Clover SA (PTY) LTD

Conceptual Engineering Design Report for Abstraction Weir

FINAL REPORT

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GTE782/13012026/01

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Prepared For	Clover Way Better™

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DECLARATION OF INDEPENDENCE

GroundTruth Environment and Engineering (GroundTruth), established in 2004, hereby acknowledge that it does not have any invested interests in the following project, and is thus independent to the proponent as required in terms of Section 33 of Government Notice Regulation 358 published under Section 24 of the National Environmental Management Act (Act 107 of 1998). Furthermore, in line with Appendix 6 of the 2014 EIA regulations (GN R982) GroundTruth under directorship of Dr Mark Graham, declares that:

- The independent specialists in this application; do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- All the work relating to the project will be performed in an objective manner, even if this results in views and findings that are not favourable to the client;
- That there are no circumstances that may compromise the objectivity of GroundTruth in performing such work;
- The expertise required in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity, are possessed by all involved;
- Compliance with the Act, regulations and all other applicable legislation;
- There are no conflicting interests, and none shall be engaged in, during the undertaking of the assigned activity;
- GroundTruth undertakes to disclose to the applicant and the competent authority all material information it may be in possession of that reasonably has or may have the potential of influencing - any decision to be taken with respect to the outcome of the project by the competent authority; and - the objectivity of any report, plan or document to be prepared by GroundTruth for submission to the competent authority;
- All the particulars furnished by team members in this document are true and correct; and
- GroundTruth is aware that any person(s) is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a) to (e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signed:

Date: 06/06/2025

Trevor Pike

Pr. Eng: 20130774

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1. INTRODUCTION

GroundTruth Environment and Engineering (GroundTruth) were contracted by Clover SA (Pty) Ltd to provide a Conceptual Civil Engineering Design Report for a proposed abstraction weir as part of a Water-Use License Application (WULA) for the Clover SA facility located on Remainder of Erf 2999, Queensburgh within the eThekwini Municipality, KwaZulu-Natal Natal. A locality map of the proposed location of the abstraction weir is provided in Figure 1-1 below:

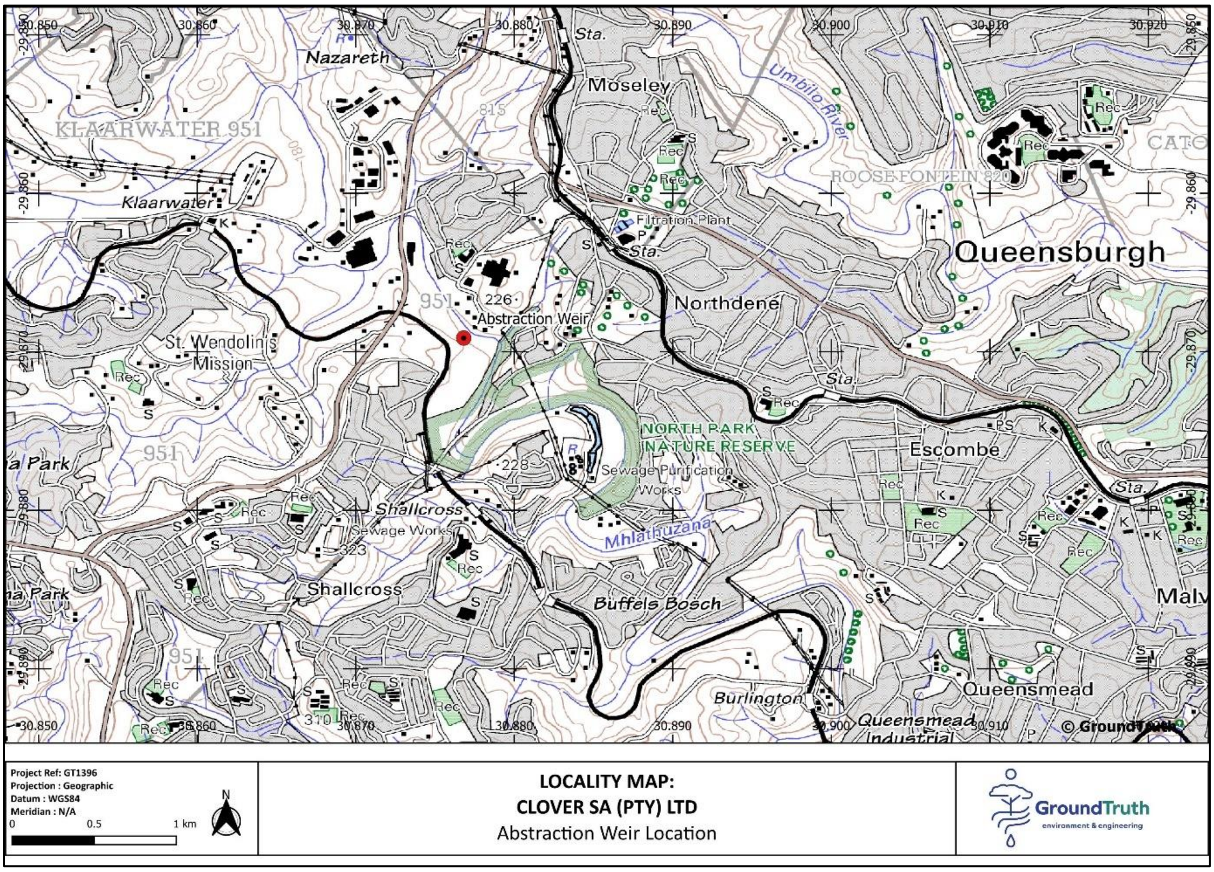

Figure 1-1 Locality map showing proposed location of abstraction weir

Clover SA is a registered dairy processing company, which is exploring the possibility of abstracting 1 500 000 m^3 / annum from the uMhlatuzana River running adjacent to their facilities.

The scope of works associated with this conceptual civil engineering design report involved undertaking the following:

- An in-field site assessment of the proposed location for the weir to determine the channel dimensions to inform the sizing of the abstraction weir;
- Running of hydrological models to inform the hydraulic sizing of the conceptual design of the abstraction weir;
- Undertaking a conceptual design of the abstraction weir; and,
- Compilation of a conceptual design report

2. HYDROLOGICAL MODELLING

Hydrological modelling for the contributing catchments to the abstraction weir was carried out utilising catchment related information gathered during the site assessment as well as information available at a desktop level. The hydrological modelling component of this study included a catchment assessment and delineation, design rainfall estimation, and peak flow evaluations for various storm events. The hydrological modelling of the various storm events was necessary to size the height of the weir spillway to accommodate the necessary storm events. The following sections summarise the input parameters and results from the hydrological modelling process.

