Design Report

Upgrading of Herold's Bay Sewer Pump Station No. 1 and Associated Rising Main

Prepared for: George Municipality
13 December 2024
Client Reference No. T/ING/010/2020

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1. Introduction

1.1 Terms of Reference

SMEC South Africa was appointed for a Multi-Year Professional Services Contract (Tender No. T/ING/010/2020), which includes the upgrade of Municipal Infrastructure by the George Municipality (GM).

Under the abovementioned appointment, SMEC South Africa was awarded the Design and Implementation for Project 20 (Work Package 3), which involves Upgrading Herold's Bay Sewer Pump Station No.1 and the associated rising main.

1.2 Problem Identification

The Herold's Bay Pump Station no. 1 (PS1) is located at the Herold's Bay beachfront, at the main parking lot on Uitspanning Street and can be accessed by following the R404 into Herold's Bay.

The pump station was refurbished in 2004 and is the main sewage pump station in Herold's Bay, receiving all sewage gravity flows from the area and pumped flows from two smaller pump stations along the cove. The sewage is subsequently pumped to the Herold's Bay Wastewater Treatment Works (WWTW).

The harsh operating conditions (highly corrosive environment and sand loading) result in high maintenance requirements and frequent breakdowns of operations of the Pump Station (PS1). The lack of critical spares and high variations in seasonal inflows compound the difficult operational situation.

Based on the development plans received from the George Municipality, the sewage that this Pump Station will have to accommodate will increase to 52L/s to service the full developable area that drains to Herold's Bay, in and beyond the current urban edge. With the upgrade, the intention is to improve the service delivery and reduce the challenges that the George Municipality (GM) experiences with the pump station's operation.

During the Concept design phase of the project, the scope of the project was refined to an upgraded low-level Pump Station at Pump Station 1 and a new high lift Pump Station (Pump Station 4) higher up the valley with screening and de-gritting facilities.

1.3 Objectives of this report

The purpose of this Design Report is to provide the George Municipality with the design and a cost estimate for the refined project. The report is based on conclusions and recommendations from the concept design, outcomes of meetings and discussions with the George Municipality, and detailed site investigations.

2. Objectives and Scope of the project

2.1 Employer's Objectives

The George Municipality has the following objectives:

- To upgrade the Pump Station in phases, with the civil, structural and bulk electrical works to accommodate the ultimate planned capacity of 52L/s. The mechanical, electrical and electronic upgrade ideally to occur in phases to accommodate short-term flows of 32L/s, and in a future phase to 52L/s.
- To construct a new Pump Station with facilities to remove grit and screenings.
- To address all the required planning aspects needed for the project outcomes, including Environmental Authorization, Water Use Licence (WUL), Survey, Material investigations, and approval from relevant authorities by application of Wayleaves.
- To ensure the project and the risks are managed and that the George Municipality is informed at all times about the progress of the project.
- To deliver public services infrastructure using labour-intensive construction methods wherever technically feasible and economically viable.
- To comply with the requirements of the statutory, legislative, and regulatory framework governing local government infrastructure provision and
- To comply with all funding conditions.

2.2 Scope of Works

The project involves the establishment of an intermediate booster pump station located inland from the beachfront, on ERF 116, situated higher up in the valley. The high-level scope of work for this project includes:

- Refurbishing and upgrading the existing pump station (PS1) located on the beachfront
- Constructing the intermediate lifting pump station (PS4)
- Installing the interlinking pipelines

The scope of work for this project at commencement was broken down into the following.

- Existing Herold's Bay Pump Station Number 1 (PS1)
  - Upgrade the existing pump station's civil infrastructure to handle 32L/s (ultimate design flow) and the mechanical operating capacity from 19 L/s to 32 L/s.
  - Refurbish the entire pump station building and equipment, including all mechanical, electrical and electronic equipment. All structures are to be stormproof as much as reasonably possible.
  - Install mechanical equipment to cater to the highly abrasive pumping conditions.
  - Install three (3) new submersible vortex pumps. The pumps shall be operated on a rotational basis as duty/assist/standby.
  - Replace the odour control unit.
  - Provide a new emergency storage tank.
  - Provide an emergency generator supply, integrated from PS4, with existing supply as a backup
  - Provide a new sand trap and manual coarse screen.
  - Provide an architectural conceptual proposal and cost estimate for the aesthetic enhancement of the existing building.

- New Pump Station Number 4 (PS4)
  - Construct a new high lift pump station (civil works) with a normal operating capacity of 52 L/s, and an emergency operating capacity of 70L/s.
  - Construct new inlet works comprising of:
    - a screening station,
    - a grit removal station,
    - a Parshall flume for inflow measurement.
  - Install two (2) new dry well pumps. The pumps shall be operated rotationally as duty/standby.
  - New MCC with variable-speed drives on all pumps, complete with PLC and HMI.
  - Install odour control unit.
  - Installation of electrical and electronic equipment associated with the new pump station and inlet works.
  - Provision of an indoor backup generator.
  - Provide above-ground fuel storage for the generator, within a dedicated room.
  - The civil works will comprise the construction of new buildings, retaining walls, fences, access roads etc.
  - Reduce sound pollution generated by the pump station as far as reasonably possible.

- Rising Main
  - Construction of a new rising main pipeline between the
    - existing pump station (PS1) and the new pump station (PS4)
    - new pump station (PS4) and the Herold's Bay WWTW.

- Bulk Electrical
  - Upgrade and relocation of the electrical mini-substation currently located on PS4 site, including all affected MV and LV cables.
  - Install new LV electrical supply cable between PS4 and PS1, integrated with generator changeover.

- Existing Operations
  - Interruptions to the operations of the existing system have to be minimised, and careful consideration is to be provided to the programming of the construction, the interfaces, and the modification of the existing pumpstation.

As the project developed, the scope changed to reduce the operation risks to the systems.

2.3 Scope of Professional Engineering Services

2.3.1 Normal Services

The Scope of Services as detailed in ECSA's Guideline for Services and Processes for Estimating Fees for Persons Registered in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000) are as follows:

- Stage 1: Inception (Completed)
- Stage 2: Concept and Viability (Completed)
- Stage 3: Design Development (This Document)
- Stage 4: Contract Documentation and Procurement
- Stage 5: Contract Administration
- Stage 6: Close-out

The Disciplines included as part of the professional service for this project include the following:

- Civil Engineering services
- Structural Engineering services
- Mechanical Engineering services
- Electrical Engineering services
- Electronic Engineering services

2.3.2 Additional Services

(a) Construction monitoring services during construction

Site Monitoring will be required during the project's execution phase, and the level of service and site personnel will be agreed upon with the Employer at a later stage of the project.

(b) Architectural Services

During the design development, the need arises to appoint an Architect for the project. Although the building layout and functionality are engineering-oriented, the following services do not form part of normal engineering service, and a specialist professional had to be appointed:

- Building plan approval is required for the project; therefore, the building design needs to comply with the building regulations. An architect is the professional who will be responsible for ensuring that the building complies with the regulations and is approved by the local authorities.
- The pump stations will be visible to the public and will be located in high-traffic tourist areas at the entrance to town and the beachfront, so it is of the utmost importance that the buildings are not only functional but also aesthetically pleasing. Architectural services are required to enhance the aesthetic look of the new building and ensure it blends in with the existing surroundings of Herold's Bay.

(c) Quantity Surveyor Services

The services of a Quantity Surveyor become apparent when the services of an Architect are required. Quantifying and producing detailed bills of quantities are excluded from the services of an Architect and structural engineer on a multidisciplinary project.

(d) Environmental Considerations

A Basic Environmental Impact Assessment is currently being conducted in accordance with the National Environmental Management Act (NEMA). On 20 January 2023, SMEC appointed Sharples Environmental Services as the lead environmental consultant to provide the essential environmental services for this project. During the investigation phase, several specialist studies were identified as necessary components of the Basic Environmental Impact Assessment and have since been completed. The following specialist services were required:

- Groundwater Impact Assessment Study
- Aquatic Biodiversity Assessment
- Terrestrial Specialist Assessment
- Heritage Specialist Assessment
- Vegetation Specialist Assessment

A water use license application (WULA) be made since a significant amount of work will be performed on the coast and within 30m meters of the water course.

At the time of writing this report, the status of the environmental processes is summarized below:

- The Notice of Intent was submitted to DEADP.
- Specialist Site Verification Report (SSVR) has been prepared and submitted to DEADP.
- Specialist studies have been completed.
- A draft BAR report has been completed.
- The pre-application public participation has been concluded, and comments have been received.

(e) Occupational Health and Safety Considerations

The George Municipality has appointed an independent Occupational Health and Safety Agent for the project. The preliminary design report has been shared with the Agent, who will prepare the site-specific health and safety specifications, conduct a site-specific baseline risk assessment, and prepare a bill of quantities for the H&S portion of the preliminary and general items. This report will be shared with the Occupational Health and Safety Agent.

(f) Topographical Survey

No existing survey data was available at the commencement of the project. UDS Civils was appointed on 20 January 2023 to provide a detailed topographical and existing services survey of the works area.

The detailed survey with all supporting documentation was received on 24 February 2023. The survey was checked for any errors and ambiguities, and the relevant updates were completed. As the project developed, further areas were surveyed and merged with the existing information.

In addition, the topographical survey data from the Rooidraai project, which is currently under construction, was requested by the George Municipality and incorporated into the data used.

A further topographical survey was required to collect data for a small area not covered during the initial or by the Rooidraai project survey. CDJ Surveyors was appointed to conduct this survey on 19 April 2024, and the data was received on 2 May 2024.

(g) Beacon relocation erf 116

During the project's design development, discrepancies were noticed in the position of erf 116. CDJ Surveyors were appointed on 19 April 2024 to do a beacon relocation survey for erf 116 and submit the beacon data to the Surveyor General. The fieldwork was completed on 2 May 2024 and was accepted by the SG on 30 May 2024.

(h) Material Investigation

SMEC appointed PeraGage Consulting on 9 March 2023 for the provision of Geotechnical Services. A summary of the findings has been presented in Chapter 3.2, and the full report was part of the Concept Design Report.

(i) Town Planning Services

Erf 116 is zoned as Transport Zone II and is owned by the George Municipality. Initially, the plan was to build the new pump station number 4 on ERF 116. However, it was later determined during the design phase that the erf was not big enough to accommodate the necessary infrastructure for the sewer pump station. In addition, it was found that a recently completed outfall stormwater infrastructure was built on a portion of ERF 116.

As a result, the George Municipality plans to purchase a portion of ERF 236/0 from the current owner to ensure enough land is available to construct pump station number 4. The subdivision and rezoning of the portion of the land that will be acquired will require Town Planning Services. Negotiation with the landowner is currently underway, and we are waiting on confirmation from the George Municipality on the way forward in this regard.

2.4 Wayleaves and Existing Services

2.4.1 Way leaves

Before commencing with construction work, the Contractor will be responsible for applying for construction wayleaves. It is anticipated that wayleaves will be required by the following authorities:

- **George Municipality:**
  - Roads and Stormwater infrastructure
  - Water and Sewer infrastructure
  - Electrical infrastructure
- **Other Service Providers:**
  - Fibre and Telecommunication network lines
  - Eskom

2.4.2 Existing Services

SMEC has obtained existing service layouts from local authority departments and service providers. The information received, did not provide the exact locations of the services, but merely a confirmation of their presence and general position.

A GPR (ground-penetrating radar) survey of the works area was conducted to identify unknown underground services and obtain a more accurate location and depth of the services.

2.4.3 Relocating of Underground Services

The following existing services will be affected by the infrastructure and will have to be relocated.

- PS1
  - The 300mm diameter stormwater outfall pipe, which currently discharges onto the beach through the terrace retaining wall at PS 1, needs to be relocated. This is necessary because its current position will clash with the new emergency storage tank that will be constructed at PS1.
  - Additionally, the existing 160mm diameter gravity sewer main must also be relocated in order to make space for the same emergency storage tank.
  - LV electrical cables running along the road and parking area, as well as main feeds into pump station.
  - Existing backup generator will need to be removed, or relocated to another location, for the emergency sump excavations.
- PS4
  - The existing MV and LV cables at and around PS4 will need to also be relocated before construction at this pump station can commence. This will need to be done in conjunction with the required miniature substation work, as detailed in section 4.6 below

3. Status Quo

3.1 Workshop Outcome

After the concept design report was submitted, a workshop was held between the design team, environmental team, and George Municipality (Infrastructure, project management, and operations) to discuss the submitted concept designs and approve the report.

The concept designs were accepted, however, the following was the decisions from the workshop that had to be incorporated into the design phase.

- The flow from the higher areas of Herold's Bay, will be diverted along Rooidraai Road to the site of Pump Station 4 (ERF 116). The gravity sewer will be designed and constructed as part of the existing contract, to upgrade Rooidraai Road (**by others**). The connection of the gravity sewer to Pump Station 4 is to be designed by SMEC.
- A single generator to be supplied, sized to handle the new Pump Station with its screening and grit removal facilities and the refurbished Pump Station 1 on the beachfront. Generator to be housed at new Pump Station site (ERF 116)
- Emergency storage volumes to be provided. The storage volumes shall be as large as reasonably possible (but minimum of 2 hours peak flow).
- Pump Station 1
    - A sand trap is to be provided before the sump. Sump to be cleaned using a vacuum truck.
    - Submersible pumps to be installed in the sump.
    - Sump, to have an operational volume and emergency volume extending to the north
    - Volume for an emergency to be maximised considering the existing infrastructure and the beach.
    - Emergency overflow to remain on the beach
    - Existing building to remain, refurbished and used to house control systems, isolation equipment and an odour control system.
- Pump Station 4
    - Top Floor
        - A flow stilling basin into which a gravity and pumping main will discharge, and exit into the screening channels.
        - Three inlet channels with manual screens (Two duty channels and an emergency channel)
        - Allowance for future installation of automated mechanical front raked screens, conveyors and washer compactors.
        - Two vortex degritters.
        - One grit classifier to the vortex degritters.
        - Odour control system.
        - MCC room, with separate inverter/battery room
    - Lower floor
        - Pump room
        - Sump
        - Generator room
        - Screenings collection room
- Land adjacent to PS4 to be procured to reduce the space constraint on the site for the new pumpstation.

3.2 Geotechnical Investigation

The geotechnical report has previously been circulated with the concept design report. The critical results are presented below.

- **Ground Profile – Existing Pump Station 1**
    - **Results**

    A layer of fill is present up to a depth of between 1.5m and 2.0m, which is underlaid by sandy alluvium that becomes sandy alluvium with cobbles and boulders down to a depth of 4.5m. After that, a completely weathered schist consists of soft and very soft rocks.

    Groundwater was recorded at 3.0m and 4.6m

    - **Implication**

    At the existing pump station, bulk excavations for a new sump could be challenging due to the substrate being predominantly saturated sandy material (below mean sea level). This means that shoring and de-watering will be essential for a safe and dry work area. For this portion of the work, the cost estimate will allow for sheet piling.

- **Ground Profile – New Pump Station 4**
    - **Findings**

    A layer of uncontrolled fill and dump material with poor engineering properties is present up to a depth of 1.6m. Then, a layer of residual to completed weathered granite schist up to a depth of 2.3m, followed by soft to medium hard rock granite schist up to 4.0m deep. Moderately weathered granite schist was encountered between 4.0m to 8.0m.

    Groundwater was recorded at 2.4m and 0.98m, and for design purposes and construction, it can be expected to be at the bedrock-soil interface at 2.4m.

    - **Implications**

    The confined area and the presence of hard rock could have potential challenges in terms of bulk excavations. Allowance will be made for chemical rock splitting in lieu of blasting and mechanical rock breaking.

    Battering the excavation will not be an option due to the confined area, and allowance will be made for shoring, more specifically sheet pilling.

    Dewatering will also be required to ensure a safe and dry excavation.

- **Ground Profile – New Rising Main**

    Test pits were excavated along the pipe route, starting at the end of Spekie Gericke Drive and continuing to the WWTW. No test pits were excavated in the roadway and this geotechnical assessment thus excludes this portion of the pipeline.

    The Geotechnical condition for the pipe route is summarised in **Figure 3-1** and **Table 3-1**.

Figure 3-1: ZONE map of 20m wide rising main corridor

Table 3-1: Summary of Geotechnical Considerations

ZONE	Geotechnical considerations
ZONE I	• Variable excavatability in completely to highly weathered schist • "Soft" excavation conditions in upper transported and residual soils • "Intermediate" excavation conditions in weathered schist bedrock • Moderate slopes • Shallow subsurface water seepage along bedrock-soil interface during and after heavy rainfall
ZONE II	• "Soft" excavatability, with some sidewall instability, in upper sandy soils • Shallow subsurface water seepage along bedrock-soil interface during and after heavy rainfall

Groundwater was not encountered during the trial pit excavation. However, excavating the rising main will require battering or shoring, particularly in zone 1.

The material samples obtained from the trial pits showed that the material cannot be used as bedding since it does not conform to the SANS 1200LB specification. Therefore, bedding material will need to be imported from commercial sources. The excavated material can be used as fill, but it will require a selection and sorting process.

4. Design

During the design phase of the system, careful consideration was given to the following key factors:

- Public safety and noise pollution,
- Public nuisance,
- Construction methodologies considering site constraints,
- Environmental hazards and regulations,
- Sustainable and efficient operating conditions,
- Robustness of the system,
- National and Municipal design standards and guidelines,
- Continuous operation during the implementation of upgrades.

4.1 Design Flows

The flows from the different catchments (within the design periods) were confirmed with the Municipality masterplan consultants during a meeting with them and the municipality in July 2024. The following table summarises the agreed design flows for the two pump stations. These flows will be used to size the mechanical components of the pump stations.

To obtain the emergency storage volumes, diurnal flow patterns will be adjusted to suit and modelled. This will be discussed in greater detail in 4.4.

Table 4-1 - Design Flows - Pump Station 1

Pump Station 1	20-year flow (m^3/s)	50-year flow (m^3/s)
PDDWF	0.005	0.005
PDDWF - Peak Season	0.013	0.013
Peak season (30% SW ingress)	0.017	0.017
Peak season (50% SW ingress)	0.020	0.020

Table 4-2 - Design Flows - Pump Station 4

Pump Station 4	20-year flow (m^3/s)	50-year flow (m^3/s)
PDDWF	0.013	0.014
PDDWF - Peak Season	0.020	0.022
Peak season (30% SW ingress)	0.043	0.046
Peak season (50% SW ingress)	0.050	0.053

4.2 Herold's Bay PS 1

4.2.1 Inlet

The inlet at the existing pump station comprises a cylindrical sand trap immediately upstream of the entrance to the sump. This structure will have a central pipe to the bottom, with a coupling at the top to connect a vacuum truck pipe for cleaning. In addition, a wall / surface-mounted manual coarse screen (25mm bar spacing) will be installed to prevent larger foreign objects from entering the sump and blocking the pumps. Both the vacuum truck suction connection and the screen will be accessible via a hinged manhole cover.

4.2.2 Sump and emergency storage

A new reinforced concrete emergency storage tank and sump will be constructed below the current parking area between PS 1 and the public ablution facilities. The tank will not protrude into the roadway of Uitspanning Street and will extend up to the terrace blocks located on the beach. The structure will be below ground and not visible to the public. The only portion of the tank that will be visible will be the access manholes. The parking, kerbs, "terraforce" blocks, benches, and waste bins will be reinstated once the tank has been constructed, returning the area to its original state.

The incoming flow from the sand trap will enter the Pump Station sump via a drop pipe. The sump and emergency storage tank will be combined, with the deepest part of the tank forming the sump, being the normal operating volume, and will be located adjacent to the existing pump station building.

The floor of the emergency tank will slope towards the operational sump. The slope will be achieved by benching, which will assist in anchoring the structure to prevent floatation.

The rising main between PS 1 and PS 4 will scour into the new sump and enter the sump at the highest point to create a flushing volume to wash possible sediment build-up into the operational sump. Due to the "low" static pressure in the rising main during scouring, the flushing may not remove the solids settled during an emergency event, and periodic manual pressure washing of the emergency sump will be required as part of maintenance.

Removable precast concrete panels or lockable hinged access covers will cover all the access points. These covers are designed to minimise the airflow in and out to reduce odour issues. Access manholes will be provided for entry. The covers over the sumps will be hinged lockable manhole covers into the sump, which will need to be periodically pressure-washed. This activity will be hazardous, and special precautions and personal protective equipment (PPE) will be required. Parking is to be allowed over the manhole covers over the submersible pumps.

Due to the space constraint at the PS4 location, the majority of the emergency storage capacity will be provided at PS 1. Once the emergency storage volume at PS 4 has reached capacity, the existing rising main will be utilised to convey sewage to the emergency storage tank at PS 1.

A total emergency storage volume of 780m^3 within the entire system. 180m^3 at PS4 and 600m^3 at PS1.

Figure 4-1: Position of proposed emergency storage tank

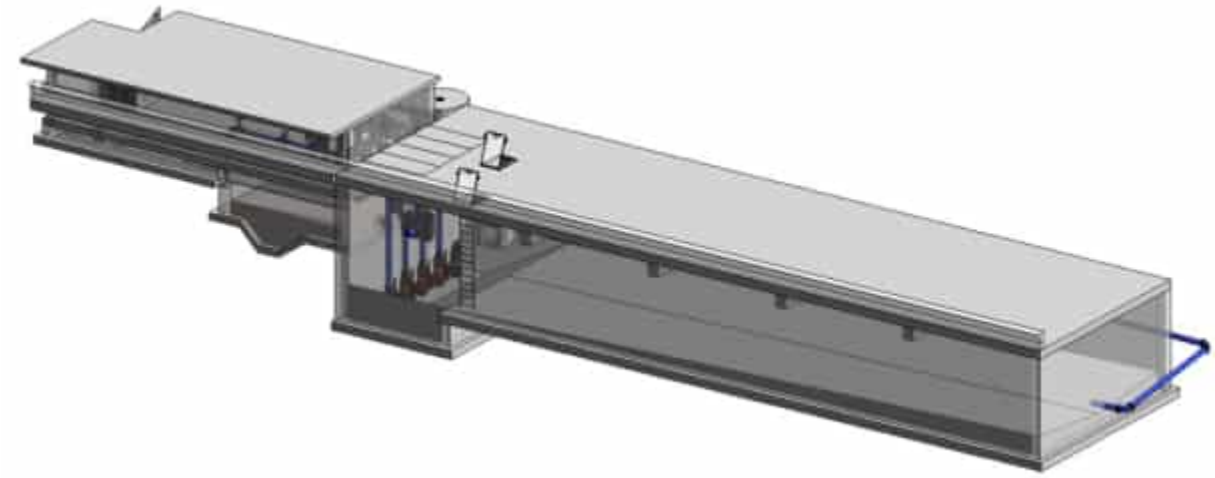


Figure 4-2: Model of proposed PS1 and emergency storage tank

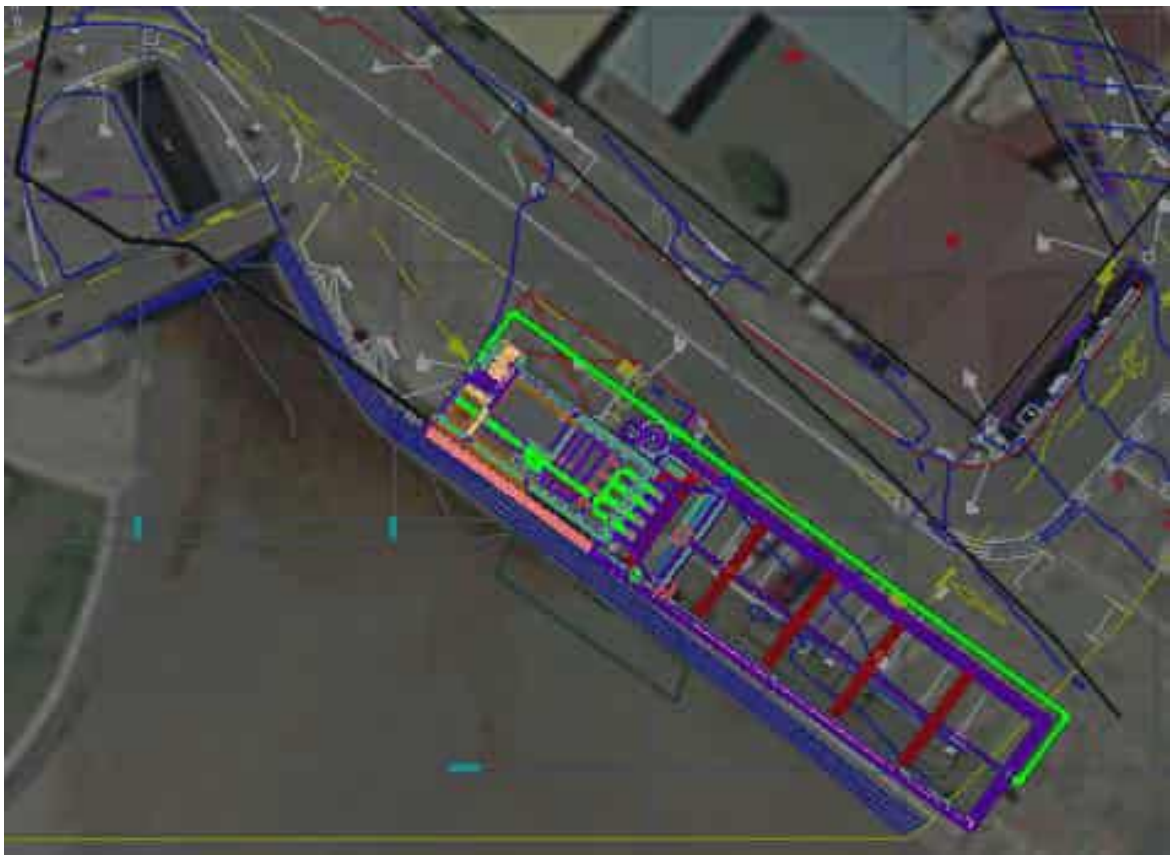


Figure 4-3: Overlay of proposed PS1 and emergency storage tank

4.2.3 Design Flows

The revised design flows (delivery) for the pumps are:

Normal operating conditions:

- **Low season:** **5 L/s**
- **Peak season:** **17 L/s**
- **Extreme events:** **32 L/s**

Extreme events are classified as events/situations where the emergency volume of the pump station has been utilised and needs to be drained, but storm events and associated ingress are excluded.

4.2.4 System Characteristics

The design of the pumping system is dependent on the pipeline system characteristics. The pipeline is discussed in paragraph 4.5.1.

Table 4-3: Pump System Characteristics

Description	Data
Maximum Water Level in Sump	3 m
Minimum Water Level in Sump	1 m
Discharge Level	18 masl
Pump Intake Level	-0.5 masl

Minimum Static Head	27.2 m
Maximum Static Head	25.2 m
Pipe Length (To PS4)	185 m
Suction Pipe Size and Type	N/A
Delivery Pipework in the Pump Station	100mm & 150mm Ø 316 SS
Delivery Pipe Size and Type	160 mm Ø uPVC
Pump Flow Rate (Normal)	17 L/s
Pump Head (Normal)	25 m
Pump Flow Rate (Extreme Events)	32 L/s
Pump Head (Extreme Events)	35.5 m

The provisional system curves based on the information above are presented below.

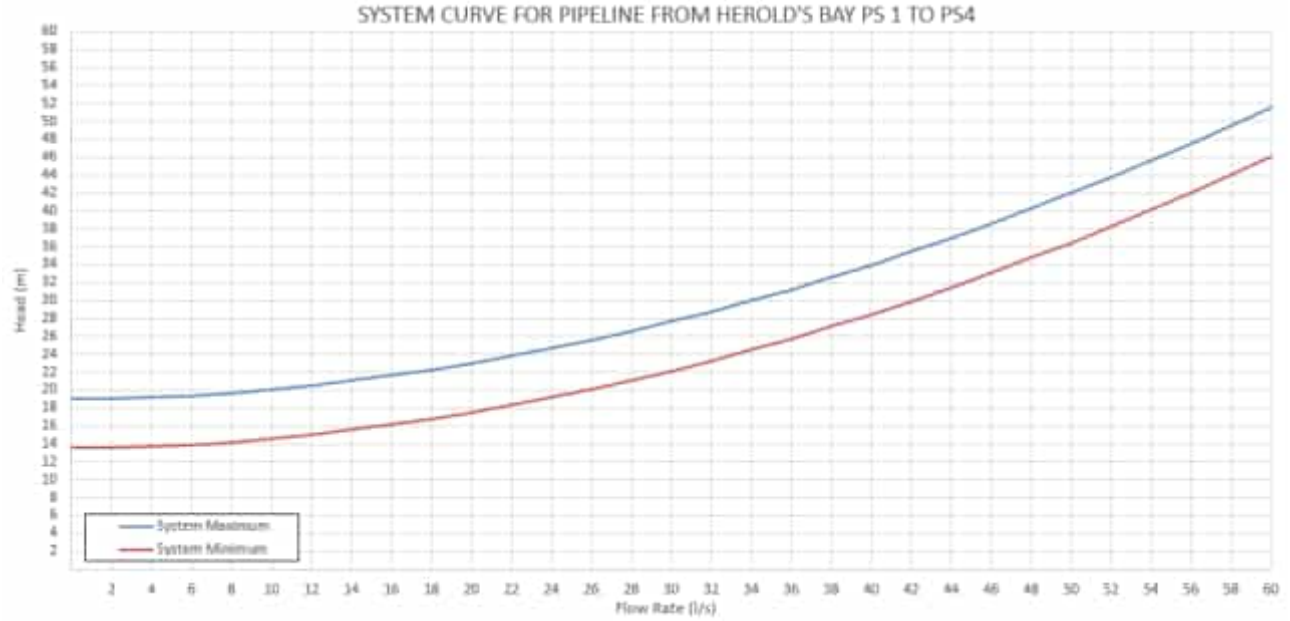


Figure 4-4: Preliminary System Curve pipeline to PS4

4.2.5 Control Philosophy

(a) Sump

For level control, the new sump will be fitted with ultra-sonic / radar level sensors including backup floats (other acceptable instrumentation) in case the primary level unit fails. It must be noted that the sump is divided into two distinct sections, namely the operating sump, within which the level setpoints will operate, and the extended storage capacity section, which will be equipped with an additional high-level alarm.

The primary level sensor will control the pumps within the sump via:

- Stop level: switch off duty pump(s);
- Start level 1: first duty pump
- Start level 2: second duty pump (assist)

The backup float switches will control the pumps within the sump via:

- Low level: switch off running pumps

- High level 1: high alarm trigger within primary pump sump
- High level 2: high alarm trigger for emergency storage sump, below overflow

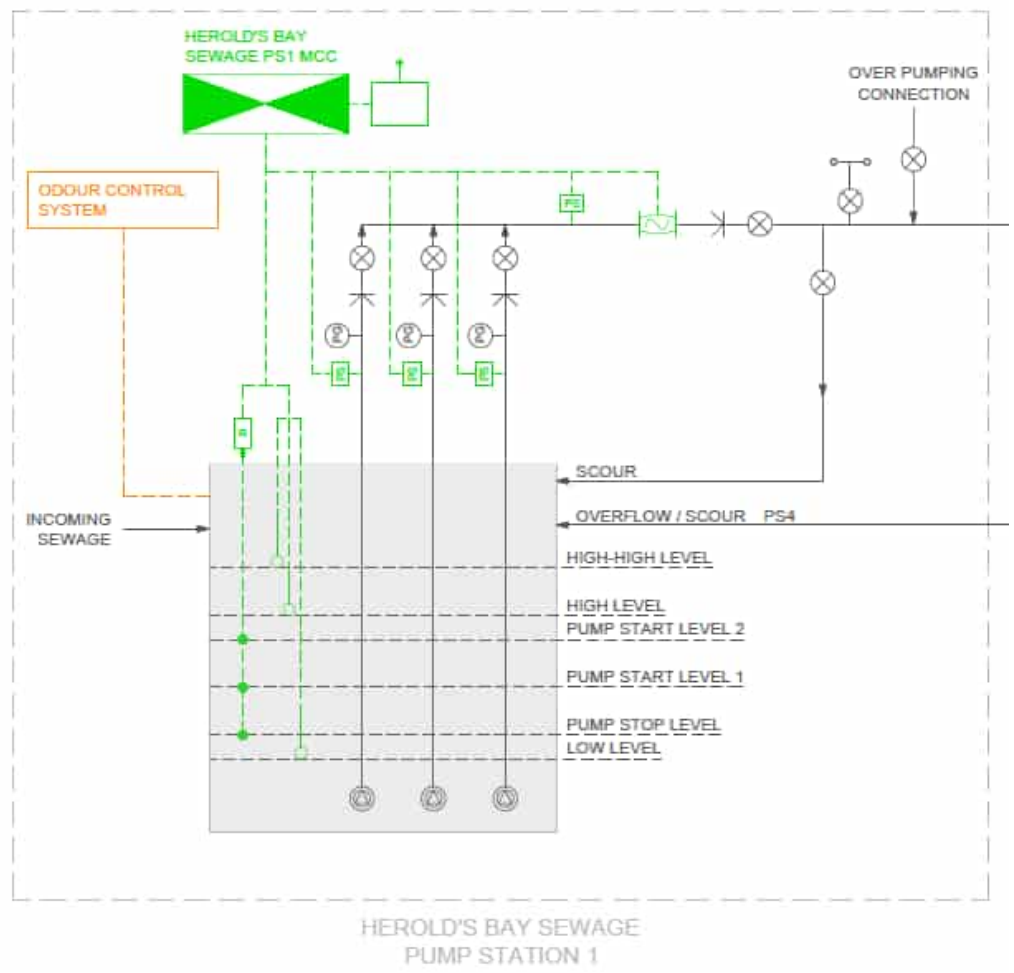


Figure 4-5: Proposed Site P&ID

It is recommended that the pumps operate on level only, and not implement any level PID control. Due to the expected low inflow, for most of the year, emptying the sump as soon as possible will be more effective than one pump trying to maintain a constant level within the operational sump. This can be adjusted, should the base flow (off-peak flows) into the Pump Station increase.

The pumps at PS1 must receive communication from the new PS4, via the telemetry system. If the pumps at PS4 are not available/operational (both, as a combination of manual, off, or trip) or the pump sump is full (via selected level below the overflow), then the pumps in PS1 must not start, or if operational, stop, and the emergency storage volume must be used to accommodate incoming sewage.

(b) Pumps controls

VSDs are proposed, to reduce pipeline stresses during starting and stopping, as well as to assist with final generator sizing (combined with PS4). Due to the proposed level control, VSDs will however not provide much energy saving at this site.

Given the proposed 1 x duty, 1 x assist and 1 x standby configuration, the pumps will be rotated to try and even out wear and tear and maintenance can be properly planned and carried out (avoidance of one pump accumulating hours and the others remaining being nonoperational). The duty rotation will be based on pumping cycles, i.e. after each pumping cycle between a start and stop, the next available pump will become a duty.

4.2.6 Pumps

The sizing of the pumps and the operational number thereof considers the design flow of the pump station as well as the emptying of the sump and emergency storage volumes in extreme events within an acceptable timeframe.

From this, the design was based on one (1) duty pump to achieve the ultimate design flow under normal operating circumstances, and two (2) duty pumps operating in parallel to achieve the extreme event flow rates required to empty the emergency storage volume (2x duty and 1x standby).

Three (3) pumps of the same manufacturer and model will be installed inside the sump. The pumps shall be centrifugal, single-stage, close-coupled, submersible type pumps equipped with a self-cleaning vortex-style impeller designed to handle unscreened sewage. The pumps shall have a minimum spherical solid handling of 80mm. Due to the high sand loading at the pump station, the impeller material shall be Duplex Stainless Steel. The motor shall have a minimum efficiency rating of IE3, with a maximum operating speed of 3,000 RPM (2-Pole).

The pump installations shall be semi-permanent type with auto-coupling equipment. Each pump shall be equipped with a suitable duckfoot bend, 316L Stainless-Steel guide rails and top bracket and a 316 Stainless-Steel lifting chain. The proposed pump set is based on the characteristics mentioned above. Although there are multiple manufacturers with suitable pumps, the design presented in this report was based on the Grundfos manufacturer's range of submersible solids handling pumps. Note that these are only provisional selections and final pump selections will be based on the appointed contractor's design during the construction phase.

Variable speed drives are installed to operate the pumps to allow the pumps' speed to be adjusted to the required flow range and assist with the start-up demand of the pumps on the generator.

The levels in the sump are set such that the effective pumping volume is sufficient to ensure the pumps do not operate more than ten (10) cycles per hour and allow enough volume for pumps to speed up to meet their operational set point prior to reaching any other level set points in the sump such as the next start level or high level.

The pump set used in this report is the Grundfos SEV80.80.150 coupled with a 15 kW 2-pole motor.

