3.3 DOMESTIC WATER SUPPLY INFRASTRUCTURE

The Ntabelanga Dam will supply potable water to 539 000 people, which is estimated to rise to 730 000 people by year 2050. The domestic water supply infrastructure will include:

- An intake structure and associated works at Ntabelanga Dam;
- Regional water treatment works at Ntabelanga Dam;
- Potable bulk water distribution infrastructure for domestic and industrial water requirements (primary and secondary distribution lines);
- Nine (9) bulk treated water storage reservoirs strategically located; and
- Pumping stations.

The stand-alone water storage, treatment works and pumping station compounds will be up to 3 ha each.

The scheme will have a single WTW located at the Ntabelanga Dam site that will treat raw water for domestic and industrial use. These works will be supplied with raw water from the dam outlet works to the WTW inlet works by gravity under all operating conditions.

Sludge produced from the settlement and filtration processes will be stored in sludge settlement tanks and drying beds which will periodically need to be dewatered and de-sludged, in an environmentally acceptable manner. The treated sludge will be disposed to farmland or at a licensed approved solid waste disposal site. The sludge will be classified before it is disposed of in order to prove that it is not hazardous. A Waste Management Licence may be required if it is disposed to land and covers more than 50 m^2.

A significant portion of the domestic water supply schemes in this area will fall under the OR Tambo and Joe Gqabi DMs (**Figure 13**). Some communities are served by existing schemes (**Figure 14**), which have been taken into account in the development of the proposed infrastructure.

The total pipeline servitudes amount to a length of approximately 375 km.

Construction of the pipelines will commence with pipes being strung out along the pipeline routes and trenches, up to 3.5 m deep and 2.5 m wide for the largest of the pipes, being excavated (**Figure 15**). Under normal circumstances a maximum of 5 km of open trench is permitted, whilst the pipes will be strung out as they arrive from the manufacturer. Excess spoil material from the trenches will be transported to a suitable disposal site and sandy material will be brought in as bedding and selected backfill for pipe protection. Once the pipes have been laid and tested, the trench will be backfilled, compacted and shaped to the natural ground profile. Topsoil will be replaced to re-establish vegetation.