2.1 Catchment Delineation

The proposed abstraction weir receives flows from a large, urbanised catchment. The catchment was delineated using publicly available satellite imagery and contour data. Figure 2-1 below illustrates the delineated catchment boundary.

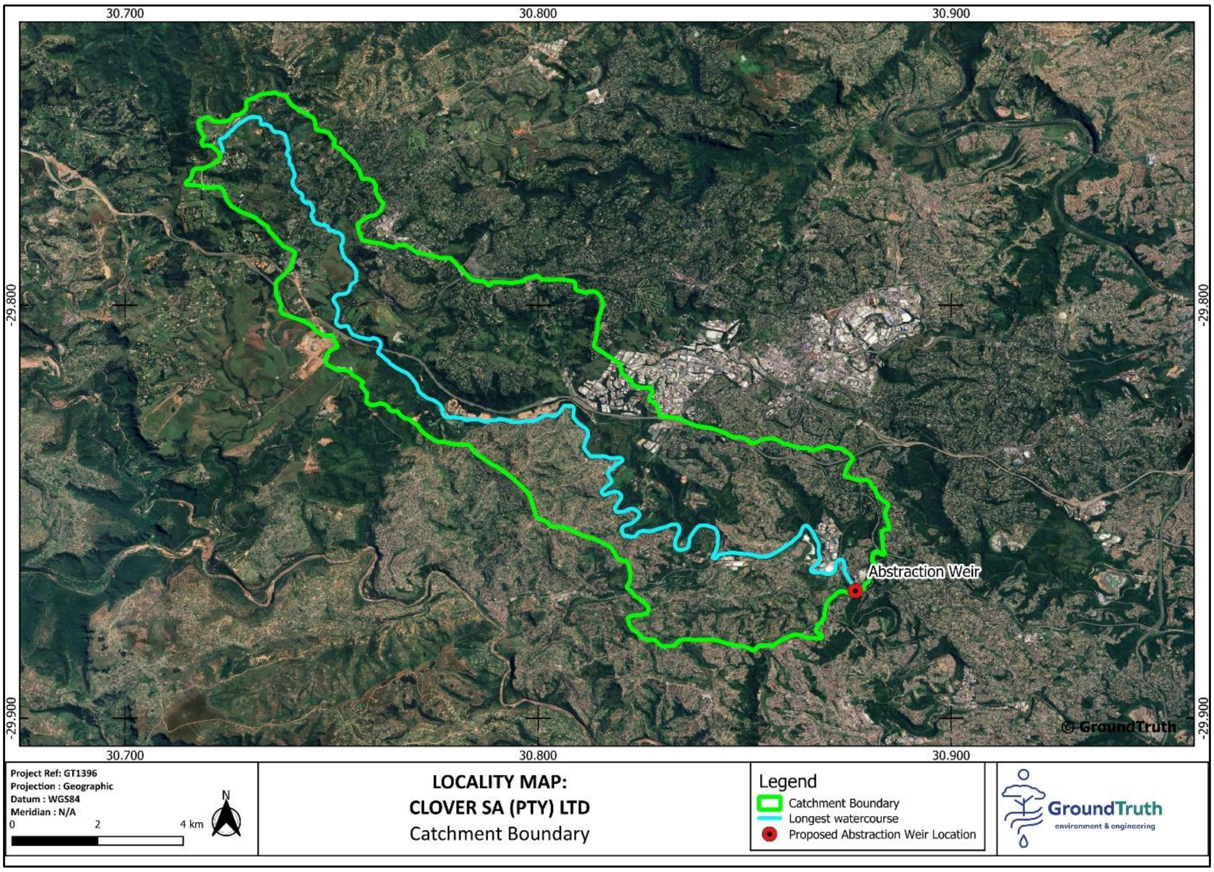

Figure 2-1 Overview of the delineated catchment boundary

The catchment is largely urbanised primarily comprised of residential areas. The catchment is approximately 79km^2 in size. The catchment characteristics are shown in Table 2-1 below.

Table 2-1 Catchment characteristics for hydrological modelling

Catchment Area (km²)	Mean Annual Precipitation (mm)	Mean Altitude (m)	Length of longest watercourse (km)	Time of concentration (hr)
79.1	786	583	32.87	5.01

2.2 Design Rainfall Estimation

The Mean Annual Precipitation (MAP) and design rainfall depth for the various return periods and durations in the catchment centroid have been estimated using the Regional L-Moment Algorithm and Scale Invariance (RLMA&SI) method (Smithers and Schulze, 2003) as incorporated in the Design Rainfall Estimation tool developed by Smithers and Schulze (2003). This method uses available rainfall data from several rainfall stations that are within the closest proximity to the catchment centroid. A gridded system is then used to estimate the design rainfall depths at the centroid of the catchment. The design rainfall depth and MAP that were extracted for the catchment for the corresponding time of concentration are shown in **Table 2-2.**

Table 2-2 Design rainfall depth (mm) at the catchment centroid for the estimated time of concentration

Recurrence Interval	2-Year	5-Year	10-Year	20-Year	50-Year	100-Year
Design Rainfall Depth (mm)	55.03	80.14	101.16	125.37	163.94	199.26

2.3 Peak Discharge Estimation

Two methods were used to calculate the peak discharge for the catchment, namely SCS-SA and the Rational Method. The SCS-SA method was selected based on the total effective catchment area to estimate a design flood peak and hydrograph for the delineated catchment. To provide a comparison, the design peak discharge was also estimated using the Rational Method. The SCS-SA and Rational Method are prescribed methods for use in South Africa by South African Nation Road Agency SOC Ltd (SANRAL) (2013), and by the Department of Water and Sanitation (Van der Spuy and Rademeyer, 2021). The rainfall depth with a duration corresponding to the Time of Concentration (*Tc*) for the catchment was used to the calculate peak discharge for the catchment when applying the Rational Method. A brief description of SCS-SA and the Rational Method are provided in **Section 2.3.1** and **Section 2.3.2**, respectively, whilst the results obtained are provided in **Section 2.3.3.**

2.3.1 SCS-SA Model

The SCS model is an event-based model used globally for design flood estimations (Hawkins *et al.*, 2014; Aichele and Andresen, 2013). The SCS-SA model was created as an adaptation to the original SCS model by Schulze and Schmidt (1987) to better represent South African soil types. The primary outputs from of the SCS-SA model are surface runoff volumes and peak discharges.