Duty Point	Description	Data
1	1 x Duty Pumping Flow Rate	17 L/s
	1 x Duty Pumping Head	23.0 m
	1 x Duty Operating Speed	2,610 RPM
2	2 x Duty Pumping Flow Rate (per pump)	16 L/s
	2 x Duty Pumping Flow Rate (Combined)	32 L/s
	2 x Duty Pumping Head	29.0 m
	2 x Duty Operating Speed	2,778 RPM

Table 4-4: PS1 proposed pump duty points

Normal Operation (Duty Point 1): The duty point is achieved with a 1 x duty pump operating at a reduced speed of 2610 RPM (44Hz), at a pump efficiency of ±41%. The operating speed can further be reduced to achieve a minimum recommended flow rate of 13 L/s. Any flow rate below 13 L/s would not be sufficient to achieve self-cleaning flow velocity in the pipework. The pump can also operate up to its maximum operating speed to achieve a flow rate of 20 L/s.

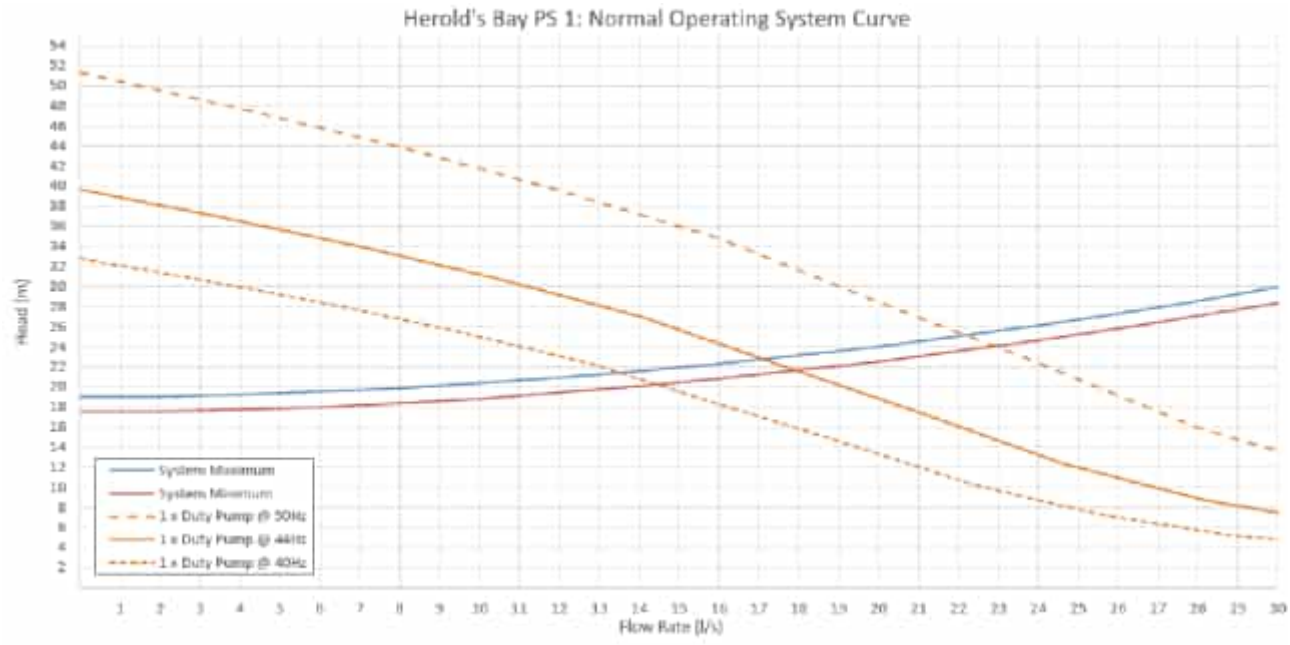


Figure 4-6: Pump and system curve PS1 – Normal

Extreme Events (Duty Point 2): The duty point is achieved with 2 x pumps operating in parallel at a reduced speed of 2778 RPM (47Hz), at a pump efficiency of ±41%. Due to this scenario only being applicable for extreme events, the pumps shall operate at their maximum operating speed until the sump has been emptied.

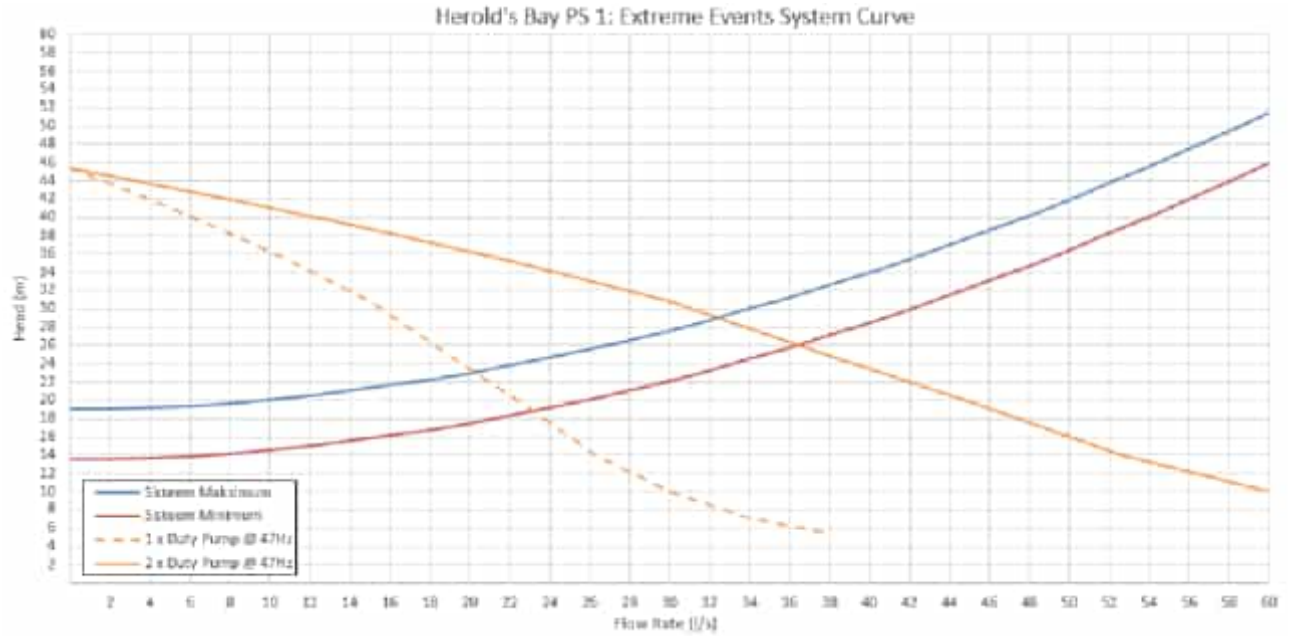


Figure 4-7: Pump and system curve PS1 - Extreme events

4.2.7 Pipework and Specials

The selection of pipe sizes in the pumping station is done to ensure the pump station is effectively and efficiently able to convey sewage throughout the required flow ranges, with minimum self-cleansing velocities and maximum recommended flows taken into consideration.

The minimum and maximum flow velocities in sewage delivery pipework are 0.8 m/s and 2.5 m/s respectively. The minimum flow velocity is to ensure a self-cleansing flow is achieved, with the maximum flow velocity being to

reduce friction losses in the pipework as well as reduce the destructive action to the installed equipment due to the abrasive content of the sewage.

Due to the corrosive environment of a sewage pump station and its proximity to the ocean, the pipework shall be flanged and manufactured from stainless steel grade 316L. All pipework shall have a minimum PN10 pressure rating.

All pipework shall include pipe supports to handle all forces generated by the pumping system. All tees and bend would be strengthened to handle maximum pressures in the system.

Pipework Layout:

A drop-chute / down-pipe will be installed at the gravity feed entrance to the sump to reduce odours created in the sump due to aeration. The sump inlet structure and drop-chute are designed such that it reduces turbulent flow at the pump's inlet.

Each pump shall have dedicated delivery pipework connecting to a common manifold before connecting to the rising main outside of the pump station building.

An over-pumping connection shall be included in a valve chamber outside the pump station building. Temporary or mobile pumps could be connected should the entire pump station need to be taken out of commissioning. By drawing from the grit settling chamber and discharging into the delivery pipework and rising main outside the pump station building, the pump station and sump can be bypassed in their entirety.

A rising main scour valve and pipework shall be included downstream of the bulk isolation and non-return valve, discharging into the pump station sump.

All pipework shall include required bracing to handle all static and dynamic forces generated by the system.

The below table outlines the pipe sizes inside the pump station and their associated flow velocities.

Table 4-5: Pipework information (PS1)

Pipework Information			
Description	Pipework Nominal Diameter	Velocity @ Duty Point 1	Velocity @ Duty Point 2
Drop-Chute	200 mm	N/A	N/A
Pump Delivery	100 mm	2.2 m/s	2.0 m/s
Delivery Manifold	150 mm	1.0 m/s	1.8 m/s
Over-pumping Connection	150mm	N/A	N/A
Scour	150mm	N/A	N/A

4.2.8 Valves

A set of non-return and isolation valves (in this order) will be installed on the delivery pipework of each pump line and the delivery common manifold.

An isolation valve will be installed on the scour pipeline and the over-pumping connection.

A flanged, double-action air release valve designed to handle sewage will be installed on the common delivery manifold downstream of the bulk non-return and isolation valve. The air release valve will be installed with an isolation valve to allow the valve to be isolated for maintenance.

The isolation valves shall be of flanged, cast iron, resilient seated gate valves with non-rising spindles equipped with hand wheels. The non-return valves shall be the flanged, single-door, swing-type valves equipped with a lever and counterweight. The non-return valves shall include required bracing to handle all static and dynamic forces generated by the system.

All equipment shall be rated to the maximum operating pressure of the installed pumps and/or the maximum system pressure.

All equipment shall be rated at PN10.

4.2.9 Odour Control System

Due to the pump station's proximity to residential, commercial, and recreational areas, an odour control system shall be installed to treat the odorous gases / substances present at the pump station.

An odour control specialist was approached to assist with selecting the odour control technology suitable for the pump station and its associated footprint.

Due to the limited available space, and the lower amount of maintenance required, a dry scrubbing system will be installed. Foul air shall be extracted via ducting by an exhaust fan from the sump and passed over / through a series of reactant / adsorbent media beds housed in sealed vessels in the pump station building, after which being discharged to the outside. Two exhaust fans, with associated isolation valves, shall be installed to operate as a duty/standby configuration.

All ducting shall be of uPVC and will be sized to suit the required flow rates.

The media beds are designed to remove targeted pollutants / odorants from the extracted air. The multi-layered media beds oxidise odorous compounds present in gases to non-odorous and environmentally friendly byproducts. The system does not require any chemical dosing or water supply.

The system is designed to treat the volume of air displaced in the sump during peak wet weather inflow to the pump station, including the overflow from Herold's Bay Sewage Pump Station 4. With a safety factor included, the system's designed flow rate is 220 m^3/h.

The volume of media required is based on the concentration of foul air of the air being treated and the service design life of the media. Without an H_2S study, the service life of the media bed cannot be accurately estimated. Based on typical domestic sewage constituents assumed, the system was designed for a media lifespan of 4 years. The variance between the foul air concentration assumptions to the actual foul air concentration will influence the media lifespan, and not affect the effectivity of the odour control system.

Spatial allowance has been made for two 1m diameter and 1.5m high vessels, ducting, and two exhaust fans. Shorter vessels were chosen due to the height restrictions in the existing pump station building for ease of service / replacement of the media beds.

4.2.10 Ancillary Mechanical Equipment

(a) Pressure Gauges:

Each pump set will be equipped with a pressure gauge on the delivery pipework (positioned inside the existing pumpstation). These gauges shall be rated for sewage applications with a measurable range of 0-10 bar (0 – 1,000 kPa), in line with the capabilities of the pump sets.

(b) Seepage Pump:

The pump station building will have a seepage/drainage pump in a collection sump. The pump will include an isolation and non-return valve, and discharge in the pump station sump. The pump will operate by level and shall have an integrated float switch.

(c) Lifting Equipment:

Due to the limited headroom, no lifting equipment will be installed inside the pump station building. All equipment installed is within the lifting ability of two workers, and no larger or heavier equipment will need transportation during the pump station's normal operation and maintenance.

No permanent equipment will be installed to remove the pumps from the sump due to the visual impact of lifting equipment. A portable collapsable tripod or a crane truck can be used to remove the installed pumps.

(d) Forced Air Ventilation:

Ventilation to the sump is sized based on 20 air volume changes per hour of the volume of air in the specific area. Based on the layout of the wet well, fresh air would be supplied to the single sump volume. The blower will be installed in the pump station building, with ducting conveying fresh air from outside the building to the sump.

Based on the volume, the blower and ducting would be sized for at least 3.5 m^3/s.

uPVC ducting would be used for the highly corrosive environment.

The blower will be manually operated when access to the sump is required.

(e) Extractor Fans:

The building's ventilation is based on 6 air volume changes per hour of the air volume in the specific area. The extractor will be installed in the pump station building, with ducting leading out of the building.

Based on the volume, the extractor and ducting would be sized for at least 0.7 m^3/s.

uPVC ducting would be used for the highly corrosive environment.

The fans will be automatically operated based on a timer, and temperature sensor / controller in the pump station building.

(f) Hand Stops:

Hand stops would be provided for the inlet structure to isolate the grit removal structure from the sump for maintenance and cleaning purposes of the sump.

The hand stops would be manufactured from hot-dipped galvanised mild steel due to the expected low frequency of use. It is suggested that the plate stops would be stored in the pump station for safekeeping.

4.2.11 Electronic Flow Metering

Inlet flow measurement would be possible by utilising a combination of level sensors and radar at the inlet gravity pipe. However, the municipality has not yet employed this technology, but it has been provided for at present.

A single electromagnetic flow meter is proposed on the common single rising main. The flow meter will be located within the pump station building, with supply through the proposed MCC UPS.

It is further proposed that overflow from PS4, towards PS1, also be monitored at PS4, to signal an alarm in this emergency situation. During operational monitoring, the overflows will have to be considered in the calculation of a water balance across the system. Refer PS4 section for more details.

4.2.12 Building Alterations

(a) Superstructure

The existing building be completely refurbished as per the best practice guidelines. All the existing pumps and pipework will be removed, and all the new pipework will be installed at the ground-floor level.

(b) Electrical Control Room

It is proposed that the MCC be installed inside a separate section of the existing building to better screen and protect against water vapour/spray and possible gases. The submersible pumps will be provided with junction boxes for remote start/stop and a motor cable termination point in close proximity to the sump (hidden from the public eye and needing authorised access).

(c) Access

One emergency access with doors opening outward for use during emergencies.

All external doors will be made of galvanized steel and equipped with stainless steel locking mechanisms to protect against corrosion.

All internal doors will be made of galvanized steel and equipped with stainless steel locking mechanisms to protect against corrosion.

(d) Natural Lighting

Make use of as much natural light as possible, but given the location, existing buildings as well protection against sea/water ingress, lighting design based upon zero-natural light.

(e) Accessibility

Adequate demarcated parking and accessibility to the pump station for emergencies. Particular consideration during the peak holiday season.

4.2.13 New Structures

(a) Emergency Storage and new Sump

The new sump and emergency storage tank will constructed of reinforced concrete. This includes the roof slab, which will be designed to accommodate light vehicle parking. Consideration is to be given to have a median devider between parking bays to prevent trucks from utilizing the parking area above the new sump and emergency storage.

Of concern is the expected ground water level and possible ingress of sea water from the beach during high tides within the area. It is anticipated that the perched water table will have an influence on the stability of the surrounding soils during construction, with possible collapse or failures within the working area. As such, the contractor should design temporary works for submittance to the engineer. These temporary works should ensure a safe working environment as well as the safety and structural integrity of all surrounding infrastructure. Typical measures could include sheet piles, continuous water removal, excavation stabilizations and cement stabilised reinstatement of imported layer works, or underpinning.

(b) Material

(i) Concrete

The emergency storage sump will be constructed using reinforced concrete.

All concrete resulting in surfaces to be exposed to raw sewage, sulphuric acid, or hydrogen sulphide will be treated with Penetron admix or similar approved.

Concrete elements to be designed to have the following minimum 28-day compressive strengths:

- Blinding: 15MPa
- Water retaining structures: 35MPa watertight concrete to BS8007
- All other concrete: 30MPa

(ii) Reinforcement

Concrete elements are to be detailed by specifying the following rebar sizes (complying with SANS 920):

- Mild steel (250MPa): R8, R10 and R12
- High yield steel (450MPa): Y10, Y12, Y16, Y20 and Y25

For corrosion protection of reinforcement, liquid retaining structures are specified to have a minimum concrete cover of 75mm.

(iii) Structural Steel

All steelwork located within the inside of liquid retaining structures is specified as 316L stainless steel to limit corrosion damage to the steelwork.

(c) Temporary Works

The design of the temporary work will be the Contractor's responsibility and will be included in the tender documentation as such. Shoring and dewatering will be required to construct the new emergency storage tank and the sump. Steel sheet piling is the preferred method of protecting excavations from water ingress and collapse.

4.2.14 Electrical, Control and Instrumentation

(a) Supply

With the reduced flow to PS1 due to the diversion of the significant amount of sewage to PS4, the intended pump station upgrade, with associated pumps, motors and ancillary equipment, will require less power than the existing, operational one.

Due to the location of PS1 (adjacent to houses and the sea), this Pump Station will be supplied with existing connection and back-up power from the PS4 changeover panel. The new bulk supply at PS4 will, under normal supply conditions, supply PS1 with the necessary power as well. The new supply cable, fed from PS4's changeover panel, will be sized for current and voltage drop, taking final route and burial conditions into account (derating factors). The cable will be installed along with the new pipeline and due to timeline constraints, most likely be installed within a sleeve that will be provided by the civil contractor.

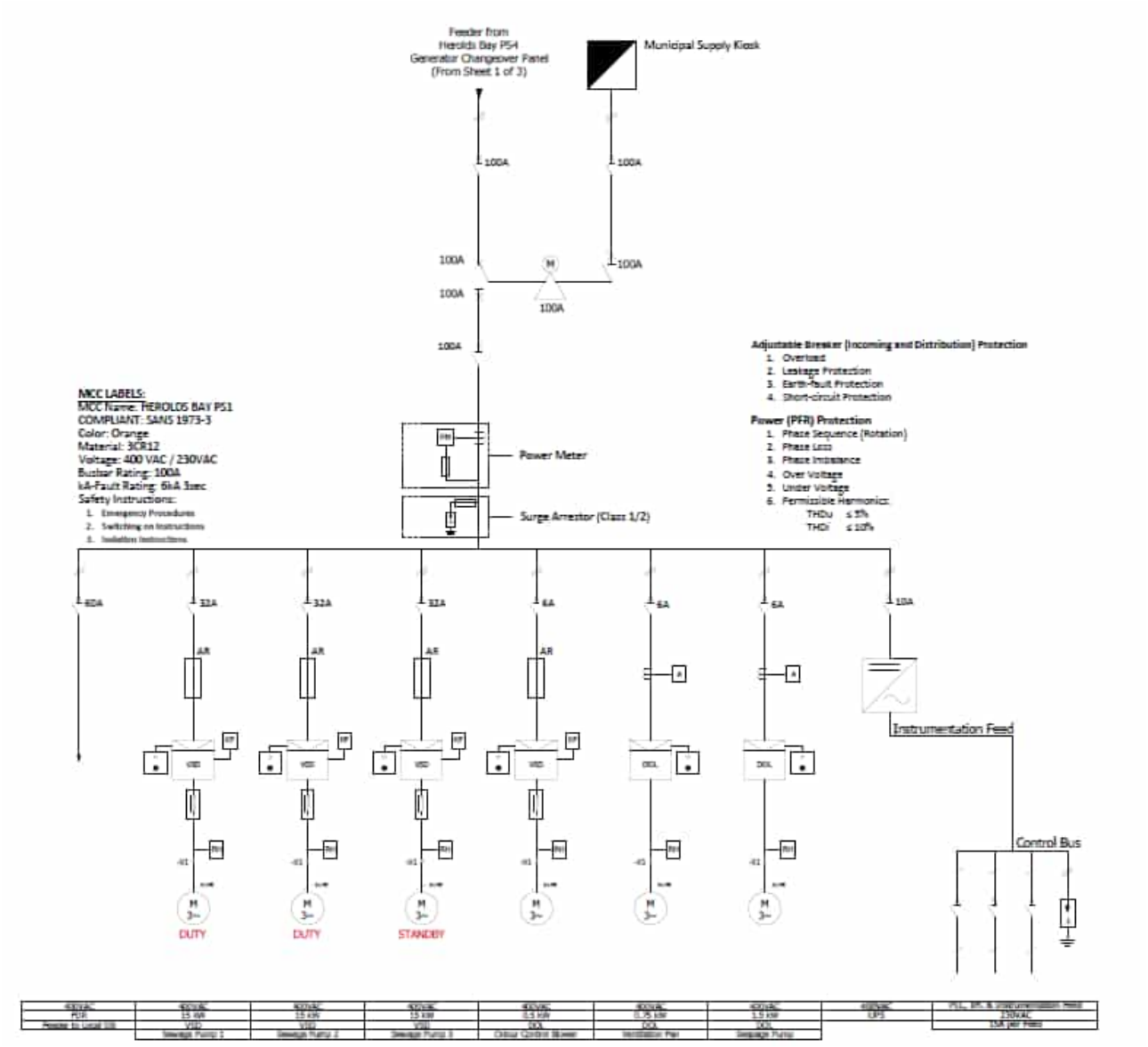


Figure 4-8: Proposed Site Single Line

The existing supply to PS1 is sufficient size for the upgrade requirement and will be kept as an emergency backup. It will be integrated into the MCC, in case the supply from PS4 is off. The Municipality's Electrical Department has requested that along with the manual change-over switch on the MCC, the cable tails inside the distribution kiosk be disconnected, and only connected once the supply is absolutely required.

(b) Estimated New Load Requirements

The table below provides a summary of the expected maximum electrical demand after the upgrade.

Table 4-6: Electrical Load Summary

Herolds Bay PS1											
Item	Existing / New	Load Description	Qty	Feeder Type	Number of Phases	Voltage [V]	Rated Current [A]	Connected Power [kW]	Connected Power [kVA]	Full load PF	Comments
1	New	Sewage Pump 1	1	VSD	3 PH	400	29	15.00	16.7	0.9	Duty
2	New	Sewage Pump 2	1	VSD	3 PH	400	29	15.00	16.7	0.9	Assist
3	New	Sewage Pump 3	1	VSD	3 PH	400		-	-	0.9	Standby
4	New	Odour Control Blower	1	DOL	3 PH	400		0.5	0.6	0.8	Duty
5	New	Seepage Pump	1	DOL	3 PH	400		1.5	1.9	0.8	Duty
6	New	Ventilation Fans	1	DOL	3 PH	400		0.75	0.9	0.8	Duty
7	New	Small Power & Lighting	1	-	1 PH	220		10	15	0.8	Intermittent
								42.75	51.77		

As can be seen from the calculations presented in the table above, the maximum expected electrical demand for the pump station is calculated to be rounded to 52 kVA (for final future flows). That equates to roughly 80-90A load.

The current supply cable and breaker size (150A) is rated for higher load requirements than the above estimated maximum load demand. The current supply is sufficient to supply the pump station after the upgrade. The existing CB and cable will be re-used, with kiosk relocated to a more accessible location, given the new inlet and sump section to be constructed.

(c) New Standby Diesel Generator

The pump station will be supplied with standby power from the PS4 generator, with an automatic changeover switch. Additional manual bypass will be available in case of possible change-over switch failure at PS1's MCC. It is currently proposed to make this a manual transfer, but it would be possible to automate the backup supply. However, should there be a power failure, the changeover at PS4 will take a while for final checks and generator transfer. This time delay will need to be factored into the automatic transition of the transfer switch at PS1, so as to prevent unnecessary switching between supplies.

(d) Motor Control Centres (MCCs)

The existing MCC will not be re-used in the project upgrade and a complete new MCC is proposed. The existing pump station will need to remain in operation for the duration of the project, and the new MCC will allow a parallel installation. The unit is outdated and does not comply with the latest standards of the George Municipality. Upon completion of the overall project, all existing equipment will be removed and delivered to the Municipal stores.

The new Motor Control Center (MCC) will be supplied by both the PS4 changeover panel and the existing kiosk. This will be achieved using two incoming circuit breakers that are both mechanically and electrically interlocked. According to the proposed single line diagram below, the Main MCC will supply power and control the sewage pump station and its associated systems, including odour control measures.

The new Motor Control Center (MCC) will be equipped with a new Programmable Logic Controller (PLC) and Human-Machine Interface (HMI). These will manage the pump station control and provide feedback to the operator. It is recommended that this site be supplied with an integral Uninterruptible Power Supply (UPS) located inside the MCC, rather than a separate inverter and battery backup system, which would require additional space and is typically designed for higher load applications. The UPS will be sized to support control circuits, telemetry, and critical instrumentation components, such as level and flow measurements. It will also be designed to provide one hour of backup power.

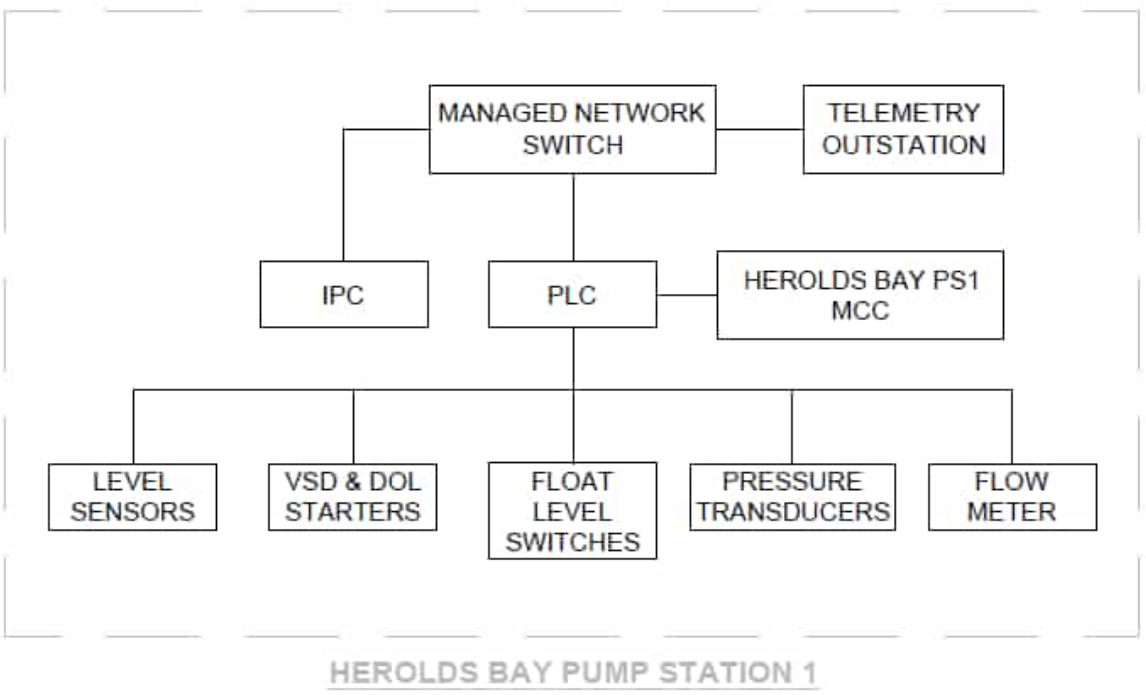


Figure 4-9: Proposed Site Network Diagram

(e) Upgrade to Telemetry & SCADA

The site is currently equipped with an older Spectrum telemetry outstation, which is part of the Municipality's broader telemetry expansion and remote SCADA monitoring and trending initiative. This outstation will not be reused; instead, a completely new GSM-based outstation is proposed for the site. This new system will include the integration of site signals and transmission to the Municipality's central SCADA station. Additionally, point-to-point communication will be required between sites PS4 and PS1 for secondary pump level control.

The central SCADA system currently displays, monitors, and trends all digital and analogue signals from the pump station. It is recommended that the pump station page be upgraded and developed to accommodate the new, larger pump station. The odour control equipment will also be included, along with all necessary analogue signals for trending and reporting purposes.

(f) Instrumentation

None of the instrumentation from the existing pump station will be reused.

The new pump station will be equipped with dual sump level sensors, backup hydrostatic pressure level sensors, and a pump delivery electromagnetic flow meter along with a pressure sensor. All data will be displayed and trended on the SCADA system.

To ensure pump and motor protection, a combination of temperature and moisture protection will be implemented, with controllers integrated into the PLC and Variable Frequency Drives (VFDs) respectively.

(g) Electrical Ancillaries

The new pump station building and site will be provided with the following ancillary electrical equipment, as discussed with the Municipality:

- Local DB for pump station building, rated for non-essential loads only. An emergency exit light, as well as a unit on battery power, will be provided inside the pump station room.
- Holistic site lighting design, integrated with security and CCTV requirements. This will be a combination of building-mounted floodlights, as well as existing road free-standing poles.

- Site electric fencing was not required.
- CCTV for perimeter protection, integrated with an armed response system, to act as an alarm system as well. Currently, no fibre is present in the town that links back to the central operational station in George. A final decision will need to be made on whether CCTV is required, or a mere alarm system is provided for.
- Internal pepper gas system to keep unauthorised users out.
- Building lighting and power design. Internal lighting (LED) to be a minimum 300lux at operational points, with a minimum 400lux provided at any electrical/control areas.

(h) Earthing Philosophy

An appropriate earthing system and network for the new pump station, and associated electrical infrastructure works, will be installed in accordance with SANS10142-1 – The Wiring of Premises: Low-Voltage Installations. The site will be assessed and designed on a single earthing and bonding principle, from the main LV supply through to the Main MCC and all associated equipment components. All electrical and metallic structures and/or components will be suitably bonded, with earthing above-ground being of the anti-theft type. All termination ancillary equipment to be stainless steel and/or equivalent in quality, and hidden as far as practically possible.

4.2.15 Drawings PS 1

The following drawings of Pump Station number 1 are attached as **Annexure A**

- **C1936 – PS1 – A101 Level 01 Plan & Section**
- **C1936 – PS1 – A102 Level 02 Plan & Section**
- **C1936 – PS1 – A103 Level 03 Plan & Section**
- **C1936 – PS1 – A104 Sections A-A & B-B**
- **C1936 – PS1 – A105 Sections C-C, D-D & E-E**
- **C1936 – PS1 – A106 Isometric View**
- **C1936 – E – PS1 – 001 Electrical Single Line Diagram**
- **C1936 – E – GEN – 002 PS1 & PS4 Network Architecture Diagram**
- **C1936 – E – GEN – 001 Piping & Instrumentation Diagram (P&ID)**
- **C1936 – M – PS1 – 01 M&E Equipment Layout (Sheet 1 of 3)**
- **C1936 – M – PS1 – 01 M&E Equipment Layout (Sheet 2 of 3)**
- **C1936 – M – PS1 – 01 M&E Equipment Layout (Sheet 3 of 3)**

4.3 New Herold's Bay PS 4

4.3.1 Pump Station Design

Due to space constraints at the allocated site of the new pump station number 4, a double-storey standalone structure was designed to house all the equipment. A client's requirement was for all equipment to be housed out of view from the public and for the building to be aesthetically pleasing and blend in with the existing surroundings of Herold's Bay. The pump station will consist of the following areas:

- **Basement**
  - Dry well pump room
- **Ground Floor**
  - Generator room, with separate bulk fuel storage tank room
  - Sump and emergency storage
  - Screenings and grit skip area
- **First Floor**
  - MCC room
  - Inverter and battery room
  - Odour control system area
  - Head of works, consisting of inlet works, screening, de-gritting, and flow measurement.
  - Space allocation for future mechanical screens with associated conveyors and washer compactors.

The raw sewage will drain under gravity to the PS4 site from the higher areas of Herold's Bay along Rooidraai Road, with PS1 pumping the remaining flow from the lower zones of Herold's Bay to PS4.

The pump station will be designed with a dry well end-suction pump configuration. To ensure redundancy, it will operate as a duty standby pump configuration. Emergency storage volume has been incorporated into the building design, with overflow from PS4 going to the larger emergency storage volume at PS1.

The PS4 will be built on a portion of ERF 116 and a portion of Erf 236/0, located along Skimmelkrans Lane, opposite Spekie Gericke Drive. The site is bordered by Skimmelkrans Road to the south, a channelized stream to the east, and a steep retaining wall and Rooidraai Road to the north and west, respectively.

Figure 4-10: Position of erf 116

4.3.2 General Arrangement of Screening & degritting

The general arrangement of the ground floor is provided in **Figure 4-13** Pump Station 4 ground floor and the first floor housing the screening and degritting at PS4 is provided in

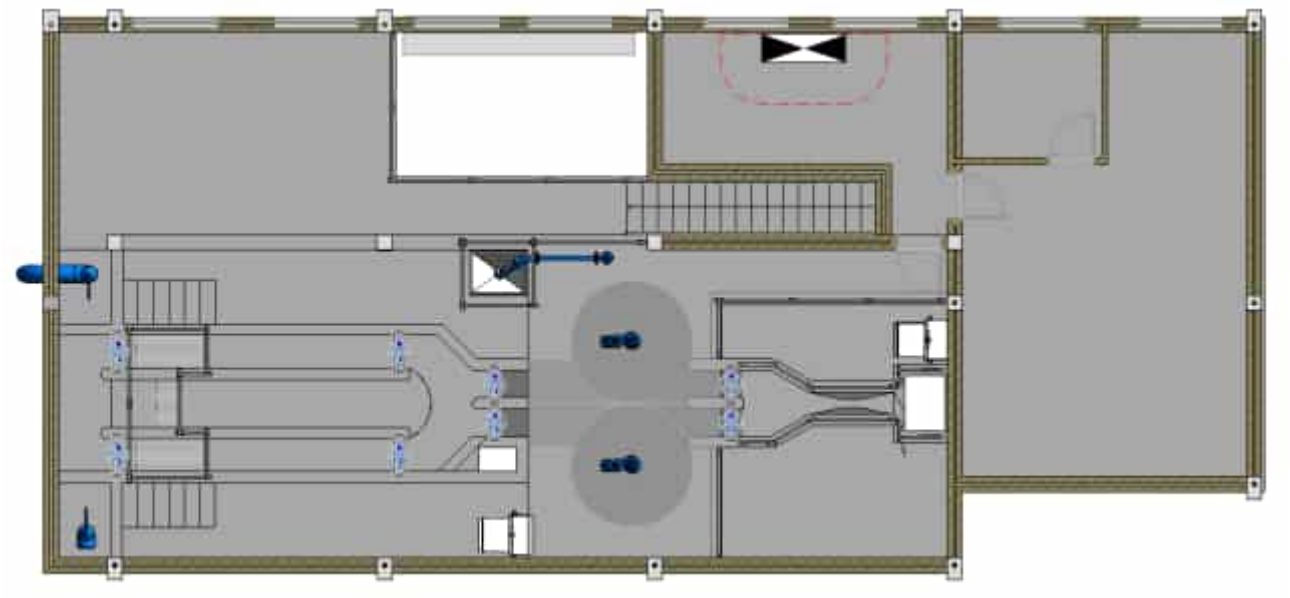


Figure 4-11- Pump Station 4 1st Floor

Figure 4-11- Pump Station 4 1st Floor

- The two incoming flows discharge into a central chamber from where the flow splits into either or both screening channels (green arrow).
- A bypass channel is included between the two main channels at a higher level (yellow arrow). If both screens are blocked or sluice gates are closed, the level in the division chamber rises and will enter the emergency bypass channel between the two main screening channels (yellow arrow). The bypass channel will have a coarse hand-rake screen.
- After exiting the screening and bypass channel(s), the screened sewage will be diverted to one or both vortex degritters (blue arrows). These will also have sluice valves on both sides to isolate them respectively. If both vortex degritters are isolated (not operational), the flow will overtop an emergency overflow weir to the sump via a flume for measurement.
- Lastly, after passing through the vortex degritters, the flow is collected in a common channel and measured by means of a flume before entering the sump (pink arrows).

