

Case Study

Landuse Suitability and Infrastructure Assessment Gaza Province Mozambique

Project brief.

In October 2005 Terrabyte Services was contracted to undertake a landuse suitability and infrastructure survey in the Gaza province of southern Mozambique. The client was involved the construction of a rice mill and the development of a rice farming enterprise to stimulate further local production in the form of a for-profit aid program.

The local region contains an existing 20,000 hectare irrigation development being currently managed by local farmers on a mostly subsistence basis and largely underutilised since the mid 1970's and in a state of disrepair.

Land for potential new irrigation development had been identified and initial rice production by the client had commenced in a small area of the existing irrigation area made available by the local community. Early crop growth was poor with salinity suspected as being a contributing factor.

Prior to further investment by the client, Terrabyte Services was contracted to undertake a detailed suitability/capability assessment of both the allocated land within the existing irrigated area, the associated irrigation supply and drainage infrastructure and the proposed new development area. Emphasis was to be given to the suitability of the land for sustainable and profitable rice production and identification of existing and potential environmental constraints or negative impacts of the proposed development.

Terrabyte Services activities were to include;

- Investigation of existing soil survey maps and information,
- Collect background satellite imagery,
- Collate existing infrastructure and resource map layer information,
- Meet with local infrastructure and agronomic managers,
- Undertake electromagnetic survey of existing and proposed development area,
- Conduct targeted soil profile investigation and description survey,
- Visual assessment of existing irrigation, supply and drainage infrastructure, and
- Reporting and presentation of findings in Maputo and London.

Project site background

Originally built by Portuguese colonists in the 1950's the 20,000ha irrigation scheme was highly productive, commercially producing a wide range of irrigated grain and vegetable crops. However following the removal of Portuguese interests during the 1970's independence push, farm collectivisation and the subsequent civil war the scheme has suffered from inappropriate management and resultant degradation. Finally the devastating flood in 2000 destroyed many of the control structures and silted the channels.

International aid programs post 2000 had rebuilt many of the larger control structures but the scheme lacks the equipment and skill to maintain many of the smaller delivery and drainage channels.

With most of the existing irrigated area not actively be farmed, current production is mainly subsistence food production. With poor co-ordination of that production resulting in small isolated areas being cropped, the entire irrigation supply system is maintained at near capacity levels despite only minor water requirements. Together with the poorly maintained channel infrastructure, the excess water has been allowed to overflow and flood many areas with resultant environmental impacts.



Fig.1 : Irrigation development - Gaza Province, Southern Mozambique

Project Methodology

Following an initial field visit in July 2005 and desktop collation of existing information, Terrabyte field staff completed the onsite electromagnetic surveying, soil mapping and local consultation between November 2005 and February 2006. Reports and presentations were delivered in Maputo, Mozambique and London in March 2006.

Satellite imagery

Initial investigations of available satellite imagery defined the geography of the study area, provided excellent background to the existing map and infrastructure information and highlighting a range of issues (fig 2-3.) not previously apparent to the client from 2 years of ground observations. These included;

- Large areas of apparent salinity
- Impact of poor channel management
- Isolated nature of existing production
- The extent of abandoned irrigated area