Stormflow depths and peak discharges are calculated using equations that use design rainfall depths and a catchment's runoff response index referred to as the Curve Number (CN). The CN is a dimensionless parameter that ranges between 0 to 100 and which accounts for three physiographic catchment characteristics, *i.e.* land cover, land treatment and soils (Savvidou *et al.*, 2016).

2.3.2 Rational Method

The Rational Method, developed by Mulvaney (1850), is a rainfall-based design flood peak estimation model. It is widely used throughout the world in small rural and urban catchments (Pilgram and Cordery, 1993), and is recommended for use in South Africa (SANRAL, 2013; Van der Spuy and Rademeyer, 2021). Pegram and Parak (2004) mentions that the Rational Method is often used in industry as a "check". It is based on the law of the conservation of mass, in which estimated design peak flows are directly proportional to the effective catchment area, rainfall intensity and a user selected runoff coefficient.

2.3.3 Results

The results obtained for the peak flow estimates for both the SCS-SA model and the Rational Method for the catchment are provided in **Table 2-3** below.

Table 2-3 Estimated design peak flows using SCS-SA and the Rational Method

Method	Design Peak Flows (m³/s)					
	2-Year	5-Year	10-Year	20-Year	50-Year	100-Year
SCS-SA	20.80	63.2	114.1	182.8	303.3	427.7
Rational Method	90.2	134.5	173.7	222.0	310.6	403.7

The difference in estimated peak events between the two models can be attributed to varying degrees of antecedent soil moisture accounting. The primary design consideration was the 1:100yr event, of which the model results are comparable.

As there is variation of the flood peaks between SCS-SA model and Rational Method for different return periods, a conservative approach was adopted and as such, the larger estimated event from the Rational and SCS-SA model was used for the hydraulic sizing of the abstraction weir.

3. KNOWLEDGE GAPS

An abstraction weir is a low-head hydraulic structure built across rivers or streams to divert a portion of the flow for purposes such as irrigation, water supply, or hydroelectric power. Proper design is critical to ensure structural stability, adequate flow abstraction, and minimal environmental impact.

The objectives of the weir design would be to control volumes of diverted water from the river, maintain downstream flow requirements, ensure sediment management and minimize ecological disruption.

The following section highlights the knowledge gaps, assumptions and limitations associated with the conceptual design of the abstraction weir.

3.1 Information Gaps

The following information gaps were noted for the conceptual design of the abstraction weir:

- The proposed site was selected based on the initial field survey. The site was found to have high channel banks and rocky material in the channel bed. However, it is unknown if there is suitable and sufficient bedrock material at the site on which to construct the weir. Without knowledge of founding conditions, the location of the abstraction weir is subject to change based on the final site selection at the detailed design phase.

3.2 The abstraction volume has not been approved at the time of the conceptual design therefore the design of the abstraction "works" i.e. pump/diversion was not included in the conceptual design. It will form part of the design considerations for the detailed design phase. Assumptions

The conceptual design of the abstraction weir relies on various assumptions. The assumptions made for the purpose of this design are as follows:

- The slope of the channel was surveyed during the field survey. Based on the surveyed slope, an estimate of the capacity of the downstream channel was calculated. This capacity was used to govern the design discharge.
- Whilst surveying cross-sections during the field survey, it was noted that at most points in the channel, bedrock was the dominant substrate beneath the overlying sediment. At those points where bedrock was not encountered, it is assumed that it was buried by deposited sediments at a depth that fieldwork equipment could not reach. The assumption for the design is that suitable bedrock material will be found across the entire footprint area of the weir to construct it upon.
- For the design of the weir, it is assumed that the bedrock over the footprint area of the weir is uniform and without any fissures, therefore preventing any risk of tunnelling to occur which could allow flows to bypass/undermine the weir. This would however need to be confirmed with a geotechnical survey, prior to the detailed design phase.
- The method of abstraction was unknown at the time of the conceptual design. It is assumed that the abstraction will be direct pumping which will take place in the pool

created upstream of the weir. As such the abstraction works were not included in the conceptual design. Should another abstraction method be found to be more feasible – such as a diversion – this will be incorporated into the detailed design of the weir.

3.3 Limitations

The following limitations apply to the conceptual design of the weir:

- The spillway of the weir was designed to be as low as possible (1m) to minimize its impact on the environment and existing upstream infrastructure caused by backwater effects. Therefore, the low spillway of the structure limits the storage capacity behind the structure.
- The availability of bedrock at the proposed site impacts the foundation design of the weir. The foundation design can only be finalised once a geotechnical survey has been completed to determine the foundation conditions.
- The ideal location for an abstraction works is on the outer bend of a river (Basson, 2006). The location of the proposed abstraction weir is situated on a straight section of river due to no natural bends of the uMhlathuzana River occurring within the property boundary of Clover. The site was therefore selected due to favourable topographical and geological features (i.e. well defined channel, steep banks for keying in the structure, and the presence of bedrock).

4. DESIGN CONSIDERATIONS

The initial design consideration for an abstraction weir involves selecting the right site based on topography, geology, hydrology and accessibility. Various sites were considered during the in-field site assessment of the river which involved the surveying of cross sections through the channel at each potential site. The site of the proposed weir was selected due to favourable topographical and geological features, as hydrological and accessibility criteria was much the same across the sites. Although a wider channel is preferred for dealing with peak flows, the proposed location of the structure was selected in a narrower section of river due to the better defined channel (absence of wide flood terraces), accompanied by stable banks and bedrock formation for keying in the structure. Figure 4-1 below shows the surveyed cross section through the channel at the proposed weir location.