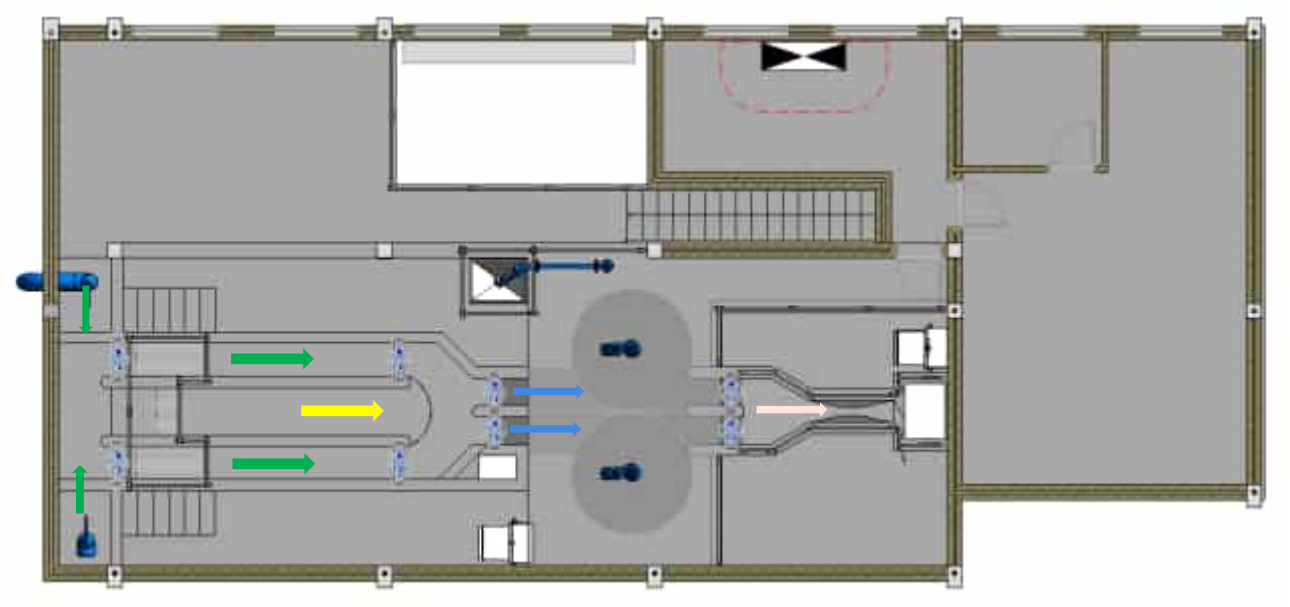


Figure 4-11- Pump Station 4 1st Floor

4.3.3 Screening

As part of the design brief and philosophy discussed above, the facility was designed to include 1 x duty mechanical bar front rake screen and 1 x standby manual hand rake bar screen in the two main channels and 1 x manual hand rake bar screen in the overflow/bypass channel. Spatial allowance was made for the possible upgrading of the one-duty hand rake bar screens in the standby channel to an automated mechanical bar rake screen should it be required in the future. Each duty channel can handle the full design inflow to the pump station.

Under normal operation, the mechanical bar front rake screen will be used to remove floating or suspended debris from the raw sewage prior to the pump station wet well, reducing the risk of pump blockages, associated downtime, and potential damage.

Although a narrower channel width would be hydraulicly preferable, the main channel widths are selected to be 500mm wide to ease maintenance and cleaning of channels, including equipment located therein.

On the evaluation of the final configuration, all supporting equipment for the screens will be provided during the initial installation, and only the screens omitted. It is therefore recommended to install at least one mechanical front rake bar screen for normal operations in the main screenings channel, one manual hand rake bar screen as standby in the second main screenings channel, and one manual hand rake bar screen in the bypass/overflow channel.

(a) **Manual Hand Rake Bar Screens:**

The screens shall be of the flat bar type bar screen. The hand-rake screens in the main channels shall have an aperture of 15mm, with the screen in the by-pass channel having an aperture of 25 mm bar spacing. The angle of the bars shall be 60° to the channel floor and shall have a minimum bar thickness of 10 mm. The screen shall span the entire width of the channels (nominal 500 mm wide for the two main channels, and 860mm wide for the overflow channel).

The screen shall be completely manufactured from 316L-grade Stainless Steel to ensure the longevity of the equipment. A specifically sized hand rake to suit the bar spacing of the screen shall be provided. The screen shall terminate on a perforated concrete platform onto which the debris is raked to drain excess liquid before the debris is transferred to the adjacent screw conveyor by means of a shovel.

(b) Automated Mechanical Bar Front-Rake Screen

Provision has been made for the future installation of mechanical screens in the two main screening channels. This section covers what has been allowed for in the current pump station layout, with the final design and sizing to be confirmed prior to the implementation of the mechanical screening equipment.

The mechanical screens will be of the front rake bar type, shall be sized to handle the full design flow, and shall have a bar spacing/aperture of 15mm. With each screen sized to handle the full design flow, the system can therefore still operate fully while a single screen is taken out of operation for maintenance purposes. Bar-type screens are proposed due to the robust nature of the design.

Although there is sufficient freeboard upstream of the mechanical screen to reduce the screen's width, 500mm is chosen to allow a larger blinding factor.

The screens are positioned in channels on either side of the overflow/bypass channel, allowing sufficient space for operators to move around within the facility as well as sufficient space between the units for day-to-day operational access and maintenance. The height of the screen field of each screen shall be suited to the channel depth, therefore 1000 mm.

The above typical information is not based on the South African environment and therefore, as a minimum, the equipment should be sized to handle at least 2 m^3/h to ensure longevity of equipment. Each screen shall at least have 4 rakes to lower the volume of debris handled per rake.

The mechanical screen frame sizes shall be designed to reach the screw conveyor situated at roughly 0.5 m above the channel and the frame length therefore required is 4 m to deposit the screened material into the conveyors.

General maintenance is required on the mechanical screens and components based on the OEM's requirements, therefore items such as the gearboxes, motors, drive shafts, bearings and chain tensioners must be easily accessible for maintenance and the relevant equipment put in place to remove components when required. The screen's inherent design allows for access to wear or serviceable parts for general maintenance to be completed, without the need to remove the entire screen unit.

The material of construction shall be selected for highly corrosive environments and South African sewage characteristics, therefore as a minimum grade 316L Stainless Steel shall be used on all components.

The debris from the screens is deposited into a screw conveyor, which then transports the debris to the washer-compactor unit where the debris is cleaned from organic matter, dried, and compacted for disposal and removal. Once this wash and dry process is complete, the washer-compactor deposits the debris into a chute, leading to a skip on the ground floor.

(c) Screw Conveyors

A screw conveyor is proposed to transfer screened debris from the screening area to the washer-compactor. Due to the limited space inside the pump station building, only one screw conveyor will be installed to convey screenings, with no standby supplied. The conveyor will be installed under the first phase to convey debris deposited by the operator to the washer compactor, negating the need for an operator to carry debris in a bucket to the skip

The screw conveyor shall be of the centreless screw type, driven by a geared electrical motor. The conveyor shall be sized to handle at least 2 m^3/h to ensure the longevity and robustness of the unit. The resulting minimum screw diameter is 273 mm and driven by a 1.1 kW motor. The complete unit, including the screw, shall be manufactured from 316L-grade Stainless Steel and the trough will have a double-colour UHMWPE liner.

General maintenance is required on the equipment and components based on the OEM's guidelines, therefore items such as the gearboxes, motors, drive shafts and bearings must be easily accessible for maintenance and the relevant equipment put in place to remove components when required. The conveyor's inherent design allows for access to wear or serviceable parts for general maintenance to be completed, without the need to remove the entire unit/s.

(d) **Washer Compactor**

One washer-compactor shall be installed to service the screens (manual or automatic) which is fed by the conveyor.

The washer compactor shall be of the shafted continuous operating type using sprayers to wash organic material from the debris. The unit shall operate with a conveyor, cleaning and compacting debris as it is deposited in the conveyor. A continuous type is proposed to prevent the buildup of rags in the unit around the shaft (before a wash cycle starts) which could cause damage. The wash water shall drain back to the sump by means of pipework. The washed debris will be compacted by a screw to reduce the liquid content and reduce the volume and conveyed through the discharge chute to the waste skip positioned on the ground floor.

The unit shall be sized to handle a minimum of 2 m^3/h debris and the complete unit, including the compacting screw, shall be manufactured from 316L-grade Stainless Steel.

The drainage pipework would be suitably sized DN100 pipework (according to SANS 62) and flanged according to SANS 1123. The pipework shall be manufactured from 316L-grade Stainless Steel and shall be properly supported by means of clamps.

The unit requires a wash water connection for the filling of the wash compartment. The wash water supply requirements are discussed in a later section of the report. The associated supply pipework from an onsite point to the washer compactor will be installed as part of the project.

Chutes are provided to direct the debris from the conveyor outlets to each of the washer compactor inlet hoppers.

General maintenance is required on the equipment and components based on the OEM's requirements, therefore items such as the gearboxes, motors, drive shafts and bearings must be easily accessible for maintenance and the relevant equipment put in place to remove components when required. The washer compactor's inherent design allows for access to wear or serviceable parts for general maintenance to be completed, without the need to remove the entire unit/s.

4.3.4 Degritting

Degritting will be achieved using two vortex degritters. A vortex degritter uses gravity and centrifugal forces to remove the grit from the flow and deposit it into a sump. The structure has a conical shape, with a central sump/hopper. Sewage enters the chamber and is kept at a constant velocity by means of a paddle system rotating in the same direction as the flow. Grit, sand and silt will be collected in the hopper-shaped bottom of the chamber. During the extraction process, high-pressure sparge water will be used to bring the settled particles into suspension to be removed. The grit is removed from the sump using a grit pump and discharged into a grit classifier. The grit classifier separates the moisture and the grit, disposing of the grit in a skip, with the effluent being redirected into the wet well.

(a) **Paddle System**

Sewage entering the chamber will be kept at a constant velocity by means of a paddle system rotating in the same direction as the flow. The paddle drive (geared motor) shall be installed above ground on the platform above the chamber, with access available to the equipment for operation and maintenance.

The paddle system shall be manufactured from 316L-grade Stainless Steel and shall be sized to suit the internal dimensions of the degritting sump. The electrical drive unit shall be positioned on top of the concrete access platform and shall consist of a geared motor. The design of the drive assembly shall allow for a hollow shaft to allow the extraction and sparge water pipework to pass through.

(b) **Grit Extraction**

Due to the location of the vortex degritters and possible frequency of cleaning, a permanently installed grit removal pump system is proposed to extract settled grit from the degritters above manually cleaning the sumps

by means of vacuum tanker trucks. The extracted grit shall be pumped to a grit classifier. A dedicated extraction pump per degritter is proposed.

Self-pumping pumps suited to the pump media are proposed to extract the grit from the hoppers and pump it to the grit classifier. The pump's material of construction would be specific to highly abrasive pump media to suit the specific application and ensure the longevity of the equipment. Due to the redundancy in the system, a standby pump set would not be required. The pump shall be supplied with an acoustic cover to ensure noise created by the pump sets is kept to a minimum.

The pump will be designed for a pump rate of 13 L/s with a provisional maximum pressure head of 6.5 m. The maximum suction lift would be 1.5 m under low flow conditions. The pump would be designed to handle the highly abrasive pump medium and would be specified with a hardened impeller and internal coating on the volute.

The proposed pump is a Gorman Rupp T3 unit operating at a speed of ± 845 rpm, equipped with a 4 pole, 3.0 kW TEFC motor. The pump shall be coupled via a belt and pully system to the motor for the required speed reduction. The pump has a reprime lift height of 2.4m at the required speed and is therefore able to prime even under low flow conditions. The pump shall be equipped with a suitable air-release valve used for priming purposes.

The suction and delivery pipework would be suitably sized at DN150 (pipe sizing according to SANS 62) and flanged according to SANS 1123, rated at 10 bar. The pipework shall be manufactured from 316L-grade Stainless Steel and shall be properly supported by means of pipe supports. The delivery pipe shall be equipped with a suitable flanged, single door swing type non-return valve and isolating RSV gate valve.

(c) Grit Classifier

The extracted grit shall be deposited into a grit classifier to be washed and then dewatered by means of the screw conveyor. Due to the spatial constraints, one grit classifier is proposed, servicing both vortex degritters.

The grit classifier shall be designed to handle a minimum flow of 16 L/s and designed to settle the grit without any agitation. It shall be capable of handling at least 2 ton/h grit with a 97% separation of particles > 0.2 mm in size. The unit shall be constructed from 316L-grade Stainless Steel and the internal centreless screw from carbon steel. The overflow discharge sewage shall be piped to the pump sump by means of a DN200 pipe (pipe sizing according to SANS 62) and flanged according to SANS 1123, rated at 10 bar. The pipework shall be manufactured from 316L-grade Stainless Steel and shall be properly supported by means of pipe supports / clamps.

The washed and dewatered grit shall be deposited into a waste skip on the ground floor of the pump station by means of a discharge chute.

The section through the proposed vortex degritter is shown in **Figure 4-12.**

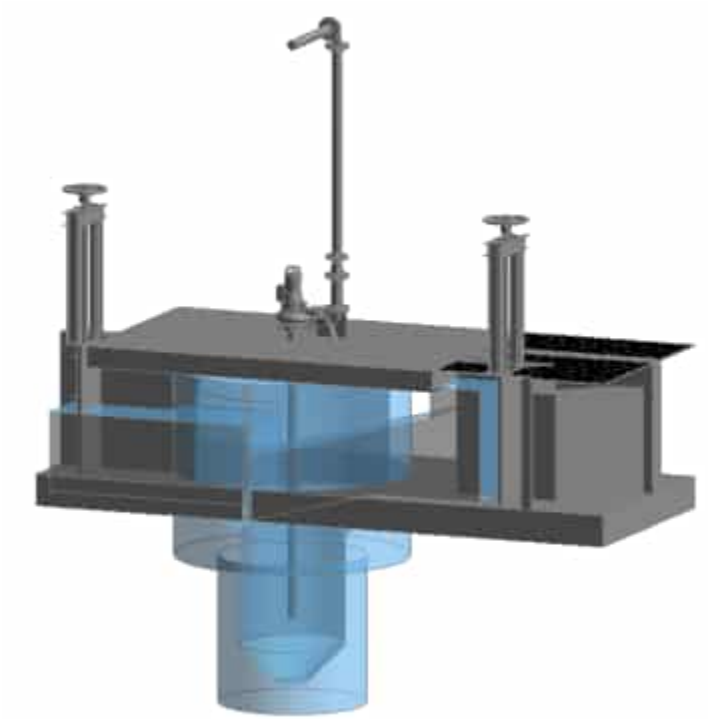


Figure 4-12 Vortex degritter with grit removal pump

4.3.5 Skip Dolly System

A combined skip dolly system is proposed, servicing both the screens' waste, as well as the grit classifiers' waste. The skip will be located on the ground floor of the pump station, with discharge chutes from the 1st floor directing screenings and waste from the washer compactor and grit classifier into the skip.

The dolly system, driven by an electrical motor (manual start intervention by the operator), will consist of one dolly mounted on a set of rails.

The system shall house a single skip and transport the skip out of the pump station building through a roller door on the roadside, where a truck can access the skip to load it.

A minimum skip size of 6 m^3 is recommended to prevent a high turnaround frequency.

As the pump station is located on the main road to the beach as well as accessible to the public, the dolly rails would be recessed into the concrete slab, minimising a tripping hazard outside the pump station, as well as enabling vehicles to pass over it with ease. The dolly rails shall be a standard rail profile of a minimum of 22 kg/m and shall be used to suit the weight of the dolly system. The dolly shall be manufactured from hot dipped galvanised and coated mild steel and driven by an electrical geared motor. It must be noted that dolly rails and channels must be kept clean and dried to prevent premature corrosion and ensure maximum longevity.

4.3.6 Wash Water Requirements

Suitable wash water would be required for the operation of the grit removal and the washer compactor. Treated effluent is not available on site and therefore potable water from the Municipal network would be used for the above operation and general wash-down actions by the operators.

A mobile, high-pressure washing system is recommended so that the area can routinely and easily be cleaned and washed down, of which the run-off is contained and diverted back into the sewage canals. The washer would be connected to the water network and rated for at least 840 L/min at 130 bar.

A suitable connection to the onsite potable water network would be made and distributed to the respective areas where it is required. In Table 4-7: Estimated Water Usage for the Inlet Works below, an estimate is made on the amount of water to be used by the respective processes:

Table 4-7: Estimated Water Usage for the Inlet Works

Process	Flow Required	Estimated Frequency	Estimated Usage Total per Month
Grit Removal	9 m^3/h (2.5 L/s)	3 min at 3-hour intervals	108 m^3
Washer Compactor	4.2 m^3/h (1.2 L/s)	10 min at 2-hour intervals	252 m^3
High-Pressure Washer	0.9 m^3/h (0.25 L/s)	8 hours per week	31 m^3
Estimated Total	**14.1 m^3/h (3.95 L/s)**	**-**	**391 m^3**

Note that the frequency of use is estimated and would depend on the frequency of grit extraction, frequency of the screen cleaning cycles and frequency/duration of operator cleaning operations. It is proposed that the Municipality investigate an alternative water source, such as final effluent, to replace the use of potable water for cleaning purposes.

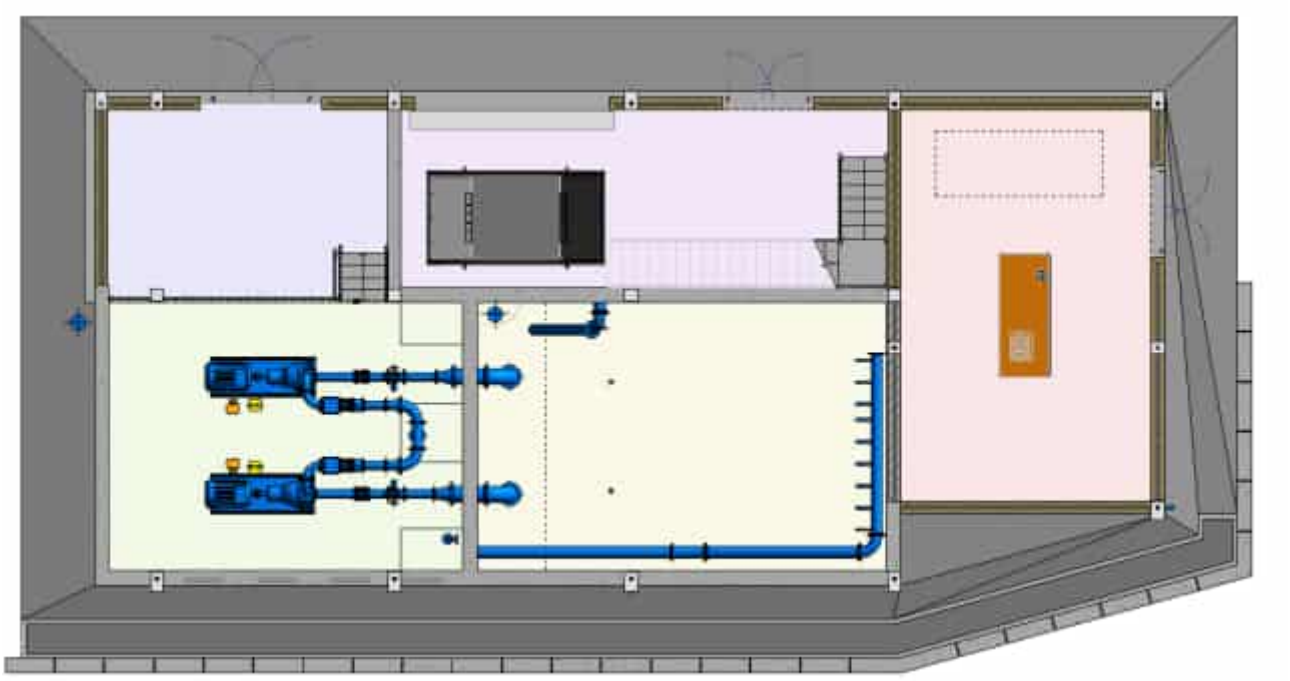


Figure 4-13 Pump Station 4 ground floor

4.3.7 Sump and emergency storage

The sump provided at PS4 will act as both an operational and emergency storage sump. Sizing of the sump resulted in a capacity in the region of 25-30m^3 with an emergency volume of 170m^3. This will provide sufficient storage and suction head for the pumps to operate at their best efficiencies. The sump will be located adjacent to the pump room to reduce suction pipe lengths as well as to ensure minimal secondary losses in the suction pipework. By having the sump adjacent to the pump room rather than below it, the pump suction pipework will be flooded, removing the need for self-priming pumps and making operations and required maintenance easier.

The emergency overflow from the sump will utilise the existing pumping main to drain the overflowing sewage from PS4 to the emergency storage tank at PS1. In the event that the emergency overflow fails, the sewage shall be discharged to the environment.

The pumping main from PS4 to the WWTW will scour back into the Pump Station sump. The combined sump capacities of pump station 1 and 4 is capable of handling the scoured volume of the rising main.

4.3.8 System Characteristics

The design of the pumping system is dependent on the system characteristics and the connections to the existing infrastructure. This pump station will receive all its incoming flow from the existing pump station PS1.

The pipeline will follow the same route as the existing pipeline up to the WWTW and is discussed in 4.5.2. The design of the pumping system is dependent on the system characteristics and the connections to the existing infrastructure. The static head that needs to be overcome is the difference between the sump level and the discharge elevation. The suction and delivery pipelines were sized to meet the current and future demands.

Table 4-8 below summarizes the key system characteristics.

Table 4-8: Pump System Characteristics

Description	Data
Maximum Water Level in Sump	26 masl
Minimum Water Level in Sump	24 masl
Discharge Level	138 masl
Pump Centreline Level	27 masl
Minimum Static Head	112 m
Maximum Static Head	114 m
Pipe Length (PS 4 to WWTW)	1,230 m
Suction Pipe Size and Type	300 mm Ø Steel Grade 316L
Delivery Pipe Size and Type	250 mm Ø Steel Grade 316L
Delivery Pipe Size and Type	200 mm Ø uPVC & Steel Grade 316L
Pump Flow Rate	52 L/s
Pump Head	122 m

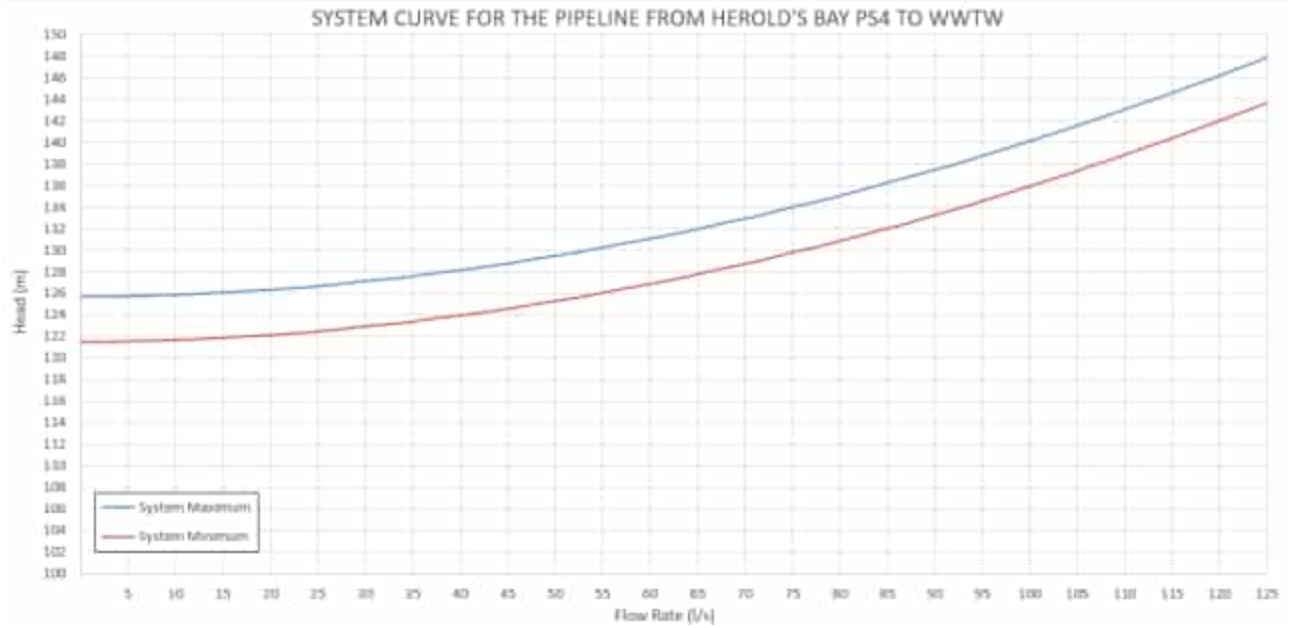


Figure 4-14 Preliminary System Curve for Pipeline between PS4 and WWTW @ 52L/s

4.3.9 Control Philosophy

(a) Inlet Works

The new inlet works equipment would operate on a fully automated basis, through a combination of levels and timers. The aim of the design is that there are two independent screening trains of equipment, with the total flow being managed in either. Both could however run together, but this will be an operator selection only. The conveyor and ancillary components are single units only, due to space constraints inside the pump station.

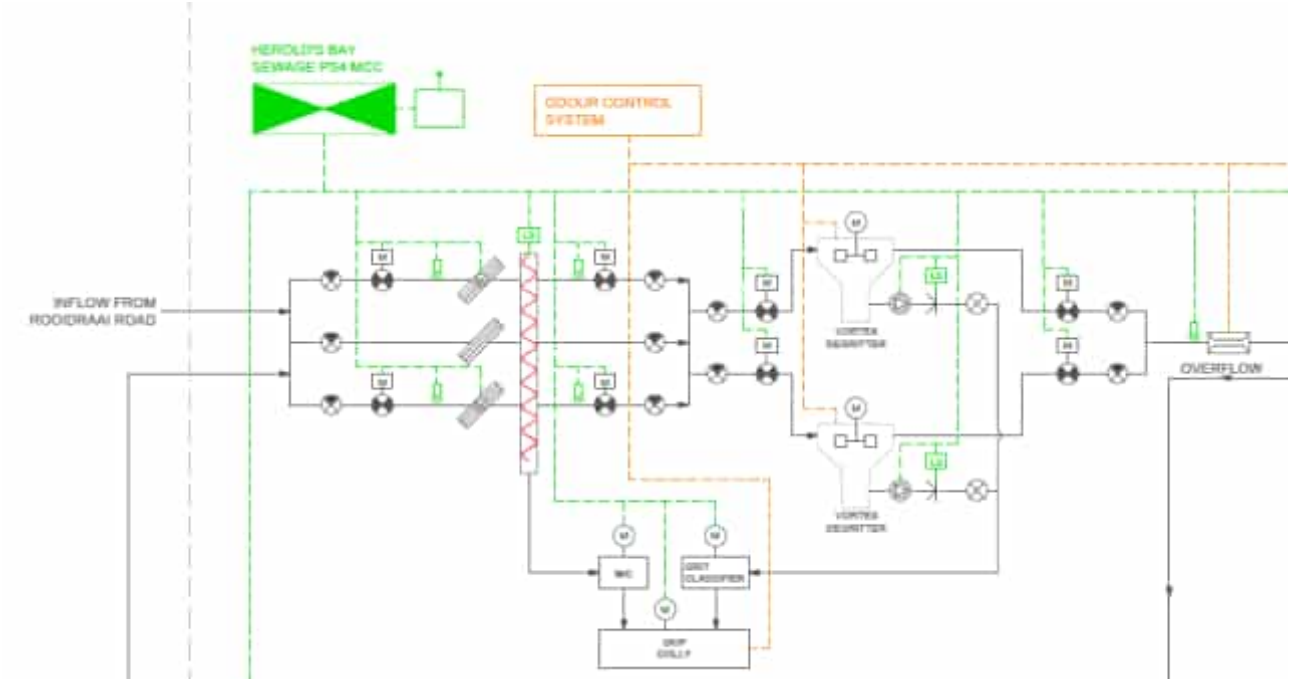


Figure 4-15 Proposed Inlet Works P&ID

Certain components, such as the conveyors and compactors, would be dependent upon upstream equipment (mechanical screens), but would be able to be run individually in manual mode.

All associated timers, level setpoints and duty of trains would be managed and operated from the Main MCC. Its proximity would also help the operators visually assess any control changes made.

(b) Sump

For level control, the new sump will be fitted with ultra-sonic / radar level sensors including backup floats (other acceptable instrumentation) in case the primary level unit fails.

The primary level sensor will control the pumps within the sump via:

- Stop level: switch off duty pump(s);
- Start level: first duty pump

The backup float switches will control the pumps within the sump via:

- Low level: switch off running pumps
- High level: high alarm trigger within sump

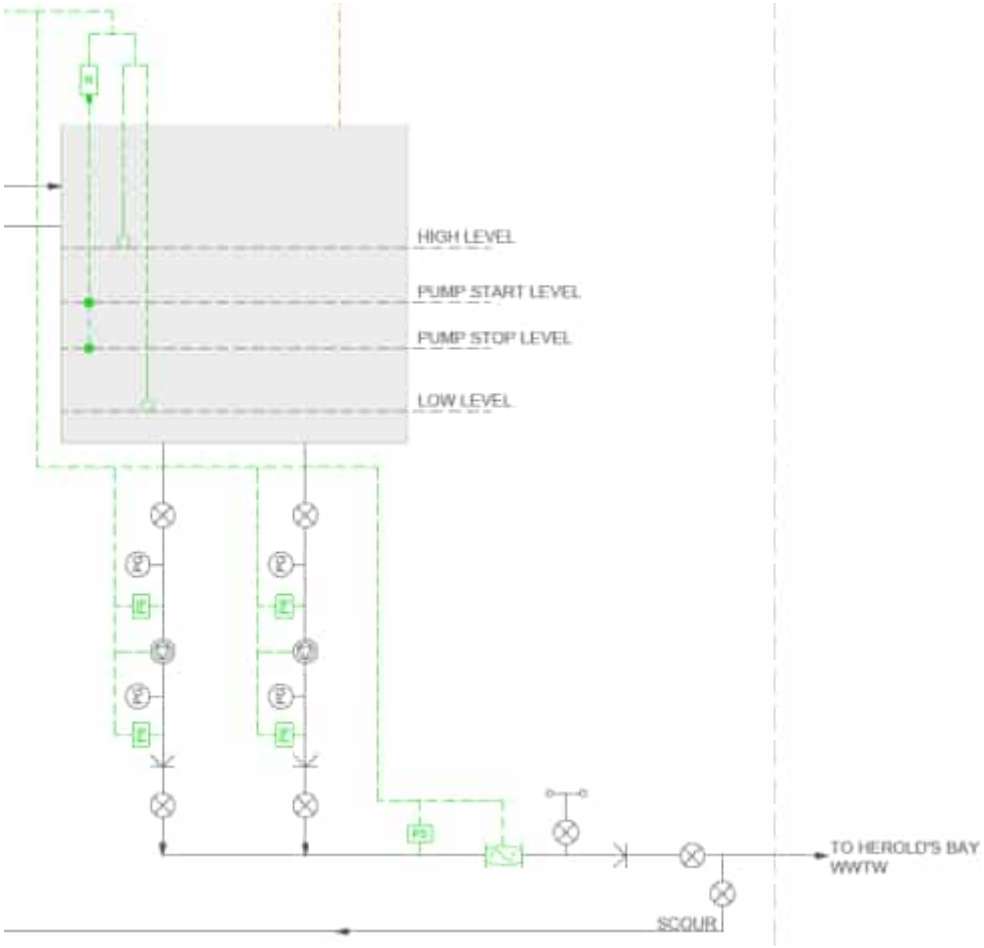


Figure 4-16 Proposed Sump and Pumps P&ID

(c) Pumps controls

VSDs are proposed, to reduce pipeline stresses during starting and stopping, as well as to assist with final generator sizing. Due to the static head and flow velocities required in the delivery pipeline, relatively high flow rates are required and as such level PID control will not be possible at this site.

Given the proposed 1 x duty and 1 x standby configuration, the pumps will be rotated to try and even out wear and tear and maintenance can be properly planned and carried out (avoidance of one pump accumulating hours and the others remaining being nonoperational). The duty rotation will be based on pumping cycles, ie after each pump cycle between a start and stop, the next available pump will become duty.

4.3.10 Electronic Flow Metering

Flow will be measured at three distinct points within the pump station.

First, the inflow will be measured by means of a level sensor, where the flow will pass through a Parshall flume before entering the sump beneath the screening facility.

Secondly, the pumped flow will be measured by means of an electromagnetic flow meter on the common delivery line, located within the pump room.

Lastly, flow detection (not measurement) will be provided at the overflow point to PS1. Due to the gravity nature of the pipeline, a goose-neck type pipework configuration will need to be provided, which could provide maintenance difficulties if this line 'stands' for a significant period of time.

4.3.11 Pumps

The sizing of the pumps and the operational number thereof considers the design flow of the pump station as well as the emptying of the sump and emergency storage volumes in extreme events within an acceptable timeframe.

Due to the high static head at the pump station, the suitable solids-handling sewage pumps available in the market that meet the required duty point have a relatively high flow rate of 52 L/s and above.

From this, the design was based on one (1) duty pump operating at a reduced speed to achieve the ultimate design flow under normal operating circumstances, and operating at a higher speed to achieve the extreme event flow rates required to empty the emergency storage volume. Provision of one (1) standby pump set is allowed (1x duty and 1x standby).

Gorman Rupp and Cornel are two manufacturers that are able to meet the duty point required at the pump station. The Cornell range of solids handling pumps is presented in this report over the Gorman Rupp pumps because of the less intricate design (a single-stage pump vs a 3-stage pump that requires an additional drive shaft and pulley system). Note that these are only provisional selections and final pump selections will be based on the appointed contractor's design during the construction phase.

Variable speed drives are installed to operate the pumps to allow the pumps' speed to be adjusted to the required flow range and assist with the start-up demand of the pumps on the generator.

The levels in the wet well are set such that the effective pumping volume is sufficient to ensure the pumps do not operate more than six (6) cycles per hour and allow enough volume for pumps to speed up to meet their operational set point prior to reaching any other level set points in the sump such as the next start level or high level.

To ensure the rising main self-cleaning velocity of ±0.7 m/s is achieved, a minimum pump rate of 60 L/s is required, and the design will be specified accordingly.

(a) Pump Selection and Curves:

From the Cornell Pumps range of solids handling pumps, the 4NHTB range (single-stage pump) can handle the current, future and extreme events demands. Based on this pump selection 185kW motors would be required to handle the power demands of the associated pumping requirements. PT100 temperature sensors shall be included for the motor windings to monitor winding temperatures.

The Cornell Pumps 4NHTB operating at 1,970 RPM and 2,000 RPM, coupled to 185 kW, 4-pole TEFC motors operating on a 1x duty and 1x standby configuration would be needed to meet the pumping requirements of the two operating scenarios. The pumps would operate with ±60% pump efficiency.

Table 4-9: Duty points PS 4

Duty Point	Description	Data
1	1 x Duty Pumping Flow Rate	60 L/s
	1 x Duty Pumping Head	131.0 m
	1 x Duty Operating Speed	1970 RPM
2	1 x Duty Pumping Flow Rate	70 L/s
	1 x Duty Pumping Head	133.0 m
	1 x Duty Operating Speed	2000 RPM

Pump Data Sheet – Cornell

Company: MNE GAH
Name:
Date: 10/3/2024

Powered By PUMP-FLO

Pump:
Size: 4NHTB
Type: Encl Solids Handling
Synch speed: Adjustable
Speed: 1970 rpm
Dia: 445 mm
Curve: 4NHTBVA
Impeller:
Specific Speeds:
ns: 19
S: —
Dimensions:
Suction: 125 mm
Discharge: 100 mm

Pump Limits:
Temperature: 121 °C
Pressure: 1207 kPa g
Sphere size: 76.2 mm
Power: —
Eye area: —

Search Criteria:
Flow: 60 l/s
Head: 131 m

Fluid:
Water
Density: 998.3 kg/m³
Viscosity: 0.9946 cP
NPSHa: —
Temperature: 20 °C
Vapor pressure: 2.339 kPa a
Atm pressure: 101.4 kPa a

Motor:
Standard: —
Enclosure: —
Speed: —
Frame: —
Sizing criteria: Max Power on Design Curve

Pump Selection Warnings:
Pump shutoff dP exceeds limit for the pump

— Data Point —

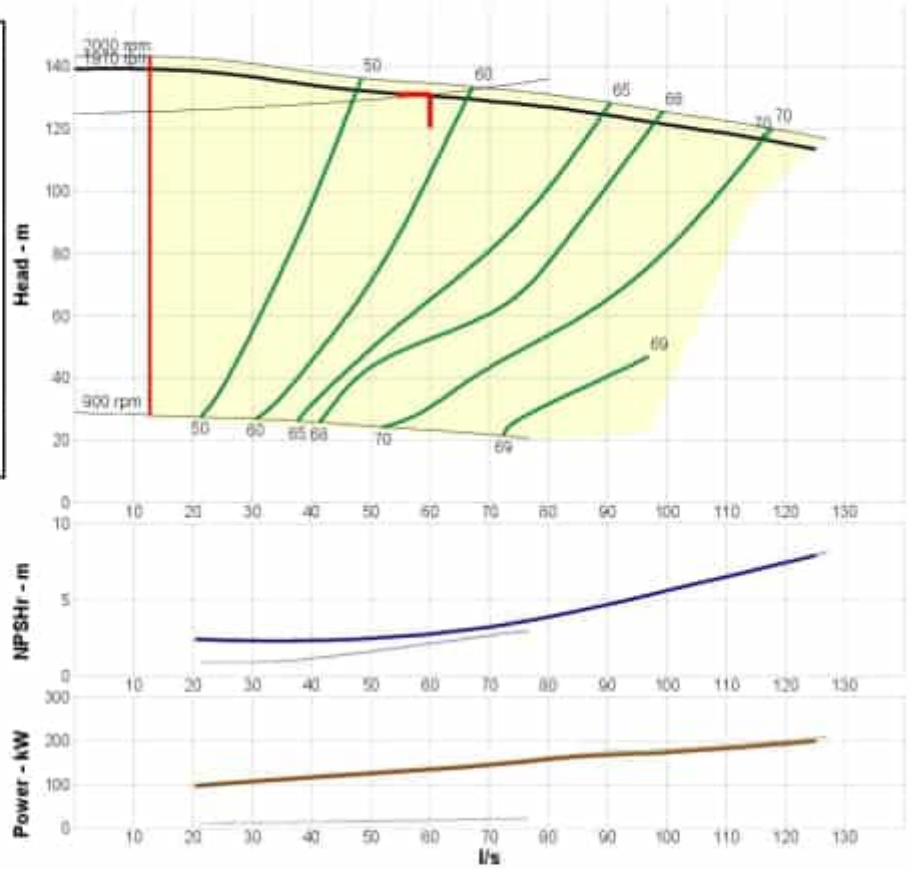
Flow	60 l/s
Head	131 m
Eff	57%
Power	134 kW
NPSHr	2.84 m

— Design Curve —

Shutoff head	139 m
Shutoff dP	1363 kPa
Min flow	12.6 l/s
BEP	70% @ 116 l/s
NOL power	200 kW @ 125 l/s

– Max Curve –

Max power: 208 kW @ 127 l/s



Performance Evaluation:

Flow l/s	Speed rpm	Head m	Efficiency %	Power kW	NPSHr m
72	1970	126	61	147	3.45
60	1970	131	57	134	2.84
48	1970	133	50	124	2.45
36	1970	135	41	112	2.44
24	1970	138	31	101	2.44

Cornell Pump Selection 10.6.2.0

Selected from catalog: Cornell 50 Vers: 3.12.3

Figure 4-17: Normal Operation (Duty Point 1): The duty point is achieved with a 1x duty pump operating at a reduced speed of 1970 RPM, at a pump efficiency of ±57%.