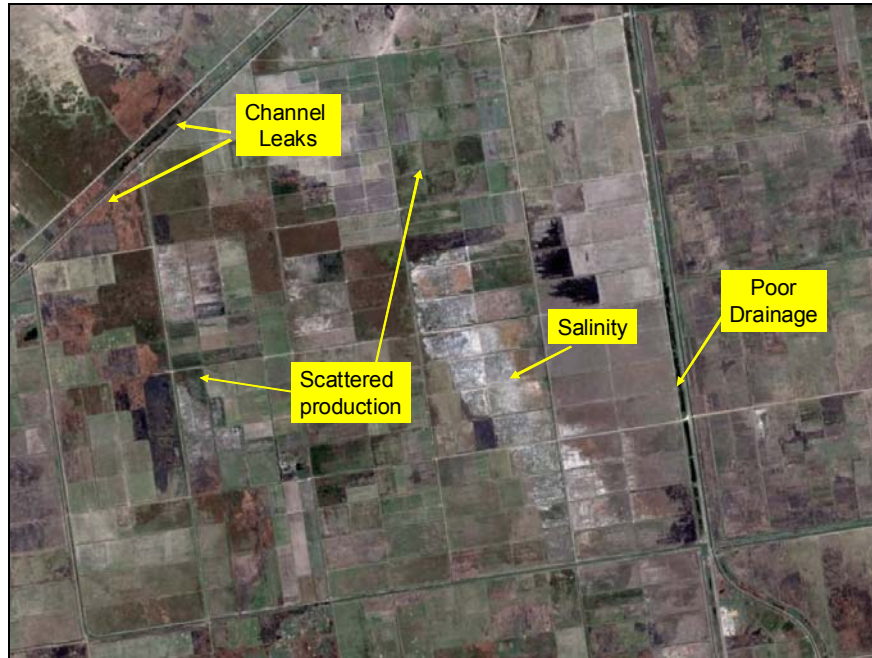


Fig.2 : Existing irrigation area management issues

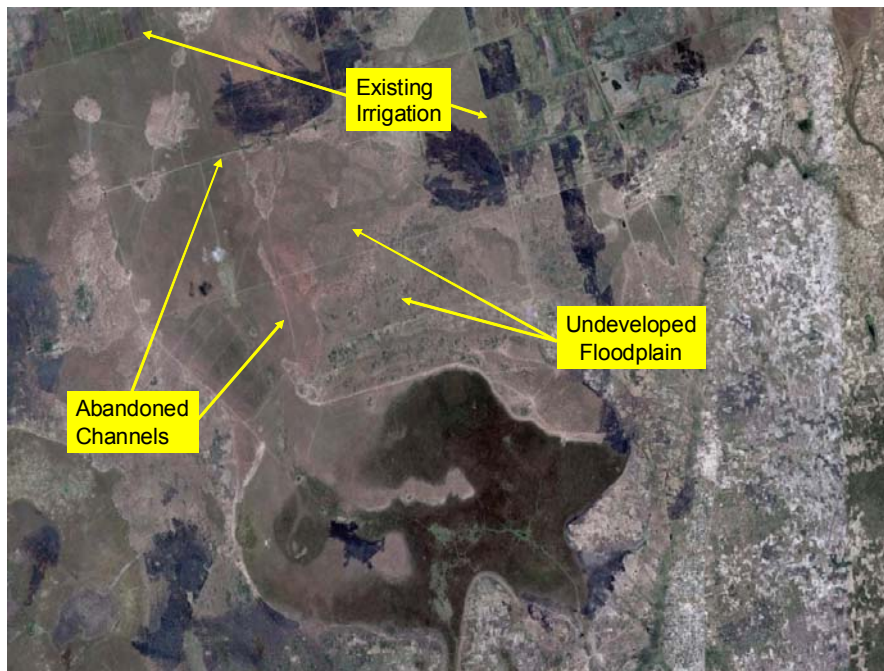


Fig.3 :Proposed irrigation development area issues.

Electromagnetic and Topographic Survey

Following assessment of the satellite imagery and collated background information, a detailed soil conductivity and topographic survey was conducted using two electromagnetic induction instruments (Geonics EM31 and EM38) and high accuracy GPS equipment.

Electromagnetic surveying measures the soils apparent electrical conductivity which is a strong indicator of the soils physical and chemical characteristics. The EM survey information is required by legislation to assess proposed new rice irrigation development areas in Australia and a proven technology for assessment of the variability of soils.

In irrigated rice developments,

- Low conductivity readings typically indicate light textured soils with potentially high drainage and low salinity,
- Medium conductivity indicates soils suitable for rice production and
- High conductivity can indicate existing or developing soil salinity and shallow water tables.

The instruments are mounted on a 4WD bike or vehicle (fig 4.) allowing access to all but the roughest and wettest land and measure soil characteristics to a depth of 6 metres.

Soil and topographic mapping was completed for;

- 1,000 hectares of previously developed irrigated land, and
- 20,000 hectares of undeveloped land currently used for limited livestock grazing.



Fig.4 : Electromagnetic induction instruments and RTK GPS mounted on a four wheeled bike

The EM survey data (fig 5.) showed a wide range of conductivity data with well defined trends across the survey area. The data clearly suggested that some areas were highly saline, some prone to develop salinity with the vast majority likely to be suitable for rice production. Utilising this information a targeted soil investigation and infrastructure assessment strategy was developed and implemented.

