1. INTRODUCTION

1.1. BACKGROUND TO THE STUDY

Numerous hydrological studies have been undertaken in Lesotho, most of which have focused on the Lesotho Highlands Transfer Scheme. However, there are many areas within Lesotho that suffer from water shortages, particularly in the Lowlands area. The Lesotho Lowlands Water Supply Scheme Feasibility Study was commissioned to investigate potential water resource developments to ensure the long-term sustainable water supply to the Lowlands area. The location of the Study Area is shown in **Figure A.1** in **Annexure A**. Parkman Ltd (UK) was appointed to undertake the assignment and WRP Consulting Engineers (SA) was contracted by Parkman Ltd (UK) to undertake the hydrology and water resources assessments.

1.2. APPROACH TO THE STUDY

The overall objective of the project was to determine the most viable and sustainable water supply schemes for the Lesotho Lowlands. This entailed a phased approach to the investigations. The first phase of the study was a broad desktop assessment of all identified schemes. **Table 1.1** provides a list of the schemes assessed and the locations of the catchments are shown in **Figure A.2** in **Annexure A**. The hydrological data published in the WR90 document was used as the basis to assess these various options. WR90 classified the region into hydrological zones for which generic draft-storage relationships have been determined, which were applied to the various dam sites listed in **Table 1.1**. The assessment of the abstraction potential from run-of-river abstraction works was also undertaken using WR90. Regionalised deficient-flow-duration-frequency relationships were used to provide an indication of the cumulative inflow expressed as a percentage of the MAR for various durations. The WR90 analyses are reported on in detail in the Intermediate Report.

Table 1.1 : Schemes identified in Phase 1.

Site name	Infrastructure type	River
Upper Ngoajane Weir	Diversion weir with no upstream storage	Ngoajane
Middle Ngoajane Dam	Dam	Ngoajane
Lower Ngoajane Dam	Dam	Ngoajane
Lower Ngoajane Abstraction	Run-of-river abstraction supported by Lower Ngoajane Dam	Ngoajane / Hololo
Upper Hlotse Dam	Dam	Hlotse
Lower Hlotse Dam	Dam	Hlotse
Lower Hlotse Abstraction A(1)	Run-of-river abstraction supported by Upper Hlotse Dam	Hlotse
Mamafubelu	Dam	Mamafubelu
Mamafubelu Abstraction B(1)	Run-of-river abstraction supported by Mamafubelu Dam	Hlotse
Mapoteng	Dam	Northern Phutiatsana
Metalong	Dam	Southern Phutiatsana
Likhutlong Dam (Upper Makhaleng)	Dam	Makhaleng
Matsapong Dam (Middle Makhaleng)	Dam	Makhaleng

Site name	Infrastructure type	River
Lower Makhaleng Dam	Dam	Makhaleng
Upper Makhaleng off bank storage	Off-bank storage dam	Makhalaneng
Lower Makhaleng off bank storage	Off-bank storage dam	Mamaebana
Lower Makhaleng abstraction point(2)	Run-of-river abstraction with no upstream storage	Makhaleng
Ha Mahooana	Dam	Quoquaane
Ha Khoeli	Dam	Korokoro

Note (1) : Same abstraction points, but supported by different upstream storages (i.e. two different schemes).

Note (2) : 2 possible locations of Lower Makhaleng abstraction point have been provided.

Three schemes were selected for detailed analysis after completion of the intermediate phase of the study, these being :

- A run-of-river abstraction directly from the Hololo River downstream of the confluence with the Ngoajane River, possibly supported with releases from a new Ngoajane Dam or from the existing Muela Dam;
- A run-of-river abstraction directly from the Hlotse River downstream of the confluence with the Mamafubelu River possibly being supported with releases from the proposed Hlotse Dam; and
- A run-of-river abstraction directly from the Makhaleng River at the Mohales Hoek road bridge possibly being supported with releases from the Matsapong Dam.

The locations of these various catchments are shown in **Figure A.3** in **Annexure A**. A more detailed hydrological and water resource analysis was undertaken for these three options, the approach to which was as follows :

- Acquire and compile all available hydrological data (mainly streamflow, rainfall and evaporation) in a database;
- Evaluate the hydrological database and select data for use in the hydrological analyses;
- Calibrate the WRSM2000 streamflow generation model using appropriate catchment rainfall and observed streamflow records;
- Generate synthetic streamflow sequences for development nodes within the identified schemes;
- Compile water resource networks of the identified schemes for the Water Resources Yield Model (WRYM); and
- Undertake stochastic yield analysis of the identified schemes in the WRYM to determine the supply capabilities at the specified level of assurance (1 in 50 years).

1.3. LAYOUT OF THE REPORT

Chapter 2 of the report provides a summary of the acquisition and assessment of the rainfall data used in this assignment while Chapter 3 provides a similar summary for the streamflow data. This is followed by a presentation of the methodology utilised to determine the yields of

the various systems. Chapter 5 describes the three systems analysed and presents the results of the analyses. The study references are presented in Chapter 6.