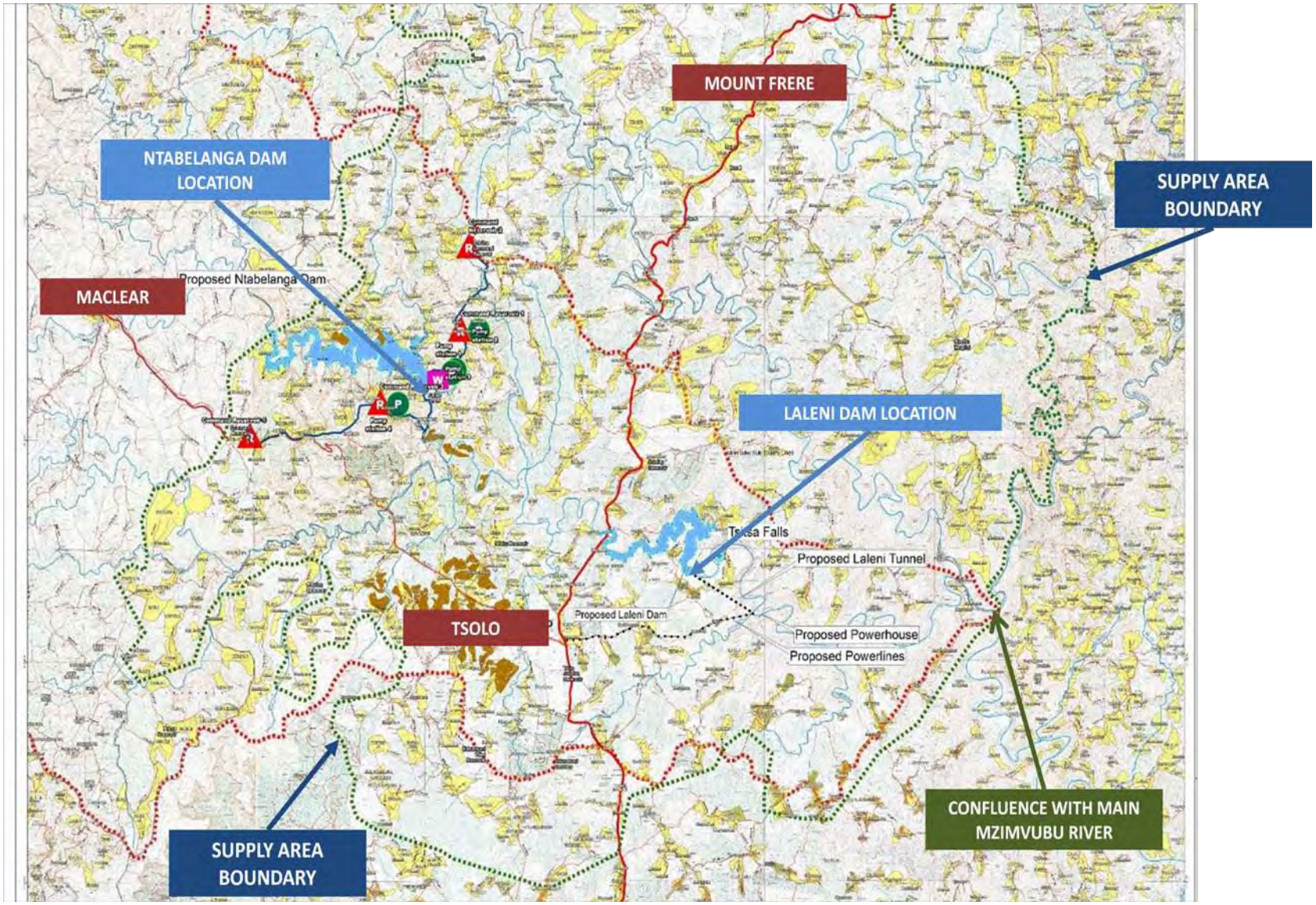

Figure 13: Ntabelanga Dam potable water supply areas

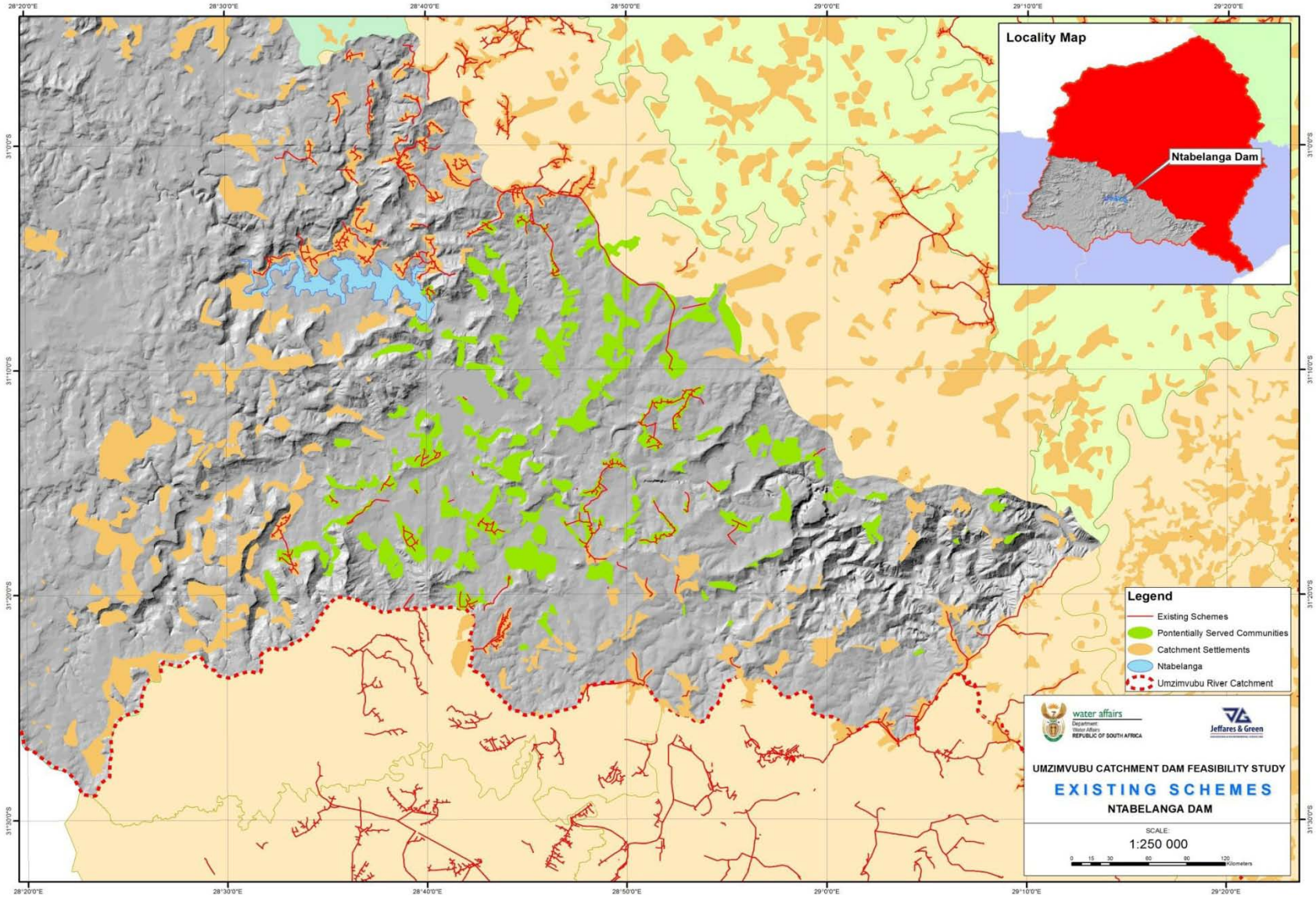

Figure 14: Existing water supply schemes

A ten to thirty meter wide strip would be impacted during constructing **(Figure 16).**

Figure 15: Pipe laying

Figure 16: Trench and working area for pipe lying

Although the reservoirs associated with the pipelines may differ according to their individual capacity and local topography, the technical details are similar for each and are presented below.

Construction Material -	Concrete or steel
Shape and Height-	Shape and height will be determined during the detail design stage but usually circular up to 8 m high (**Figure** 17). Steel reservoirs are rectangular.
Area Required -	Approximately 2 ha

Storage Capacity-	Approximately 1 Mℓ to 30 Mℓ providing between 4 and 24 hours storage per site, but subject to finalisation.
Fencing and Security-	Each reservoir will be fenced. No permanent security staff will be present on site.

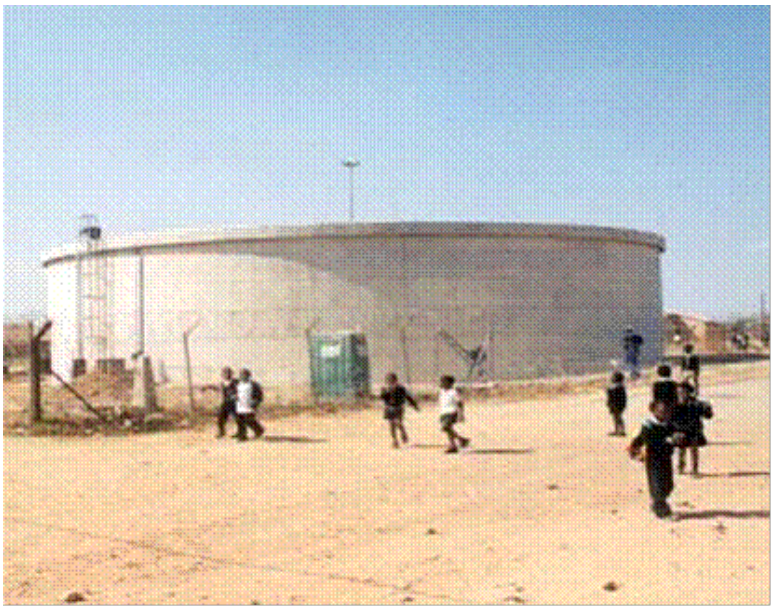

Figure 17: View of a typical large concrete reservoir

3.4 IRRIGATION

The Ntabelanga Dam will also provide water to irrigate approximately 2 900 ha. This project includes bulk water conveyance infrastructure for raw water supply to edge of field.

