Emergency Preparedness Plan:- Metolong Dam and Raw Water Pump Station

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Project Background

- The Metolong Dam and Water Supply Programme (MDWSP) was initiated to address the demand for water for domestic and industrial consumption in the lowlands, particularly in Maseru and its surroundings and as well as in other towns;
- MDWSP comprises of a dam, treatment plant and distribution system to meet Maseru's domestic and industrial potable water requirements up to the year 2020 and possibly beyond;
- The dam being built is a Roller Compact Concrete Dam (RCC Dam):height of 83m; a crest length of approx. 278m, a Raw Water Pump Station (RWPS) and a spillway at full supply level of 1671masl.
- The Dam is being impounded as construction continues and to date the water level is at 1636 masl at the Dam Wall

Dam Safety

The selection of a suitable area to locate the Dam is paramount to minimize dam failure and safety risk.

Therefore selection of the area where the dam is located was based on the following:

- Fairly narrow section of the valley – cost implications;
- Around a bent - reduce flood velocity;
- Minor geological features – more stable rock

Emergency Preparedness

Justification to develop an Emergency Preparedness Plan (EPP):

- A considerable number of villages (from 30 - 68Kms) downstream of the Dam are in grave danger should there be a dam failure;
- Potential loss of life due to dam failure is about 968.
- Many agricultural fields are located along the river and flood area. Farmers may be working in their fields when the failure occurs;
- Cultivated farm land that will be damaged due to dam failure is about 2 800 hectares;
- Infrastructure such roads, power lines and communication lines will be affected.
- the hazard rating for Metolong Dam failure is “High”- catastrophic disaster

Emergency Preparedness Plan (EPP)

EPP sets out the following major aspects:

- defines the responsibilities of stakeholders in the implementation of the EPP;
- provides procedures designed to identify conditions which could endanger Metolong Dam in time to take mitigation measures;
- notification of relevant emergency management officials of possible, impending, or actual failure of the dam;
- procedures to be followed in response to emergency situations that may occur;

EPP Development

The Plan was developed in line with the following:

- The Federal Emergency Management Agency (FEMA);
- The Mohale Dam EPP;
- The Lesotho Disaster Management Act No. 2;
- The requirements of the World Bank's Operational Policy 4.37;
- Implementation of its provisions is based on the Kingdom of Lesotho existing administrative structures;
- Consultations with stakeholders that are already involved in the disaster management situations;

EPP Development cont’d

- Desk top studies;
- Simulation of flood lines for production of inundation maps

Emergency Classification

Emergency situations categorized into three levels depending on severity:

- Condition A - Non-Failure Emergency Situation
- Condition B - A Potential Failure Situation is Developing
- Condition C - Failure is Imminent or Has Occurred

Condition A - Non-Failure Emergency Situation

- non-failure condition occurs when:
  - the outlet works functions are operated e.g. **Scheduled additional** In-stream Flow Releases (IFR);
  - Metolong Dam Spillway begins to discharge water
- there is no danger of dam failure,
- flow conditions are such that flooding is expected to occur downstream of the dam and could affect river activities including:
  - sand mining
  - vehicular washing
  - animal grazing
- A flood alert will be issued to EPP contacts, as soon as spillway discharges water. However it should be highlighted that **the dam is NOT in danger of failing!!!**

Condition B - Potential Failure Situation Developing

- It is reached when the 100 year flood is experienced;
- Corresponding discharge is estimated to be 650 m3/s; and
- Water surface elevation is 1673.77 masl.

Condition C - Failure is Imminent or Has Occurred

There is failure of the dam itself or its foundation, leading in large or rapidly increasing uncontrolled releases of water from the reservoir:

- It can be identified by the formation of a breach in the dam or foundation.

Implementation of the EPP

Responsibilities:

1. Water and Sewerage Company (WASCO):
   - will be responsible for the operation, maintenance and surveillance of the dam including initiation of notification procedures during an emergency
   - Responsibilities will be carried out by Dam Safety Team (DST), which comprises of the following:
     - Dam Safety Engineer (DSE) – is the EPP Coordinator and has sole mandate to evoke the Notification Procedures
     - Dam Safety Field Engineer (DSFE) – is designated to assume the duties of the DSE in his absence and assumes same responsibilities as DSE during an emergency