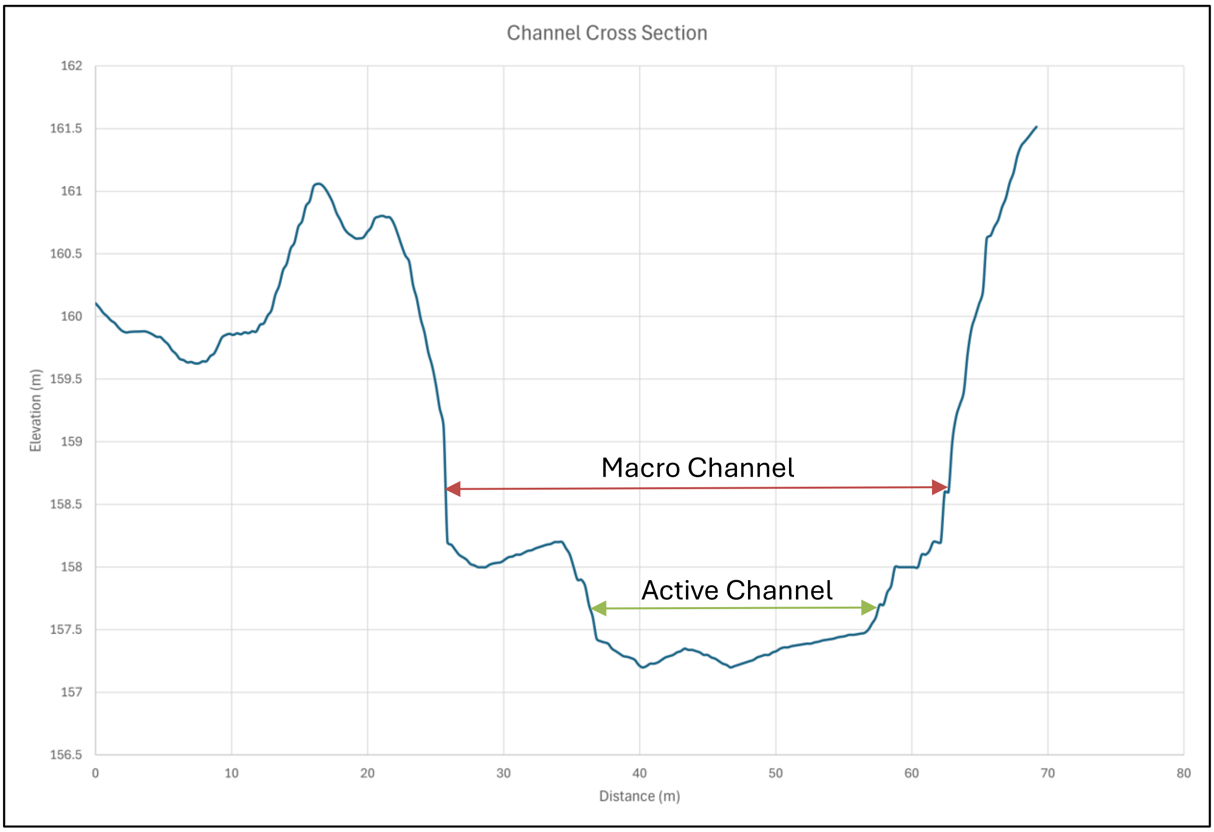

Figure 4-1 Surveyed cross section through the channel at the proposed weir location facing upstream

The sizing of the weir needs to ensure that hydraulic design criteria such as design flow, crest elevation, discharge capacity and energy dissipation are considered. The above all need to be considered concurrently and hence require iterative processes to achieve the desired design result. Information obtained from the hydrological modelling, which pertains to river discharges, is the biggest design criterion as the designed structure needs to safely manage peak flood flows without adverse effects such as structural failure, scouring, erosion and undermining of the structure occurring. Furthermore, factors such as the type of weir, the materials and the foundation treatment are important structural design criteria which affect the durability and hydraulic needs of its functioning.

The site was surveyed as having two channel formations as per Figure 4-1. The smaller being the current active channel (width of 20m) and the larger being the macro channel which would accommodate peak flood flows (width of 32m). A spillway height of 1m above the active channel was selected during the iterative design process to act as a low-head weir providing enough head for the abstraction requirements, whilst still allowing base flows to pass the structure. The width of the entire channel comprised of both the main and macro channel was used to inform the spillway length of the design (32m). Using the standard rectangular weir flow equation, the discharge over the weir was determined (Q = 58m^3/s) for an overflow depth of 1m. An overflow depth of 1m was selected based on the downstream channel capacity. Using Mannings open channel flow equation, at a flow depth of 1m, the active channel has already reached its downstream capacity, being 39m^3/s, and will back flood onto the surrounding banks of the macro channel once the discharge capacity (Q = 58m^3/s) of the weir is reached. This will create drowned out conditions at the weir itself during discharge capacity (1m overflow depth across 32m). This means that flows exceeding the 1m overflow depth of the weir will behave closer to natural flow conditions, with sedimentation, erosion, etc occurring uninfluenced by the weir. The weir has a sufficient downstream apron slab to protect it from scouring, undercutting and erosion generated from spillway flows. Where the flows exit the apron slab and re-enter the active channel, earthworks reshaping would need to be carried out to safely convey flows back into the channel.

A trapezium-shaped mass gravity weir was selected for the design as it is structurally sound under the expected flow conditions. Additionally, a mass gravity weir does not require much reinforcing and helps reduce construction costs. The heel of the mass gravity weir is critical to locking the structure into the foundation material of the site, and hence the dimensions stipulated in the conceptual drawing in Appendix 1, although most likely adequate, are subject to change pending a geotechnical report.

5. CONCLUSIONS AND RECOMMENDATIONS

This report serves to provide details of the conceptual design of the proposed abstraction weir located at the Clover Queensburgh facility as part of a WULA for Clover SA (PTY) Ltd.

In summary, the scope of the conceptual design of the weir was as follows:

- An in-field site assessment was completed to select a proposed location for the weir. The dimensions of the channel were surveyed to inform the sizing of the abstraction weir;
- Hydrological models were run to inform the hydraulic sizing of the of the abstraction weir. This included catchment delineation, design rainfall estimation and peak discharge estimation. Two methods were used to determine the design discharge, namely the Rational Method and SCS-SA; and,
- Using various design considerations, a conceptual design of the weir was completed, and a conceptual drawing of the weir was drafted.

The knowledge gaps identified in Section 3 of this report indicate that a geotechnical study of the site is required to determine the foundation conditions of the weir. The geotechnical report will inform the final site selection of the weir and the foundation design of the weir during the detailed design phase. The second information gap – the approved abstraction volume – is the primary requirement for the design of the abstraction works. Upon approval of the WULA, the abstraction quantity will be used in the detailed design phase to design the abstraction works.

During the field survey the channel was found to be highly sedimented. This is most likely due to run-off occurring further upstream in the catchment. High sediment loading in the channel will further decrease the storage capacity of the weir over time. It is recommended that a sediment management plan be incorporated into the detailed design of the weir to maintain sufficient storage capacity behind the structure.

