63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

Nuclear 1 Hydrology Peer Review

Report

Version - 1

13 August 2015

Gibb (Pty) Ltd.

GCS Project Number: 13-803

Client Reference: GCS - J31314 Nuclear 1 Peer Review

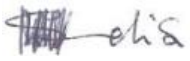
Report
Version - 1

13 August 2015

GIBB (Pty) Ltd.

13-803

DOCUMENT ISSUE STATUS

Report Issue	Draft		
GCS Reference Number	GCS Ref - 13-803		
Client Reference	GCS - J31314 Nuclear 1 Hydrology Peer Review		
Title	Nuclear 1 Hydrology Peer Review Report		
	Name	**Signature**	**Date**
Author	Daniel Fundisi		August 2015
Document Reviewer	Karen King		August 2015
Director	Alkie Marais		August 2015

CONTENTS PAGE

1 INTRODUCTION 4
2 SCOPE OF WORK 4
3 REVIEWED DOCUMENT 4
4 COMMENTS AND RECOMMENDATIONS 5
4.1 FULFILLMENT OF TERMS OF REFERENCE 5
4.2 REPORT OBJECTIVITY 5
4.3 TECHNICAL, SCIENTIFIC AND PROFESSIONAL CREDIBILITY 5
4.4 DEFENSIBILITY OF METHODOLOGY AND STUDY APPROACH 5
4.5 INFORMATION GAPS, OMISSIONS OR ERRORS 6
4.6 SENSIBILITY OF RECOMMENDATIONS AND PRESENTATION OF BEST OPTIONS 7
4.7 ALTERNATIVE VIEWPOINTS PRESENTATION AND CLARITY OF STATEMENT 7
4.8 ACCESSIBILITY OF STYLE OF REPORT TO NON-SPECIALISTS 7
4.9 MEETING OF NORMAL STANDARDS OF PROFESSIONAL PRACTICE AND COMPETENCE 8
5 CONCLUSIONS 8
6 REFERENCES 8

1 INTRODUCTION

GCS Water and Environment (Pty) Ltd. (GCS) was appointed by Gibb (Pty) Ltd. to conduct a peer review of the hydrology report compiled by SRK Consulting based on the Hydrological Assessment for a proposed Nuclear Power Station project. The project sites are located at Thyspunt in the Eastern Cape Province, and at Bantamsklip and Duynefontein in the Western Cape Province of South Africa.

2 SCOPE OF WORK

The scope of work for the hydrology peer review study is as follows:

- Assess the document/ report in terms of its fulfilment of its Terms of Reference set;
- Consider whether the report is entirely objective;
- Consider whether the report is technically, scientifically and professionally credible;
- Consider whether the method and the study approach are defensible;
- Identify whether there are any information gaps, omissions or errors;
- Consider whether the recommendations presented are sensible and present the best options;
- Consider whether there are alternative viewpoints around issues presented in the report and if these are clearly stated;
- Consider whether the style of the report is written so as to make it accessible to non-specialists, technical jargon is explained and impacts are described using comparative analogies where necessary; and
- Report on whether normal standards of professional practice and competence have been met.

3 REVIEWED DOCUMENT

The reviewed document is a Hydrological Assessment Report compiled by SRK Consulting for Gibb (Pty) Ltd. The report is titled 'Environmental Impact Assessment for the Proposed Nuclear Power Station (Nuclear 1) and Associated Infrastructure: Hydrology Environmental Impact Report' (SRK, 2011) and was based on the Environmental Impact Assessment (EIA) conducted by Gibb in support of Eskom's Nuclear-1 project.

4 COMMENTS AND RECOMMENDATIONS

The underlying sections clarify GCS' hydrological report review, broken into sections as specified in the scope of works.

4.1 Fulfillment of Terms of Reference

- The overall document fulfils its intended purpose.

4.2 Report Objectivity

- The report is largely objective. Areas which need attention are highlighted in the forthcoming sections.

4.3 Technical, Scientific and Professional Credibility

- **Section 2.2.5: Long Term Hydrology Details:** More recent data from the WR2005 database (these were the most recent hydrological data available in 2011) instead of the far older WR1990 data should have been used since this report was compiled in 2011. Or alternatively a comparison between the WR90 and WR2005 could have been done. Current data are necessary and make more scientific sense since changes in quantity and patterns of rainfall are expected.
- **Section 1.2.1: Methodology:** Certainly more than one and at least three peak flow calculation methods should have been employed. In this manner the results of the three methodologies could be verified against each other and the most site appropriate and robust methodology could have been selected as the final option.

4.4 Defensibility of Methodology and Study Approach

- **Section 1.2.1: Methodology:** The use of one peak flows calculation method (SCS Method) is not scientifically prudent, but the method chosen is an acceptable method. Other methods such as any of the Rational Methods, the Standard Design Flood method and the Midgley and Pitman method could have been used together with the SCS method and the best method for the site selected based on scientific judgement and experience.
- **Section 2.1.9: Description of Model:** HEC-RAS model input parameters could have been explained further to help clarify what these are to non-technical people. A paragraph would do to explain the chosen Manning's roughness coefficients, explain what mixed regime is and to explain the boundary condition selected in the model. For instance, photographs of the sites showing vegetation and the general terrain would assist to justify the manning's 'n' values used.