The entire Mzimvubu catchment was considered in the identification of high potential land for irrigated agriculture. During Phase 1 of the feasibility study, a desktop GIS exercise was carried out to identify high potential irrigable soils according to certain criteria, for purposes of ranking the dam sites identified. The criteria were:

- High potential soils according to soil form, depth, texture;
- Slope less than 12%;
- Elevation less than 60 m above the river at the dam site, or in the river below the dam site;
- Distance less than 5 km from the dam wall or either side of the river below the dam site; and
- Water deficit – medium to high water stress (shortage of natural rainfall).

The land identified around Ntabelanga Dam now met the following criteria:

- High potential soils;
- Slope less than 12; and
- Water deficit – medium to high water stress (shortage of natural rainfall).

The Irrigation Development study (DWA, 2013a) identified about 2 450 ha of the high potential land suitable for irrigated agriculture associated with the Ntabelanga Dam site. This land is located in the Tsolo area and the rest near the proposed Ntabelanga Dam and along the river, close to the villages of Machibini, Nxotwe, Culunca, Ntshongweni, Caba, Kwatsha and Luxeni (**Figure 18**).

Agricultural land near the river will be supplied with raw water pumped by pipeline from the nearest river abstraction point on the Tsitsa River, downstream of the Ntabelanga Dam.

For the Tsolo area schemes, raw water would be pumped from the dam to a storage reservoir and delivered to the edge of these fields through a bulk water distribution system. These lands are located near to the following settlements/wards: Godini, Qhotira, KuGubengxa, St Cuthberts, Jwabuleni, Mazizini, KwaNomadolo and Gumbini. For the other areas, raw water would be abstracted directly from the adjacent dam or river using mobile pumping systems.

The proposed farming model is commercial irrigation farming. Forty five (45) rationalised farming units of between 40 ha and 90 ha each (average of 60 ha) are envisaged. This will require acceptance of a change of land use and mind set from the current subsistence farming approach.

Distribution of water to the farming units will be mostly gravity based, with booster pumping stations for higher lying areas.

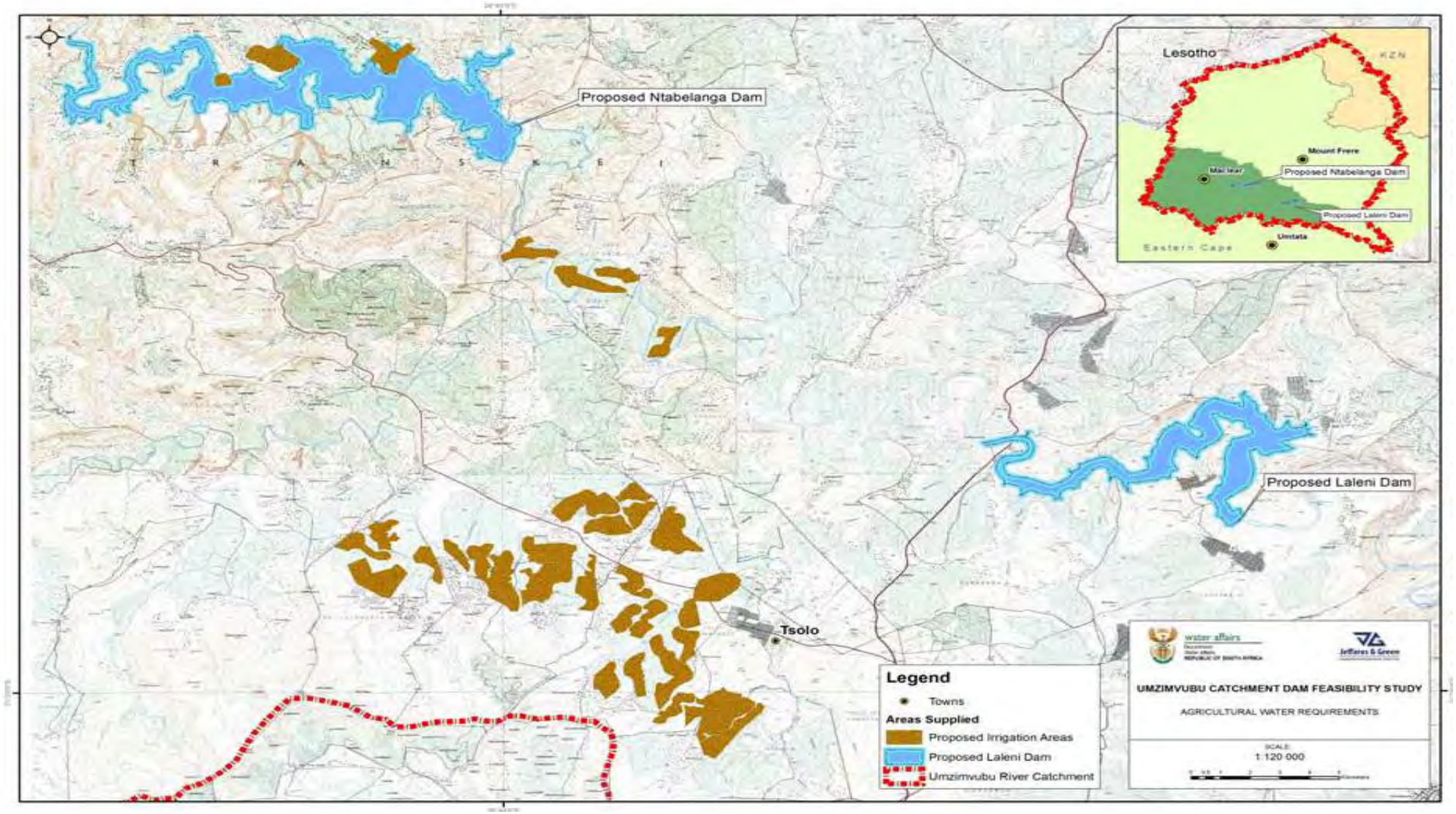

Figure 18: Proposed irrigation areas

3.5 POWER

The feasibility study findings indicate that the viability of the proposed Ntabelanga Dam is dependent on its development as a strategic part of a conjunctive hydropower scheme. A dam at the Lalini site, also on the Tsitsa River upstream of the Tsitsa Falls, is considered to be a viable hydropower generation scheme (**Figure 19**).