Abstraction works for the weir were not explicitly designed for during this stage of the project, however, considerations for the works would need to follow that of Basson (2006) with some suggestions being:

- River abstraction structures which divert water from the stream whilst limiting the sediment load that enters the diversion system (i.e allows sediment transport to be maintained through the structure) are the sought-after solution.
- An abstraction works built on a stable outer bend of a river is the ideal location as it will make use of secondary flows to help manage sediment intakes into the diversion structure. Due to the nature of the Clover property boundary, the selected site for the abstraction works could not make use of an outer bend in the river, however it did consider a stable reach. Therefore, the abstraction point for the selected weir location would need to consider high sediment loads and requires a capable sediment management strategy (eg, sand pump systems, sediment intercepting galleries, groynes, sediment sluice gates, guide banks and vanes, and dividing walls).
- Weirs are constructed to impound water to create positive suction heads at pumps during low flows, this however creates slower flow velocities which increase the sediment deposition rates upstream of the weir. A solution to this is barrages with large gates to allow floods to pass freely and flush the accumulated sediments, however these are expensive and require high maintenance and are not always practical in South Africa

due to large flow variations between droughts and major floods. Therefore, a low spillway height weir was selected to allow minimal sedimentation to occur whilst still providing enough of a positive head.

- As pumps are often used to abstract water from the river, it is important to ensure that they will operate trouble free. The design of the pump sump is crucial in ensuring that optimum performance and efficiency conditions are met for the pump with general guidelines such as:
    - Flow towards the intake should be uniform across the width of the channel,
    - Excess flow energies should be well dissipated before arriving at the intake,
    - In channel obstructions should be streamlined to avoid flow separation near the intake,
    - Average flow velocities should be kept low: ~0.6m/s for flow into the pumping station and ~0.3m/s approaching the bellmouth,
    - Minimum depth of submergence of 1.5 times bellmouth diameter for turned down intakes and 1.0 times diameter for horizontal intakes

6. REFERENCES

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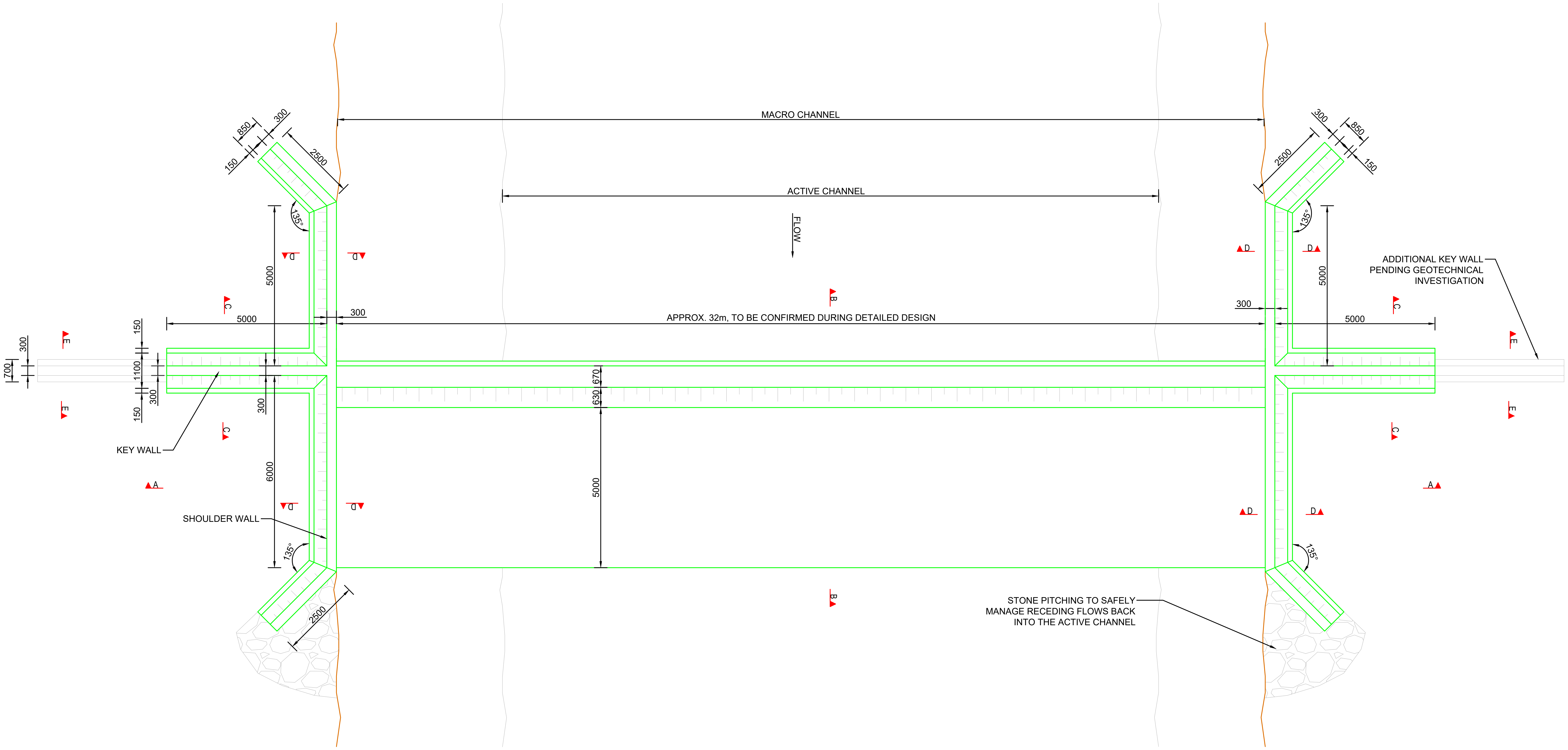
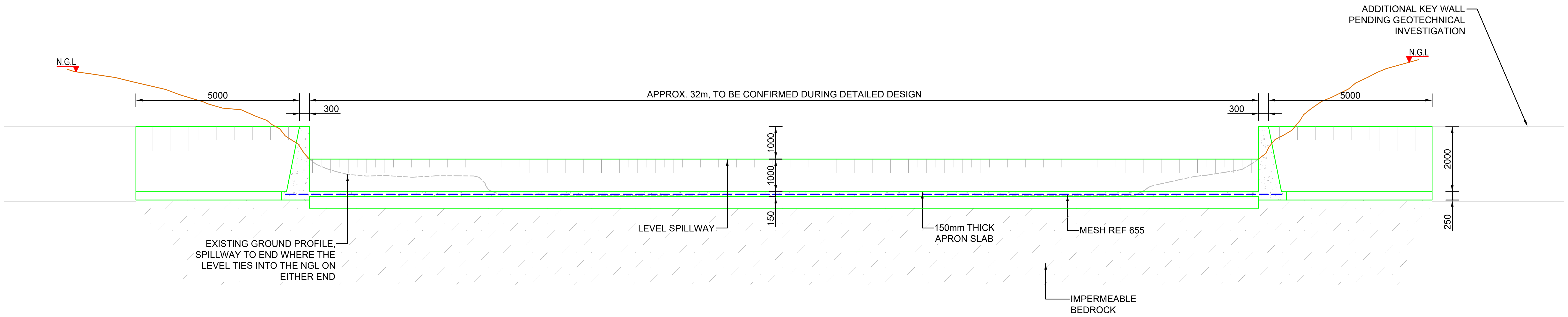
7. APPENDIX 1 – CONCEPTUAL DESIGN DRAWING