Implementation of EPP cont’d

2. Disaster Management Authority (DMA) has the following mandate:
   - establish Village Disaster Management Teams (VDMTs);
   - Install sirens within villages for warning notification;
   - prompt coordination with member agencies and the VDMT’s for timely and effective warning and evacuation from the affected areas
3. District Disaster Management;
4. VDMTs;
5. Lesotho Mounted Police Services:
   - Provision of evacuation support to VDMTs; and
   - Receives warning messages from two radios relay them to VDMTs
6. Lesotho Defence Forces:
   - Provide helicopter services during emergencies when air evacuation is needed

Dam Monitoring and Surveillance

DST will have to monitor the following in order to determine potential serious situation:

- Excessive/increase amounts of seepage
  - Check drains in the gallery for any abnormal increase in quantities of seepage.
- Movement on the dam crest;
  - Check for deflection on the dam crest.
- Spillway Obstruction
  - Check spillway to ensure no blockage due to debris.

Dam Monitoring and Surveillance

- High inflows;
  - Check for water levels that are higher than normal reservoir levels.
  - Check weather forecast for expected amounts of precipitation.
  - Check for rapid rate of rise of water levels.
- Widespread flooding;
  - Perform an aerial site inspection.

Dam Monitoring and Surveillance

Continuous monitoring of the Dam through installed instruments to determine:

No	Instrument Installed	Parameter to measure
1.	Physical piezometers	Uplift pressure
2.	Temperature meters	RCC curing
3.	3-D Crack meters	Monitors movement at the joints
4.	Inverted Pendulums	Deflection of the Dam
5.	Multipoint Extensometer	Detection of cracks and their location
6.	3-D Accelerometer	Dam vibrations
7.	V-notch weirs	Amount of seepage through the Dam

Dam Monitoring and Surveillance

Regular physical inspections:

- DSE shall carry out **routine inspections** every **six months**;
- **Special surveillance** of the dam shall be performed **immediately after** an earthquake or major flood;
- **During flood season** (October – April), **weekly surveillance** of the dam and its appurtenant structures shall be performed by the DSE;