There will be a small hydropower plant at Ntabelanga Dam to generate between 0.75 MW and 5 MW (average 2.1 MW). This will comprise a raw water pipeline from the dam to a building containing the hydropower turbines and associated equipment, and a discharge pipeline back to the river just below the dam wall. The impact is expected to be similar to that of a pumping station.

The hydropower plant at the proposed Lalini Dam and tunnel (used conjunctively with the Ntabelanga Dam) will generate an average output of 30 MW if operated as a base load power station and up to 150 MW if operated as a peaking power station. The power plant will require a pipeline (approximately 4.6 km) and tunnel (approximately 3.2 km) linking the dam to the power plant downstream of the dam and below the gorge. Neither the Lalini Dam nor the hydropower plant will be visible from the Tsitsa Falls.

The power line linking the Lalini hydro-electric power station to the existing Eskom grid will be approximately 13 km. It is expected that monopole structures will be used, which after planting, will protrude between 19.2 m and 21 m.

3.6 AFFECTED INFRASTRUCTURE

The area to be inundated by the dams will submerge some roads as well as other infrastructure such as power lines.

3.6.1 Roads

Approximately 80 km of local roads will be re-aligned in the Ntabelanga Dam area (indicated in magenta in **Figure 20**). Additional local roads will also be upgraded to support social and economic development in the area (indicated in red in **Figure 20**). The road design will be very similar to the existing roads and will be constructed using similar materials.

All road designs will be submitted to the relevant road authorities to obtain their approval before construction commences.

The major items of work to be carried out are the following:

- Clearing of the road footprint;
- Construction of the roads with gravel surfacing;

- The gravel for the pavement layers and fill will be obtained from DMR approved borrow pits and/or cuttings along the road;
- All stormwater drainage will be accommodated using either pipe or portal culverts; and
- The existing roads will be utilised whilst the new realigned sections are constructed; in order to avoid the need for temporary detours during construction.

Materials required for the construction of the roads will be sourced as far as possible from borrow areas with existing permits or from commercial sources. Any new sources required will be subject to separate approval processes.