Pump Data Sheet – Cornell

Company: MNE GAI
Name:
Date: 10/3/2024

Powered By PUMP-FLO

Pump:
Size: 4NHTB
Type: End Solids Handling
Synch speed: Adjustable
Curve: 4NHTBVA
Specific Speeds:
Dimensions:
Speed: 2000 rpm
Dia: 445 mm
Impeller:
ns: 19
S: —
Suction: 125 mm
Discharge: 100 mm

Pump Limits:
Temperature: 121 °C
Pressure: 1207 kPa g
Sphere size: 76.2 mm
Power: —
Eye area: —

Search Criteria:
Flow: 69 l/s
Head: 133 m

Fluid:
Water
Density: 998.3 kg/m³
Viscosity: 0.9946 cP
NPSHa: —
Temperature: 20 °C
Vapor pressure: 2.339 kPa a
Atm pressure: 101.4 kPa a

Motor:
Standard: —
Enclosure: —
Speed: —
Frame: —
Sizing criteria: Max Power on Design Curve

Pump Selection Warnings:
Pump shutoff dP exceeds limit for the pump

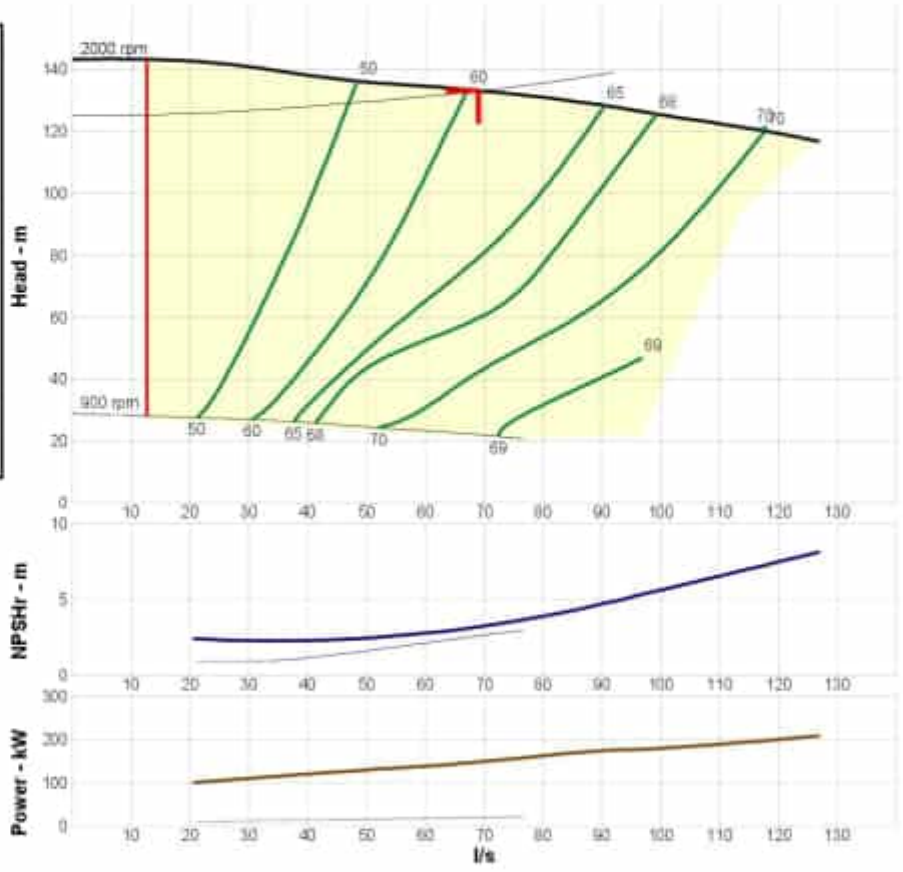
— Data Point —

Flow:	70 l/s
Head:	133 m
Eff:	61%
Power:	150 kW
NPSHr:	3.31 m

— Design Curve —

Shutoff head:	143 m
Shutoff dP:	1403 kPa
Min flow:	12.6 l/s
BEP:	70% @ 118 l/s
NOL power:	209 kW @ 127 l/s

— Max Curve —
Max power:
209 kW @ 127 l/s



Performance Evaluation:

Flow l/s	Speed rpm	Head m	Efficiency %	Power kW	NPSHr m
62.8	2000	138	63	165	4.22
69	2000	133	60	149	3.24
55.2	2000	135	54	135	2.68
41.4	2000	138	45	122	2.44
27.8	2000	141	34	108	2.44

Cornell Pump Selection 10.6.2.0 — Selected from catalog: Cornell 50 Vers: 3.12.3

Figure 4-18: Extreme Events (Duty Point 2): The duty point is achieved with 1x pumps operating in parallel at 2000 RPM, at a pump efficiency of ±60%.

4.3.12 Pipework and Specials

The selection of pipe sizes in the pumping station is done to ensure the pump station is effectively and efficiently able to convey sewage throughout the required flow ranges, with minimum self-cleansing velocities taken into consideration.

Incoming sewage into the wet well has been screened and the remaining larger solids settled out in the vortex degritter, thus only organic material is expected in the wet well. The minimum recommended suction pipe velocity for sewage with organic matter is 0.6 m/s, with the maximum being 1.5 m/s. The maximum recommended velocity in the inlet bell of the suction pipework is 1 m/s.

The minimum and maximum flow velocities in sewage discharge pipework are 0.8 m/s and 2.5 m/s respectively. The minimum flow velocity is to ensure a self-cleansing flow is achieved, with the maximum flow velocity being to reduce friction losses in the pipework as well as reduce the destructive action to the installed equipment due to the abrasive content of the sewage.

The pipework shall be flanged and manufactured from grade 316L Stainless Steel due to the corrosive environment of a sewage pump station. The suction pipework shall be rated at PN10, and the delivery pipework shall be rated at PN25.

All pipework shall include pipe supports to handle all forces generated by the pumping system. All tees and bend would be strengthened to handle maximum pressures in the system.

(a) Pipework Layout:

Each pump shall have a dedicated suction pipework from the sump and delivery pipework connecting to a common manifold before connecting to the rising main outside of the pump station building.

A rising main scour valve and pipework shall be included downstream of the bulk isolation and non-return valve, discharging into the pump station overflow pipework leading to Herold's Bay Sewage Pump Station 1. By discharging into the overflow pipework, the entire rising main can be drained.

The below table outlines the pipe sizes inside the pump station and their associated flow velocities.

Table 4-10: Pipework information PS4

Pipework Information			
Description	**Pipework Nominal Diameter**	**Velocity @ Duty Point 1**	**Velocity @ Duty Point 2**
Pump Suction	300 mm	0.9 m/s	1.0 m/s
Pump Delivery	250 mm	1.2 m/s	1.4 m/s
Delivery Manifold	250 mm	1.2 m/s	1.4 m/s

4.3.13 Valves

Isolation valves will be installed on each pump suction pipework.

A set of non-return and isolation valves (in this order) will be installed on the delivery pipework of each pump line as well as the delivery common manifold located outside the pump station building in a valve chamber.

An isolation valve will be installed on the scour pipeline.

A flanged, double-action air release valve designed to handle sewage will be installed on the common delivery manifold downstream of the bulk non-return and isolation valve. The air release valve will be installed with an isolation valve for maintenance purposes. The air release valve shall have a drainage pipe connected, leading to the drainage/seepage sump.

Isolation valves shall be of flanged, cast iron, resilient seated gate valves with non-rising spindles equipped with hand wheels. The non-return valves shall be the flanged, single-door, swing-type valves equipped with a lever and

counterweight. The non-return valves shall include required bracing to handle all static and dynamic forces generated by the system.

All equipment shall be rated to the maximum operating pressure of the installed pumps and/or the maximum system pressure.

The pressure rating shall be PN10 and PN25 for the suction and delivery equipment respectively.

4.3.14 Odour Control System

Due to the relativity of the pump station to residential property, an odour control system shall be installed to treat the odorous gasses / substances present at the pump station.

Odour control specialists were approached to assist with the selection of the odour control technology suitable for the pump station and the associated footprint thereof.

Due to the limited available space, and the lower amount of maintenance required, a dry scrubbing system shall be installed. Foul air shall be extracted via ducting by an exhaust fan from the sump and passed over / through a series of reactant / adsorbent media beds housed in vessels in the pump station building, after which being discharged outside. Two exhaust fans shall be supplied to operate as a duty / standby configuration.

All ducting shall be of uPVC Class 12 and shall be sized to suit the required flow rates.

The media beds are designed to remove targeted pollutants / odourants from the extracted air. The multi-layered media beds oxidise odorous compounds present in gases to non-odorous and environmentally friendly byproducts. The system does not require any chemical dosing or water supply.

The areas being treated include the sump, inlet channels, and the skip. The system is designed to treat the volume of air displaced in the sump during peak wet weather inflow to the pump station including the extreme inflow for emptying the sumps. With a safety factor included, the designed flow rate of the system is 600 m^3/h.

The volume of media required is based on the concentration of foul air of the air being treated and the service design life of the media. Without an H_2S study, the service life of the media bed cannot be accurately estimated. With safe assumptions made, the system has been designed for a media lifespan of 3 years. The variance between the foul air concentration assumptions to the actual foul air concentration will influence the media lifespan, and not affect the effectivity of the odour control system.

Spatial allowance has been made for a 2m diameter and 2.2m high vessels, ducting, and exhaust fans. Shorter vessels were chosen for the future replacement of the media beds.

4.3.15 Lifting Equipment

Provision is made for the overhead travelling crane on the 1st floor (head of works) inside of the pump station with a minimum rating of 1 tonne safe working load (SWL). The layout of the pump room is such that all equipment can be reached by the crane to ease installation and maintenance. The crane rails will extend the entire area of the head of works to ensure all equipment can be maintained / serviced / installed / replaced. Equipment can be lowered via an opening in the floor to the ground floor at the skip holding area for removal from the building. The crane's design and corrosion protection shall take into account the highly corrosive environment, height, and available lifting height consider the installation of future mechanical screens.

4.3.16 Ancillary Mechanical Equipment

(a) Pressure Gauges:

Each pump set will be equipped with a pressure gauge on the delivery pipework. These gauges shall be rated for sewage applications with a measurable range as per the below list

- Main Sewage Pumps Suction: of 0-25 bar (0 – 2,500 kPa)
- Main Sewage Pumps Delivery: of -0-25 bar (0 – 2,500 kPa)
- Grit Removal Pumps: of 0-10 bar (0 – 1,000 kPa)

(b) Seepage Pump:

A seepage/drainage pump will be installed in the pump room, 1st floor, and skip holding areas located in their respective collection sumps. The pumps will include isolation and non-return valves, and discharge in the pump station sump. The pump will operate by level and shall have an integrated float switch.

(c) Forced Air Ventilation:

Ventilation to the sump is sized based on 20 air volume changes per hour of the volume of air in the specific area. Based on the layout of the wet well, fresh air would be supplied to the single sump volume. The blower will be installed in the pump station building, with ducting conveying fresh air from outside the building to the sump.

Based on the volume, the blower and ducting would be sized for at least 2.5 m^3/s.

uPVC ducting would be used for the highly corrosive environment.

The blower will be manually operated when access to the sump is required.

(d) Extractor Fans:

The building's ventilation is based on 6 air volume changes per hour of the volume of air in the specific area. The extractor will be installed in the pump station building, with ducting leading out of the building.

Two sets of extractor fans would be required, one for the pump room, and one for the screening facility.

Based on the volume, the extractor and ducting would be sized for at least 1.0 m^3/s and 2.0 m^3/s for the pump room and screening area respectively.

uPVC ducting would be used for the highly corrosive environment.

The fans will be automatically operated based on a timer, and temperature sensor/controller in the pump station building.

(e) Hand Stops:

Hand stops would be provided for the inlet structure to isolate each section of the screening and grit removal structures for maintenance and cleaning purposes. The hand stops will be located upstream and downstream of the two penstocks in two main screening channels and the two vortex degritters. In total, eight (8) hand stops would be required.

The hand stops would be manufactured from hot-dipped galvanised mild steel due to the expected low frequency of use. It is suggested that the plate stops would be stored in the pump station for safekeeping.

4.3.17 Building Infrastructure

The building structure design will be based on best practices, taking into consideration the available space at the location and the system requirements. The building size will be based on the size of the infrastructure needed to be housed within it; this includes the screens, degritting channels, sump, and pumps for the ultimate design capacity, along with the electrical equipment such as generators, transformers, and MCC panels chosen for the final approved design. The site is extremely small and the layout configuration and building options are limited. The entire work will be housed within the structure with an odour control facility. The layout of the building must allow sufficient space for operations and maintenance.

The exterior façade of the Pump Station needs special architectural consideration to minimize its visual impact. An architect has been engaged to design a facade that softens the appearance of the structure, reducing its aesthetic impact. However, this redesign will not change the internal layout or functionality of the pump station. This is further discussed in **section 4.6** of this report.

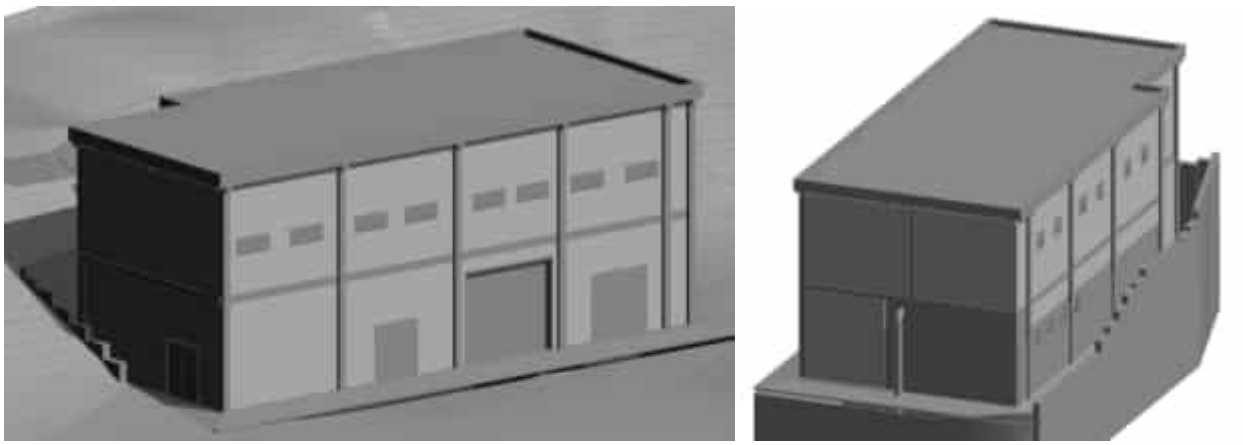


Figure 4-19 Overall functional building structure of PS4

4.3.18 Pipe Bridge

A 200mm diameter uPVC class 34 gravity sewer line draining sewerage from the higher areas of Herold's Bay along Rooidraai Road must be connected to the inlet works on the first floor of the new pump station. **Figure 4-20** below is information the municipality provided regarding the connection point next to Rooidraai Road.

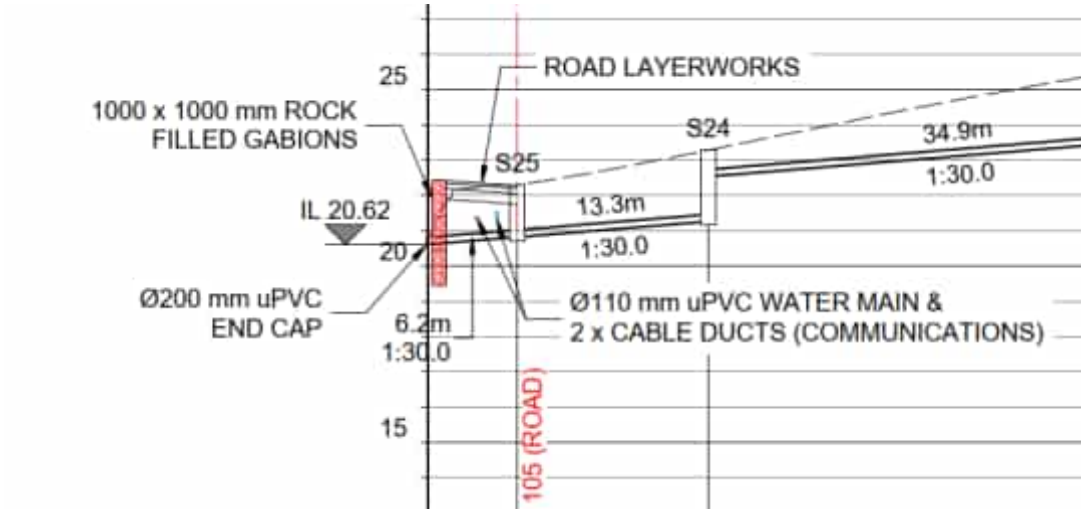


Figure 4-20: Road connection detail

Due to the elevation difference between Rooidraai Road and ERF 116, a pipe bridge spanning 25m will be required to support the pipeline.

This bridge will consist of a 2m deep, 1.5m wide galvanised lattice steel structure supported on reinforced concrete foundations and plinths as support.

Figure 4-21: Pipe Bridge location

As part of the Pump Station construction contract, the connection of the new pipeline along Rooidraai road to the pumpstation, and the change over of the existing reticulation to the Rooidraai road outfall sewer will be required.

4.3.19 Structure

(a) Reference Documents

Standards, specifications, and design aids used to perform the structural design:

Table 4-11: Reference documents

#	Reference	Title
1	SAISC (2012)	The Green Book. Structural Steel Connections. Southern African Institute of Steel Construction. 1st Ed. 2012
2	SAISC (2005)	The Red Book. Southern African Steel Construction Handbook. Southern African Institute of Steel Construction. 5th Ed. 2005
3	SANS 10100-1: 2000	Code of Practice. The structural use of concrete. Part 1: Design
4	SANS 10100-2: 2014 (Edition 3)	Code of Practice. The structural use of concrete. Part 2: Materials and execution of work
5	SANS 10144: 2012	Detailing of steel reinforcement for concrete

#	Reference	Title
6	SANS 10145: 2018 (Edition 2)	Concrete masonry construction
7	SANS 10160-1: 2019 (Edition 1.3)	Basis of structural design and actions for structures and industrial structures. Part 1: Basis of structural design
8	SANS 10160-2: 2011 (Edition 1.1)	Basis of structural design and actions for structures and industrial structures. Part 2: Self weight and imposed loads
9	SANS 10160-3: 2019 (Edition 2.1)	Basis of structural design and actions for structures and industrial structures. Part 3: Wind actions
10	SANS 10160-4: 2017 (Edition 2)	Basis of structural design and actions for structures and industrial structures. Part 4: Seismic actions and general requirements for structures
11	SANS 10160-5: 2011 (Edition 1.1)	Basis of structural design and actions for structures and industrial structures. Part 5: Basis for geotechnical design and actions
12	SANS 10160-6: 2011 (Edition 1.1)	Basis of structural design and actions for structures and industrial structures. Part 6: Actions induced by cranes and machinery
13	SANS 10160-7: 2011 (Edition 1.1)	Basis of structural design and actions for structures and industrial structures. Part 7: Thermal actions
14	SANS 10160-8: 2011 (Edition 1.1)	Basis of structural design and actions for structures and industrial structures. Part 8: Actions during execution
15	SANS 10161: 1980	The design of foundations for structures
16	SANS 10162-1: 2011 (Edition 2.1)	The structural use of steel. Part 1: Limit-states design of hot-rolled steelwork
17	SANS 10162-2: 2011 (Edition 2)	The structural use of steel. Part 2: Cold-formed steel structures
19	SANS 10164-1: 2000-12-13	The structural use of masonry. Part 1: Unreinforced masonry walling

(b) Design Software

The following software was used in the process of the design:

- PROKON version 5.1

(c) Design working Life

As stipulated in SANS 10160-1, Section 4.6, the standard requires that structures should be designed for a minimum working life of 50 years. This working life specification ensures that structures provide adequate performance, durability, and safety over a long period, taking into account environmental exposure, loading conditions, and intended usage.

(d) Design Considerations

The following aspects were considered during the detailed design:

- **Geotechnical Considerations**
    - The Geotech report specifically investigated deep founding levels, therefore, for shallow foundations a bearing capacity of 150 kPa were assumed. This will have to be confirmed by an updated Geotech report.
    - It is recommended that a slope stability investigation be done on the embankment to the north of the site.
    - It is further recommended, due to the depth of the excavations, that the Geotechnical Engineers conduct regular site inspections throughout the project's execution.
- **Architectural Aesthetics**
    - To align with the aesthetics of the surrounding area, the exterior of the pump station will incorporate facades that enhance the building's visual appeal. The primary structural design will account for and support these facades, ensuring seamless integration without compromising functionality or structural integrity
- **Structural Integrity**
    - Foundations: The superstructure foundation along with the floors and walls will be integrated in such a manner as to form a monolithic structure.
    - Retaining walls: To be a combination of Loffelstein blocks, reinforced concrete walls or other suitable applications, depending on the positioning and placement of such walls.
    - The roof will be designed as a flat reinforced concrete slab, complete with the capacity to handle the loads of an overhead crane.
    - The Pump Station superstructure will consist of a combination of concrete walls and floors as well as concrete frame and brick infill panels. Typically, the walls located below ground level will be concrete walls and, in combination with a series of columns will be supporting the suspended floors and brick infill walls above
    - The structural members of the building were designed to resist dead loads, live loads, and wind loads, as well as dynamic forces imposed by the overhead crane, pumps, and other equipment. The design also accommodates minor seismic loading to ensure overall structural stability and resilience.
- **Mechanical Requirements**
    - To support the overhead crane on the concrete columns, corbels were integrated into the design. The crane's specifications, including its Safe Working Load, spatial constraints, and required lifting heights, were carefully considered. Additionally, the design of the first-floor slab accounted for the connection of the crawl beam to its soffit.
- **Constructability**
    - Given the proximity of the Rooidraai Road embankment to the site, temporary stabilization measures will be required during construction to ensure the safety and integrity of the embankment.

(e) General Notes

- All basement walls and slabs on the ground to be cast with Penetron admixture or similar approved,
- All concrete roofs to be cast with Penetron admixture or similar approved,
- All joints in basement walls, slabs on ground and between basement walls and slabs to be cast with an expansive seal such as Penebar or similar approved inside the joint.

(f) Structural Materials

The structural members were designed with the following material properties:

(i) Concrete

Concrete elements were specified to achieve the following minimum 28-day compressive strengths:

- Blinding concrete: 15 MPa
- Water-retaining structures: 30 MPa, watertight, designed according to BS 8007
- All other concrete: 30 MPa

(ii) Structural Steel

- Structural steel: Grade 355JR
- Plate work steel: Grade 300W
- Cold-formed steel: Commercial grade

All steelwork located within the inside of liquid retaining structures is specified as 316L stainless steel to limit corrosion damage to the steelwork.

(iii) Reinforcing Steel

Reinforcement for concrete elements was detailed with the following rebar sizes, in compliance with SABS 920:

- Mild Steel (Tensile yield strength = 250 MPa): R8, R10, R12
- High Yield Steel (Tensile Yield Strength = 450 MPa): Y10, Y12, Y16, Y20, Y25, Y32

For corrosion protection of reinforcement, liquid retaining structures are specified to have a minimum concrete cover of 75mm.

(g) Durability

The durability of the concrete structures is achieved by specifying the appropriate concrete mix-design and concrete cover to the various members.

(i) Concrete Cover

The characteristic minimum cover to reinforcement for normal-density and low-density concrete without taking fire stability into account (SANS 10100-2:2014) is shown below.

Table 4-12: Concrete cover to outermost reinforcement from Table 3 of SANS 10100-2:2014

1	2	3	4	5	6	7
Condition of exposure	Description of member/surface to which the cover applies	Class of concrete				
		20	25	30	40	50
		Characteristic minimum cover mm				
Moderate	1.1 Surfaces protected by the superstructure, such as the sides of beams and the undersides of slabs and other surfaces not likely to be moistened by condensation 1.2 Surfaces protected by a waterproof cover or permanent formwork not likely to be subjected to weathering or corrosion 1.3 Enclosed surfaces 1.4 Structures or members that are permanently submerged in water	50	45	40	30	25
Severe	2.1 All exposed surfaces 2.2 Surfaces on which condensation takes place 2.3 Surfaces in contact with soil 2.4 Surfaces permanently under running water	NA	50	45	40	35
	2.5 Cast in-situ piles: i) Wet cast against casing ii) Wet cast against soil iii) Dry cast against soil	 50 75 75	 50 75 75	 50 75 75	 50 75 75	 50 75 75
Very severe	3.1 All exposed surfaces of structures within 30 km from the sea 3.2 Surfaces in rivers polluted by industries 3.3 Cast in situ piles, wet cast against casings	NA NA NA	NA NA NA	NA NA NA	60 60 80	50 50 80
Extreme	4.1 Surfaces in contact with sea water or industrially polluted water 4.2 Surfaces in contact with marshy conditions	NA	NA	NA	65	65

(ii) Fire Stability

Based on Table 5 in SANS 10400-T:2011, the building was classified as D3, corresponding to a low-risk industrial occupancy category. For the double-storey structure, this classification required that structural elements provide a minimum fire resistance rating of 30 minutes. However, for the basement, the structural elements were required to provide a 120-minute fire resistance rating.

- **Beams & Columns**

The following table below presented the minimum cover requirements based on these fire resistance ratings for beams and columns (SANS 10100-1:2000).

Table 4-13: Fire resistance of reinforced concrete beams (Table 43 from SANS 10100-1:2011)

1	2	3	4	5	6	7
Description	**Minimum dimension of concrete** mm **Fire resistance** h					
	4	**3**	**2**	**1,5**	**1**	**0,5**
a) Siliceous aggregate concrete:						
1) average concrete cover to main reinforcement	*[1]65	*[1]55	*[1]45	35	25	15
2) beam width	280	240	180	140	110	80
b) As in (a) with cement or gypsum, 15 mm thick, with light mesh reinforcement:						
1) average concrete cover to main reinforcement	*[1]50	40	30	20	15	15
2) beam width	250	210	150	110	85	70
c) As in (a) with vermiculite/gypsum plaster**[1] or sprayed asbestos, 15 mm thick, on light mesh reinforcement securely fixed to the beam:						
1) average concrete cover to main reinforcement	*[1]25	15	15	15	15	15
2) beam width	170	145	115	85	60	60
d) Low density aggregate concrete:						
1) average concrete cover to main reinforcement	50	45	35	30	20	15
2) beam width	250	200	160	130	100	80
*[1]Supplementary reinforcement may be necessary to hold the concrete cover in position (see 7.2.6). **[1]Vermiculite/gypsum plaster should have a mix ratio in the range 1,5:1 to 2:1 by volume.						

Based on the above table, elements above the ground level should have a minimum average concrete cover to the main reinforcement of 15mm. For the basement, the minimum average cover to the main reinforcement should be 30mm

- **Slabs**

The following table presented the minimum cover requirements based on these fire resistance ratings for slabs (SANS 10100-1:2000).

Table 4-14: Fire resistance of reinforced concrete floors (Table 45, SANS 10100-1:2011)

1		2	3	4	5	6	7
Floor construction		**Minimum dimension of concrete** mm **Fire resistance** h					
		4	**3**	**2**	**1,5**	**1**	**0,5**
a) Solid slab	Average cover to reinforcement Depth, overall*[1]	25 150	25 150	20 125	20 125	15 100	15 100
b) Cored slabs in which the cores are circular or are higher than they are wide. Not less than 50 % of the gross cross-section of the floor should be solid material	Average cover to reinforcement Thickness under cores Depth, overall*[1]	25 50 190	25 40 175	20 40 160	20 30 140	15 25 110	15 20 100
c) Hollow box sections having one or more longitudinal cavities, which are wider than they are high	Average cover to reinforcement Thickness of bottom flange Depth, overall*[1]	25 50 230	25 40 205	20 40 180	20 30 155	15 25 130	15 20 105

Based on the above table, the minimum average cover to reinforcement would be 15mm for slabs above the ground level. For the basement, the minimum average cover to the main reinforcement should be 20mm.

- **Walls**

As stated in SANS 10100-1:2000 clause 7.6.1, the concrete cover to the reinforcement should be a minimum of 15mm for walls above the ground level. For walls in the basement, the minimum concrete cover reinforcement would be 25mm.

(h) Minimum Cover for Structural Elements

With the use of the tables mentioned in section 2.6.1 and 2.6.2 above, which indicated the cover requirements for Fire and Durability requirements, the minimum member covers are listed below.

Table 4-15: Minimum Cover for Structural Elements

Element	Strength	Minimum Cover	Final
Foundations	30 MPa	40 mm	
Retaining walls	30 MPa	30 mm	
Columns	30 MPa	40 mm	
Beans	30 MPa	40 mm	
Slabs	30 MPa	30 mm	
Walls	30 MPa	40 mm	

(i) Fatigue

Fatigue concerns arise when structural members and connections are subjected to cyclic loading with sufficient frequency and magnitude to initiate microcracking, which can lead to progressive failure over time. The risk of fatigue failure is directly related to the number of loading cycles and the magnitude of the applied loads. According to design standards, fatigue resistance evaluation is not required if the number of cycles of live load application during the design life of the structure is expected to be less than 20,000. In such cases, the loading conditions are considered insufficient to induce fatigue-related damage that would compromise the structural integrity of the system.

(j) Design Loads

The design approach prescribed by the South African National Standards (SANS) follows the Limit States Design (LSD) philosophy. This methodology ensures the safety, serviceability, and durability of structures under ultimate and serviceability limit states. The design parameters, including design loadings, load combinations, exposure conditions, and the design standards utilized for the detailed design of the individual structural elements and components, are outlined as follows:

(i) Permanent Actions (Dead Load)

For building structures, self-weight is defined as the permanent action comprising all components that constitute the primary structural frame and fabric of the building, which are not expected to be removed throughout the building's design life:

Table 4-16: Dead Loads

Element	Load (KPa)
Screed - 50mm thick	1.725 kPa
Solar Panels	0.2 kPa
Brickwork	Value varies with respect to height – density of 23 kN/m^3

Suspended Ceilings and insulation	0.25 kPa
Fire sprinkler-suspended pipes	0.05 kPa

(ii) Imposed Actions (Live Load)

In buildings, these are variable or transient forces applied to a structure during its use. The values in the table below have been used as the minimum.

Table 4-17: Imposed Loads

Element	Load (KPa)
Roof – non - accessible	0.25 kPa
Floors	2.5 kPa

(iii) Wind loads

The fundamental value of the basic wind speed at the site is 40 m/s, based on Terrain Category A, in accordance with SANS 10160-3. The calculations incorporated a topography factor (T) of 1.0. The resulting wind pressures for wind directions at 0° and 90° were calculated to be approximately 1 kPa.

(iv) Seismic Actions

As can be seen from the figure below, the site is located in a seismic zone with a peak ground acceleration of 0.05g. This area is considered a low seismic hazard zone as there is minimal seismic risk.

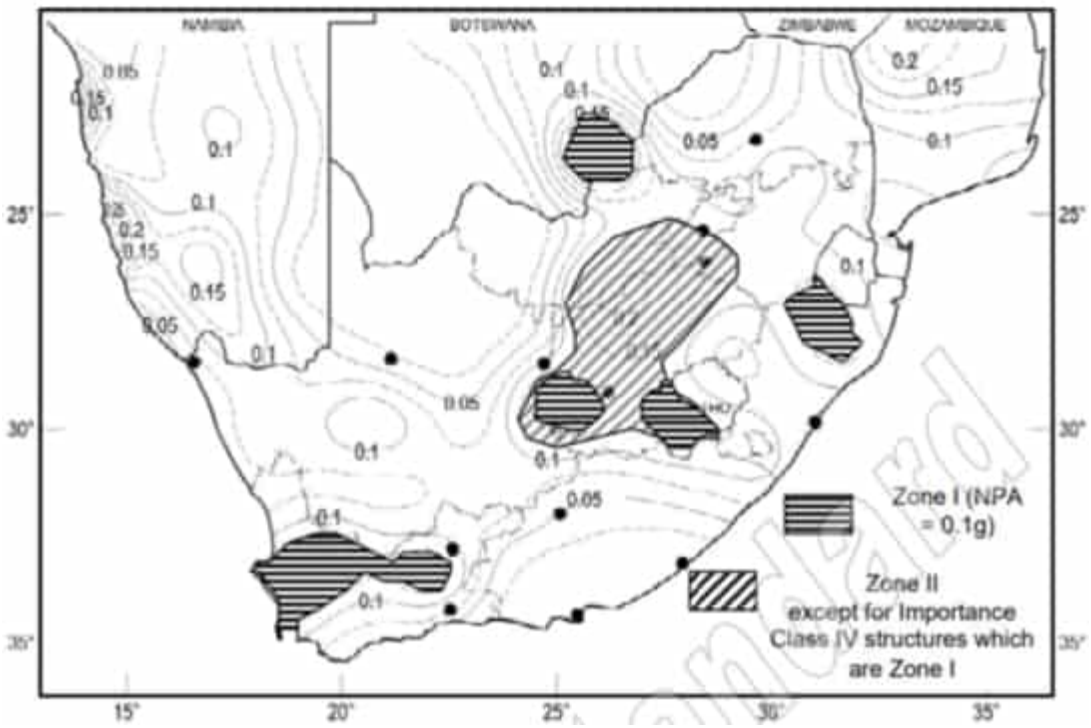


Figure 4-22: Seismic hazard zones in South Africa

However, to resist these minor lateral loads and minimise any risk to the structure, the following seismic reinforcing detailing would be applied.

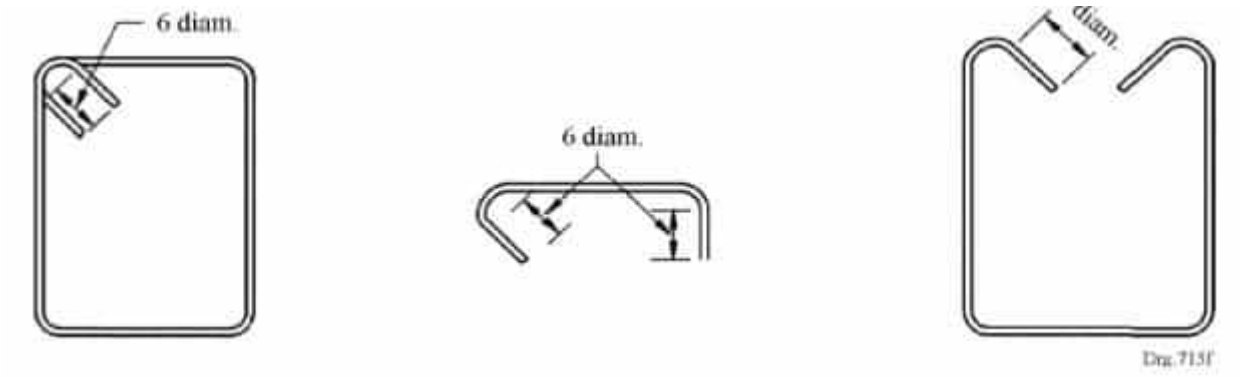


Figure 4-23: Seismic shear stirrup reinforcing detailing requirements

4.3.20 Electrical, Control and Instrumentation

(a) New Main Supply to Pump Station

The existing Skimmelkrans miniature substation needs to be relocated and upgraded due to the new pump station location. Please refer to the section below for additional bulk electrical design requirements. This section of the report addresses the low voltage (LV) supply to the site from the newly installed miniature substation.