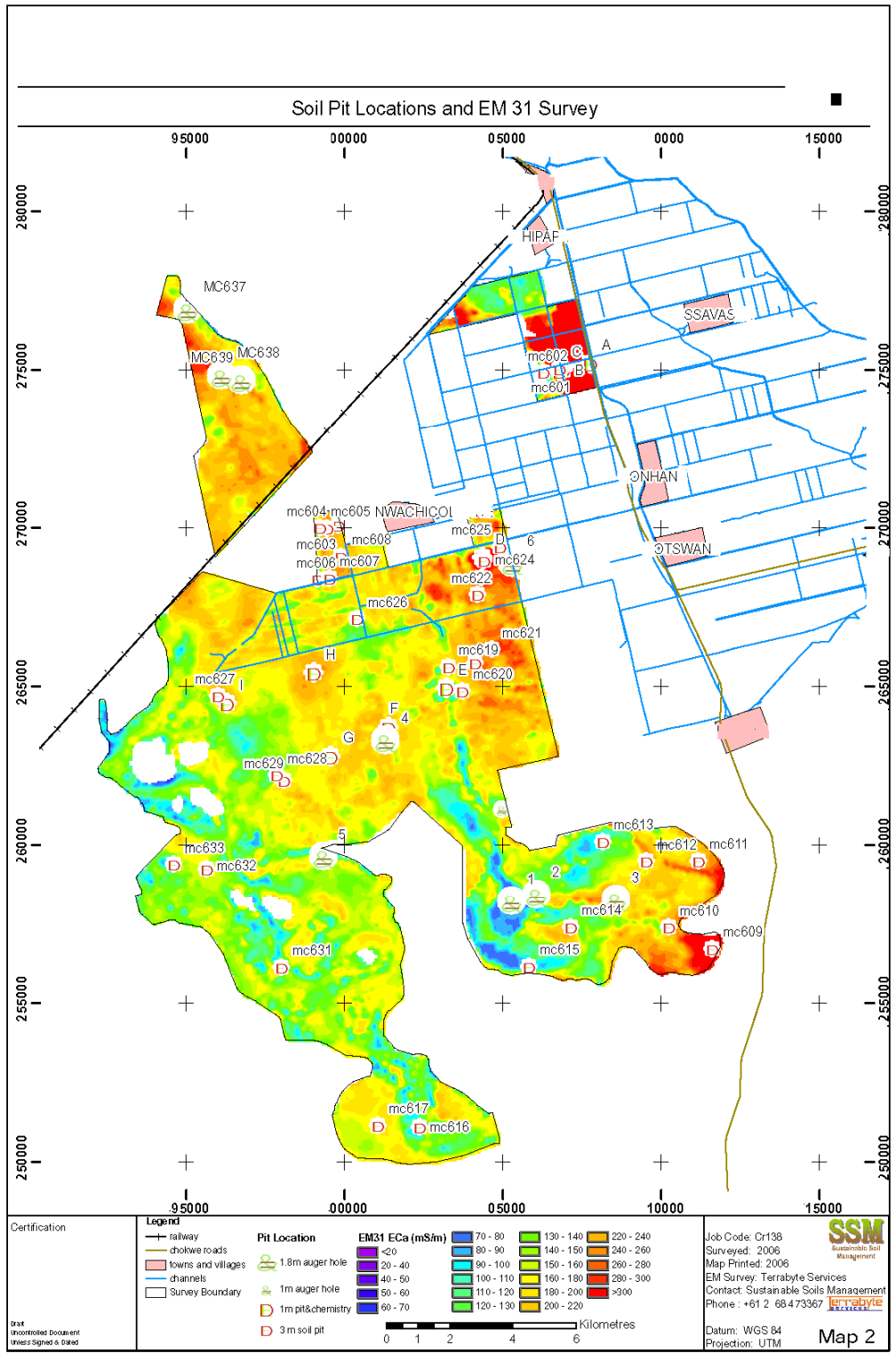


Fig.5 : 21,000 hectare survey area. Apparent conductivity and soil pit locations

The targeted soil profile investigation plan was developed to initially determine the magnitude of difference between the highest, lowest and average conductivity locations, and correlate soil conditions and soil conductivity, from this further sampling is determined as required. Additionally, these investigations identified soil conditions at the time of surveying. Initial fieldwork (fig 6.) involved both physical soil description with samples retained for chemical assessment.



Fig.6 : Detailed soil investigations conducted at locations based on the apparent conductivity maps

Results/ Recommendations

Interpreting the satellite, EM, soils, topographic and background information and field observations, the following recommendations were made;

1. Within the existing irrigation area, a large proportion of the land is marginally suitable to unsuitable for rice production because of elevated salinity. This land should not be irrigated unless remedial work is undertaken to lower salinity.
2. Existing salinity is likely to have been caused by previous and current irrigation system management in relation to fields, supply and drainage infrastructure. Cleaning of all channels to remove excessive weed growth and improved drainage water management is required to address the salinity issues.
3. Small areas in the proposed new development area are unsuitable for irrigation due to their raised elevation.
4. Small areas at the lowest locations of the undeveloped areas show potential for future development of saline conditions. These areas will require specific management strategies if they are to be developed.
5. The large majority of the proposed area is suitable for development and sustained rice production

A simple map (fig 7.) highlighting the classes of suitability for rice production was generated and supplied.