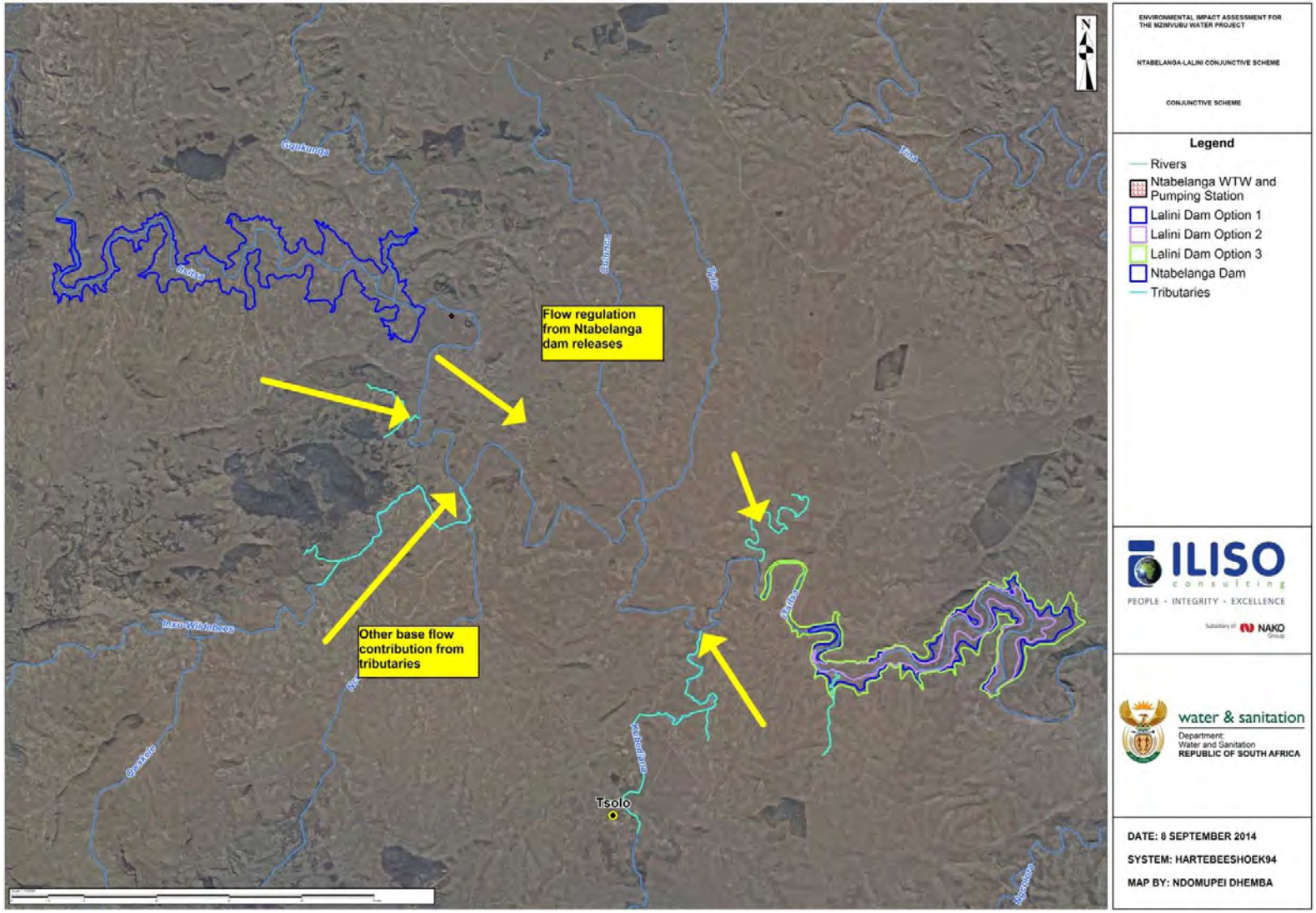

Figure 19: Proposed Ntabelanga-Lalini Conjunctive Scheme

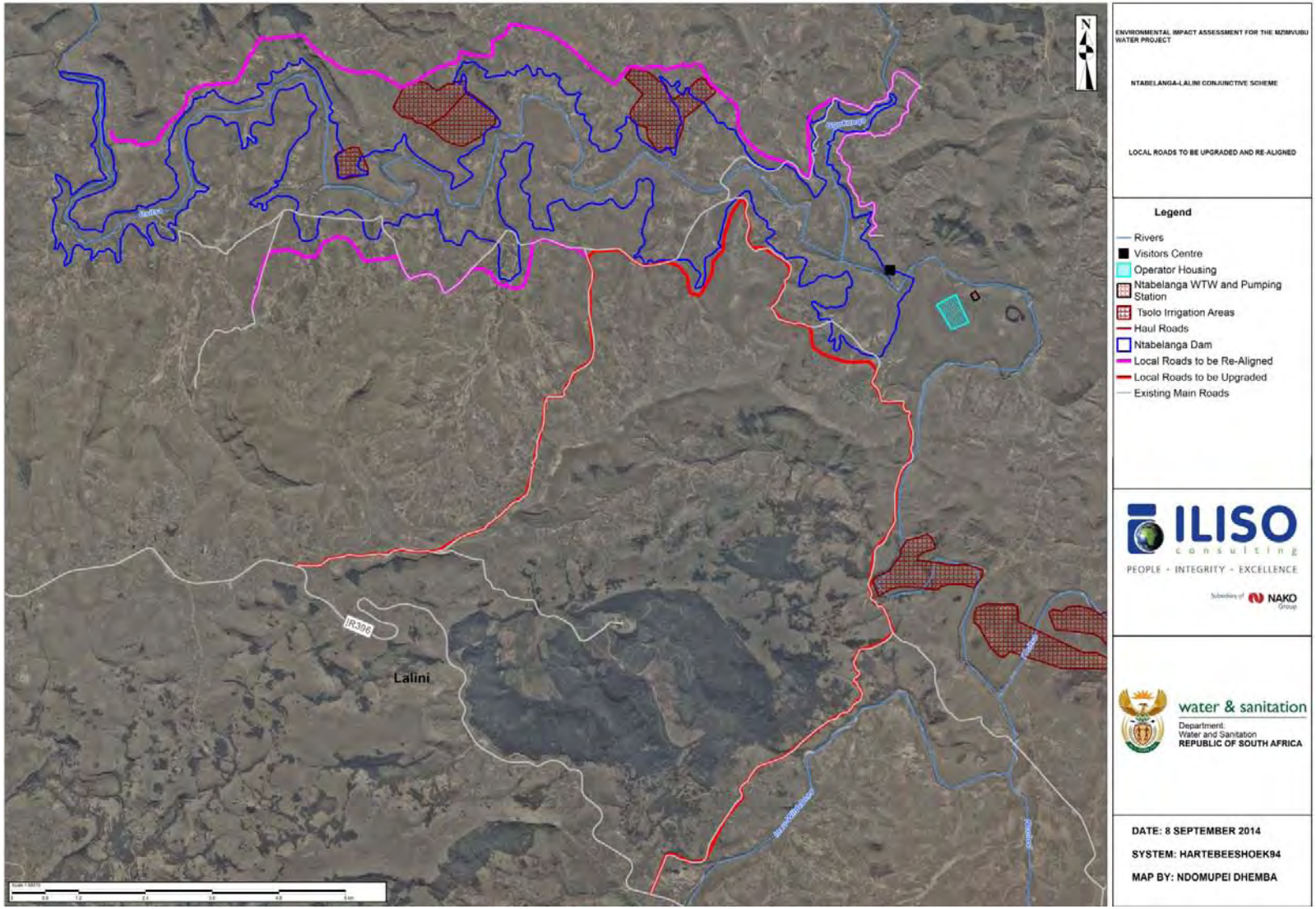

Figure 20: Re-alignment of inundated roads and upgrading of access roads in the vicinity of the Ntabelanga Dam site

3.6.2 Power lines

Power line realignments will be required due to dam inundation levels for both the Ntabelanga and Lalini Dams. Consultation with Eskom is on-going to determine how affected areas will be re-connected. This will be finalised at detailed design stage when formal applications are submitted to Eskom for new power supplies.

Figure 21 and **Figure 22** indicate how the existing power line network will be affected by the inundation at the Ntabelanga and Lalini Dams respectively.