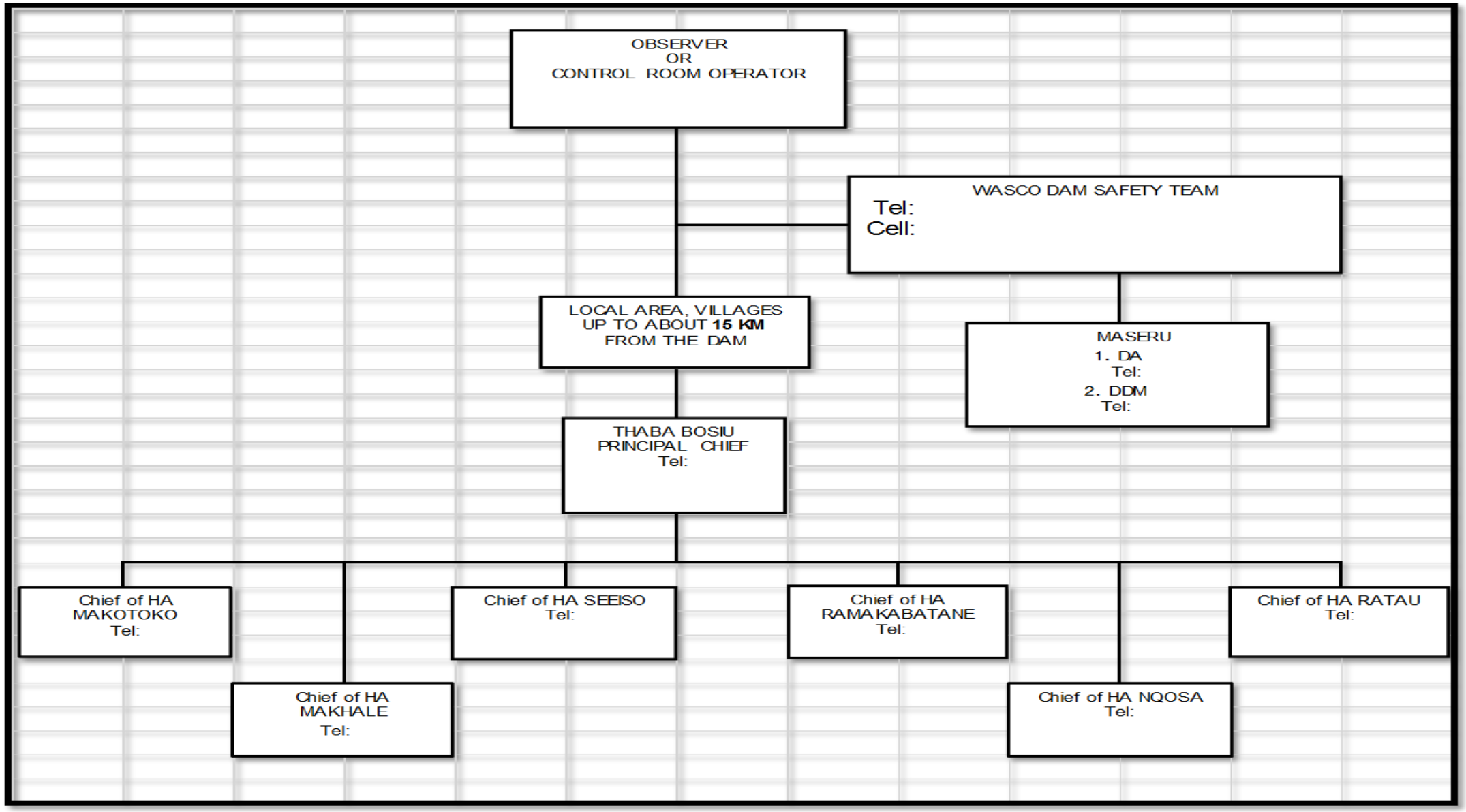
Emergency Notification

- After receiving information/data from the Control Room, the DSE will do analysis and the issue emergency warning.
- Warning shall be issued either under a “sunny day”, or a “flood day” when the structural condition of the dam is such that:
  - failure is imminent or;
  - a potentially hazardous situation is developing.
- The warning shall be sent to EPP contacts following the appropriate Communication Flow Chart i.e. Condition A/B/C

Emergency Notification cont’d

- Should Emergency Condition B/C develop, a siren shall be sounded to alert everyone situated in proximity to the dam site, to move to higher ground, especially anyone crossing the river, grazing animals, or working in the fields immediately downstream.
- The VDMTs of villages within 30km downstream of the dam, will be warned through cellular phone communication and/or manually controlled siren system installed in each village.
- Depending on the severity of the Dam Incident, the Chief Executive Officer (CEO), DMA shall be contacted at the discretion of the District Administrator and the DSE