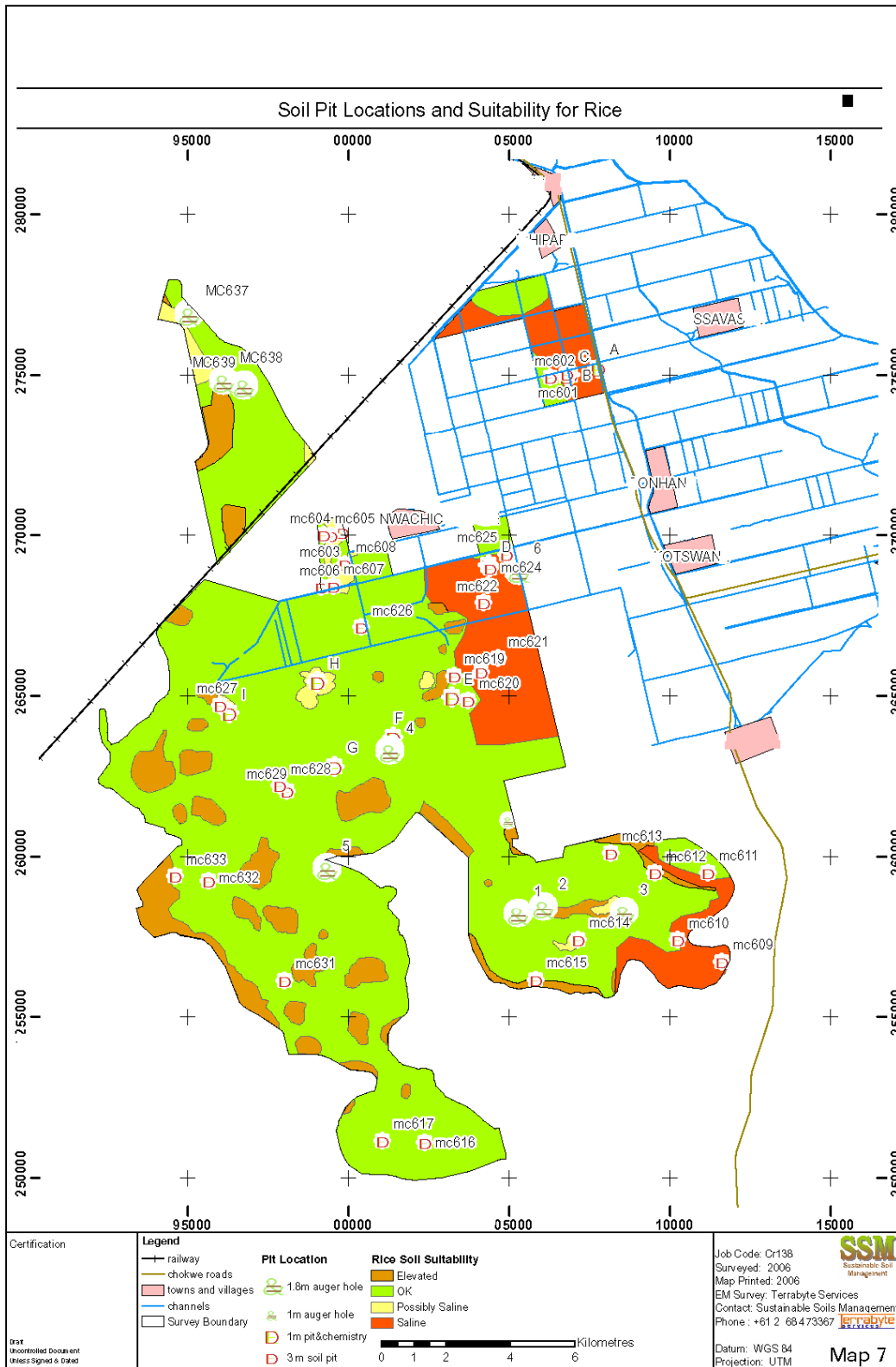


Fig.7 : Rice Suitability Classification

Outcomes

The work undertaken by Terrabyte clearly;

1. Collated a range of existing data and newly surveyed information,
2. Identified the existence, extent and likely impact of salinity within the study area,
3. Highlighted the most likely causes of this salinity, and
4. Classified the soils of the study area and their suitability of for sustainable rice production.

As a result of the work undertaken by Terabyte, the client has been able to proceed with confidence to ;

1. Abandon attempts to continue rice production in the existing irrigated development where the existence and extent of salinity was identified.
2. Commenced negotiation with local land managers for access to non-saline land
3. Commenced development of irrigation development and environmental management plans for the areas identified as being suitable for rice production.
4. Undertaken discussion with the local irrigation system management to discuss improved irrigation supply and drainage management.