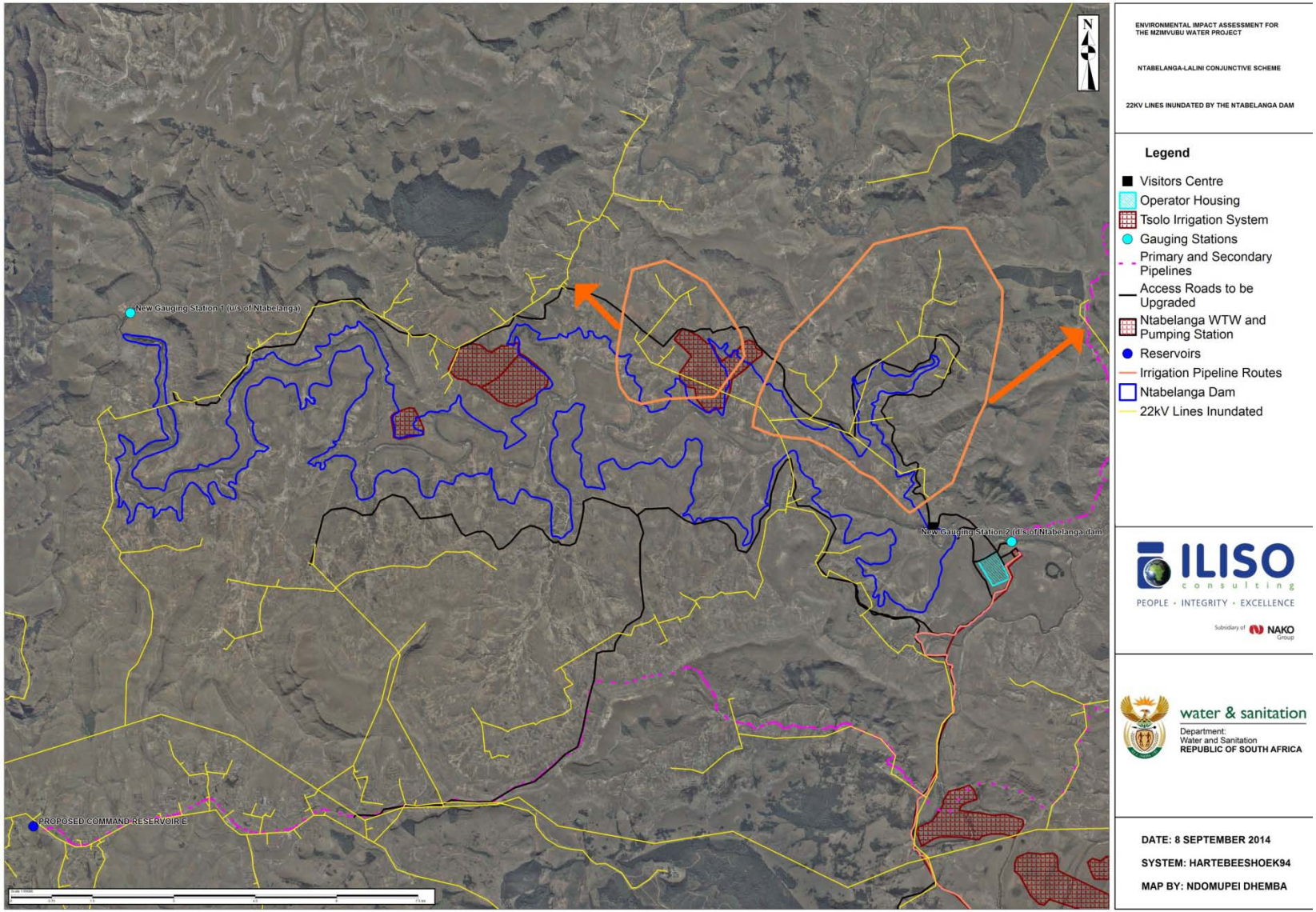

Figure 21: Affected power lines at Ntabelanga Dam

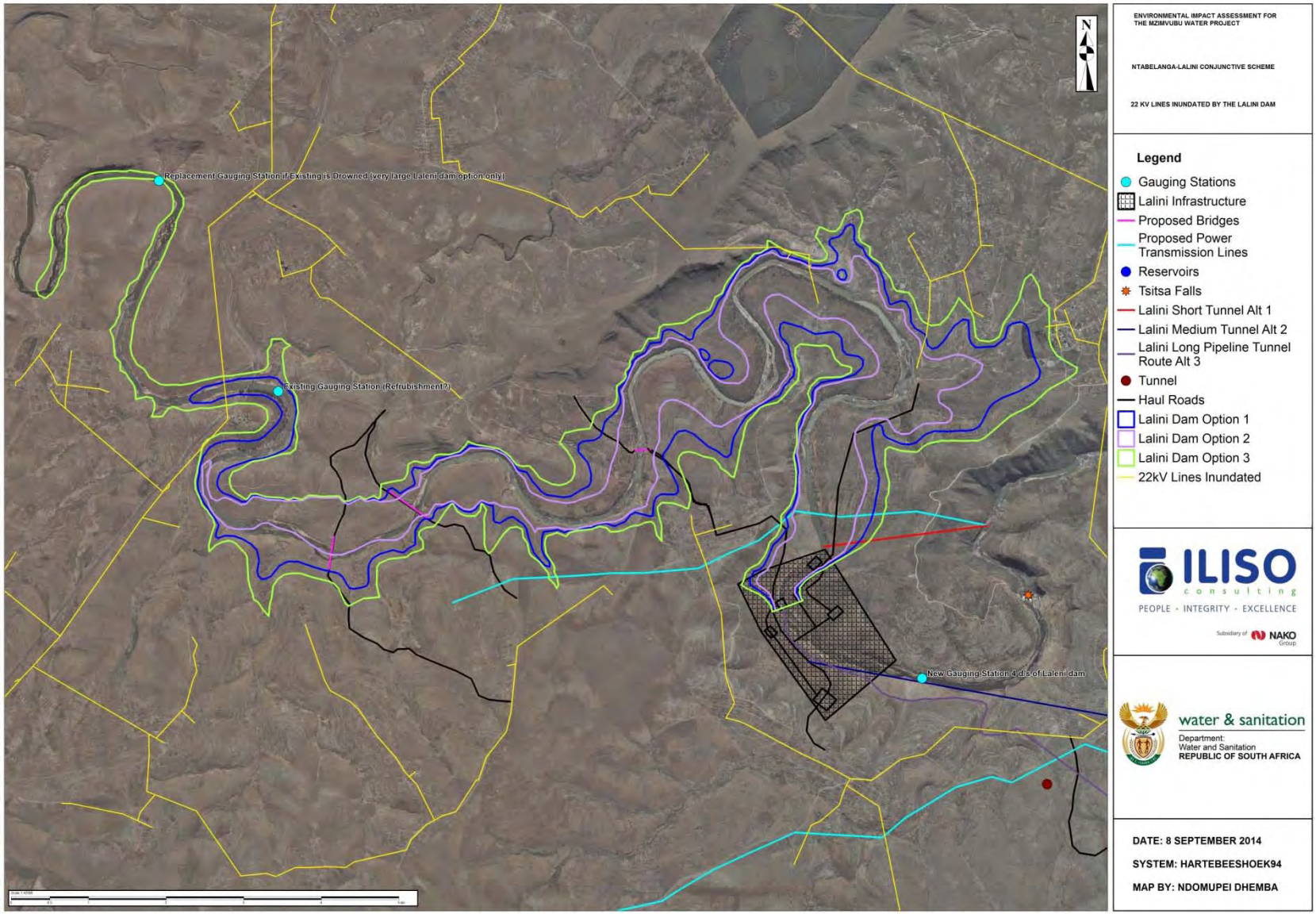

Figure 22: Affected power lines at Lalini Dam

3.7 LALINI DAM BORROW AREAS

Three borrow areas and one rock quarry will be required for the construction of the Lalini Dam and associated works. One core borrow area, one shell/fill borrow area, one sand borrow area and one rock quarry have been identified to source the required materials.