Notification for Condition A – Non-Failure Emergency Situation

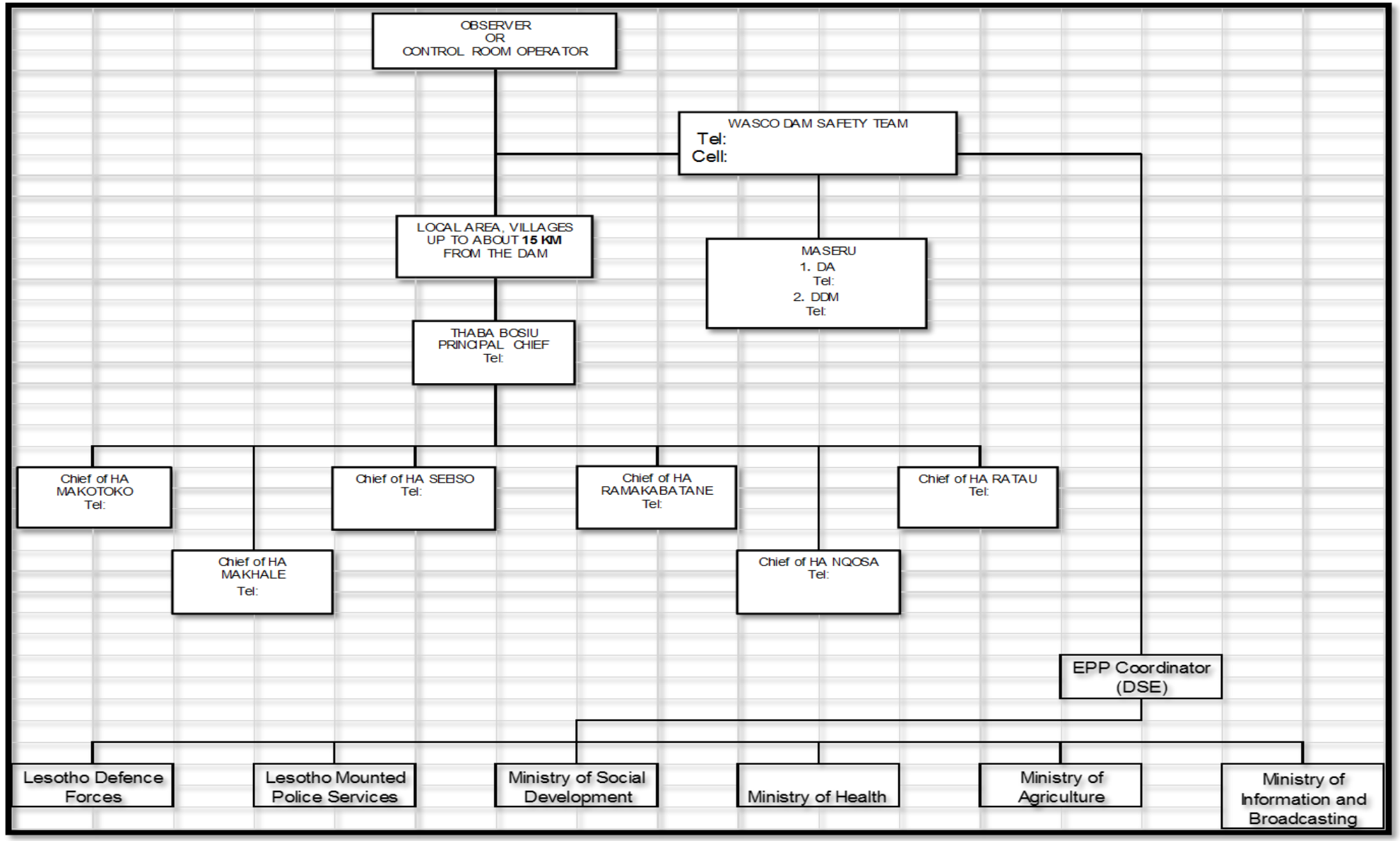


Notification for Condition C – Failure is Imminent or Has Occurred

Condition C will be implemented when a dam failure has been occurred and indicators are:

- the reservoir water level is rapidly falling; and
- a flood wave moving downstream has materialized;
- DSE will issue warning to DMA;
- DMA will responsible for prompt coordination with member agencies and the VDMT’s for timely and effective warning and evacuation from the affected areas.

Notification for Condition C – Failure is Imminent or Has Occurred



Emergency Response

Emergency Routes:

- The Metolong Dam is accessible through a 35 km tarred road from Maseru; and
- 10 km gravel road from the tarred Mohale road.

- A siren on Site shall be sounded to alert everyone in proximity to the dam to move to higher Condition B/C develop;
- All affected areas are either in deep gorges or relatively wide valleys. In any affected village / town, the houses at lower levels would be inundated while most of the houses are above the maximum inundation limit.

Emergency Response

- agricultural land is relatively close to the river bank, therefore evacuation process shall involve:
  - Moving the residents of the houses within the limit of inundation to higher ground,
  - Warning the farmers to come out of their fields and move to higher ground,
  - Installing stop signs on roads leading to inundated areas, and
  - Warning the people using ferry services.

Challenges

- Access to villages on the right bank situated within 30kms stretch downstream of the Dam are not easily accessible due to poor roads;
- Access to the River within the 30km is not easy thereby making evacuation slow;
- Limited funds to put up all the necessary infrastructure in place;
- Attendance to sensitization meetings was poor and this led to rescheduling of a number of meetings;
- Overall emergency preparedness within the Country needs to be strengthened

Achievements to date

- The EPP document is completed except for finalization of appendices such as maps showing marked access routes to relief centres;
- Consultation with main stakeholders when developing the EPP;
- EPP has been approved by World Bank;
- Warning Sign boards to be installed at crossing points downstream of the Dam are being manufactured;
- There interim arrangements in place to implement EPP during construction;
- Villages situated within 30kms downstream have been sensitized on EPP;
- Three drill exercises were conducted for Emergency Condition A

Way forward

- All trails, village dirt roads etc. leading to these evacuation centres shall be identified and marked on the inundation maps given
- The DA shall identify alternative trails, paths and village dirt roads leading to the evacuation centres and mark them on the inundation maps;
- The DA will identify the number of relief centres required in the area affected by a dam-break flood and improve his plan to suit this event
- Nearby all weather and fair-weather roads shall be identified to move any casualty from the evacuation centre to the nearby medical aid station.
- The VDMTs shall be provided with adequate numbers of flashlights to safely reach the affected areas and help evacuate the affected residents to evacuation centres.

Conclusion

- The EPP document is good enough to enable the DST to implement the dam safety requirements;
- The EPP is a living document and necessary revisions should be made to make sure that is always current;
- Allocation of resources is vital to enable adequate implementation of the EPP;
- Constant collaboration with stakeholders should be maintained.