PLAN VIEW



SECTION A-A

NOTES:

ACRONYMS AND ABBREVIATIONS:

1. N.G.L - NATURAL GROUND LEVEL
2. I.L - INVERT LEVEL
3. W.L - WETLAND LEVEL
4. OMC - OPTIMUM MOISTURE CONTENT

EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE AS PER DRAWING, UNLESS OTHERWISE SPECIFIED.

5. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.

3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 150mm LAYERS AT OPTIMUM MOISTURE CONTENT TO 93% MOD AASHTO.

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 16-19mm.

2. ALL CONCRETE TO BE MIN 25MPa CONCRETE MIX:

   1 BAG CEMENT
   65L SAND
   85L STONE
   21L WATER

3. 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING AND MESH UNLESS OTHERWISE SPECIFIED.

4. ALL MESH REINFORCING TO HAVE 500mm OVERLAPS BETWEEN SHEETS.

5. CONSTRUCTION JOINTS TO BE USED WHEREVER NEW CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.

6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.

7. CONCRETE WALLS CAST IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.

8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.

9. FOUNDATION IMPROVMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL AS NECESSARY

NOTE - CONCEPTUAL DESIGN:

1. FOUNDATION AND SLAB DETAILS PENDING GEOTECHNICAL INVESTIGATION
2. ADDITIONAL KEY WALLS AND WING WALLS PENDING GEOTECHNICAL INVESTIGATION
3. ONCE ALLOWANCE FOR APPROPRIATE OFFTAKE/ABSTRACTION INFRASTRUCTURE HAS BEEN CONSIDERED, MAY AFFECT THE FINAL DESIGN
4. PENDING CHOSEN ABSTRACTION TYPE, THE ALLOWANCE FOR SEDIMENT MANAGEMENT MAY CHANGE THE FINAL DESIGN

PRELIMINARY DESIGN
DRAWING
NOT FOR CONSTRUCTION

GroundTruth
environment & engineering

CLIENT:

Clover
Way Better™

PROJECT: CLOVER WULA

DESCRIPTION: MASS GRAVITY WEIR

INTERVENTION NO.: CLOV-001

DATE:	MAY 2025		
DRAWN:	B. VAN ZYL		
DRAWING CHECKED:	T.PIKE		
DESIGNED:	B. VAN ZYL		
DESIGN CHECKED:	T. PIKE		
SCALE: AS SHOWN	SIZE: A2	REV: 00	
DRAWING NO:	GTE782-01-001		

LATITUDE	LONGITUDE
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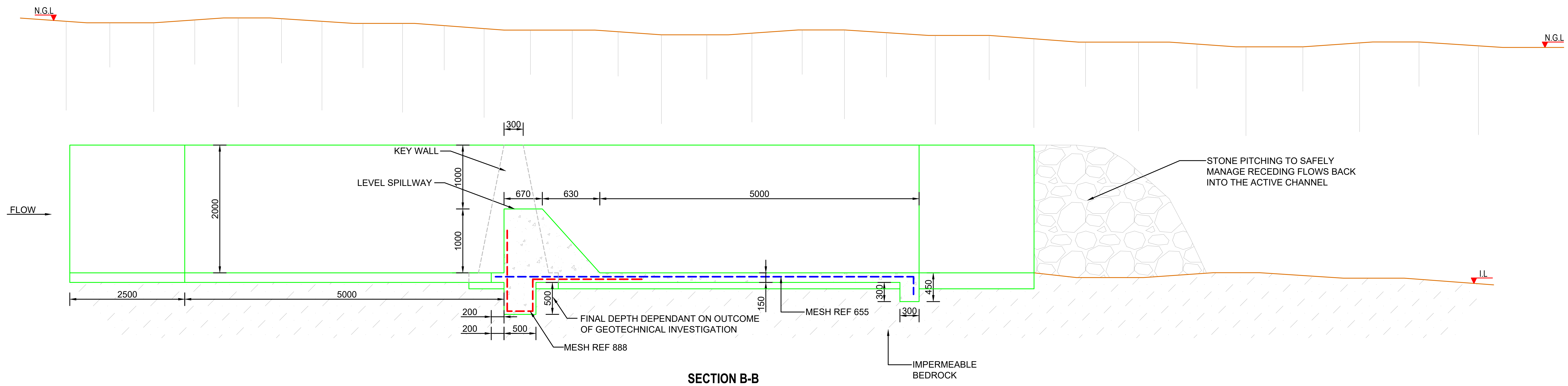