The proposed borrow areas and rock quarry are located within the appropriation line of the dam basin, upstream of the dam wall and in most cases below the Full Supply Level (FSL) **(Figure 23). Table 5** details the estimated area and volumes of material required from the various borrow areas and the rock quarry for Lalini Dam.

Table 5: Estimated Volumes and Areas for Lalini Borrow Pits and Quarry Area:

Material to be Mined	Estimated Area (m^2)	Estimated Volume (m^3)
Fill Borrow Pit	370 000	740 000
Core Borrow Pit Site	400 000	1 000 000
Sand Borrow Pit Site	900 000	1 000 000
Rock Quarry Site	52 500	750 000

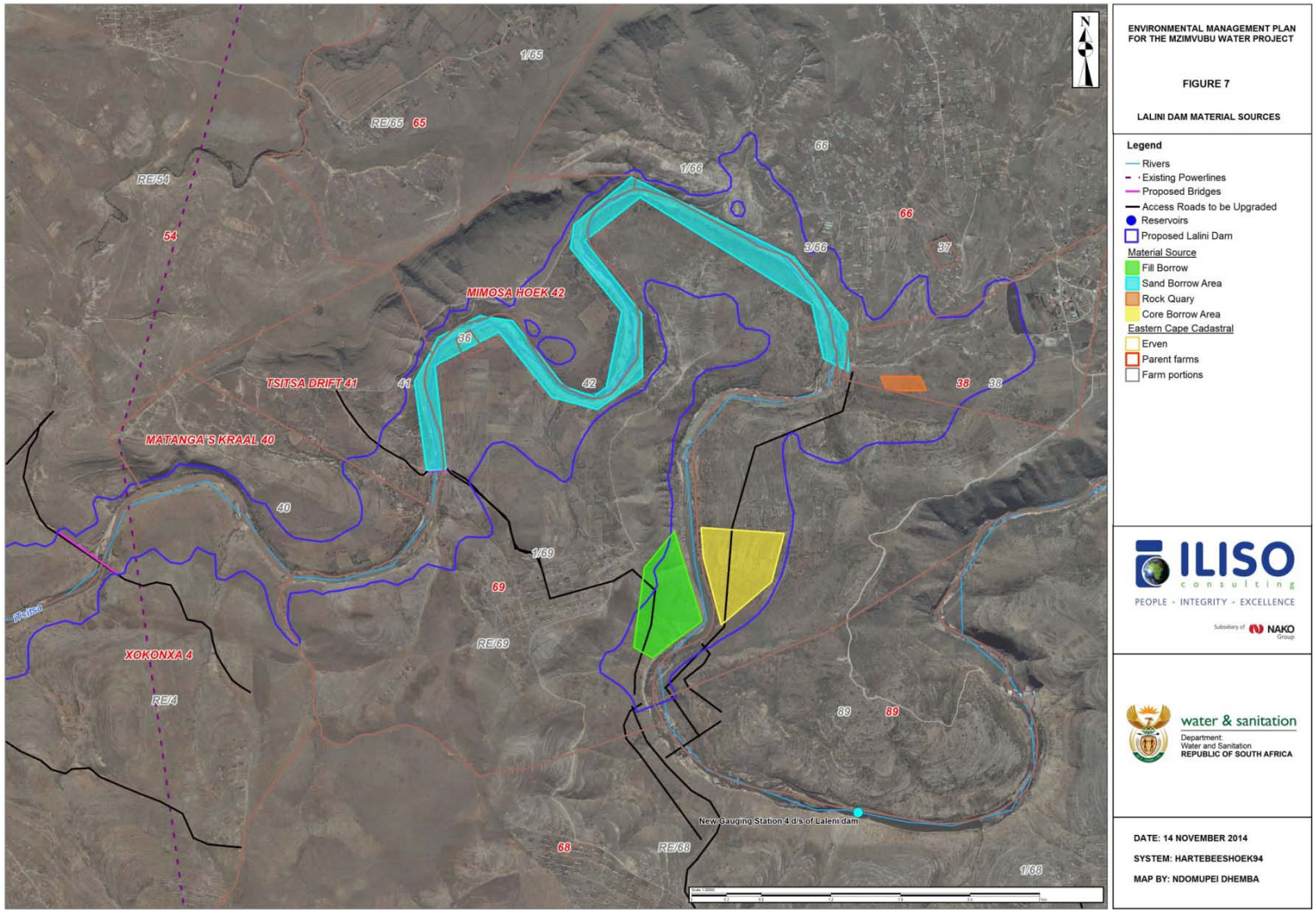

Figure 23: Lalini Borrow pits and Quarry Area

3.7.1 Core Borrow Pit

The core borrow pit is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed borrow area. The current access road will have to be upgraded.

3.7.2 Shell Borrow Area

The shell borrow pit is located upstream of the dam wall on the right bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed borrow area.

3.7.3 Rock Quarry

The rock quarry is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed quarry area.

3.7.4 Sand Borrow Area

General Description

The area demarcated for the sand borrow pit is located upstream of the dam wall across the left and right banks of the river. The mining operations will take place within the riverine environment. The Mzimvubu subWMA is important with regards to fish corridors for movement of threatened fish between habitats. In this regard the riverine environment is considered to merit particular protection.

This activity forms part of the water use license application to the DWS for the MWP. The best practice guideline for small scale mining developed by DWS will be adhered to as a minimum requirement together with any other conditions that DWS may impose.

3.7.5 Access

Access roads to the proposed borrow and quarry areas will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPR. In general, access roads will be constructed in accordance with provincial standards and codes of practice and in consultation with the Engineer.

Access to the riverbed for the purpose of conducting excavations in the riverbed, shall be through the use of only one access at a time. The location of the access to the river channel across the river-bank shall be at a point of the riverbank where the least excavation and damage to vegetation will occur and shall not be wider than is reasonably required. The position of the river access together with all planned future access points must be indicated on a layout plan.

3.8 NTABELANGA DAM BORROW AREAS

Five borrow areas and one rock quarry will be required for the construction of Ntabelanga Dam and associated works. Two core borrow areas, two fill borrow areas, one sand borrow area and one rock quarry have been identified to source the required materials.