- **Section 1.2.2: Legislative Framework and Regulatory Guidelines:** The provisions of the IAEA legislation followed in the study should be described in detail upfront and referred to in the text. This is necessary as this is the most significant piece of legislation for this study. The summary given for the nuclear standards and guidelines is too skeletal; it refers to the relevant documents for the study but the contents of these documents are not described for readers to get an understanding of what they recommend. Most stakeholders will not read the IAEA documents.

4.5 Information gaps, omissions or errors

Information gaps, omissions or errors are specified below for each of the relevant sections in this report. The information gaps may cause difficulty in defending the document.

- **Section 1.2.3: Assumptions and Limitations:** At this stage it has been assumed that the entire plant area (to the extent of the anticipated footprint) will be paved when operational. This assumption is fine if verified by client.
- **Section 1.2.3: Assumptions and Limitations:** It is also assumed that the site footprint will have a surface area of approximately 60 ha and the depth would be about 15 m for the conceptual site positions. Again, this assumption is fine if verified by client.
- **Section 2.1.3: Rainfall Details:** A comparison between SAWS, WR90 and local rain gauge (despite only 4 years' data) should have been undertaken.
- **Section 2.1.9: Description of Model:** Model input parameters for the HEC-RAS model need to be explained as described in Section 4.4.
- **Section 2.1.11: Flood line Determination:** HEC-RAS flow velocities which were tabulated have not been used or commented on.
- **Section 2.1.11: Flood line Determination:** Figure 2.3: Flood lines are very unclear and should be plotted at a far larger scale with proposed infrastructure or the development area overlaid.
- **Section 2.1.11: Flood line Determination:** An explanation should be given of why flood lines were determined only at a few sections.
- **Section 1.2.2: Legislative Framework and Regulatory Guidelines:** A description of the IAEA legislation should be provided upfront so that stakeholders understand what the legislation recommends.

4.6 Sensibility of Recommendations and Presentation of Best Options

- **Section 6.2: Recommendations:** Storm Water Management measures have been recommended, however, no alternatives have been presented from which the best options could be selected. A list of structural control measures is provided for each site without stating or illustrating exact locations of where these are required.
- **Section 1.2.1: Methodology:** HEC-RAS 3.2 was used. This was the latest version in 2011 but there is a 4.1 version out now.

4.7 Alternative Viewpoints Presentation and Clarity of Statement

- **Section 1.2.3: Assumptions and Limitations:** GCS agrees with SRK (2011) that there is no data source that describes probable future rainfall patterns (General circulation models are non-specific and scenario driven); if you want to know what future rainfall is likely to look like you need to do a lot of number crunching to generate future 'virtual records'.

- It would have been worth mentioning, however, that almost all General Circulation Models predict future increases in extreme rainfall events and that local changes in land use, changes in local circulation patterns and other local factors do generate differing results. Detailed analysis of trends within a local record will often provide a more reliable analysis of past and future climates.

- As a side note: There is now an official South African climate change report (DEA Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) for South Africa. Climate Change Implications for the Water Sector in South Africa. Pretoria, South Africa) (clearly after 2011) that provides general information for each tertiary catchment (expect higher early summer rain, lower late summer rain and longer drought periods). The values provided are based on global weather patterns and scenarios.

4.8 Accessibility of Style of Report to Non-Specialists

- Technical jargon has been explained in most sections. Where more clarity is required, this has been indicated in the relevant sections of this report, for instance; provision of a brief explanation of model input parameters in HEC-RAS would help enable non-technical readers to understand better understand the report.

4.9 Meeting of Normal Standards of Professional Practice and Competence

- Generally the report meets the normal standards of professional practice and competence.

5 CONCLUSIONS

The areas that need attention include the Methodology, Flood Reduction Measures and the Recommendation sections, for the reasons specified in the sections above:

- More than one peak flow calculation method should be used in order to select the most appropriate method for the project sites.
- The explanation of the boundary conditions and other input parameters used in the HEC-RAS model should be presented more clearly.
- Alternative flood control measures should be presented and best options specified considering site specific conditions.
- Alternative views should have been mentioned in the climate change section.

6 REFERENCES

SRK. (2011). *Environmental Impact Assessment for the proposed nuclear power station ('nuclear-1') and associated infrastructure: Hydrology Environmental Impact Report*. SRK.