The new miniature substation will supply a dedicated CB sized for both pump stations. A new LV cable will supply the generator changeover panel, which has two outgoing feeds, PS4 and PS1. The generator and changeover are discussed in further detail below.

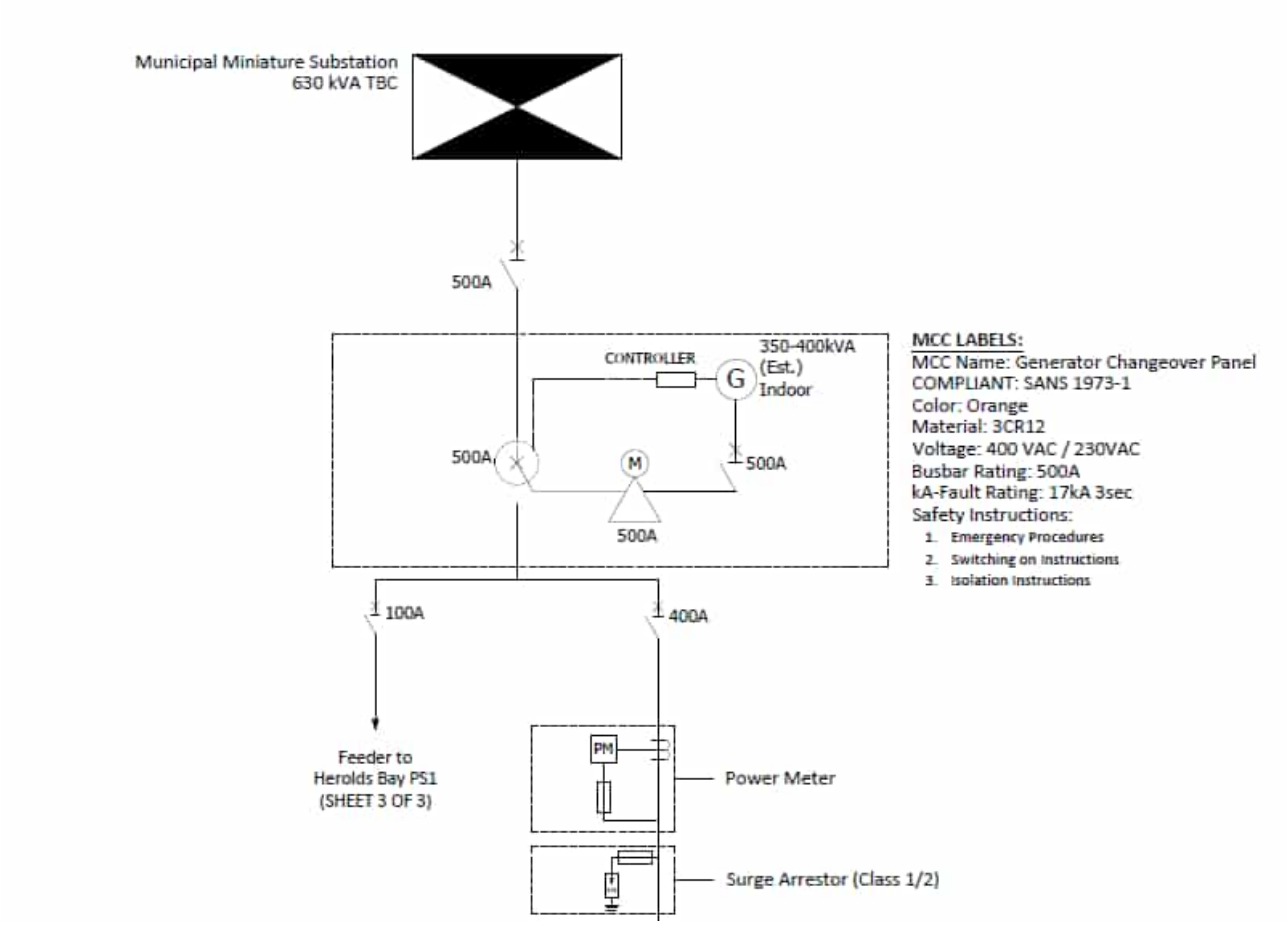


Figure 4-24 Proposed Single-Line Diagram

(b) Estimated Load Requirements

The table below provides a summary of the expected maximum of the new pump station only.

Table 4-18: Electrical Load Summary – PS4

Herolds Bay PS4											
Item	Existing / New	Load Description	Qty	Feeder Type	Number of Phases	Voltage [V]	Rated Current [A]	Connected Power [kW]	Connected Power [kVA]	Full load PF	Comments
1	New	Sewage Pump 1	1	VSD	3 PH	400	370	185.00	205.6	0.9	Duty
2	New	Sewage Pump 2	1	VSD	3 PH	400		-	-	0.9	Standby
3	New	Mechanical Screen 1	1	VSD	3 PH	400		1.10	1.2	0.9	Duty
4	New	Mechanical Screen 2	1	VSD	3 PH	400		1.10	1.2	0.9	Duty
5	New	Screw Conveyor	1	VSD	3 PH	400		1.1	1.2	0.9	Duty
6	New	Skip Dolley	1	F/R	3 PH	400		0.55	0.7	0.8	Duty
7	New	Washer Compactor Washer 1	1	DOL	3 PH	400		6	7.5	0.8	Duty
8	New	Washer Compactor Screw 1	1	VSD	3 PH	400		2.2	2.4	0.9	Duty
9	New	Vortex Degritter Paddle Drive 1	1	VSD	3 PH	400		0.75	0.8	0.9	Duty
10	New	Vortex Degritter Paddle Drive 2	1	VSD	3 PH	400		0.75	0.8	0.9	Duty
11	New	Grit Pump 1	1	VSD	3 PH	400		4	4.4	0.9	Duty
12	New	Grit Pump 2	1	VSD	3 PH	400		4	4.4	0.9	Duty
13	New	Grit Classifier Screw	1	VSD	3 PH	400		1.1	1.2	0.9	Duty
14	New	Odour Control Blower	1	DOL	3 PH	400		2.2	2.8	0.8	Duty
15	New	Ventilation Fans	4	DOL	3 PH	400		0.37	0.5	0.8	Duty
16	New	Seepage Pump 1	1	DOL	3 PH	400		1.5	1.9	0.8	Duty
17	New	Seepage Pump 2	1	DOL	3 PH	400		1.5	1.9	0.8	Duty
18	New	Electric Crane	1	-	3 PH	400	10.8	1.5	1.9	0.8	Duty
19	New	Actuated Valves	10	VSD	3 PH	400		2.2	2.4	0.9	Intermittent
20	New	Small Power & Lighting	1	-	1 PH	220		10	15	0.8	Intermittent
								226.92	257.91		

With the new electrical design philosophy of one centralised generator supplying both pump stations, a combined load must be determined, as per table below.

Table 4-19: Electrical Load Summary – PS1 and PS4 Combined

Herolds Bay Combined Loading									
Item	Existing / New	Load Description	Qty	Feeder Type	Number of Phases	Voltage [V]	Connected Power [kW]	Connected Power [kVA]	Comments
1	Upgraded	Herolds Bay PS1	1	-	3 PH	400	42.75	51.8	-
2	New	Herolds Bay PS4	1	-	3 PH	400	226.92	257.91	-
							269.67	309.68	

The calculations presented in the table above indicate that the maximum expected electrical demand for the new pump station is approximately 260 kVA, in addition to the necessary supply load of PS1, which is about 52 kVA. Depending on the available spare capacity in the network, the final size of the mini-substation will need to accommodate this additional supply requirement, along with all existing loads on the miniature-substation.

(c) New Standby Diesel Generator

A new indoor generator will be provided at PS4, with an associated underground bulk fuel tank, transfer pump and internal day tank. This generator will be provided with an automatic change-over system, providing both PS4 and PS1 with emergency, backup power.

The following high-level calculation can be done to confirm the generator requirements:

Capacity for one (1) motor starting (VSD): 205 kVA (no in-rush loading)

Balance of Pump Station 4:	50 kVA
PS1 Loading:	52 kVA
Total Installed Load (no diversity):	310 kVA
Generator capacity (80% loading):	350 - 400 kVA

The size of the generator required should be able to handle the power requirements of the pump station with one large motor running, and the start-up requirements of the worst-case condition at PS1. A roughly sized 350-400kVA standby generator is suggested for the new pump station. This will however be subject to final phasing and staging of the installed pumps and will need to be designed and confirmed by the Contractor and specialist supplier. If there is only one duty pump for the initial phase, or possibly a smaller unit, then the generator will need to be made either smaller, provided with a load bank to maintain acceptable generator operational levels, or a specifically specified engine offered must be able to handle low loads without incurring detrimental implications over the life of the unit.

The bulk fuel tank is currently proposed to be of the above-ground type in a dedicated, adjacent to the generator room. The tank is sized for a minimum 24-hour full-load, operational/pumping period. This equates to a standard 2.5kL tank, double-walled (providing roughly 29 hours' minimum backup time, taking worst-case loading and both pump stations together). Given the inflow patterns and size of pumps, the fuel would be enough for a few days though. A fuel transfer pump would be required, to pump the fuel between the bulk and internal day-tank. The day tank would act as the suction point, in close proximity to the engine. Both tanks are fitted with level sensors, for automatic filling control. The bulk tank will need to be SANS compliant, with the building designed accordingly as well.

The generator must be designed for low noise emission levels, due to pump station proximity within this residential area, It is recommended that noise levels of maximum 60dBA be specified, measured at 7m. This will be done through a combination of attenuation louvres, installing a canopy set within the building, and utilising sound-absorption materials against the inner walls. The outlet louvre and exhaust are directed away from any houses, toward the rear of the pump station. Some deflection could however occur and noise suppression means will need to be integrated to the outer embankment walls.

(d) New Telemetry & SCADA

A completely new GSM-based outstation is proposed for the site, including all site signal integration and transmission to the Municipality's central SCADA station. The outstation will be networked to the MCC's managed switch. Note the point-to-point communication also required between sites PS4 and PS1, for secondary pump level control.

The central SCADA currently displays, monitors and trends all digital and analogue signals from the pump station. It is recommended that the town's landing page be upgraded and developed to include this new pump station. The inlet works and odour control equipment will also be incorporated, as well as all necessary analogue signals, for trending and reporting purposes.

(e) New Motor Control Centre

A new indoor MCC will be provided for the pump station and associated equipment. The PLC will control the new inlet and pump station facility, with the intended HMI to provide graphic feedback to the operator on-site. A managed switch will be provided, to allow for a networked signal configuration with the pump station between the MCC, PLC, HMI, generator controller and telemetry outstation. Refer inverter and battery section below, as dedicated feeds to the control, telemetry and instrumentation components within the pump station.

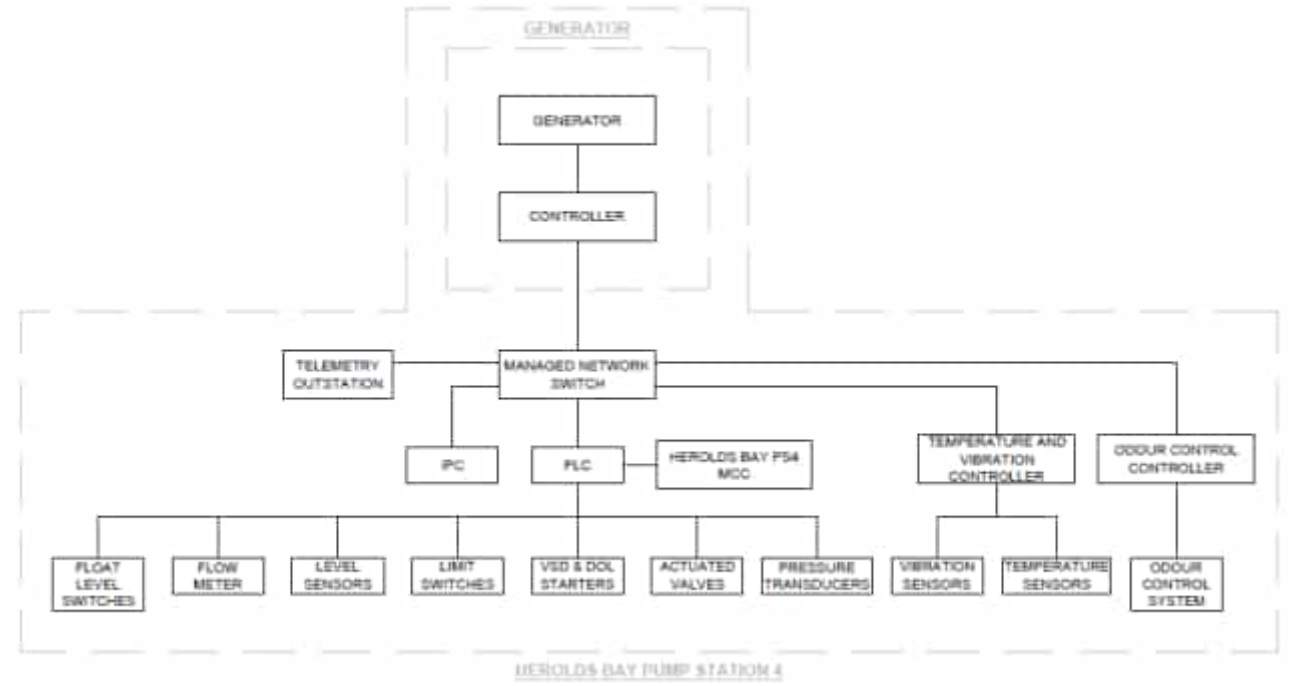


Figure 4-25 Proposed Site Network Diagram

A redundant air-conditioning system is proposed for the Main MCC Room as well as Inverter/Battery Room, to provide controlled environmental conditions for the large VFC's and PLC and other electronic equipment.

(f) Pump and Motor Protection

In addition to the standard torque, starter and field E-Stop protections, additional temperature and vibration protection is recommended, and provided, for the two main sewage pumps.

The temperature and vibration probes must be installed on the drive and non-drive ends of both pumps and motors. The vibration protection must be individual frequency identification, and not just generator vibration, to further assist the Municipality with fault identification. These sensors, along with a speed sensor, will integrate into a field-mounted controller, which will be networked back to the MCC's managed switch. Final setpoints for warnings and alarms to be configured as per final supplier requirements.

Additional 4-20mA PT100's are required for the motor windings.

(g) Inverter and Battery Room

A dedicated inverter with a battery backup supply is recommended for all critical control systems, security, instrumentation, as well as lighting, instead of a standard UPS configuration. Due to the lithium batteries, a separate, fire-rated room is proposed, with dedicated and specialised fire suppression. The final sizing, configuration and redundancy of the system will be dependent upon Contractor equipment sizing. Redundant batteries are proposed, should anyone become faulty, the system will continue to operate as normal.

(h) New Building Small Power & Lighting

The new pump station building and site will be provided with the following ancillary electrical equipment, as discussed with the Municipality:

- Local DB for pump station building. The DB will be split between Essential and Non-Essential loads.
- A holistic site lighting design, integrated with security and CCTV requirements. This will combine building-mounted floodlights with existing road free-standing poles.
- Site electric fencing was not required.

- CCTV for perimeter protection, integrated with an armed response system, to act as an alarm system as well. Currently no fibre is present in the town that links back to the central operational station in George. A final decision will need to be made whether CCTV is required, or mere alarm system provided for.
- An internal pepper gas system will keep unauthorised users out. However, this will be limited to the MCC, inverter, and generator rooms, as the rest of the structure is too large for effective gas operation.
- Building lighting and power design. Internal lighting (LED) is to be a minimum of 300 lux at operational points, with a minimum of 400 lux provided at any electrical/control areas. Internal lights will be connected onto the Essential load section of the Local DB, to ensure adequate light in power failure and/or emergency evacuation situations.

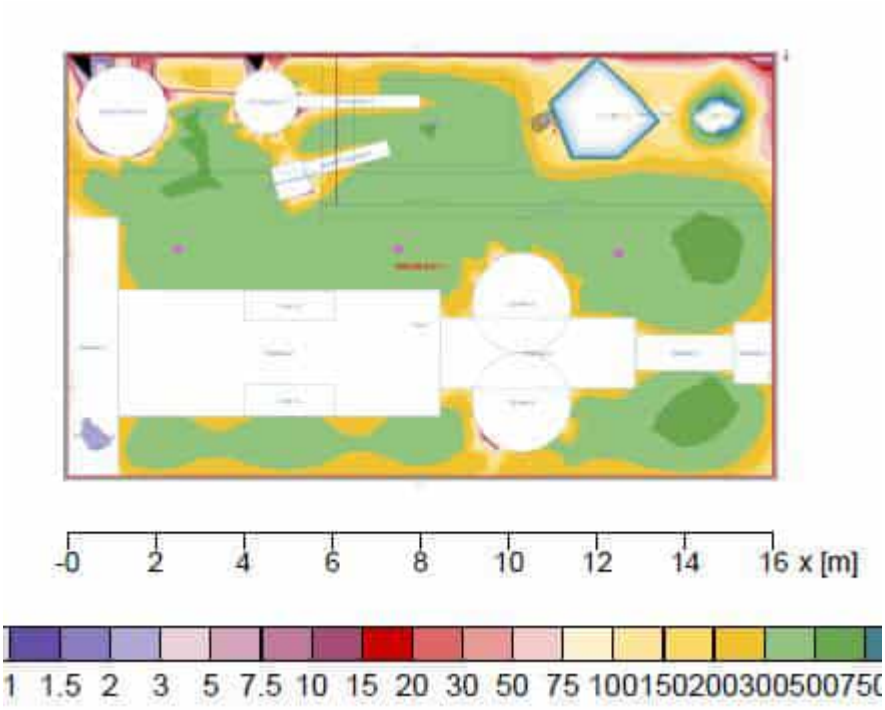


Figure 44-26 Screening Room Lighting Design

Figure 44-27 Screening Room Render

(i) General Earthing and Bonding

For the proposed new pump station buildings, a network of inter-connected earth electrodes (consisting of earth rods and conductors) will be installed around the buildings to ensure an overall resistance to earth of 1 Ω or less providing an effective earth mat. The minimum requirements for the earth rods and electrodes are provided in the tables below. The number of earth rods to be installed around the building will be calculated during the design finalisation and may reduce based on the soil resistivity measurements taken on-site as per the position.

(i) Earth Electrode Rods:

Table 4-20: Standard for Earth Rod Dimensions

Material	High Tensile Steel, Copper Coated
Size	Ø 16 mm
Length	1,800 mm

(ii) Earth Electrode Conductors:

Table 4-21: Standard for Earth Electrode Dimensions

Material	Bare Copper (Stranded)	Bare Copper (Solid)	Copper-Clad Steel (Stranded)
Size	70 mm^2	Ø 10 mm	95 mm^2

Earth electrodes shall be installed as deep as possible, but not less than 900mm below the natural ground level. Deep-buried electrodes exhibit less steep voltage gradients at the soil surface during times of discharge and reduce the risk of mechanical damage or theft of the earth electrode. The network of underground earth electrodes and conductors around the building will be bonded onto a 50mm x 6mm bare copper bar (main earth bar), installed inside the pump station building equipment room by means of a 120mm^2 bare copper conductor.

Each of the other equipment rooms within the building will also be equipped with a 50mm x 6mm bare copper earth bar (safety earth bar). These safety earth bars within the rooms will be connected to the building's main earth bar by means of 70mm^2 PVC-covered copper conductors to ensure the integrity of the equipotential platform created within the building.

All accessible conductors, portions of the electrical plant, or equipment which do not form part of an electrical circuit but have the possibility of accidentally becoming energised during normal or fault conditions, shall be bonded to the nearest safety earth bar.

4.3.21 Future Consideration

Consideration has been given to the design and layout of the pump station for the installation of automated front rake screens, screening conveyors, washer-compactors, and associated equipment. The manual hand rake screens included in this contract can be removed and replaced with automated screens and the necessary equipment and controls without requiring major modifications to the structure of the screening channels.

The automated screens, screw conveyor, and washer-compactors will be installed on the first floor, and they will discharge the screenings down a chute into a skip located on the ground floor. Therefore, the municipality has the option to install automated mechanical front rake screens along with all the ancillary equipment.

4.3.22 Drawings PS 4

The following drawings of Pump Station Number 4 are attached as **Annexure B**

- **C1936 – PS4 – A101 Inlet works Plan layout & isometric views**
- **C1936 – PS4 – A102 Inlet works section A-A, B-B & Isometric views**
- **C1936 – PS4 – A103 Inlet works Section C-C & Isometric views**
- **C1936 – E – GEN – 001 Piping & Instrumentation Diagram (P&ID)**
- **C1936 – E – GEN – 002 PS 1 & PS 4 network Architecture Diagram**
- **C1936 – E – PS4 – 001 PS4 Existing MV Reticulation (Sheet 1 of 2)**
- **C1936 – E – PS4 – 001 PS4 Proposed MV Reticulation (Sheet 2 of 2)**
- **C1936 – E – PS4 – 002 Skimmelkrans Miniature Substation Configuration**
- **C1936 – E – PS4 – 003 PS1 & PS4 Electrical Single Line Diagram (Sheet 1 of 2)**
- **C1936 – E – PS4 – 003 PS1 & PS4 Electrical Single Line Diagram (Sheet 2 of 2)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 1 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 2 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 3 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 4 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 5 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 6 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 7 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 8 of 9)**
- **C1936 – M – PS4 – 01 M&E Equipment Layout (Sheet 9 of 9)**

4.4 Emergency Storage

4.4.1 Introduction

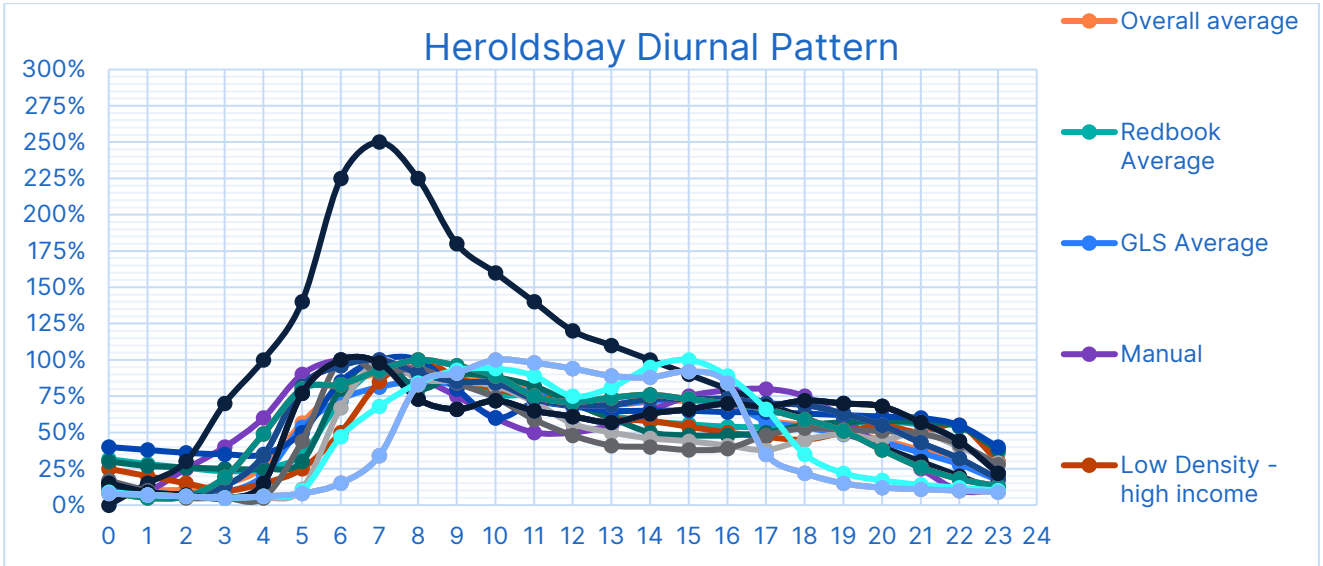
During the design development, the George Municipality indicated they wanted the emergency storage in the system to be as large as possible, to enable them to handle an emergency event and prevent the pollution of the beach, and that they intended to use the emergency storage volume or part thereof during to accommodate the flows during ESKOM load shedding, in order to reduce the additional financial burden of the use of diesel to run the generators to run the pumpstations.

An integrated model of the inter dependent pumpstations forming the systems was built to assess the possible emergency events the system can absorb before discharging to the environment. The model and associated results are highly dependent on the incoming diurnal flow patterns adopted for the two pumpstations in the system (PS1 and PS4) and the time when the emergency event ends.

Four scenarios are presented to provide the envelope within which the system will operate during the design lifetime. All scenarios are based on the agreed design peak flows, used to size the mechanical equipment. The scenarios do not make allowance for extra-ordinary volumes of stormwater ingress into the system (based on observations during rain events, the agreed allowance for ingress is substantially lower than the actual ingress. The operational philosophies for the pumpstations are described in greater detail in chapters 4.2.2 and 4.3.7 respectively, and will not be repeated here.

Typical diurnal flow patterns were generated from the “Redbook” and the GM municipal masterplan and adjusted to provide the inflow into the pumpstations. These were assigned to the and assigned to the pumpstations (high income, medium density patterns). These patterns have the peak flow during the morning, and minimum flow late at night / early morning.

Figure 4-28: Diurnal flow patterns



The following scenarios are presented:

- Operational* emergency sump volumes
  - PS1 600m^3
  - PS4 180m^3

  *(maximum volume before overflow)

- Scenario 1:
  To determine minimum and maximum time to fill the emergency storage. Complete power failure (no grid power and no back-up generator) with an empty emergency storage sump.
  - starting at 22:00, with no power restoration
  - starting at 07:00, with no power restoration

- Scenario 2:
  To determine minimum and maximum periods to empty emergency storage sump. Startup of the pump systems with full emergency storage is full.
  - Starting at 22:00
  - Starting at 07:00

These four scenarios should provide the operational envelope within which the system will function under normal operating conditions.

Multiple, sequential power interruptions were not modelled, as the system will be able to handle this

4.4.2 General scenario conditions

The following were the general conditions applicable to all scenarios in the model.

- Design incoming peak flows*
  - PS1 10L/s
  - PS4 45L/s
  - Combined flow 55L/s

- Design emergency peak flows (pump duties)
  - PS1 25L/s
  - PS4 70L/s

4.4.3 Results

Scenario 1 a) – maximum emergency storage time

Table 4-22 : Emergency storage time - off peak (scenario 1a)

Emergency Volumes				
Time	SP4	SP1	time frame	
22:00	0%	0%	0	Hours
02:00	100%	8%	4	Hours
07:00	100%	100%	9	Hours

Scenario 1 b) – power failure at commencement of peak daily flow

Table 4-23: Emergency storage time – peak (scenario 1b)

Emergency Volumes				
Time	SP4	SP1	Time Frame	
07:00	0%	0%	0	Hours
08:00	100%	8%	1	Hours
11:25	100%	100%	4	Hours

Scenario 2 a) – draining of emergency storage during off-peak flows

Table 4-24: Time to drain emergency storage - off-peak (scenario 2a)

Emergency Volumes				
Time	SP4	SP1	time frame	
22:00	100%	100%	0	Hours
00:50	0%	52%	2	Hours
03:50	0%	0%	5.5	Hours

Scenario 2 b) – draining of emergency storage during peak flows.

Table 4-25: Time to drain emergency storage – peak (scenario 2b)

Emergency Volumes				
Time	SP4	SP1	time frame	
07:00	100%	100%	0	Hours
16:25	94%	0%	9.25	Hours
21:00	0%	0%	14	Hours

The results above are dependent on the pattern of the selected diurnal flow patterns, and as such can only provide an indication of how the system will respond. The results indicate that the system under peak design flows (over daily peak), can accommodate a 4-hour power supply interruption before spilling onto the beach, and it will take between 6 and 14 hours to drain the emergency storage volumes again.

Should the water ingress into the system be more than allowed for in the peak flow, or the diurnal flow patterns be flatter, the period could be significantly less.

In the interim period, while the design flows are not realised, or if the actual diurnal patterns peaks are narrower than the peaks assumed, the periods could be significantly longer.

Based on the above, it is our professional opinion that in the short term, the emergency volume could be used to alleviate the impact of load shedding, but that this should not become an institutionalised arrangement, and the volume should only be used for emergency situations or planned maintenance activities.

4.5 Rising Main

The planning and design of the wastewater transfer infrastructure are based on the following principles:

- The provision and installation of isolating, air, non-return and scour valves will be limited to essential locations as required for the efficient functioning of the system.
- Pipelines are to be routed such that it has minimal interference with other structures, parallel to the existing pipe.

- Pipelines to follow services corridor where possible and available.
- All valve assemblies are to be housed in reinforced concrete valve chambers – non-accessible by the public.
- Pipes are to be placed underground where possible.

4.5.1 Pipeline between Pump Station 1 to Pump Station 4

(a) Horizontal Alignment

The new rising main will start at PS1, and be installed adjacent to the existing pipeline. The existing pipeline runs in the Skimmelkrans road reserve and is installed below ground level. The road is an average of 6m wide, and the final route will have to be assessed very carefully to minimise the impact on vehicle access to the beachfront and properties during construction. The stream crossing at Uitspanning Road will be done at the same position as the existing pipe crossing, which is upstream from the roadway. The suspended section of pipe will be of 316L stainless steel and will be self-supporting.

The pipeline route will follow the alignment of the existing pipeline with an offset of 2m.

(b) Vertical Profile

The pipeline will follow Skimmelkrans Road between PS1 and PS4, accordingly, there are no significant vertical bends in the profile.

The route and indicative vertical profile of the pipeline route are shown in **Figure 4-29** below.

Figure 4-29 Route and vertical profile pipeline between PS1 and PS4

(c) Hydraulic Design

The pipeline will be designed to accommodate the ultimate flow of 25 L/s, however, the line will be evaluated against the interim design flow of 19 L/s.

The first-order friction head loss estimate was determined using the Hazen-Williams formula and associated coefficients.

For transient event estimates, the first-order pressure change estimate was made using Joukowsky's formula. Due to the low head, the short length of the pipeline, and the pipeline discharges into the atmosphere, no serious concerns were identified.

The provisional results have been provided below.

Table 4-26 - Pipeline between P1 and P4 - Provisional hydraulic results

Description	Result
Minimum internal diameter (mm)	149
Velocity @ 25L/s (m/s) (ultimate design)	1.47
Velocity @ 19L/s (m/s) (interim design)	0.9
Head loss @ 25L/s (m)	7.2
Head loss @ 19L/s (m)	2.4
Transient Event Estimate – Maximum (m)	< +-53.4
Pipe Class (PN)	10

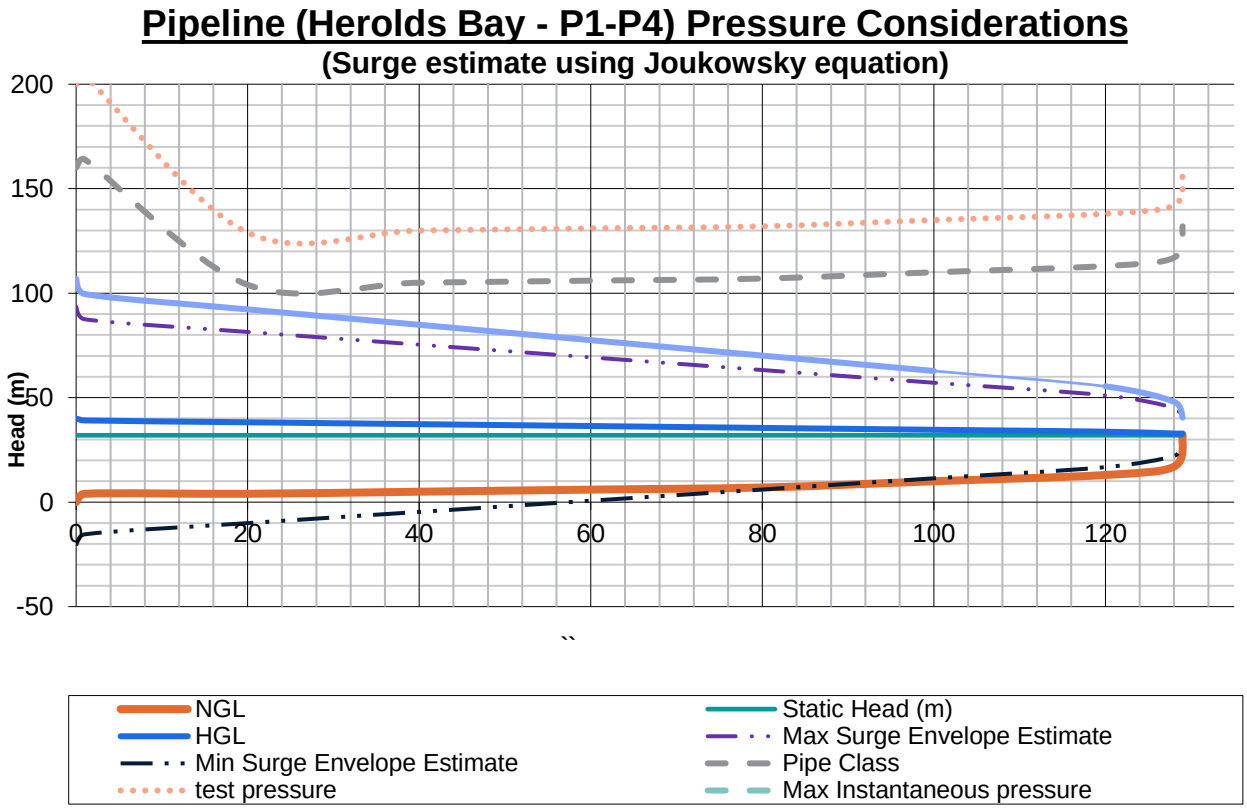


Figure 4-30 Pipeline between PS1 and PS4 - Preliminary hydraulic results @ 25L/s

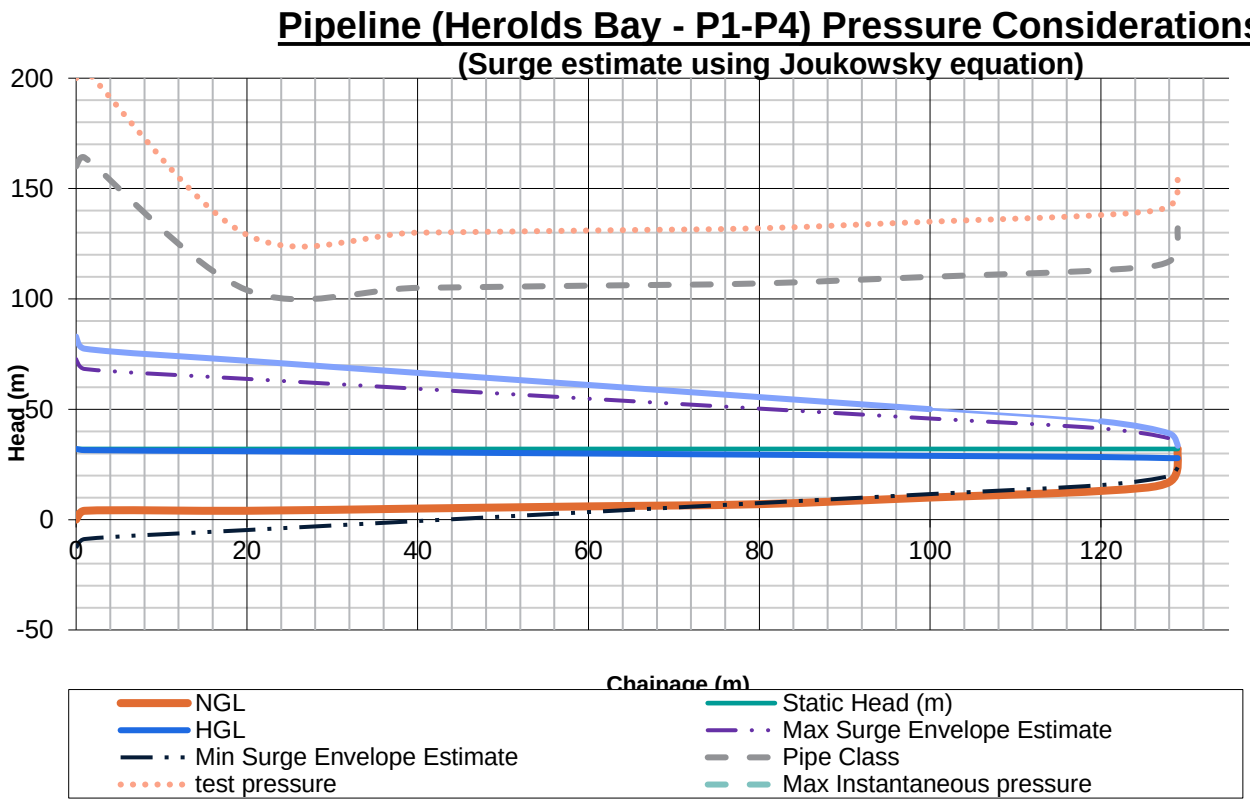


Figure 4-31 Pipeline between PS1 and PS4 - Preliminary hydraulic results @ 19L/s

Based on the assessment, the provisional pressure class of the pipeline is 10 bar (100m) for both flow scenarios.