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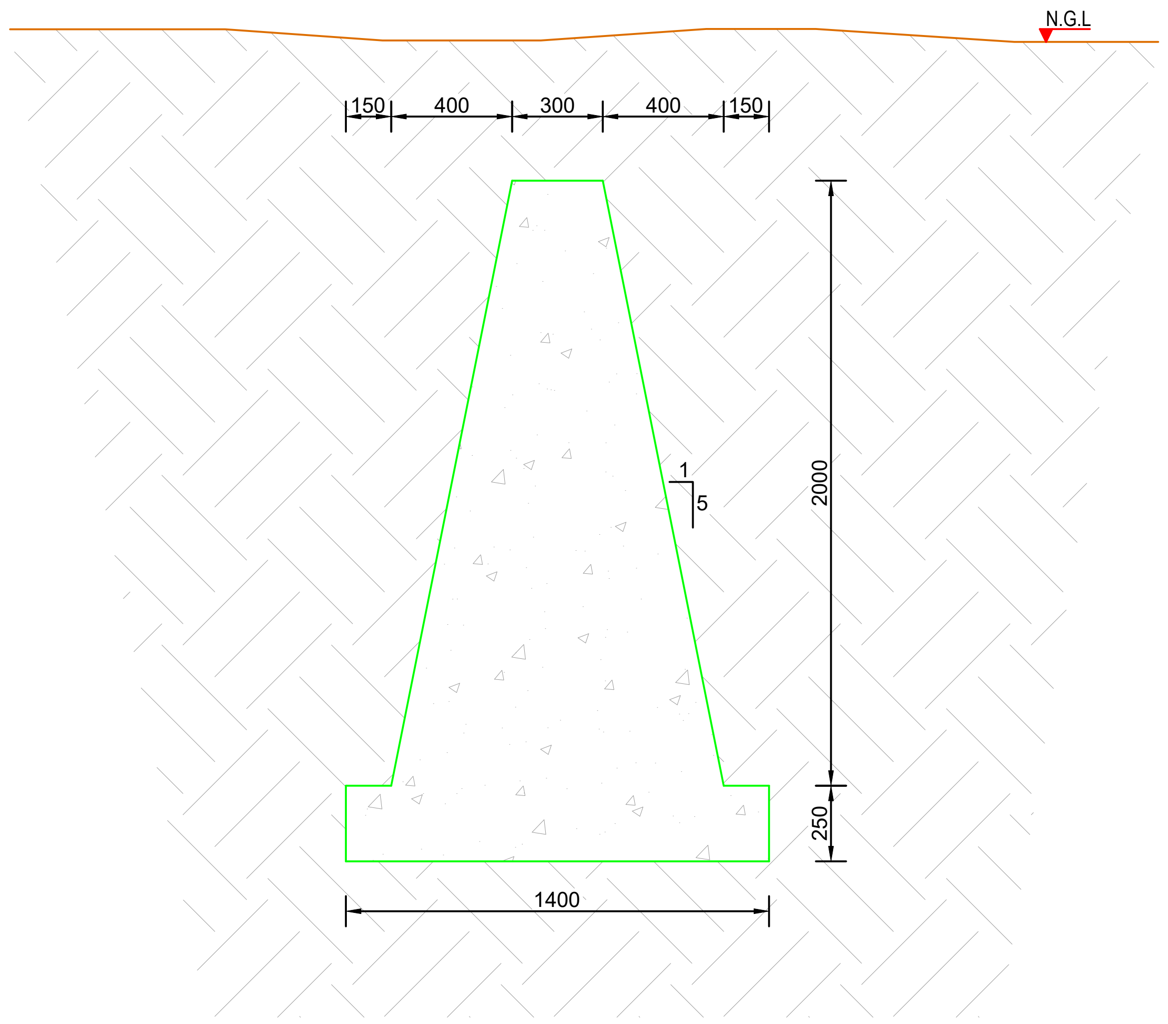

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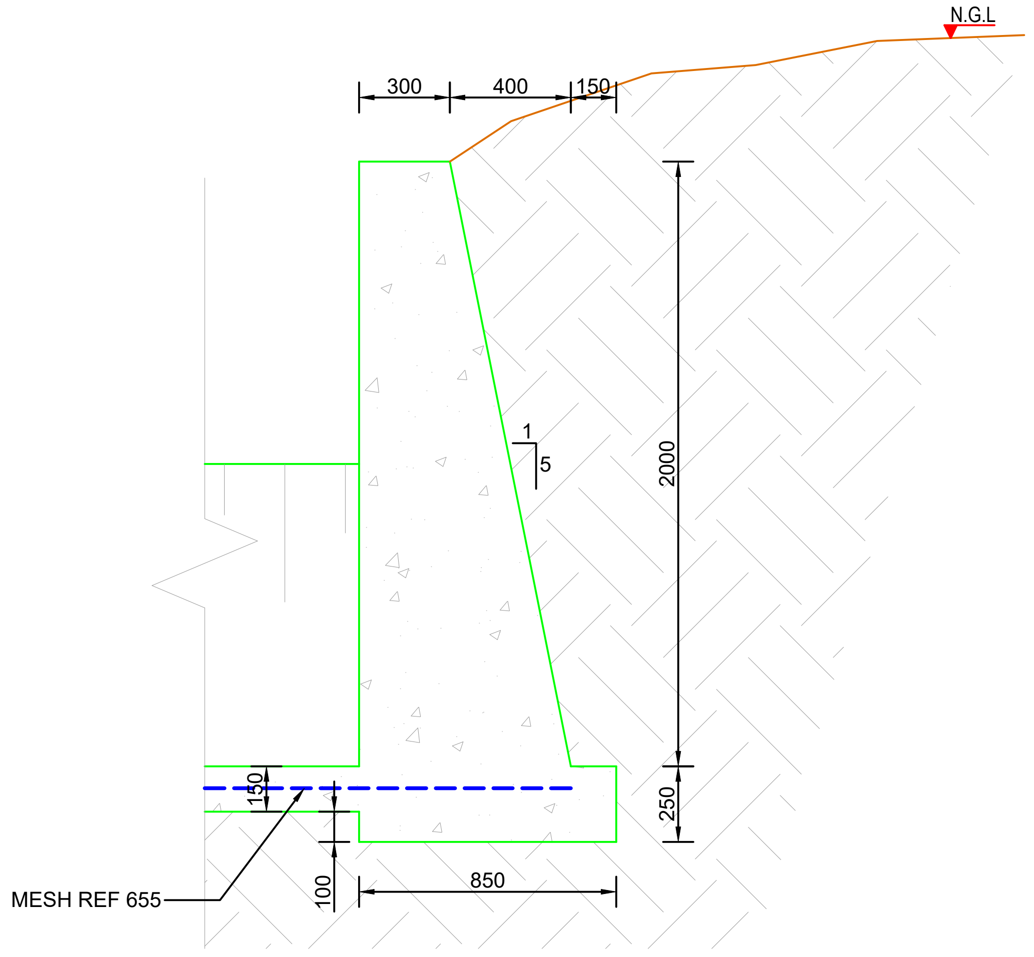
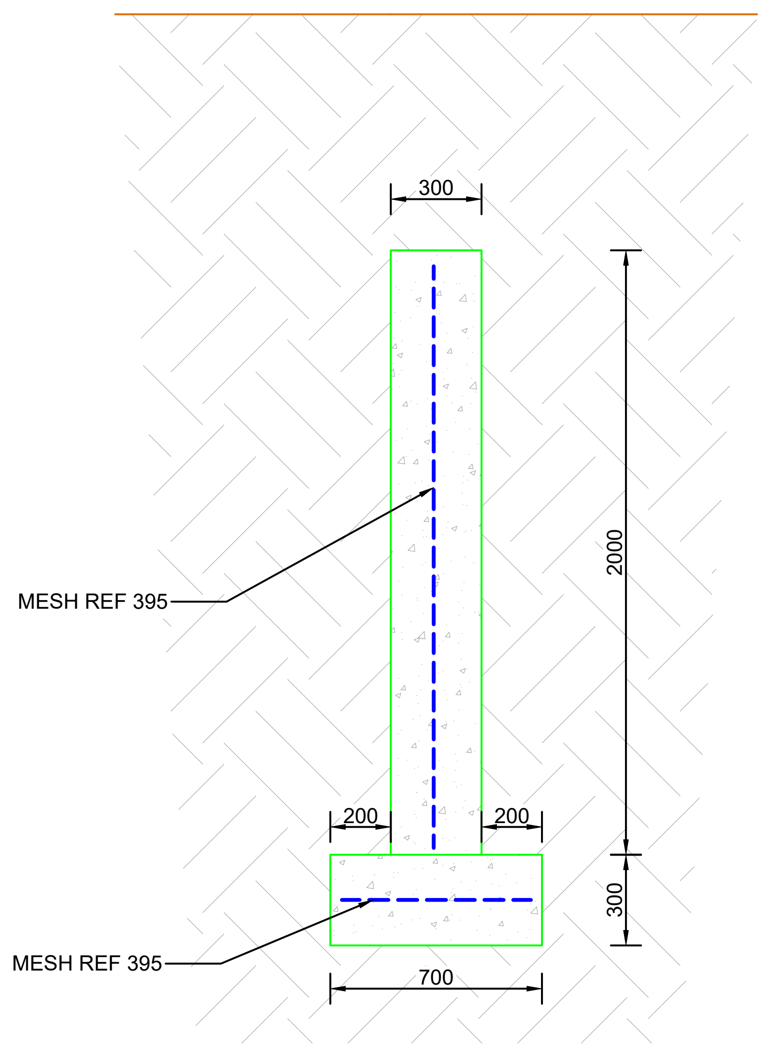