SRK Responses to GCS Nuclear-1 Hydrology EIR Peer Review (Report Version – 1 of 13 August 2015)

GCS Review Comments (*as Quoted)*	SRK Responses
Technical, Scientific and Professional Credibility Section 2.2.5: Long Term Hydrology Details: *More recent data from the WR2005 database (these were the most recent hydrological data available in 2011) instead of the far older WR1990 data should have been used since this report was compiled in 2011. Or alternatively a comparison between the WR90 and WR2005 could have been done. Current data are necessary and make more scientific sense since changes in quantity and patterns of rainfall are expected.*	We are in agreement. We did compare the WR2005 MAP which remained the same but there are other parameters that change. This was not used in any of the detailed calculations but formed part of the regional information. The report was updated using the WR2012 data.
Section 1.2.1: Methodology: *Certainly more than one and at least three peak flow calculation methods should have been employed. In this manner the results of the three methodologies could be verified against each other and the most site appropriate and robust methodology could have been selected as the final option.*	We did do some comparisons for order of magnitude but the adopted model was assessed in detail as part of the VERIFICATION AND VALIDATION (V&V): Surface Water Models for the site safety reports (SSRs). Additional information on the adopted flood method was included.
Defensibility of Methodology and Study Approach Section 1.2.1: Methodology: *The use of one peak flows calculation method (SCS Method) is not scientifically prudent, but the method chosen is an acceptable method. Other methods such as any of the Rational Methods, the Standard Design Flood method and the Midgley and Pitman method could have been used together with the SCS method and the best method for the site selected based on scientific judgement and experience.*	As per previous comment above this was addressed in the V&V in detail. We included a section on the criteria used in choosing the SCS model.
Section 2.1.9: Description of Model: *HEC-RAS model input parameters could have been explained further to help clarify what these are to non-technical people. A paragraph would do to explain the chosen Manning's roughness coefficients, explain what mixed regime is and to explain the boundary condition selected in the model. For instance, photographs of the sites showing vegetation and the general terrain would assist to justify the manning's 'n' values used.*	This was explained in more detail in the SSRs. We have included more information on the chosen parameters used in the HEC-RAS model.
Section 1.2.2: Legislative Framework and Regulatory Guidelines: *The provisions of the IAEA legislation followed in the study should be described in detail upfront and referred to in the text. This is necessary as this is the most significant piece of legislation for this study. The summary given for the nuclear standards and guidelines is too skeletal; it refers to the relevant documents for the study but the contents of these documents are not described for readers to get an understanding of what they recommend. Most stakeholders will not read the IAEA documents.*	The legislative Framework and Regulatory Guidelines were discussed at great length during the SSR with international external reviewer's familiar with the nuclear SSR, client, consultants etc. We have re-written and expanded on the legal framework where applicable

4.5 Information gaps, omissions or errors Information gaps, omissions or errors are specified below for each of the relevant sections in this report. The information gaps may cause difficulty in defending the document. ***Section 1.2.3: Assumptions and Limitations:*** *At this stage it has been assumed that the entire plant area (to the extent of the anticipated footprint) will be paved when operational. This assumption is fine if verified by client.*	This was provided by the client and may change, depending on the approved layout during detailed design stage.
Section 1.2.3: Assumptions and Limitations: *It is also assumed that the site footprint will have a surface area of approximately 60 ha and the depth would be about 15 m for the conceptual site positions. Again, this assumption is fine if verified by client.*	This was provided by the client and may change, depending on the approved layout during detailed design stage.
Section 2.1.3: Rainfall Details: *A comparison between SAWS, WR90 and local rain gauge (despite only 4 years' data) should have been undertaken.*	One must bear in mind that we are trying to predict the 1:10 000 return period and therefore need to use the longest rainfall records available. A separate detailed assessment on all the rainfall was carried out by the Meteorology specialist. This included a separate V&V report. The hydrology calculations were based on the information provided by the Meteorology specialist.
Section 2.1.9: Description of Model: *Model input parameters for the HEC-RAS model need to be explained as described in Section 4.4.*	This was explained in more detail in the SSRs. We have included more information on the chosen parameters used in the HEC-RAS model.
Section 2.1.11: Flood line Determination: *HEC-RAS flow velocities which were tabulated but have not been used or commented on.*	This was done in the SSR. The velocities were applied to the Velocity x Depth impact grid. A few paragraphs were also included on the velocities.
Section 2.1.11: Flood line Determination: *Figure 2.3: Flood lines are very unclear and should be plotted at a far larger scale with proposed infrastructure or the development area overlaid.*	Agreed. The black and white figures are not clear and colour was used in SSR. We have adjusted the drawings indicating floodlines to make clearer.
Section 2.1.11: Flood line Determination: *An explanation should be given of why flood lines were determined only at a few sections.*	This was done in the SSR. We included an explanation in the EIR.
Section 1.2.2: Legislative Framework and Regulatory Guidelines: *A description of the IAEA legislation should be provided upfront so that stakeholders understand what the legislation recommends.*	The legislative Framework and Regulatory Guidelines were discussed at great length during the SSR with international external reviewer's familiar with the nuclear SSR, client, consultants etc. We have re-written and expanded on the legal framework where applicable including the IAEA.