(d) Implications of surge assessment

There are no critical concerns highlighted by the preliminary surge assessment on the pipeline between PS1 and PS4. The area close to PS1 (chainage 0 to round 65), minor sub-atmospheric pressures are indicated, however the provision of a vacuum break valve in the Pump Station will alleviate the issue.

(e) Pipeline Material Selection

Placing the pipeline in the road reserve will require a directly buried pipeline at a minimum cover of 1m. Local deviations may be required to avoid existing services. The pipe material will be uPVC, class 10, with the exception of the stream crossing, which will be 316 SS, 5mm wall thickness.

4.5.2 Pipeline between PS4 and Herolds Bay WWTW

(a) Horizontal Alignment

The new pumping main will leave PS4 and follow Speckie Gerecke Drive up to the intersection of Gus Meyer Avenue (0-220m). From there, it will follow the existing pipeline and servitude up the ridge to the WWTW (220 m-1,470 m). The servitude will have to be expanded to accommodate the new pumping main.

Gus Meyer Road is approximately 5m wide with no sidewalks and provides access to the residential properties along the southern edge of the road and a steep slope on the northern side. This will require special attention during the detailed design and construction phases to ensure uninterrupted access to the properties, protect the existing pumping main, and have sufficient space to construct the new main.

(b) Vertical Profile

The pumping main will follow the road reserve for the first 200m. The slopes are moderate, but from here on, the route follows the existing servitude and pipeline. The route will cut through thick coastal shrubs and up a steep slope to the WWTW.

The pipeline route and first-order vertical profile have been provided in **Figure 4-32**, below.

Figure 4-32 Pipeline route and vertical profiles for the pipeline between PS4 to WWTW

(c) Servitude

Although the existing pipeline runs within the servitude, the width of the servitude is insufficient to accommodate the second pipeline. Accordingly an additional servitude will have to be applied for. The extent of the additional servitude is 4m on the northern side of the existing servitude.

(d) Hydraulic Design

The pipeline will be designed to accommodate the peak design flow of 60L/s.

The first-order Head loss was estimated using the Hazen-Williams formula for friction.

For transient events estimates, the first-order pressure change estimate was made using Joukowsky's formula. This assumes no impact from air valves or VSD drives and assumes a complete change in flow regime within 5 seconds. The provisional results have been provided in **Table 4-27** below.

Table 4-27: Pipeline between PS4 and Oxidation Ponds - Provisional Hydraulic Results

Description	Results
Nominal diameter (mm)	350
Velocity @ 60L/s (m/s)	0.83
Head loss @ 60L/s: (m)	5.7
Transient Event estimated Maximum - (m)	+-58
Pipe Class (PN)	
0m to 200m	20
200m to 370m	16
370m to 1,470m	10

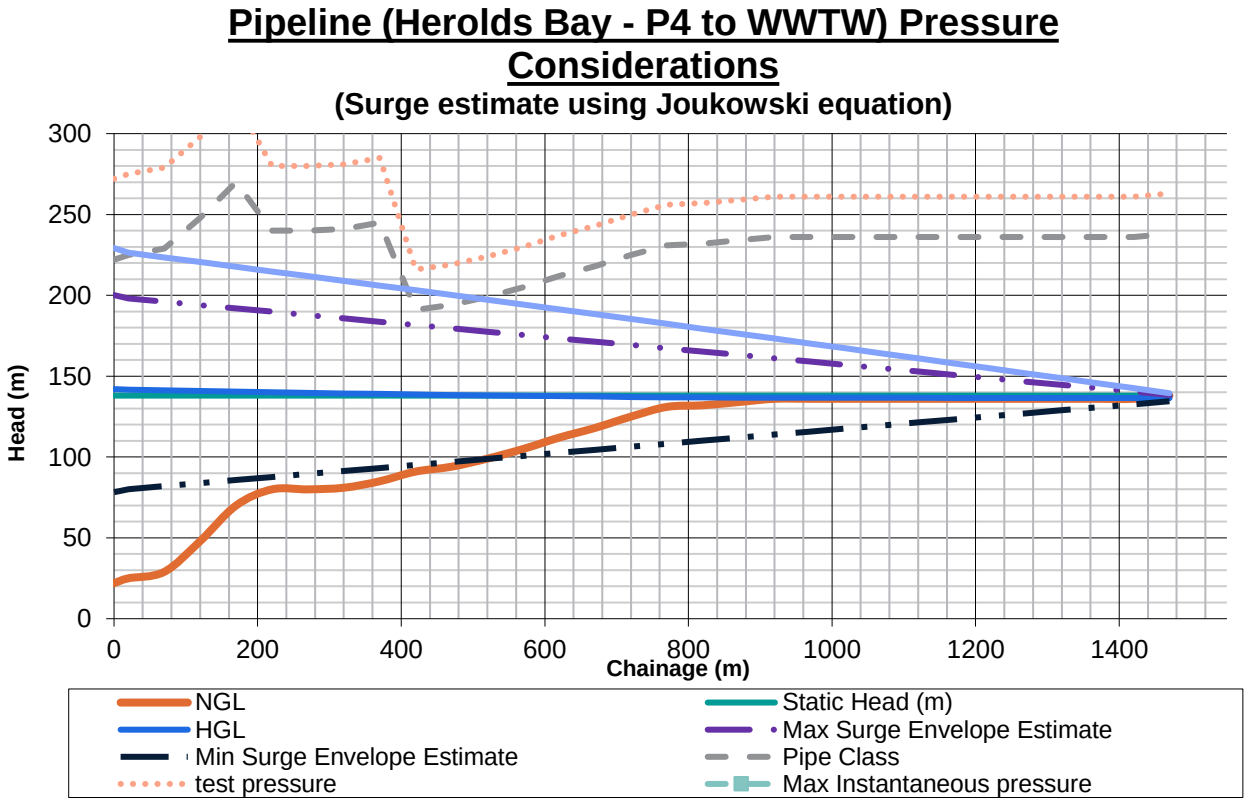


Figure 4-33: Pipeline between PS4 and WWTW- Preliminary hydraulic results @ 52L/s

(e) Implications of surge assessment

There are no critical concerns highlighted by the surge assessment, on the positive pressure estimate on the pipeline, however, the lower pressure envelope indicates that during a transient event (surge), the water column may separate from chainage 200 to chainage 1,400. This will require the installation of dual functioning (vacuum and controlled air release valves), to prevent pipeline failure, and based on the current vertical alignment, two (2) sets will be required, the first at the high point between chainage 200 and 250 profile, and the second round chainage 800m.

(f) Pipeline Material Selection

The pipeline will be of uPVC class 20 in the lower section and then decrease to class 16 and class 10 as the route approaches the WWTW. All exposed pipework will be 316L stainless steel, as per GM preference.

(g) Site Clearance and Earthworks

The first 205 meters of the pipeline will be installed in the road reserve of Speckie Gerecke Drive. It will then run through coastal thicket and granite fynbos vegetation, requiring clearance. This latter section of the site is steep, with a maximum gradient of approximately 35%. A 10-meter-wide area will need to be cleared to allow for adequate working space during construction.

(h) Future Access to Pipeline

The disturbed area through the vegetation will be rehabilitated and there will be no permanent vehicle access along the pipeline route. The only way to access the area will be via the existing jeep track from the WWTW to the cellular mast. The pipeline route is currently overgrown, and there is no access to the existing pipeline for maintenance. Therefore, the current access restrictions will remain unchanged.

4.5.3 Above-ground vs Below ground pipelines

(a) Above-ground pipelines

(i) Material selection

For above-ground pipelines, the typical design is either a pipe resting on the ground or placed on supports anchored on the ground. The former is typically used in the agricultural section for temporary installations and will not be considered here.

Rigid pipelines are typically used in these installations unless support trusses are added to allow the pipe segments to span from support to support. Rigid pipes would include thick-walled carbon steel, concrete and cast iron pipes.

(ii) Construction methodology

The pipeline is constructed by

- clearing the route of vegetation (if endangered plants are present, these to be protected or removed and relocated).
- remove the topsoil from the support footing footprint and stockpile this to prevent contamination.
- excavate to footing founding level and dispose of at approved site
- place precast pipe support / or cast in situ concrete plinths/pipe supports.
- deliver pipe segments to site and install
- apply / install protection
- construct thrust blocks

(iii) Advantages:

- Less excavation required
- Marginally smaller footprint
- Possibly shorter construction period
- Easy visual inspection
- Easier pipe repair
- Possibly lower cost (if flanged steel pipes are used, the cost of the steel for the flanges may negate a significant portion of the saving in excavation)

(iv) Disadvantages:

- Only selected material can be used (typically steel or precast concrete pipes), due to the requirement to span from support to support. If thermos plastic pipes are used, additional supports are required
- Pipeline will be exposed to
    - the elements, including solar radiation, winds, rain and sea spray.
    - fire (during bushfire events)
    - increased likelihood of vandalism
- Permanent visual impact
- Create a permanent barrier
- Follows the natural ground level.
- Requires specialised movement joints
- Requires larger thrust blocks (does not use the in-situ soil as effectively)

(b) Below ground pipelines

Buried pipelines are where the pipes are buried below ground. This is the standard method for the construction of pipelines used in the public sector in South Africa.

(i) Material selection

There are numerous pipe materials available in South Africa. All of these can be buried.

Metal pipelines are typically used in high-temperature and higher-pressure systems. Most metal pipelines will require additional work to prevent corrosion, which includes coating, lining and possibly cathodic protection. This would be material-specific.

Thermo-plastic pipeline are typically used in low pressure, low temperature and highly corrosive liquids.

(ii) Construction methodology

The pipeline is constructed by

- clearing the route of vegetation (if endangered plants are present, these to be protected or removed and relocated).
- removing the topsoil removed and stockpile this to prevent contamination.
- Excavating a trench to required depth. The excavation can be either, all or a combination of the following, hand excavation, back-actor, track excavator, rock fracturing or blasting.
- The material removed from the trench, which cannot be used in the construction will then be removed from site and used of elsewhere or disposed of at authorised site. The suitable material to backfill the trench will be stockpiled on site, to backfill the trench,
- A layer of bedding sand will be placed and compacted in the bottom of the trench.
- The pipe segments will be installed onto the sand.
- The pipe will then be covered with some more bedding material (sand) and compacted. This layer is to protect the pipe.
- The trench will then be backfilled and compacted in layers.

(iii) Advantages:

- All pipe material can be used for material selection.
- Vertical alignment can be levelled to reduce number of high points to minimise number of air-valves / scour valves and associated chambers required.
- Bedding can assist with structural integrity and stability of final structure.
- Well known construction methodology.
- Infrastructure protected from:
    - elements (rain, solar radiation, heat, wind and sea spay)
    - fires
- Low permanent visual impact
- Does not cause permanent obstruction to animal or human movement.
- Less prone to vandalism

(iv) Disadvantages:

- Larger construction footprint (trench excavation, material storage, and working space)
- More costly to:
    - perform leak detection
    - repair leaks
- May be more costly due to larger volume of excavation, and increased risk if hard rock excavation which may require blasting.
- If carbon steel pipes are used as material, cathodic protection will be required.
- reinforced concrete thrust blocks are required (number of may be reduced if a continuously welded pipe is used)

4.5.4 Pipework and Fittings

The following specifications shall apply to pipes and fittings:

SANS 719:	Electric welded carbon steel pipes for aqueous fluids – large bore for pipelines and fittings exceeding 150 mm in diameter
SANS 1123:	Pipe flanges
SANS 664:	Cast iron gate valves for waterworks
BS5155:	Butterfly valves

SANS 16422: Pipes and joints made of oriented unplasticized polyvinyl chloride (PVCO) for the conveyance of water under pressure.

4.5.5 Thrust Blocks

The purpose of the thrust block is to support the bend and stop the pipe joints from being pulled apart causing a joint failure. The thrust block is part of the design to safely transit the unbalanced thrust forces to the undisturbed soil. As mentioned above, no thrust blocks will be designed for changes in the vertical profile due to changes in the direction being smaller than 10 degrees, but several thrust blocks are needed to support the pipe along with changes in the horizontal alignment of the new pipe and on the vertical steep alignment.

The internal pressure of the pipe acts perpendicular to any plane with a force equal to the pressure, P, times the area of the pipe (using the internal pipe diameter). The thrust block design is based on the SANS 2001-DP2:2010 manual for medium-pressure pipelines.

The shape of the thrust block is designed as a trapezium with a height that is adequate to ensure the area required to withstand the thrust forces with a minimum thickness of 100mm around the pipe.

The concrete of the thrust blocks is Class 25/19 for all Bends and Tees.

4.5.6 Valves, Fittings and Specials

(a) Valve Chambers and Ancillary Equipment

The following design approach was followed for the various components:

- Reinforced concrete valve chambers.
- Steel pipework to SANS 719, Grade B – painted epoxy lined; high build polyurethane coated; and
- All valves and fittings shall be internally and externally coated with fusion-bonded epoxy.

(b) Isolating Valves

The flanges shall be double-flanged with Ductile Iron bodies and stainless steel trim and shall conform with all relevant sections of SANS 664 or BS 5163, specifications, and subsequent amendments. The flanges shall be drilled to BS4504 or SANS 1123 for 16 bar working pressure as specified and compatible with pipework flanges.

Gate valves shall be of the RSV gate type, VOSA, Premier, or similar approved. Valves shall be Class 16, clockwise closing and shall have non-rising spindles of high-quality high tensile manganese bronze. The direction of closing shall be cast into the handwheel (where specified) or valve casing with the words “OPEN” and “CLOSE” respectively. The gate shall be guided within the body of the valve to fit accurately onto the seat and to avoid possible buckling. Where extended spindles are required, they shall be suitably supported to prevent swaying and buckling and to guarantee the intended use of the valve. All gate valves shall be drop-tight when tested in accordance with the requirements of BS 5163.

All valves shall be capable of being operated manually with a maximum applied torque of 100Nm.

Valves shall be grit blast cleaned to S15 standard and a solvent-free sintered epoxy powder applied in one coat by the use of arc-spray machines to provide a dry film thickness of not less than 450 microns.

The isolating valves for the air valve shall be supplied with a cast iron hand wheel. All other valves shall be provided with a cap top for use with a valve key.

(c) Air Valve

Air valves are to be positioned at key points in the pipeline, on equal tee pieces, and will be dual-functioning valves suitable for use in sewage applications. Minimum nominal diameter 100mm with isolating valve to facilitate easy replacement.

4.5.7 Rising Main Drawings

The following drawings of Rising mains pipelines are attached as **Annexure C.**

- **C1936 – 520 – 001- Plan and Profile – PS1 to PS4**
- **C1936 – 520 – 002- Plan and Profile – PS4 to WWTW (CH0 – 300)**
- **C1936 – 520 – 003- Plan and Profile – PS4 to WWTW (CH300 – 600)**
- **C1936 – 520 – 004- Plan and Profile – PS4 to WWTW (CH600 – 900)**
- **C1936 – 520 – 005- Plan and Profile – PS4 to WWTW (CH900 – End)**

4.5.8 WWTW Inlet Works

The pipeline will terminate in a new reinforced concrete screenings chamber at the plant. The new chamber will consist of a manual 316 SS 15mm bar screen, from where the flow will pass through a pre-fabricated Parshall flume, before entering a division chamber that will discharge into the pond system.

The chamber will be similar to the existing chamber and will replace it. (A temporary discharge will have to be created, to allow the existing line to pump into the ponds, while the existing structure is replaced.

4.6 Architectural

The integration of the existing PS1 Pump Station, located on Uitspanning Street northeast of the Herold's Bay promenade, is planned alongside the proposed PS4 Pump Station, which is within walking distance of PS1 along Skimmelkrans Lane and connected by an existing pedestrian pathway. Although both pump stations affect the surrounding residential and public landscapes, the unique site constraints and topographical features of Herold's Bay require the use of these specific locations. (**Annexure D** pg3).

4.6.1 Pump station 1 (PS1)

The existing structure not only disrupts the natural flow of the landscape, creating a physical and visual barrier that forces pedestrians onto the street, but it also undermines the potential of the area as a cohesive, pedestrian-friendly public space. By forming a significant break in the promenade, interrupts the continuity and accessibility of the public beachfront, detracting from the opportunity to establish a seamless and inviting pedestrian experience. This disconnection limits the full potential of Herold's Bay as a vibrant, accessible destination that prioritizes pedestrian safety and fosters active engagement with its natural beauty and public amenities. Transforming this space into a unified, pedestrian-oriented promenade would enhance its role as a functional and attractive public space, solidifying its status as a premier beachfront destination (**Annexure D** pg7).

The concept focuses on preserving the integrity of the existing building and its beachfront views by retaining the low height of the current structure. Simultaneously, it aims to create a public space that maximizes viewing opportunities. While the existing building is oriented southward towards the promenade, the primary objective is to reorient it to face the sea without altering the original structure. The proposal involves adding a lightweight structure over the existing building and rotating the footprint. This approach will provide 360-degree viewing opportunities and enable access from all four sides, enhancing the functionality and experience of the space (**Annexure D** pg6).

Figure 4-34: PS 1

The proposed concept seeks to resolve the pedestrian safety challenges posed by the existing structure by introducing multiple pathways that navigate around it, enhancing accessibility and connectivity. Beyond its functional improvements, the design will serve as a dynamic public space, fostering opportunities for community interaction, social gatherings, and scenic viewing. The addition will integrate seamlessly into the landscape while

standing out as an iconic architectural feature, reinforcing Herolds Bay's identity and enhancing its appeal as a distinctive tourist destination. Furthermore, it will form a critical link within the promenade, uniting the previously disrupted flow and replacing the existing barrier with a cohesive and inviting element that enhances the pedestrian experience (**Annexure D** pg8).

Regulations

- Building occupancy: D4, A1
- Fire requirements specify 4-hour fire-rated walls and doors for the bulk fuel tank room, generator room, and backup power room. A fire engineer to be appointed to review and approve all fire requirements.
- Fire protection as per SANS 10400-T:2023
- Stairs and balustrades as per SANS 10400-M:2023
- Natural ventilation as per SANS 10400-o:2023 or as specified by the mechanical engineer.
- Acoustic damping of doors, windows, and louvers shall be carried out according to the specifications provided by the specialist or mechanical engineer.
- Odor control measures shall be implemented as per the specialist's or engineer's design and specifications.

SMEC South Africa's Architectural appointment for PS1 is only to produce a conceptual design and cost estimate for beautifying the existing pump station number 1 building and the surrounding area that will be affected by the upgrading of PS1. The Client must provide guidance on the way forward regarding the beatification of the existing PS1 building.

4.6.2 PS 4

The design concept focuses on deconstructing the traditional form of a service building to integrate seamlessly into a residential landscape. By echoing residential elements, forms, and proportions, the building is scaled down to harmonize with its surroundings. This approach introduces softer features and a careful selection of materials creating a structure that feels more cohesive within its context while reducing its perceived scale.

Incorporating unexpected forms and features for a service building helps create an illusion that softens its functional purpose, allowing it to blend seamlessly into a residential context. This approach enhances the building's presence, making it feel like a welcome addition rather than an imposition within the surrounding environment.

Figure 4-35: PS4

The design incorporates a green roof over the bulk fuel storage area, which extends the site's natural vegetation and merges with the existing sloped backdrop. This feature not only reduces the building's visual impact but also harmonizes it with the surrounding landscape by utilizing the site's natural elements. The green roof, along with the external walls of the fuel tank room, will serve a dual purpose: functioning as the building's envelope while also acting as a retaining wall, further embedding the structure into its context (**Annexure** D pg15).

The selection of materials considers the environmental context of the location and maintenance-free principles. Incorporating sustainable materials and energy-efficient designs helps minimize the environmental impact of infrastructure buildings, supporting sustainability and resilience (**Annexure D** pg17).

Colour can be introduced in key design elements to reflect cultural, heritage, historical, or contextual identities, adding depth and meaning to the building. Alternatively, colour can simply bring a playful or humorous character to the facade, enlivening its appearance and adding a unique, engaging touch.

By incorporating natural lighting, open spaces, and intuitive wayfinding systems, architects can design environments that feel welcoming and are easy to navigate. This human-centered approach ensures that infrastructure buildings meet the needs of diverse users, enriching their overall experience (**Annexure D** pg19).

Regulations

- Building occupancy: J1, D4,
- Fire requirements specify 4-hour fire-rated walls and doors for the bulk fuel tank room, generator room, and backup power room. A fire engineer is to be appointed to review and approve all fire requirements.
- Fire protection as per SANS 10400-T:2023 and SANS:10131
- Stairs and balustrades as per SANS 10400-M:2023
- Natural ventilation as per SANS 10400-o:2023 or as specified by the mechanical engineer.
- Acoustic damping of doors, windows, and louvers shall be carried out in accordance with the specifications provided by the specialist or mechanical engineer.
- Odor control measures shall be implemented as per the specialist's or engineer's design and specifications.

Refer to the following additional information attached to this report:

Annexure D – Design Report

Annexure E - Architectural Drawings PS1 Drawings

Annexure F – Architectural Drawings PS 4

4.7 Bulk Electrical

This section specifically addresses the MV supply requirements for the PS4.

4.7.1 Existing Configuration

The location of the new pump station is near an existing 315kVA minisub called Skimmelkrans on Skimmelkrans Lane next to erf 116. It is fed from the same ring feeder as the Uitspanning and Herold's Bay Hotel minisubs, with a 70mm^2 3 core PILC underground cable. It was confirmed by the Masterplan representative, on behalf of the Municipality, that the current minisub only runs at 46kVA, under peak loading. The existing minisub further has several large CBs feeders installed in its main LV distribution section, as captured in the single line below.

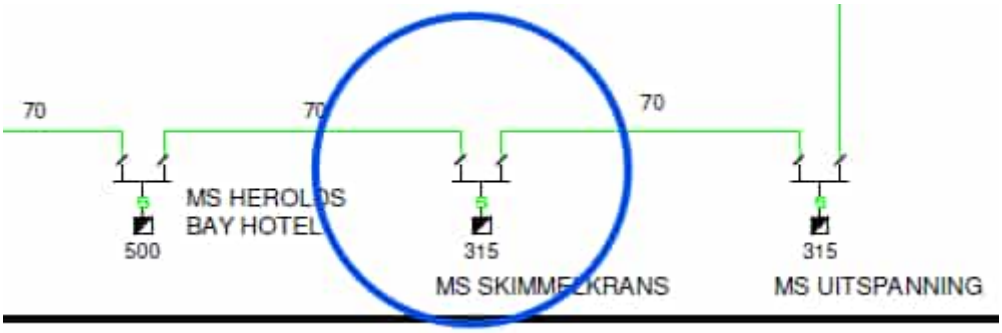


Figure 44-36 Current MV-Ring Configuration

The existing minisub is currently installed in the location of the new pump station site and will need to be relocated, along with any underground MV and LV supply cables.

4.7.2 Upgrade Requirements

A new supply point is needed for the pump station, as the loading tables in previous sections indicate a total additional peak load of approximately 280 kVA. Consequently, the existing 315 kVA transformer is insufficient to meet this demand and does not provide any spare capacity on the minisub.

It is recommended that the minisub be both relocated and upgraded as part of this project. The next available transformer size is 500 kVA, which would offer about 220 kVA for existing installations and 280 kVA for the new pump station supply. Given that the current low voltage (LV) feeders are under-utilized, the 220 kVA capacity may be inadequate if all existing installations are developed to their full potential.

Furthermore, the Municipality has standard sizes for transformers and minisubs, which are either 500 kVA or 800 kVA, with no intermediate size of 630 kVA available.

Therefore, it is currently assumed that an 800 kVA miniature substation will be necessary at this location. If a 500 kVA transformer is preferred or deemed sufficient, then the available capacity for existing installations would be limited to 220 kVA. This does not consider any potential future network expansions or developments in the area.

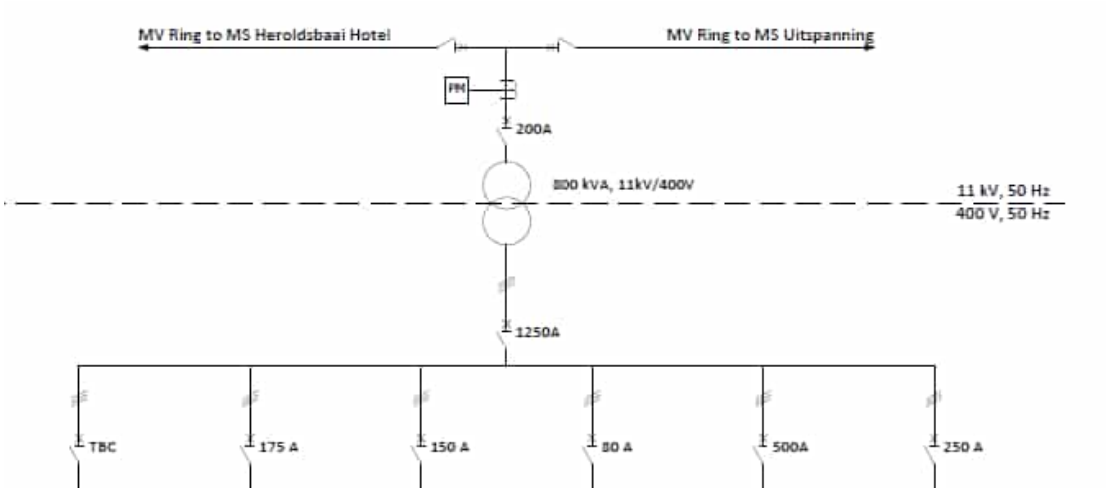


Figure 44-37 Current MV-Ring Configuration

Due to the intended upgrade of the Skimmelkrans minisub, the GM's electrical department will need to perform a final and updated site load study and capacity assessment. A preliminary study was performed as part of the previous phase, which confirmed that there is sufficient capacity for the intended upgrade. Any additional network requirements would need to be confirmed before going out to tender on this project.

Existing MV cables will need to be re-routed, as well as existing LV-kiosk and associated supply cables.

4.8 Stormwater Ingress

The design flows used in the design, are based on flows obtained from the Master Plan documentation and feasibility study for the Herold's Bay sewage infrastructure. These were based on industry norms for sewage generated per erf and allowable ingress of external flows.

During the rainy season of 2024, the design team was on site on 4 June 2024 and based on the visual assessment, the stormwater ingress into the sewage network significantly exceeds the allowances made. (The pumps in PS 1 were operational, and the emergency overflow was discharging at full capacity onto the beach, and the two manholes nearest the pump station, were discharging sewage onto the parking lot, through the venting holes in the covers).

The emergency storage volume provided in this document will, however, provide limited attenuation of these peaks. This should not become a permanent solution and the municipality should address the issue of stormwater ingress urgently.

Photo 1: Surcharging Sewer Main Upstream of PS 1

Photo 2: Surcharging Sewer Manhole Upstream of PS 1

Photo 3: Emergency overflow discharging

5. Capital Cost Estimate

The project cost outlined below is based on the assumption that this is a signal construction project. We recognize that there is a strong likelihood that multiple construction phases may be necessary to complete the entire project. The client's available budget will be the primary factor in determining how these construction phases are structured.

5.1 Construction Cost

The construction cost below is based on current prices. Construction can start no sooner than early 2026. CPA was added to the forecast cost at the beginning of 2026.

Description	Construction Cost Estimates
PUMP STATION 1	
Building Cost	R 3 500 425.00
Civil Works	R 750 000.00
Mechanical Works	R 2 765 000.00
Electrical Works (LV)	R 1 438 690.00
Telemetry	R 186 000.00
Architectural Beautification	R 1 613 300.00
PUMP STATION 4	
Building Cost	R 9 340 642.00
Civil Works	R 850 000.00
Mechanical Works	R 12 868 700.00
Electrical Works (LV)	R 4 672 950.00
Electrical Works (MV)	R 2 332 500.00
Telemetry	R 304 500.00
Generator	R 2 915 000.00
RISING MAIN PS 1 – PS 4	R 678 369.61
RISING MAIN PS 4 – WWTW	R 3 883 814.47
ENVIRONMENTAL REHABILITATION	R 1 000 000.00
Sub-Total	**R 49 099.891.08**
P&G	R 12 274 972.77
Sub-Total	**R 61 374 863.85**
Contingencies (15%)	R 9 206 229.58
CPA (15%)	R 9 206 229.58
Sub Total	**R 79 787 323.58**
VAT (15%)	R 11 968 098.45
Total	**R 91 755 421.46**

Figure 5-1: Construction Cost

5.2 Professional Fees

The proposed fee arrangement is outlined below in accordance with our appointment on the George Municipality's panel, as established by their Multi-Year Professional Services Framework Contract (Tender T/ING/010/2020). Professional fees are based on the guidelines outlined for Services and Processes for Estimating Fees for Registered Professionals, in accordance with the Engineering Professions Act of 2000, as published in Gazette No. 44333 on 26 March 2021.

Given the Scope of Work described above, with an estimated construction cost of R 79 787 323.58 (excluding VAT), a complexity factor of 1.00, and a 10% discount, our standard fees are detailed in the accompanying documentation, which also illustrates how the professional fees will be distributed throughout the project life cycle.

Table 28: Normal Professional Fees

Normal Fees	Amount
Civil And Structural Fees	R 2 681 421.20
Additional Design Fees Structural	R 544 233.02
Mechanical Fees	R 2 068 735.33
Electrical Fees	R 1 238 634.02
Electronic Fees	R 846 902.88
Total Normal Professional Fees	**R7 379 926.45**

Table 29: Normal Fees per Stage

Stage	%	Amount	Cumulative Amount
Inception	5	R368 996.32	R368 996.32
Concept and Viability	25	R1 844 981.61	R2 213 977.93
Design Development	25	R1 844 981.61	R4 058 959.55
Documentation and Procurement	25	R1 844 981.61	R5 903 941.16
Contract Administration and Inspection	15	R1 106 988.97	R7 010 930.12
Close-Out	5	R368 996.32	R7 379 926.45

In addition to the above, the following additional services and Sub-Consultant Services are envisaged to be required during investigations and in the execution of the project, as indicated in **Table 30**, below. The cost for construction monitoring and ECO services below is an estimated cost for a project duration of 15 months.

Table 30: Additional Professional Fees

Addition Fees				
Description	**Unit**	**Qty**	**Rate**	**Total**
Construction monitoring	Months	15.00	R130 000.00	R1 950 000.00
Topo survey	Sum	1.00	R56 300.00	R56 300.00
Geotech	Sum	1.00	R204 493.00	R204 493.00
Environmental Specialists - Terrestrial	Sum	1.00	R50 000.00	R50 000.00
Environmental Specialists - Aquatic	Sum	1.00	R40 000.00	R40 000.00
Environmental Specialists - Wetland & Riparian	Sum	1.00	R25 000.00	R25 000.00
Environmental Specialists - Heritage	Sum	1.00	R45 000.00	R45 000.00

Environmental Specialists - Vegetation	Sum	1.00	R35 000.00	R35 000.00
Environmental Specialists - Archeological	Sum	1.00	R65 000.00	R65 000.00
Environmental Specialists - WULA	Sum	1.00	R60 000.00	R60 000.00
Environmental Specialists - Groundwater study	Sum	1.00	R54 445.00	R54 445.00
Environmental (BAR)	Sum	1.00	R180 000.00	R180 000.00
QS	Sum	1.00	R137 000.00	R137 000.00
Architecture	Sum	1.00	R600 934.76	R600 934.76
ECO	Months	15.00	R15 000.00	R225 000.00
				R3 728 172.76

Table 31: Professional Fee Summary

Professional Fee Summary	Totals
Normal Services	R7 379 926.45
Additional Services	R 3 728 172.76
Total (excl VAT)	**R 11 108 099.21**
VAT (15%)	R 1 666 214.88
Total (incl. VAT)	**R 12 774 314.09**

5.3 Project Cost Summary

The table indicates the total capital cost estimate for the project:

Table 32: Project Cost Estimate

Summary	Totals
Construction Cost	R 79 787 323.58
Professional Services	R 11 108 099.21
Total (excl VAT)	**R 90 895 422.79**
VAT (15%)	R 13 634 313.42
Total (incl. VAT)	**R 104 529 736.20**

6. Project Programme and Cashflow

6.1 Programme

The critical dates for the project are shown in **Figure 4-30** below, and is based on the following criteria.

- The designs for the project will be completed as one deliverable, irrespective of whether the project will be constructed in phases.
- The environmental process will be on the critical path.
- The dates outlined below are based on a single 15-month construction period. The project can be completed under multiple contracts and over several years. It is anticipated that the client's budget will determine the approach to implementation.
- Construction during the peak season (December – March) is not preferred and should be prevented as far as possible, particularly at PS 1. This will be considered during the implementation strategy discussions with the client.
- The bid specification meeting is dependent on receiving environmental authorisation. Once received, the project can be advertised.
- Application for the DAFF permit can only be submitted after building plan approval and Environmental Authorisation has been obtained.