SECTION D-D



SECTION E-E

NOTES:

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EARTHWORKS/ EARTH STRUCTURES:

1. ALL CUT AND FILL SLOPES TO BE AS PER DRAWING, UNLESS OTHERWISE SPECIFIED.

5. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.

3. SOIL FOR BERMS AND BACKFILL TO BE COMPACTED IN 150mm LAYERS AT OPTIMUM MOISTURE CONTENT TO 93% MOD AASHTO.

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4. ALL MESH REINFORCING TO HAVE 500mm OVERLAPS BETWEEN SHEETS.

5. CONSTRUCTION JOINTS TO BE USED WHEREVER NEW CONCRETE IS CAST AGAINST PREVIOUSLY CAST CONCRETE.

6. IF REBAR OR MESH CROSSES A CONSTRUCTION JOINT, IT SHOULD BE CONTINUOUS THROUGH THE JOINT AND EXTEND 600mm INTO EACH SIDE.

7. CONCRETE WALLS CAST IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.

8. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.

9. FOUNDATION IMPROVMENTS TO BE MADE AS DIRECTED BY THE ENGINEER. REMOVE ANY UNSUITABLE MATERIAL AND REPLACE WITH SELECTED MATERIAL AS NECESSARY

NOTE - CONCEPTUAL DESIGN:

1. FOUNDATION AND SLAB DETAILS PENDING GEOTECHNICAL INVESTIGATION
2. ADDITIONAL KEY WALLS AND WING WALLS PENDING GEOTECHNICAL INVESTIGATION
3. ONCE ALLOWANCE FOR APPROPRIATE OFFTAKE/ABSTRACTION INFRASTRUCTURE HAS BEEN CONSIDERED, MAY AFFECT THE FINAL DESIGN
4. PENDING CHOSEN ABSTRACTION TYPE, THE ALLOWANCE FOR SEDIMENT MANAGEMENT MAY CHANGE THE FINAL DESIGN

PRELIMINARY DESIGN DRAWING
NOT FOR CONSTRUCTION

GroundTruth
environment & engineering

CLIENT:

Clover
Way Better

PROJECT: CLOVER WULA

DESCRIPTION: MASS GRAVITY WEIR - SECTIONS

INTERVENTION NO.: CLOV-001

DATE:	MAY 2025
DRAWN:	B. VAN ZYL
DRAWING CHECKED:	T.PIKE
DESIGNED:	B. VAN ZYL
DESIGN CHECKED:	T. PIKE
SCALE: AS SHOWN	SIZE: A2 REV: 00
DRAWING NO:	GTE782-01-002

LATITUDE	LONGITUDE
29°52'06.77"S	30°52'35.43"E

8. APPENDIX 2 – INTERVENTION BOOKLET

This section provides the intervention notes of the proposed abstraction weir as part of a Water-Use License Application (WULA) for the Clover SA facility located on Remainder of Erf 2999, Queensburgh within the eThekwini Municipality, KwaZulu-Natal Natal. The details provided includes the following:

- Intervention type.
- Design objective.
- Co-ordinates of intervention.
- Date of when the structure was planned.
- Reference number for the typical drawings and/or layouts of the intervention.
- In addition to the tabulated information, a photograph, layout, and bill of quantities have been provided.

Figure 8-1 CLOV-001 Abstraction Weir Locality and Layout

8.1 Intervention CLOV-001

Table 8-1 Intervention W12-001 Details

Intervention Type	Concrete Mass Gravity Abstraction Weir
Design Objective	A low-head hydraulic structure to cater for abstraction needs whilst maintaining downstream flow requirements.
Longitude	30°52'35.43"E
Latitude	29°52'06.77"S
Approved By	Trevor Pike
Date	June 2025
Detailed Design Drawings	GTE782-01-001 & GTE782-01-002

Figure 8-2 Location of proposed Concrete Mass Gravity Abstraction Weir looking downstream

8.1.1 *Estimated Bill of Quantities*

Table 8-2 Intervention CLOV-001 Estimated BOQ

Items	Unit	Quantity
25MPa Concrete for weir	m^3	*120.8*
Excavation for weir	m^3	*190.4*
Earthworks for weir	m^3	*123.4*
Mesh Ref 655	m^2	*160.0*
Mesh Ref 888	m^2	*85.4*
Stone pitching	m^2	*15.0*