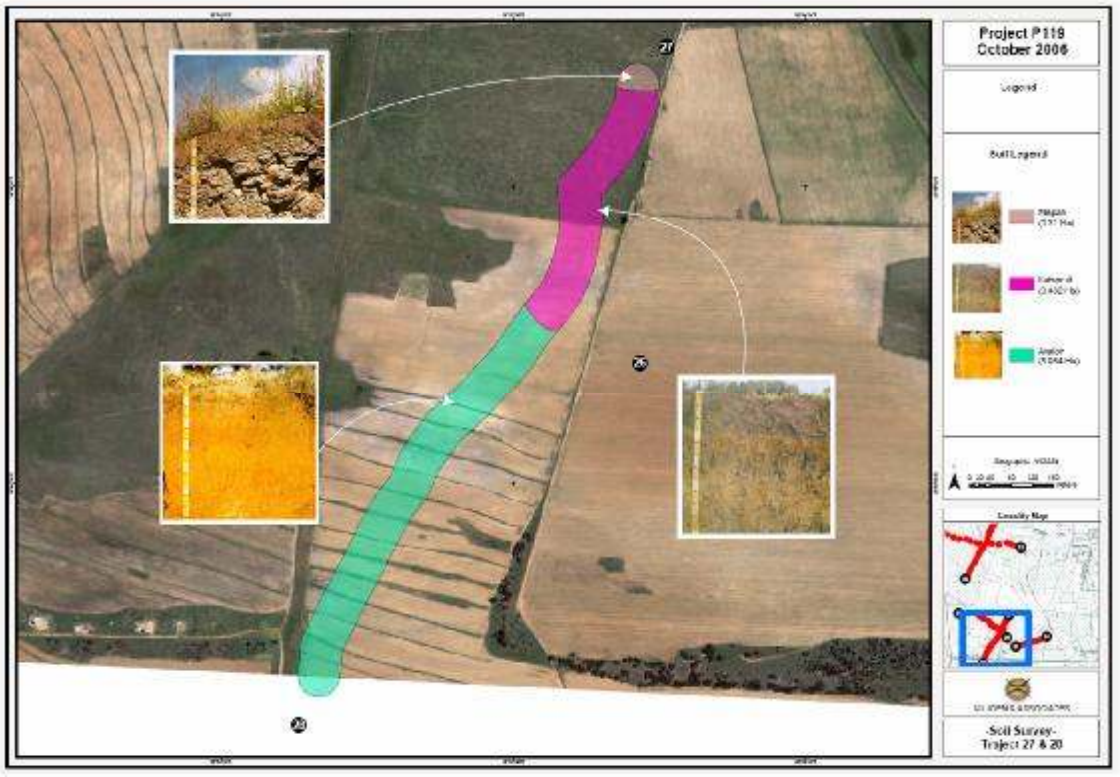


Figure 18. Transect 27 & 28 soil types.

The wetland boundaries associated with Katspruit soils along the predetermined transects are illustrated in **Figures 5** to **18**.

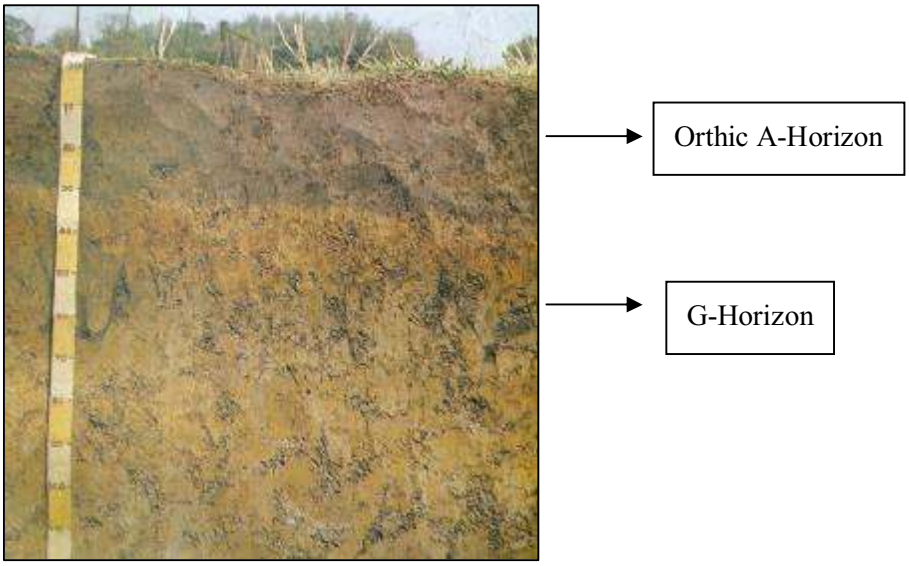


Figure 19. Katspruit soil.

One distinctive soil type, *i.e.* Katspruit (**Figure 19**) associated with wetland conditions was observed during the soil survey. The Katspruit soil is characterised by a G-Horizon underneath an orthic A-horizon with distinctive gley mottling characteristics caused by anaerobic soil moisture conditions resulting in the reduction and

precipitation of iron and manganese. The G-horizon is characterised by a high clay content containing predominantly 2:1 clay minerals typical of wetland conditions.

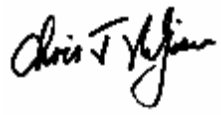
Figure 20. Hutton and Mispah soils (*left to right*).

Hutton and Mispah soils (**Figure 20**) were encountered on the wetland boundaries, with Hutton soil characterised by an orthic A-horizons overlying a red apedal B-horizon characterised by low clay content, well aerated and good drainage properties. The Mispah soil has a distinctive hard rock layer beneath the orthic A-horizon and under wetland conditions usually associates with sub-surface preferential seepage path ways.

6 CONCLUSIONS

- The wetland areas along the predetermined transects are associated with one distintive soil type classified according the South African Taxonimical Soil Classification System, *i.e.* Katspruit soil characterised by gley mottling anaerobic soil conditions.

- Demarcation of the wetland boundaries were conducted through identification of Hutton and Mispah soils characterised by low clay content well drained and aerated profiles.



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