Table 33: Key Dates

No.	Stages	Prelim Design Report Dates	Detailed Design Report Dates	Status
1	**Preliminary Design**			
1.1	Submission of Preliminary Design Report Rev 1	14 February 2024	-	Complete
1.2	Client Approval	28 February 2024	14 March 2024	Complete
1.3	Submission of Preliminary Design Report Rev 2	-	28 May 2024	Complete
1.4	Client Approval	-	3 July 2024	Complete
2	**Detail Design**			
2.1	Client works shop	-	17 October 2024	Complete
2.2	Submission of Draft Design Report	-	13 & 30 August 2024	Complete
2.3	Submission of Detail Design Report	12 July 2024	13 December 2024	Complete
2.4	Client Approval	23 July 2024		
3	**Environmental Authorisation**			
3.1	Submit Draft BAR & EMPr client review	09 April 2024	9 April 2024	Complete
3.2	Start 30-day PP	29 April 2024	13 September 2024	Complete
3.3	Compile Comments and Response tables from 30-day PP	-	13 December 2024	
3.4	Submit application to DEADP	28 June 2024	16 January 2025	
3.5	Start 2nd round of PP	29 July 2024	12 February 2025	
3.6	Submit final BAR report to DEADP	5 September 2024	2 April 2025	

3.7	Receive Authorisation	25 February 2025	1 August 2025	
4	**DAFF Permit**	-	5 December 2025	
5	**Procurement**			
5.1	Tender Advert	1 March 2025	5 August 2025	
5.2	Tender Closing	24 March 2025	3 September 2025	
5.3	Submit Tender Evaluation Report to Client	11 April 2025	23 September 2025	
5.4	Appoint Contractor	15 May 2025	5 December 2025	
6	**Construction**			
6.1	Construction Starts	15 May 2025	5 December 2025	
6.2	Construction Complete	15 August 2026	5 March 2027	

The updated programme is attached as **Annexure G.**

6.2 Cashflow

This high-level cashflow is based on a 15-month constriction period and the program above in **section 6.1** of the report. A breakdown of the professional fee cashflow is attached as **Annexure H.**

Table 34: Project Cashflow

Date	Professional Fees (Excluding VAT)	Construction Cost (Excluding VAT)	Combined Cost (Excluding VAT)	Cumulative Cost (Excluding VAT)	
Oct-22	R125 153.03	R0.00	R125 153.03	R125 153.03	Actual
Nov-22	R0.00	R0.00	R0.00	R125 153.03	
Dec-22	R0.00	R0.00	R0.00	R125 153.03	
Jan-23	R0.00	R0.00	R0.00	R125 153.03	
Feb-23	R0.00	R0.00	R0.00	R125 153.03	
Mar-23	R87 588.26	R0.00	R87 588.26	R212 741.29	
Apr-23	R0.00	R0.00	R0.00	R212 741.29	
May-23	R0.00	R0.00	R0.00	R212 741.29	
Jun-23	R606 841.86	R0.00	R606 841.86	R819 583.15	
2022/23 FY				**R819 583.15**	
Jul-23	R0.00	R0.00	R0.00	R819 583.15	
Aug-23	R0.00	R0.00	R0.00	R819 583.15	
Sep-23	R0.00	R0.00	R0.00	R819 583.15	
Oct-23	R196 487.75	R0.00	R196 487.75	R1 016 070.90	
Nov-23	R0.00	R0.00	R0.00	R1 016 070.90	
Dec-23	R0.00	R0.00	R0.00	R1 016 070.90	
Jan-24	R0.00	R0.00	R0.00	R1 016 070.90	
Feb-24	R0.00	R0.00	R0.00	R1 016 070.90	
Mar-24	R196 283.53	R0.00	R196 283.53	R1 212 354.43	
Apr-24	R0.00	R0.00	R0.00	R1 212 354.43	
May-24	R107 997.85	R0.00	R107 997.85	R1 320 352.28	

Jun-24	R0.00	R0.00	R0.00	R1 320 352.28	
2023/24 FY				**R500 769.13**	
Jul-24	R0.00	R0.00	R0.00	R1 320 352.28	
Aug-24	R125 153.04	R0.00	R125 153.04	R1 445 505.32	
Sep-24	R0.00	R0.00	R0.00	R1 445 505.32	
Oct-24	R0.00	R0.00	R0.00	R1 445 505.32	
Nov-24	R902 916.40	R0.00	R902 916.40	R2 348 421.72	
Dec-24	R0.00	R0.00	R0.00	R2 348 421.72	
Jan-25	R224 953.89	R0.00	R224 953.89	R2 573 375.61	
Feb-25	R66 000.00	R0.00	R66 000.00	R2 639 375.61	
Mar-25	R155 186.95	R0.00	R155 186.95	R2 794 562.56	
Apr-25	R2 224 388.69	R0.00	R2 224 388.69	R5 018 951.25	
May-25	R0.00	R0.00	R0.00	R5 018 951.25	
Jun-25	R0.00	R0.00	R0.00	R5 018 951.25	
2024/25 FY				**R3 698 598.97**	
Jul-25	R461 245.40	R0.00	R461 245.40	R5 480 196.65	
Aug-25	R461 245.40	R0.00	R461 245.40	R5 941 442.05	
Sep-25	R0.00	R0.00	R0.00	R5 941 442.05	
Oct-25	R521 338.88	R0.00	R521 338.88	R6 462 780.93	
Nov-25	R120 186.95	R0.00	R120 186.95	R6 582 967.88	
Dec-25	R461 245.41	R0.00	R461 245.41	R7 044 213.29	
Jan-26	R230 817.96	R1 536 640.00	R1 767 457.96	R8 811 671.25	
Feb-26	R230 817.96	R2 482 280.00	R2 713 097.96	R11 524 769.21	
Mar-26	R230 817.96	R3 427 900.00	R3 658 717.96	R15 183 487.16	
Apr-26	R230 817.96	R4 373 520.00	R4 604 337.96	R19 787 825.12	
May-26	R230 817.96	R5 319 160.00	R5 549 977.96	R25 337 803.07	
Jun-26	R230 817.96	R6 264 780.00	R6 495 597.96	R31 833 401.03	
2025/26 FY				**R26 814 449.78**	
Jul-26	R 230 817.96	R7 210 410.00	R7 441 227.96	R39 274 628.98	
Aug-26	R 230 817.96	R8 156 040.00	R8 386 857.96	R47 661 486.94	
Sep-26	R 230 817.96	R9 101 660.00	R9 332 477.96	R56 993 964.90	
Oct-26	R 230 817.96	R8 865 260.00	R9 096 077.96	R66 090 042.85	
Nov-26	R 230 817.96	R7 446 820.00	R7 677 637.96	R73 767 680.81	
Dec-26	R 230 817.96	R6 028 370.00	R6 259 187.96	R80 026 868.76	
Jan-27	R 230 817.96	R4 609 940.00	R4 840 757.96	R84 867 626.72	
Feb-27	R 230 817.96	R3 191 490.00	R3 422 307.96	R88 289 934.67	
Mar-27	R 230 818.02	R1 773 050.00	R2 003 868.02	R90 293 802.69	
Apr-27	R -	R0.00	R0.00	R90 293 802.69	
May-27	R -	R0.00	R0.00	R90 293 802.69	
Jun-27	R 387 024.36	R0.00	R387 024.36	R90 680 827.05	
2026/27 FY				**R58 847 426.02**	
Jul-27	R -	R0.00	R0.00	R90 680 827.05	
Aug-27	R -	R0.00	R0.00	R90 680 827.05	
Total	**R10 893 507.05**	**R79 787 320.00**	**R90 680 827.05**		

Forecast

7. Recommendations

Based on the detailed design report for the upgrading of Herold's Bay Sewer Pump Station No. 1 (PS1) and the construction of the new Pump Station No. 4 (PS4), the following recommendations are made to ensure the successful implementation and operation of the project:

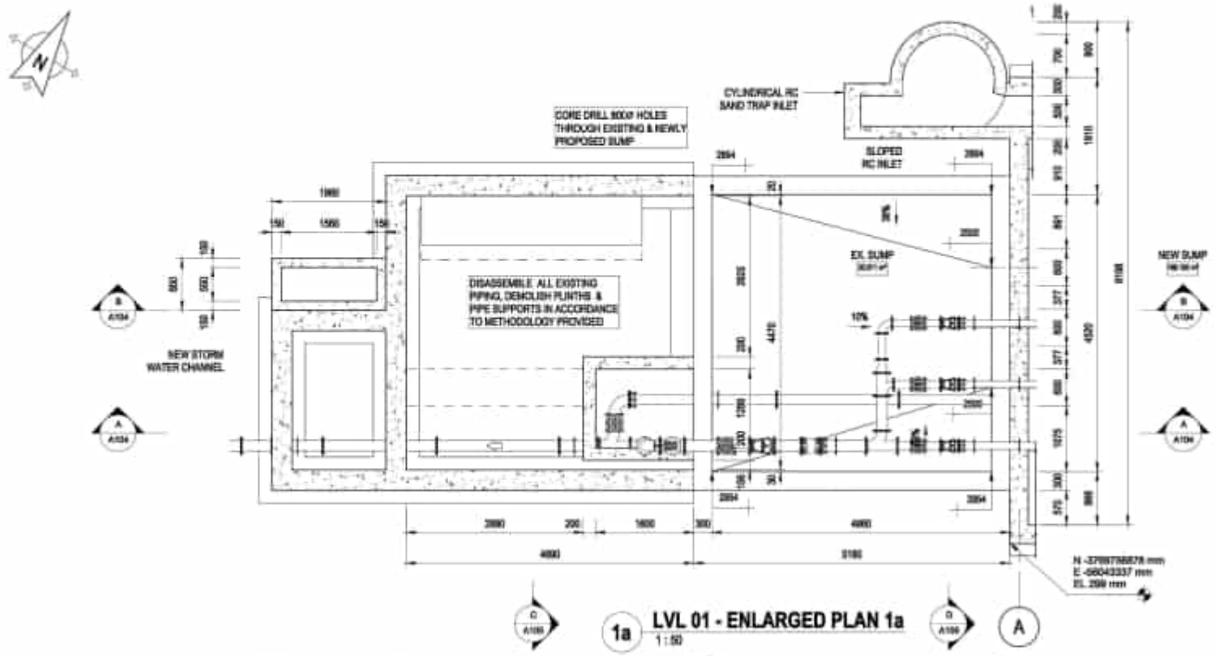
1. **Pump Station 1 (PS1):**
    - Construct a 600m^3 sump and emergency tank to handle peak flows and provide emergency storage.
    - Install three new submersible pumps with Variable Speed Drives (VSD) to improve operational efficiency and reduce energy consumption.
    - Refurbish the existing structures and sump to enhance durability and functionality.
    - Install all new mechanical and electrical equipment.
    - Implement an odour control system to mitigate the impact on nearby residential and recreational areas.
2. **Pump Station 4 (PS4):**
    - Construct a new pump station with facilities for primary and manual screening, de-gritting, and a pump sump with pumps.
    - Provide 180m^3 of emergency storage to manage overflow situations.
    - Install two new pumps with VSD drives, a Motor Control Centre (MCC), and associated stainless steel pipework.
    - Install an indoor diesel generator with a storage tank to provide backup power to both PS4 and PS1, ensuring continuous operation during power outages.
3. **Pipeline Construction:**
    - Construct a new 200m long pipeline between PS1 and PS4, directly buried in the road reserve, using 200mm nominal diameter uPVC pipes.
    - Construct a new 1,300m long pipeline between PS4 and the Wastewater Treatment Works (WWTW), with air valves to manage pressure and prevent pipeline failure.
4. **Operational Considerations:**
    - Address stormwater ingress as a priority to prevent unnecessary sewage discharges into the environment. Implement measures to reduce stormwater infiltration into the sewage system.
    - Ensure continuous monitoring and maintenance of the pump stations and pipelines to maintain operational efficiency and prevent breakdowns.
5. **Architectural and Aesthetic Enhancements**:
    - Integrate architectural features that blend with the surrounding residential and public landscapes, enhancing the visual appeal and functionality of the pump stations.
    - Implement design elements that minimize the visual impact and create a cohesive and inviting public space.
6. **Project Phasing and Budgeting:**
    - Execute the project in multiple phases, if required, based on the available budget and construction timelines. Prioritize critical components to ensure the most urgent needs are addressed first.
    - Regularly review and update cost estimates and project timelines to reflect current market conditions and ensure financial feasibility.
    - Aline implementation not to affect the busy tourism session in Herold's Bays.

7. **Stakeholder Engagement and Communication:**
    - Maintain open communication with all stakeholders, including the George Municipality, local residents, and environmental authorities, to ensure transparency and address any concerns promptly.
    - Conduct regular progress meetings and provide updates to keep all parties informed about the project's status and any changes to the plan.
8. **Additional Services**
    - Clarity is required from the Client regarding the beatification of PS1.
    - It is envisioned the services the services of a fire engineer will be required for PS 4.

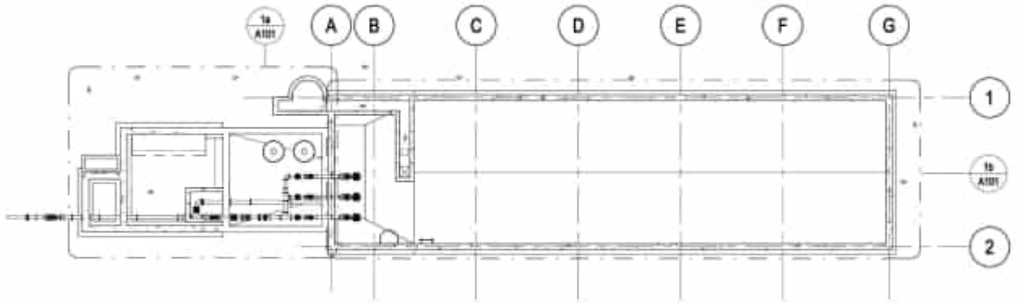
By implementing these recommendations, the Herold's Bay sewer system can be significantly improved, ensuring it meets current and future demands while minimizing environmental impacts and operational challenges.

Annexure A PS 1 Drawings

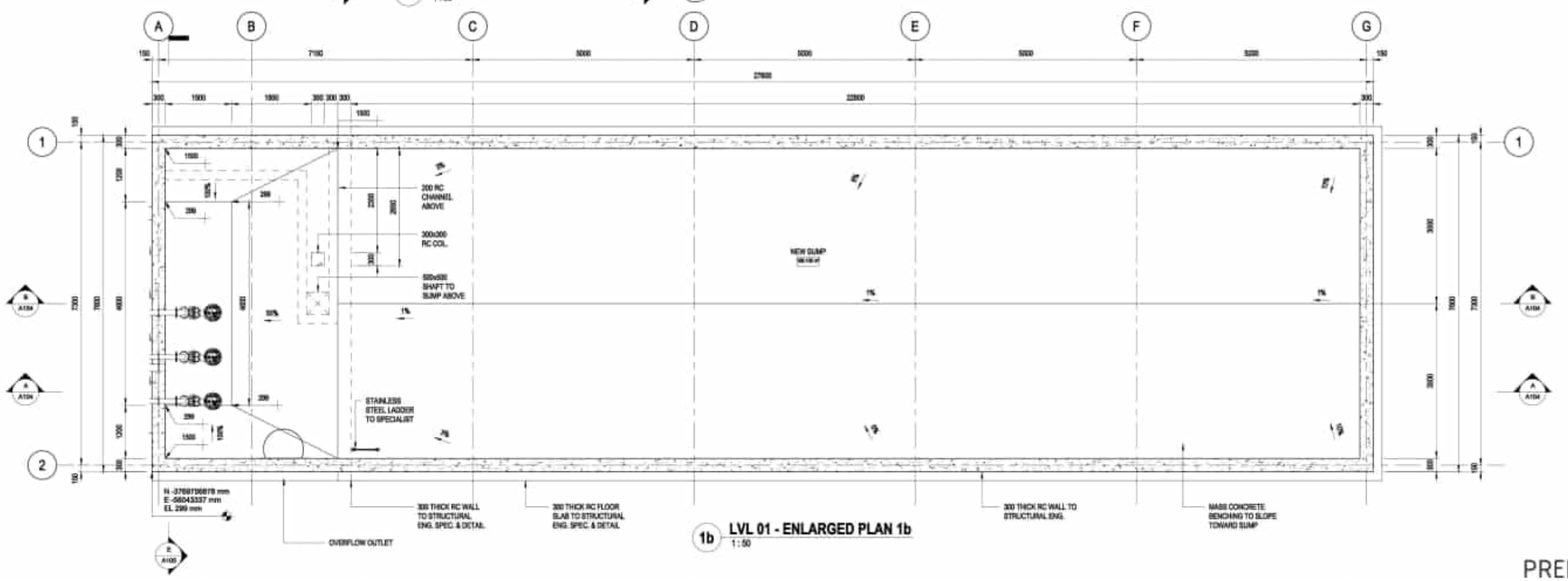
NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.



1a **LVL 01 - ENLARGED PLAN 1a**
1 : 50



1 **KEY PLAN LVL 01**
1 : 150



1b **LVL 01 - ENLARGED PLAN 1b**
1 : 50

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WORK No	APPROVAL
2			-	-
1			-	-
			-	-

TITLE	NAME
DRAFTER	G. MAHER
DRAFTING CHECK	S. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.ORONJE
PROJECT DIRECTOR	T.ORONJE

DRAWING APPROVED:
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1
SCALE 1:50
SCALE 1:100

DESIGNER: SMEC Southern Africa, Member of the Surbana Jurong Group; SABS ISO 9001

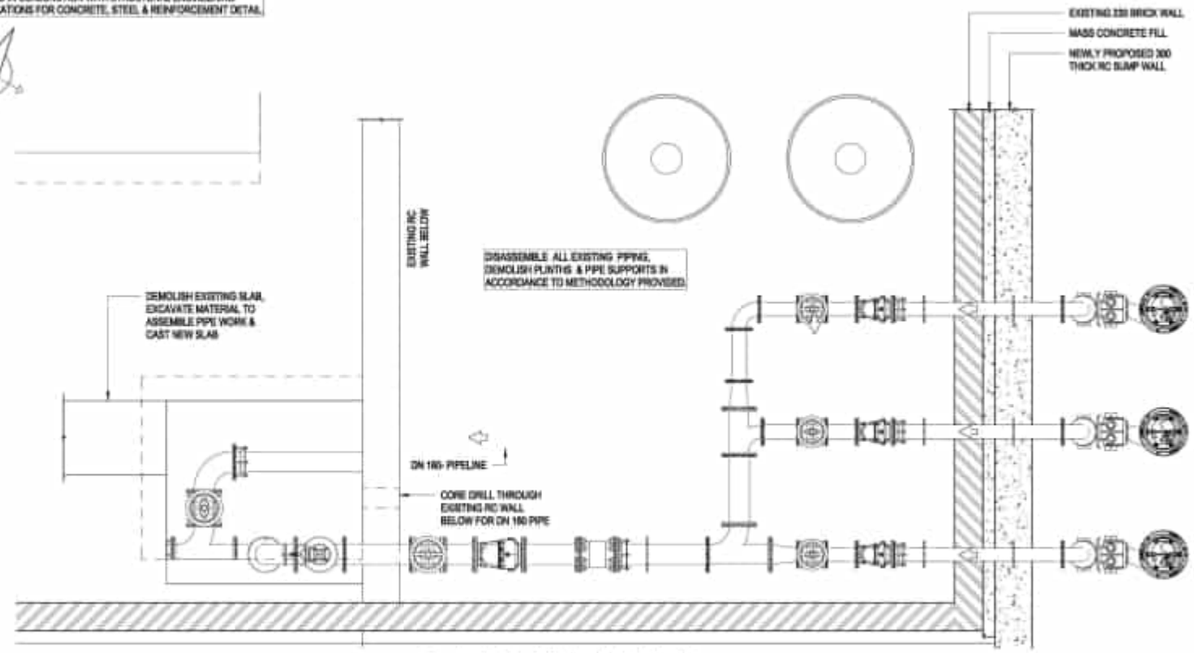
CLIENT: GEORGE

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMPSTATION 1 ADDITIONS & ALTERATIONS - LVL 01 PLAN SECTIONS

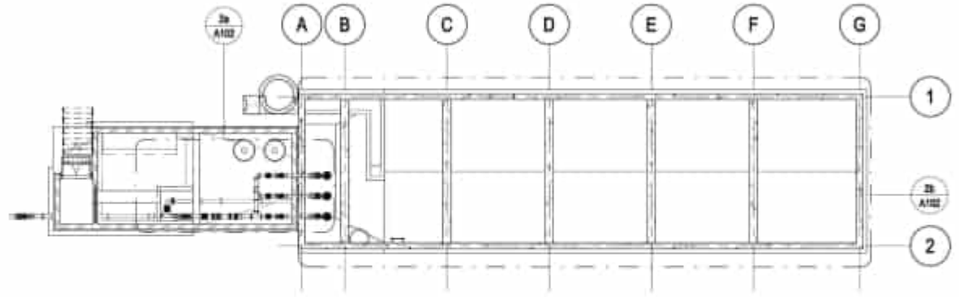
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1924		A101	

PLOT DATE: THU 12/12/2024 10:13:51 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.



2a LVL 02 - ENLARGED PLAN 2a
1 : 25



2 KEY PLAN LVL 02
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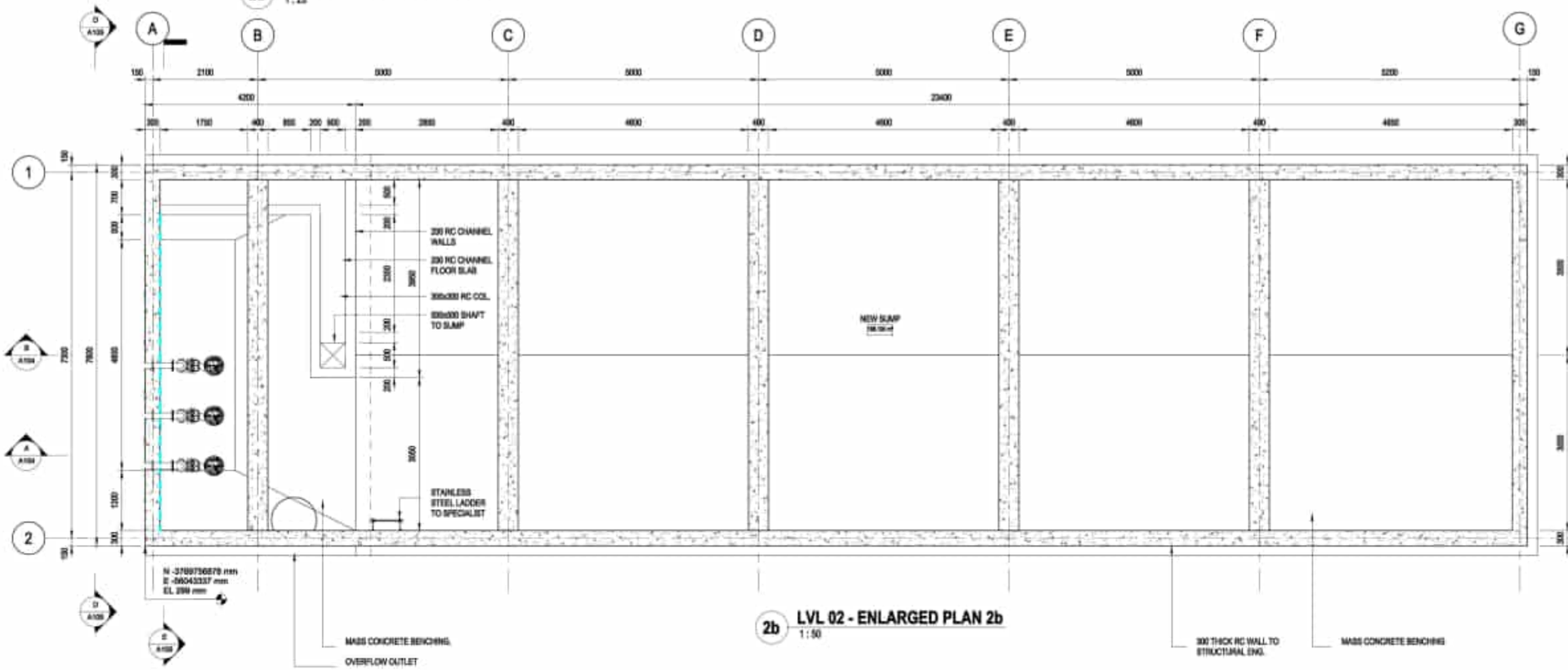


2b LVL 02 - ENLARGED PLAN 2b
1 : 50

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WORK No	APPROVAL
1			-	-
			-	-
			-	-

TITLE	NAME
DRAFTER	G. MARES
DRAFTING CHECK	G. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.CRONJE
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED:
ENGINEER: _____
PR ENG NR: _____
SIGNATURE: _____

SCALES AT A0 & A1 SIZE DRAWING
SCALE 1:1
SCALE 1:50
SCALE 1:100

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

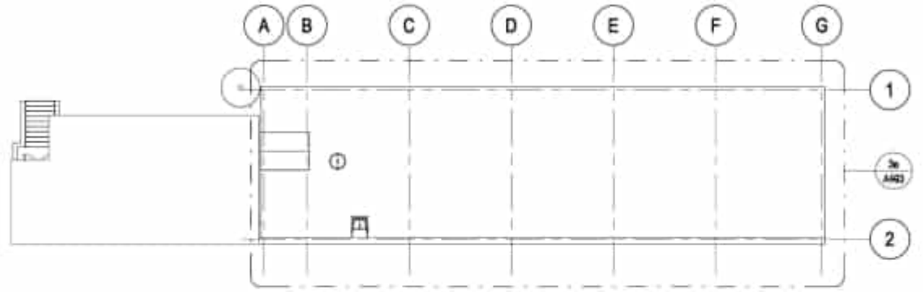
CLIENT
GEORGE
THE CITY FOR ALL SEASONS

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMPSTATION 1 ADDITIONS & ALTERATIONS - LEVEL 02
PLAN SECTIONS

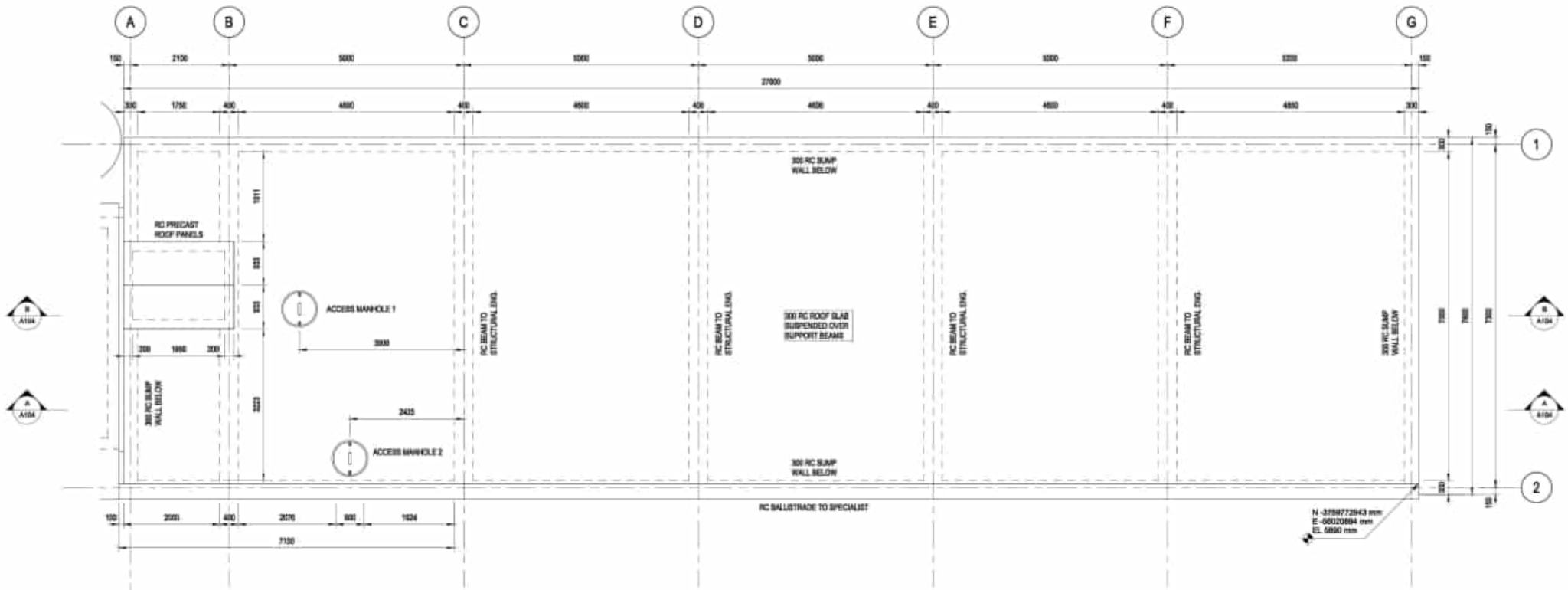
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1924		A102	

PLOT DATE: THU 12/15/2024 10:13:51 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.



3 **KEYPLAN LVL 03**
1 : 150



3a **LVL 03 - ENLARGED PLAN 3a**
1 : 50

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WSP No	APPROVAL
2			-	-
1			-	-
			-	-

TITLE	NAME
DRAFTER	G. MAREE
DRAFTING CHECK	S. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.OBINJE
PROJECT DIRECTOR	T.OBINJE

DRAWING APPROVED:
ENGINEER: _____
PR ENG NR: _____
SIGNATURE: _____

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 0.5 0 1 2
SCALE 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

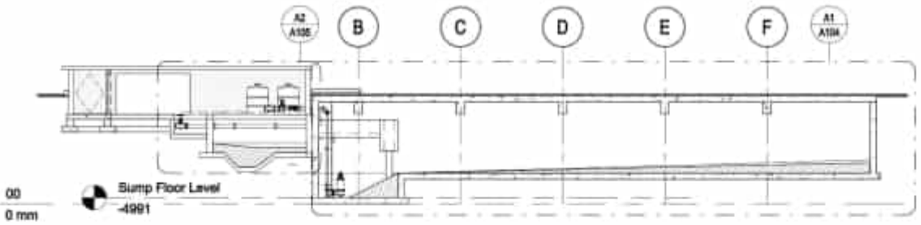
CLIENT
GEORGE
THE CITY FOR ALL SEASONS

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMPSTATION 1 ADDITIONS & ALTERATIONS - LEVEL 03
PLAN SECTION

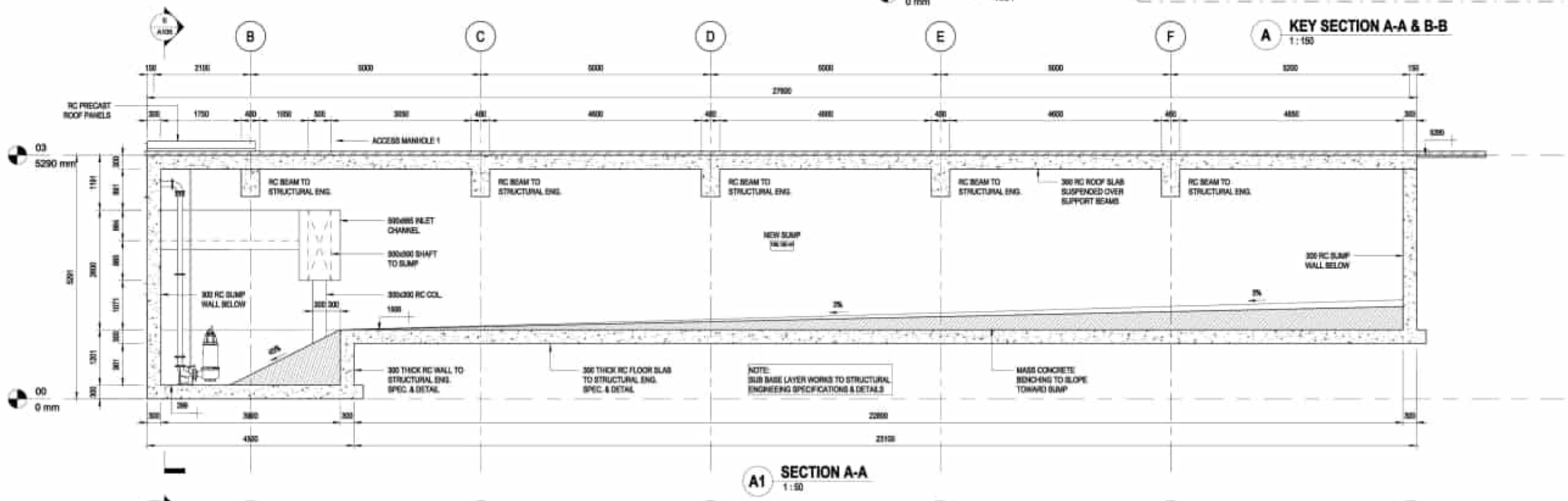
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1924		A103	

PLOT DATE: THU 12/12/2024 10:17:45 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.



A KEY SECTION A-A & B-B
1 : 150



A1 SECTION A-A
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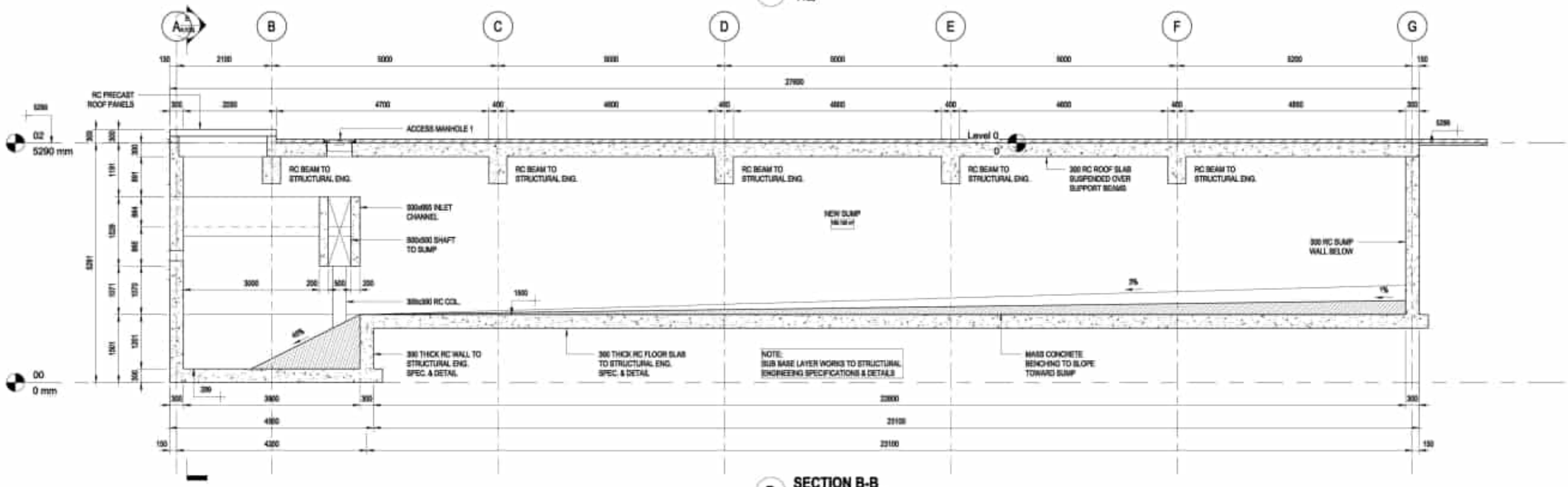


B SECTION B-B
1 : 50

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WIR No	APPROVAL
2			-	-
1			-	-

TITLE	NAME
DRAFTER	G. MAREE
DRAFTING CHECK	S. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.CRONJE
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED:
ENGINEER: _____
PR ENG NR: _____
SIGNATURE: _____

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1
SCALE 1:50
SCALE 1:100

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

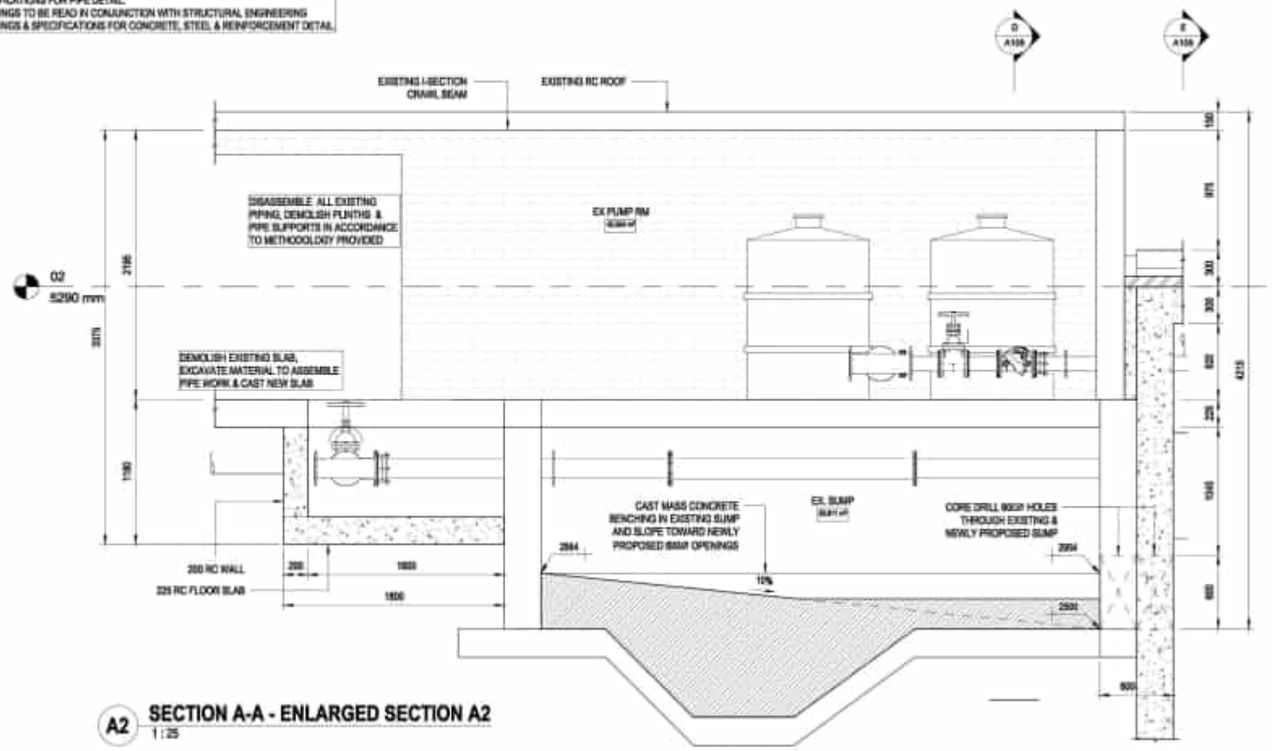
CLIENT
GEORGE
THE CITY FOR ALL SEASONS

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMPSTATION 1 ADDITIONS & ALTERATIONS - SECTIONS A-A & B-B

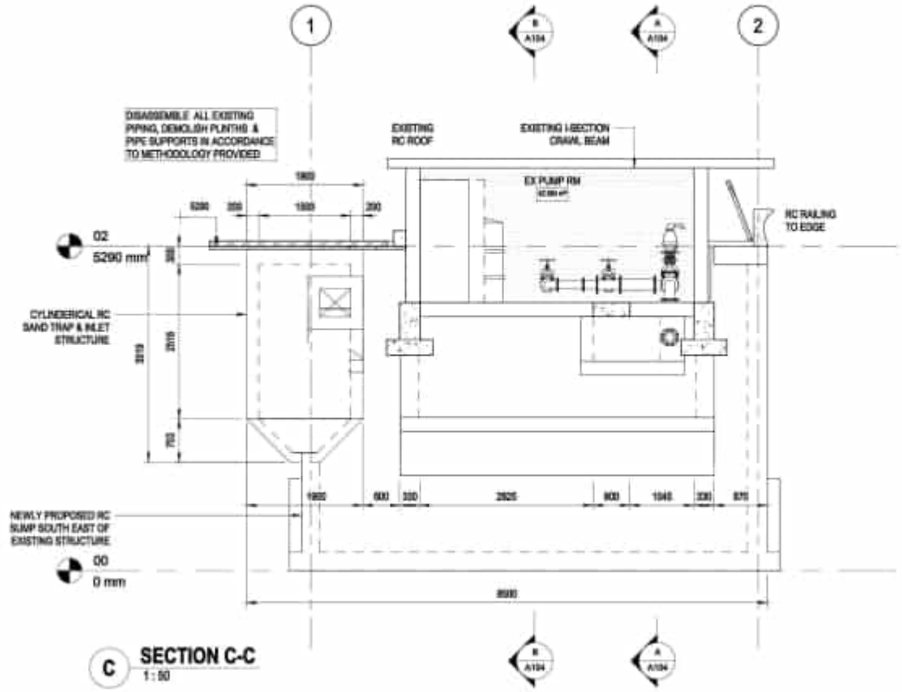
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1924		A104	

PLOT DATE: THU 12/12/2024 10:17:58 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

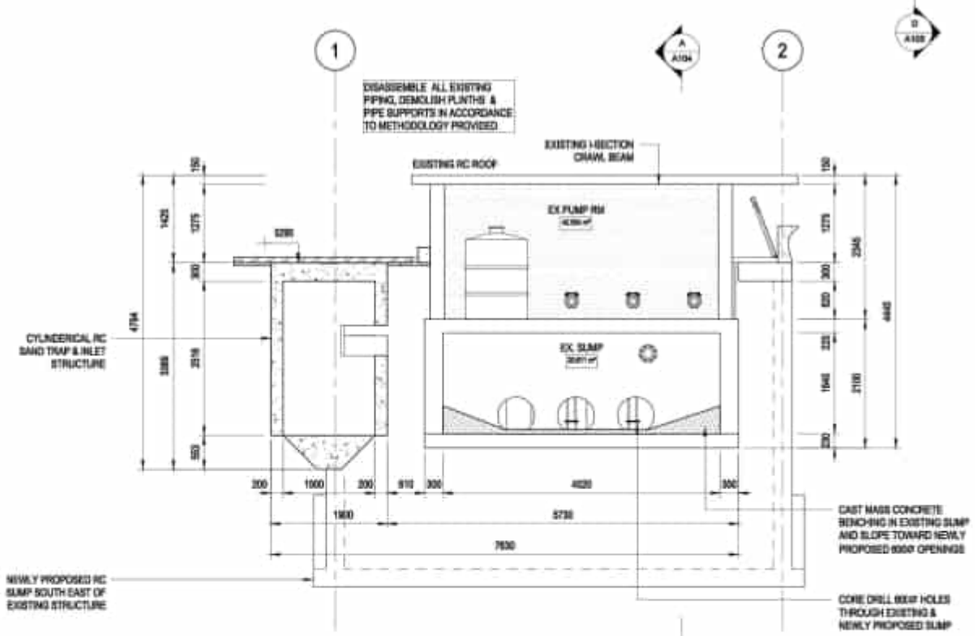
NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL, & REINFORCEMENT DETAIL.