The proposed borrow areas and rock quarry are located within the appropriation line of the dam basin, upstream of the dam wall and in most cases below the FSL **(Figure 24). Table 6** details the estimated area and volumes of material required from the various borrow areas and the rock quarry.

Table 6: Estimated Volumes and Areas for Ntabelanga Borrow Pits and Quarry Area:

Material to be Mined	Estimated Area (m^2)	Estimated Volume ($m^{3)}$
Core Material Borrow Pit 1	95 549.78	260 000
Core Material Borrow Pit 2	109 899.81	75 000
Shell/General Fill Borrow Pit 1	313 179.38	2 100 000
Shell/General Fill Borrow Pit 2	120 916.02	
Sand Borrow Pit	111 715.65	105 000
Rock Quarry	34 134.72	362 500

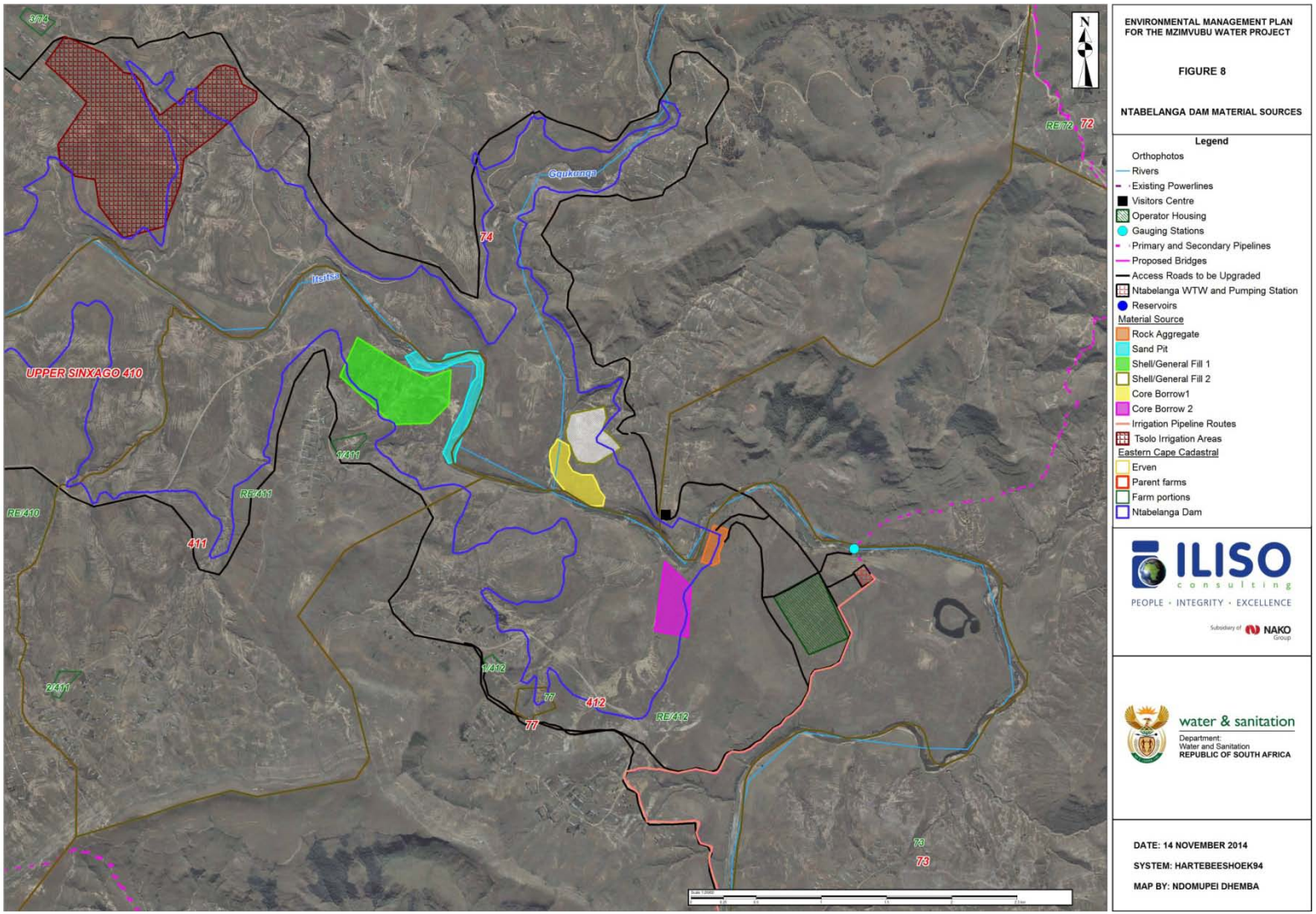

Figure 24: Ntabelanga borrow and quarry areas

3.8.1 Core Borrow Pit 1

The core borrow pit 1 is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed borrow area.

3.8.2 Core Borrow Pit 2

The core borrow pit 2 is located upstream of the dam wall on the right bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed borrow area.

3.8.3 Fill Borrow Pit 1

The fill borrow pit 1 is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure within the vicinity of the proposed borrow area.

3.8.4 Fill Borrow Pit 2

The fill borrow pit 2 is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 this report the area exhibits transformed vegetation and there is no infrastructure within the vicinity of the proposed borrow area.

3.8.5 Rock Quarry

The rock quarry is located upstream of the dam wall on the right bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed quarry area.

3.8.6 Sand Borrow Area

The area demarcated for the sand borrow pit is located upstream of the dam wall across the left and right banks of the river. The mining operations will take place within the riverine environment.

This activity forms part of the water use license application to DWS for the MWP. The best practice guideline for small scale mining developed by DWS will be adhered to as a minimum requirement together with any other conditions that DWS may impose.

3.8.7 Access

Access roads to the borrow and quarry areas will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPR. In general access roads will be constructed in accordance with provincial standards and codes of practice and in consultation with the Engineer. Access to the riverbed for the purpose of conducting excavations in the riverbed, shall be through the use of only one access at a time.

The location of the access to the river channel across the river-bank shall be at a point of the riverbank where the least excavation and damage to vegetation will occur and shall not be wider than is reasonably required. The position of the river access together with all planned future access points must be indicated on a layout plan.