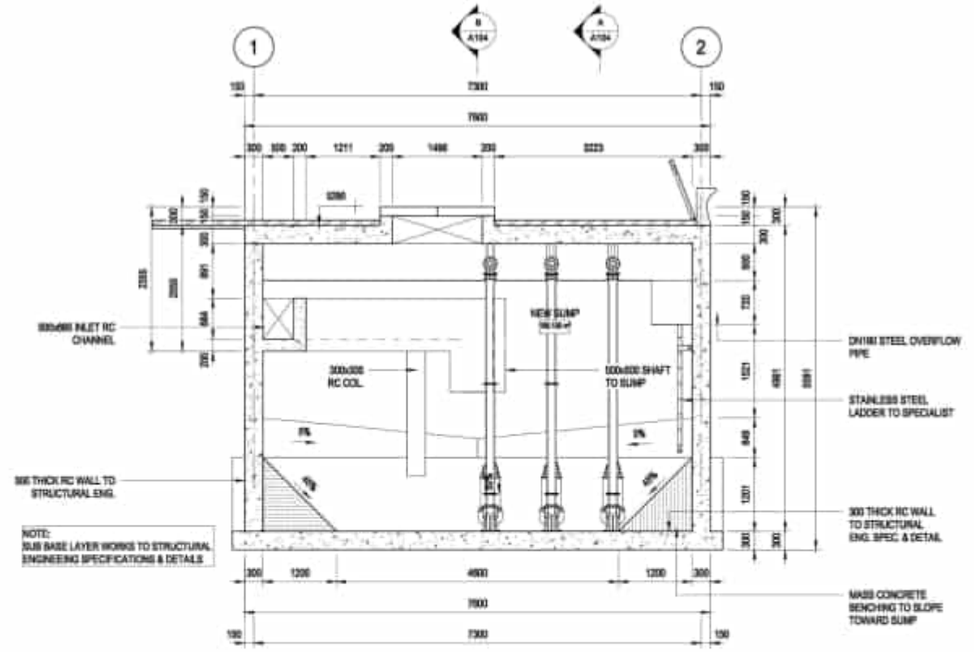
A2 SECTION A-A - ENLARGED SECTION A2
1 : 25



C SECTION C-C
1 : 50



D SECTION E-E1
1 : 50



E SECTION E-E
1 : 50

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WSR No	APPROVAL
2			-	-
1			-	-
			-	-

TITLE	NAME
DRAFTER	G. MAREE
DRAFTING CHECK	S. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.CRONJE
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED:
ENGINEER: _____
PR ENG NR: _____
SIGNATURE: _____

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1
SCALE 1:50
SCALE 1:100

DESIGNER: SMEC South Africa, Member of the Surbana Jurong Group; SABS ISO 9001

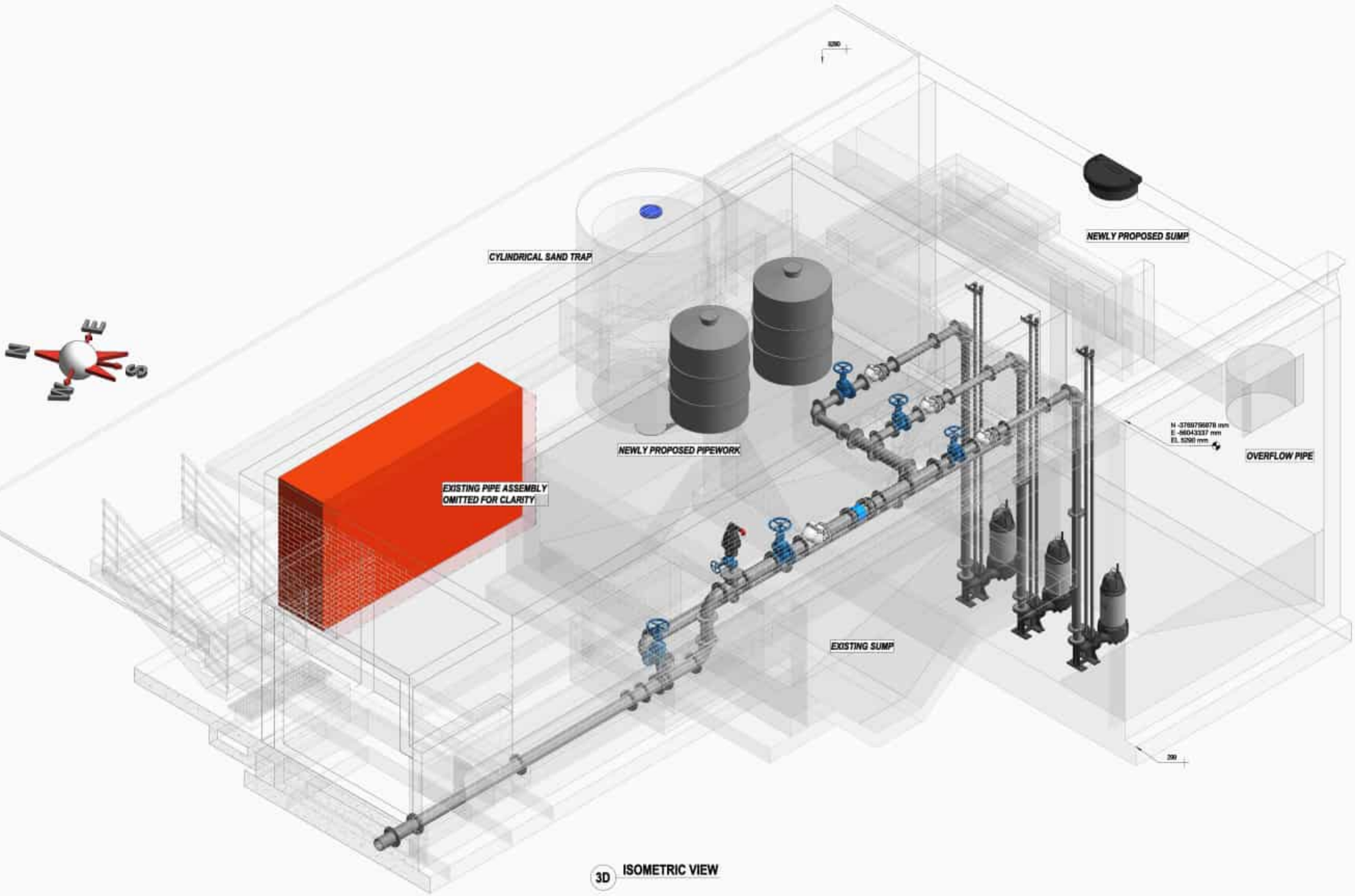
CLIENT: GEORGE

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMPSTATION 1 ADDITIONS & ALTERATIONS - SECTIONS C-C, D-D & E-E

PROJECT NO:	PHASE	DRAWING NUMBER	REVISION
C1924		A105	

PLOT DATE: THU 12/12/2024 10:59:02 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.



3D ISOMETRIC VIEW

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WIN No	APPROVAL	TITLE	NAME
			-	-	DRAFTER	G. MAREE
			-	-	DRAFTING CHECK	G. WHALLEY
			-	-	DESIGNER	S. FAUSTINO
					DESIGN CHECK	G. WHALLEY
2					PROJECT MANAGER	T.CRONJE
1					PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED:
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 0.5 0 1 2
SCALE 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

CLIENT
GEORGE
THE CITY FOR ALL REASONS

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMPSTATION 1 ADDITIONS & ALTERATIONS - ISOMETRIC VIEW

PROJECT NO	PHASE	DRAWING NUMBER	REVISION
C1924		A106	

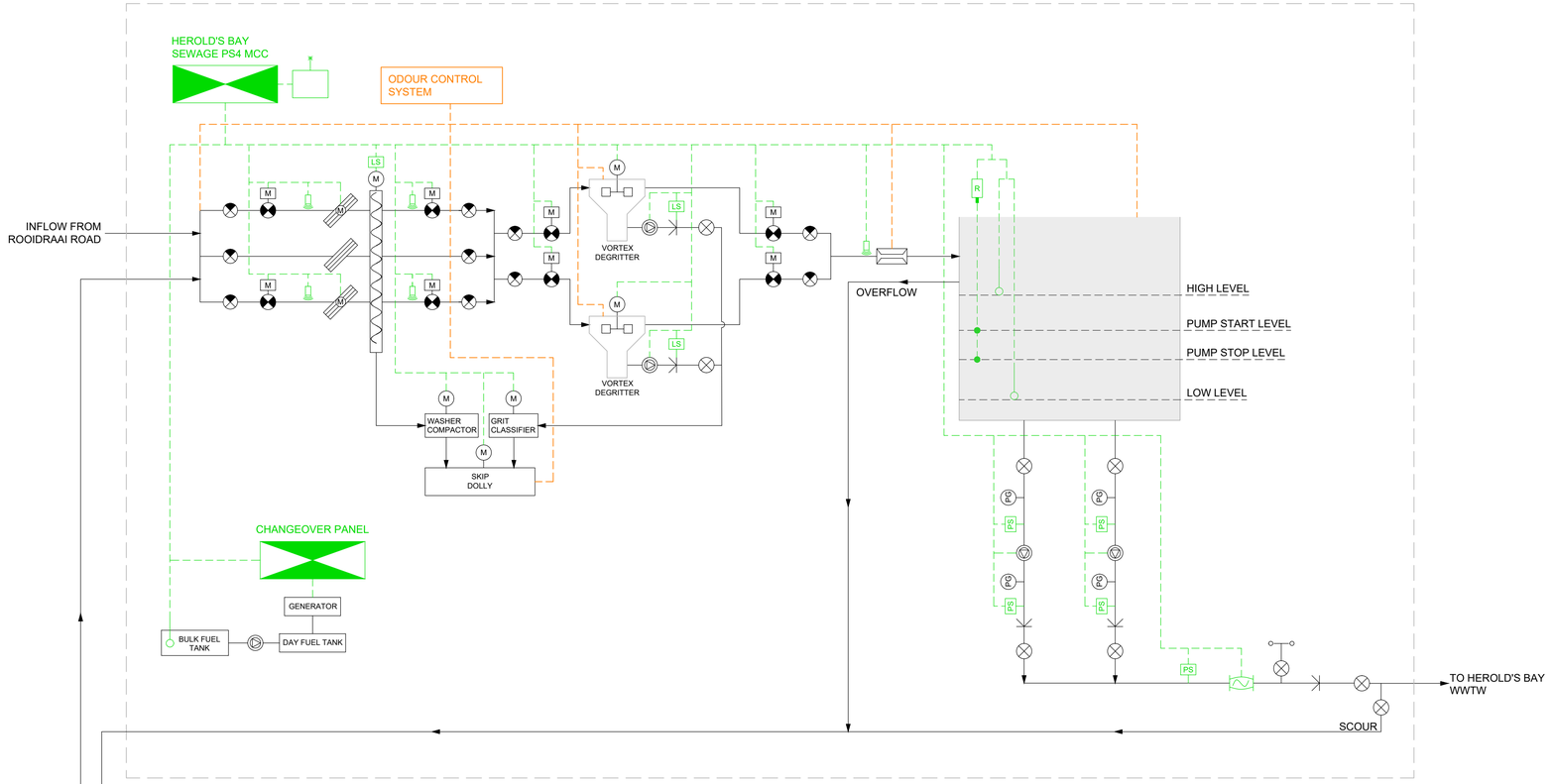
PLOT DATE: THU 12/12/2024 10:59:05 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

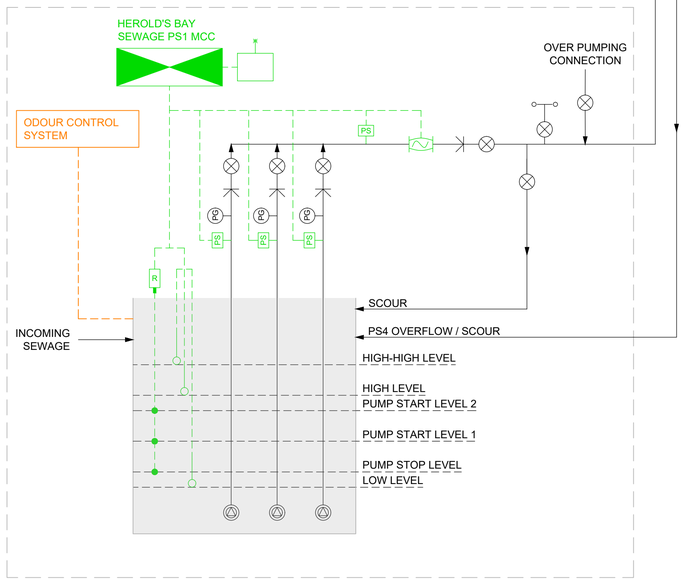
MECHANICAL LEGEND:	
SYMBOL	**DESCRIPTION**
	PUMP/MOTOR SET
	ISOLATING VALVE
	SLUICE GATE
	HAND STOP
	MANUAL BAR RAKE SCREEN
	MECHANICAL SCREEN
	SCREW CONVEYOR
	NON-RETURN VALVE
	AIR RELEASE VALVE
M	MOTORISED COMPONENT
M	ELECTRICAL ACTUATION
	PADDLE DRIVE
PG	PRESSURE GAUGE
	ODOUR CONTROL EXTRACTION

ELECTRICAL LEGEND:	
SYMBOL	**DESCRIPTION**
	MCC / DB
	CHANGEOVER
GENERATOR	GENERATOR

INSTRUMENTATION LEGEND:	
SYMBOL	**DESCRIPTION**
	RADAR LEVEL SENSOR
PS	PRESSURE SENSOR
LS	LIMIT SWITCH
	ULTRASONIC LEVEL SENSOR
	FLOAT LEVEL SWITCH
	TELEMETRY OUTSTATION
	ELECTROMAGNETIC FLOW METER
	SITE COMMUNICATION NETWORK

CIVIL LEGEND:	
SYMBOL	**DESCRIPTION**
	PARSHALL FLUME
	FLOW INDICATION
	VORTEX DEGRITTER
	WET WELL AREA / SUMP AREA





REVISIONS					DESIGNED	T. AUGUSTYN
					CHECKED	T. BRINK
					DRAWN	W. SAPTO
A	09-12-2024	FOR INFORMATION PURPOSES	TA		CHECKED	T. BRINK
NO.	DATE	DESCRIPTION	INITIAL			

SIGNED _____
SMEC South Africa
DATE _____

smec an SNC company
PO Box 10633 George 6530
13 Progress St George 6529
e-mail: george@smec.com website: www.smec.com
Tel (044) 873-5029 Fax (044) 873-5086

GEORGE THE CITY FOR ALL REASONS

SIGNED _____
DATE _____

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION

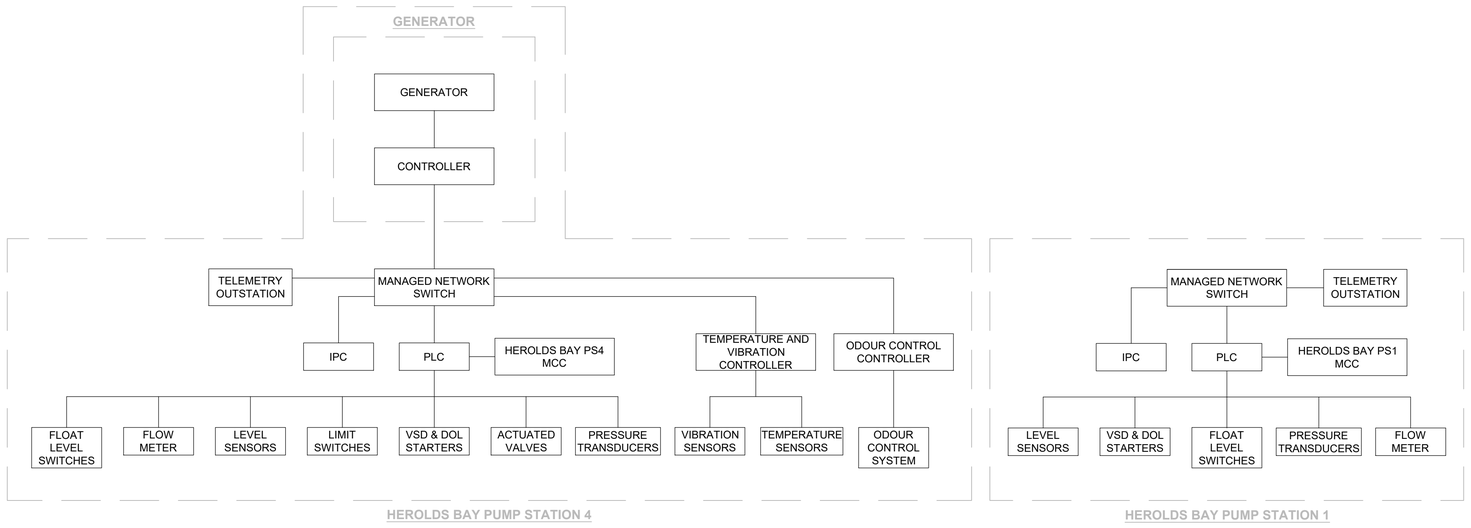
PIPING & INSTRUMENTATION DIAGRAM (P&ID)

SIZE	SCALE
A1	N.T.S

PROJECT DRAWING NUMBER: C1936 - E - GEN - 001

REV	SHEET No.
0	1 OF 1

SCALE BAR 1 : 1000 — 0, 10m, 25m, 50m, 100m



REVISIONS							
					DESIGNED	AB STEENKAMP	
					CHECKED	AB STEENKAMP	
					DRAWN	JD CAROLISSEN	
0	09-12-2024	DETAILED DESIGN	ABS		CHECKED	AB STEENKAMP	
NO.	DATE	DESCRIPTION	INITIAL				

SIGNED

SMEC South Africa

DATE

smec an SNC company
PO Box 10633 George 6530
13 Progress St George 6529
e-mail: george@smec.com website: www.smec.com
Tel (044) 873-5029 Fax (044) 873-5086

GEORGE THE CITY FOR ALL REASONS

SIGNED

DATE

GEORGE MUNICIPALITY HEROLDS BAY PUMP STATION

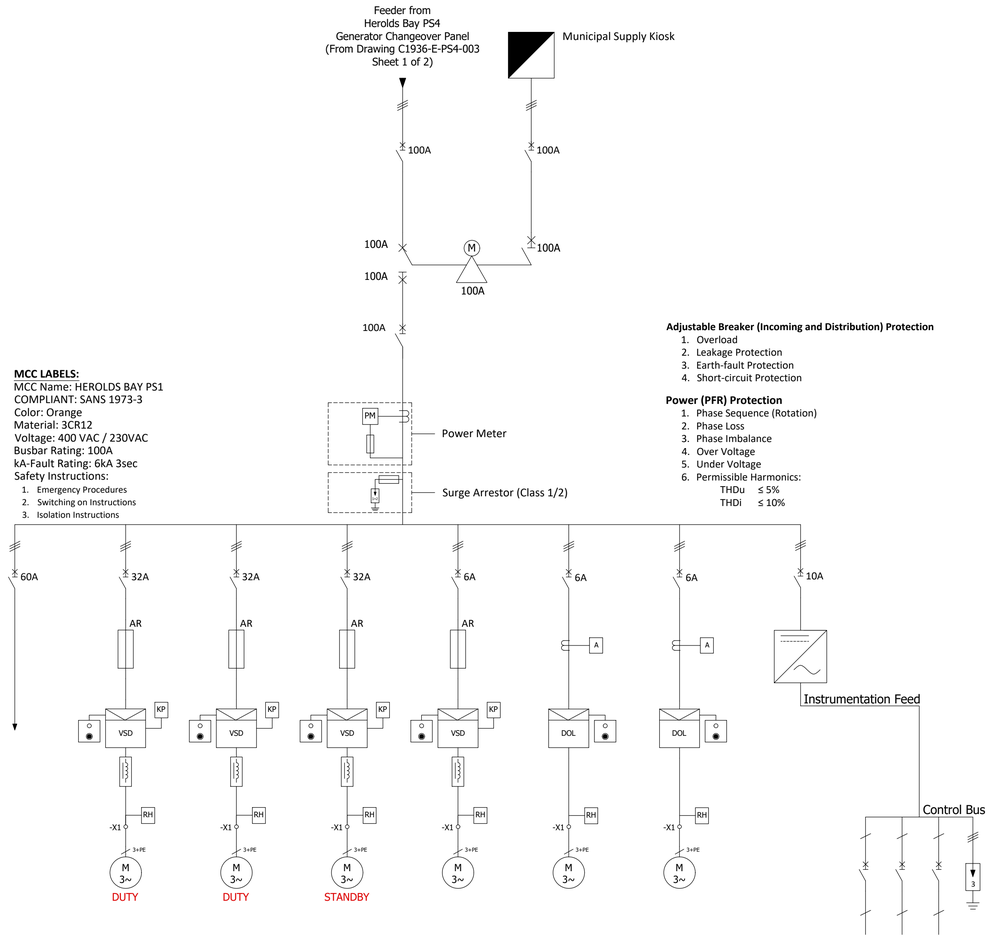
PUMP STATION 1 AND PUMP STATION 4 NETWORK ARCHITECTURE DIAGRAM

SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER
C1936 - E - GEN - 002

REV	SHEET No.
0	1st OF 1

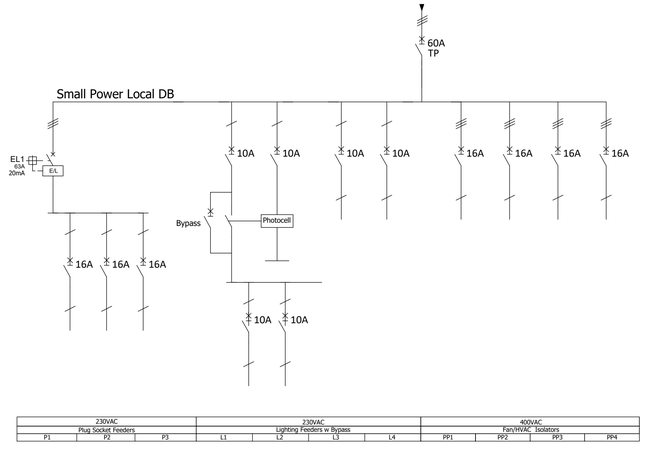
SCALE BAR 1 : 1000
100m 50m 25m 10m 0



MCC LABELS:
MCC Name: HEROLDS BAY PS1
COMPLIANT: SANS 1973-3
Color: Orange
Material: 3CR12
Voltage: 400 VAC / 230VAC
Busbar Rating: 100A
kA-Fault Rating: 6kA 3sec
Safety Instructions:
1. Emergency Procedures
2. Switching on Instructions
3. Isolation Instructions

Adjustable Breaker (Incoming and Distribution) Protection
1. Overload
2. Leakage Protection
3. Earth-fault Protection
4. Short-circuit Protection

Power (PFR) Protection
1. Phase Sequence (Rotation)
2. Phase Loss
3. Phase Imbalance
4. Over Voltage
5. Under Voltage
6. Permissible Harmonics:
   THDu ≤ 5%
   THDi ≤ 10%



LEGEND:

- Air Circuit Breaker
- Circuit Breaker
- Air Circuit Breaker Bus-coupler
- Bus-coupler
- Isolator
- Mechanical Interlock
- Electrical Interlock
- Key Type Interlock System
- 3p Fuse
- AR Ultra Rapid Semiconductor Fuse
- Phase Indication
- Smart Power Meter
- CT & Ammeter
- Running Hour Meter
- Combined Class 1&2 Surge Arrestor
- Surge Arrestor Class 3
- Power Factor Correction Unit
- Active Harmonic Filter
- Power Transformer
- Control Transformer
- Inline UPS
- Motor Starter:
  DOL: Direct on Line
  FW/REV: Forward Reverse
  SS: Soft Starter
  VSD: Variable Speed Drive
- 3p Contactor
- 3p Contactor Forward / Reverse
- Thermal Overload
- Door Mount Keypad/HMI
- Output Choke (dV/dT)
- 3P Motor
- 3P Motor w Torque Limiter
- 3P Earth Leakage Unit
- Actuator Valve
- Photocell w Contactor
- Emergency Stop
- Local Control Station
- 3P Motor w Heater
- Motorized Mechanically and Electrically Interlocked Changeover Mechanism
- Miniature Substation
- Supply Kiosk
- Emergency Backup Generator

REVISIONS						
				DESIGNED	AB STEENKAMP	
				CHECKED	AB STEENKAMP	
				DRAWN	JD CAROLISSEN	
0	09-12-2024	DETAILED DESIGN	ABS	CHECKED	AB STEENKAMP	
NO.	DATE	DESCRIPTION	INITIAL			

SIGNED
SMEC South Africa
DATE

smec an SNC company
PO Box 10633 George 6530
13 Progress St George 6529
e-mail: george@smec.com Tel (044) 873-5029
website: www.smec.com Fax (044) 873-5086

GEORGE THE CITY FOR ALL REASONS

SIGNED
DATE

GEORGE MUNICIPALITY
HEROLDS BAY PUMP STATION

PUMP STATION 1
ELECTRICAL SINGLE LINE DIAGRAM

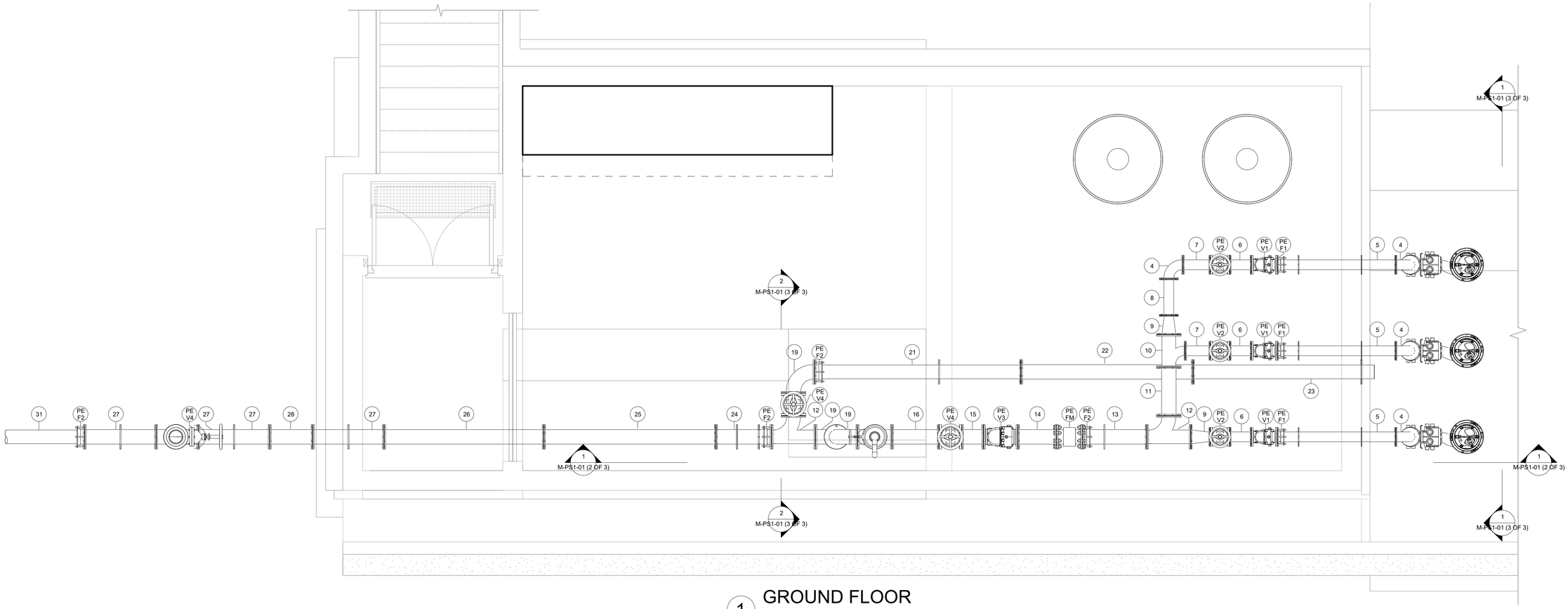
SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER: C1936 - E - PS1 - 001

REV	SHEET No.
0	1st OF 1

SCALE BAR 1 : 1000 (100m, 50m, 25m, 10m, 0)

PLOT DATE TIME
2024/12/12 16:02:48



1 GROUND FLOOR
1 : 25

PIPE SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
1	Ø80 mm x Ø100 mm	ECCENTRIC REDUCER: FBE	PN10	3
2	Ø100 mm	PIPE : FBE	PN10	3
3	Ø100 mm	PIPE : F+PE	PN10	3
4	Ø100 mm	90º BEND : FBE	PN10	4
5	Ø100 mm	PUDDLE PIPE : F+PE + Restraining Flange	PN10	3
6	Ø100 mm	PIPE : FBE	PN10	3
7	Ø100 mm	PIPE : FBE	PN10	2
8	Ø100 mm	PIPE : FBE	PN10	1
9	Ø100 mm x Ø150 mm	CONCENTRIC REDUCER: FBE	PN10	2
10	Ø100 mm x Ø150 mm	UNEQUAL SWEPT TEE	PN10	1
11	Ø150 mm	PIPE : FBE	PN10	1
12	Ø150 mm	90º SWEPT TEE : FBE	PN10	2
13	Ø150 mm	PIPE : F+PE + Restraining Flange	PN10	1
14	Ø150 mm	PIPE : FBE	PN10	1
15	Ø150 mm	PIPE : FBE	PN10	1
16	Ø150 mm	PIPE : FBE	PN10	1
17	Ø150mm	TEE : FAE	PN10	1
18	Ø150 mm	PIPE : FBE	PN10	1
19	Ø100 mm	90º BEND : FBE	PN10	3
20	Ø150 mm	PIPE : FBE	PN10	1
21	Ø150 mm	PUDDLE PIPE : F+PE	PN10	1
22	Ø150 mm	PIPE : FBE	PN10	1
23	Ø150 mm	PUDDLE PIPE : F+PE	PN10	1
24	Ø150 mm	PUDDLE PIPE : F+PE + Restraining Flange	PN10	1
25	Ø150 mm	PIPE : FBE	PN10	1
26	Ø150 mm	PIPE : FBE	PN10	1
27	Ø150 mm	PUDDLE PIPE : FBE	PN10	3
28	Ø150 mm	PIPE : FBE	PN10	1
29	Ø150mm	TEE : FAE	PN10	1
30	Ø150mm	OVER-PUMPING CONNECTION	PN10	1
31	Ø150 mm	PIPE : PBE	PN10	1

EQUIPMENT SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PE F1	Ø100 mm	ADAPTOR FLANGE	PN10	6
PE F2	Ø150 mm	ADAPTOR FLANGE	PN10	4
PE FM	Ø150 mm	ELECTROMAGNETIC FLOWMETER : FBE	PN10	1
PE P	N/A	PUMPSET, COMPLETE	N/A	3
PE V1	Ø100 mm	NON-RETURN VALVE	PN10	3
PE V2	Ø100 mm	GATE VALVE	PN10	3
PE V3	Ø150 mm	NON-RETURN VALVE	PN10	1
PE V4	Ø150 mm	GATE VALVE	PN10	3
PE V5	Ø50 mm	GATE VALVE	PN10	1
PE V6	Ø50 mm	AIR RELEASE VALVE	PN10	1

GENERAL NOTES:

1. CONTRACTOR TO VERIFY ALL LEVELS, HEIGHTS & DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF WORK.
2. LARGE SCALE DRAWINGS ENJOY PREFERENCE OVER SMALL SCALE DRAWINGS.
3. DO NOT SCALE DRAWINGS, DIMENSIONS ONLY TO BE USED.
4. DAMAGE TO UNKNOWN SERVICES - THE CONTRACTOR'S LIABILITY WHEN HE ENCOUNTERS UNKNOWN SERVICES IS TO NOTIFY THE ENGINEER/PROJECT MANAGER THEREOF IMMEDIATELY AND TO SUSPEND ALL AFFECTED WORK IN THE IMMEDIATE VICINITY UNTIL WRITTEN INSTRUCTION TO PROCEED HAS BEEN GIVEN BY THE PROJECT ENGINEER.
5. IF ANY PARTICULARS OR THE MEANING OF THE DESCRIPTION OF ANY ITEM IS NOT CLEAR OR IS AMBIGUOUS, INDISTINCT OR CAUSES CONFUSION AS TO ITS MEANING OR IF ANY OBVIOUS ERROR OCCURS ON THE DRAWINGS, THE CONTRACTOR MUST INFORM ILISO IMMEDIATELY IN ORDER TO HAVE THE ERROR CORRECTED OR EXPLAINED, AS THE CASE MAY BE.
6. CONTRACTOR TO CONFIRM ELECTRICAL LAYOUT AND LIGHT FITTING TYPES WITHCLIENT PRIOR TO COMMENCEMENT OF ANY BUILDING WORK.
7. COPYRIGHT RESERVED BY ILISO.
8. ALL WORK TO BE EXECUTED IN ACCORDANCE WITH THE NATIONAL BUILDING REGULATIONS AND THE LOCAL BY-LAWS & REGULATIONS.

NOTES:

1. ALL PIPEWORK BE HOT-DIPPED GALVANIZED AND EPOXY COATED MILD STEEL, FLANGED TO SANS 1123 1600/3 AND 1600/3 FOR SUCTION AND DISCHARGE.
2. FBE = FLANGED BOTH END
3. FAE = FLANGED ALL END
4. F+PE = FLANGED + PLAIN
5. VJFA = FLANGE ADAPTOR
6. FTF = FLANGE TO FLANGE
7. CTE = CENTRE TO END
8. CONTRACTOR TO PROVIDE PIPE SUPPORTS TO SECURE ALL PIPEWORK.
9. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE INDICATED.
10. CONTRACTOR TO CONFIRM ALL DIMENSIONS ON SITE PRIOR TO PROCUREMENT OR FABRICATION OF EQUIPMENT.
11. ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MECHANICAL AND ELECTRICAL SPECIFICATION.
12. ALL BUILDING AND STRUCTURAL DETAIL IS ONLY FOR ILLUSTRATIVE PURPOSES. THE APPLICABLE CIVIL AND STRUCTURAL DRAWINGS SHALL GOVERN.

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
			-	-
			-	-
			-	-
2				
1				

TITLE	NAME
DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED

ENGINEER: .....

PR ENG NR: .....

SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING

SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05

SCALE 1:50 — 0.5 0 1 2

SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER

SMEC South Africa
Member of the Surbana Jurong Group

SABS ISO 9001

CLIENT

GEORGE
THE CITY FOR ALL REASONS

GEORGE MUNICIPALITY

HEROLD'S BAY PUMP STATION

PUMP STATION 1 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS1-01 (1 OF 3)	A

DRAWING FILE LOCATION / NAME

150 mm ON ORIGINAL

A1

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

PLOT DATE TIME
2024/12/12 16:02:47

NOTES:

1. ALL PIPEWORK BE HOT-DIPPED GALVANIZED AND EPOXY COATED MILD STEEL, FLANGED TO SANS 1123 1600/3 AND 1600/3 FOR SUCTION AND DISCHARGE.
2. FBE = FLANGED BOTH END
3. FAE = FLANGED ALL END
4. F+PE = FLANGED + PLAIN
5. VJFA = FLANGE ADAPTOR
6. FTF = FLANGE TO FLANGE
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GENERAL NOTES:

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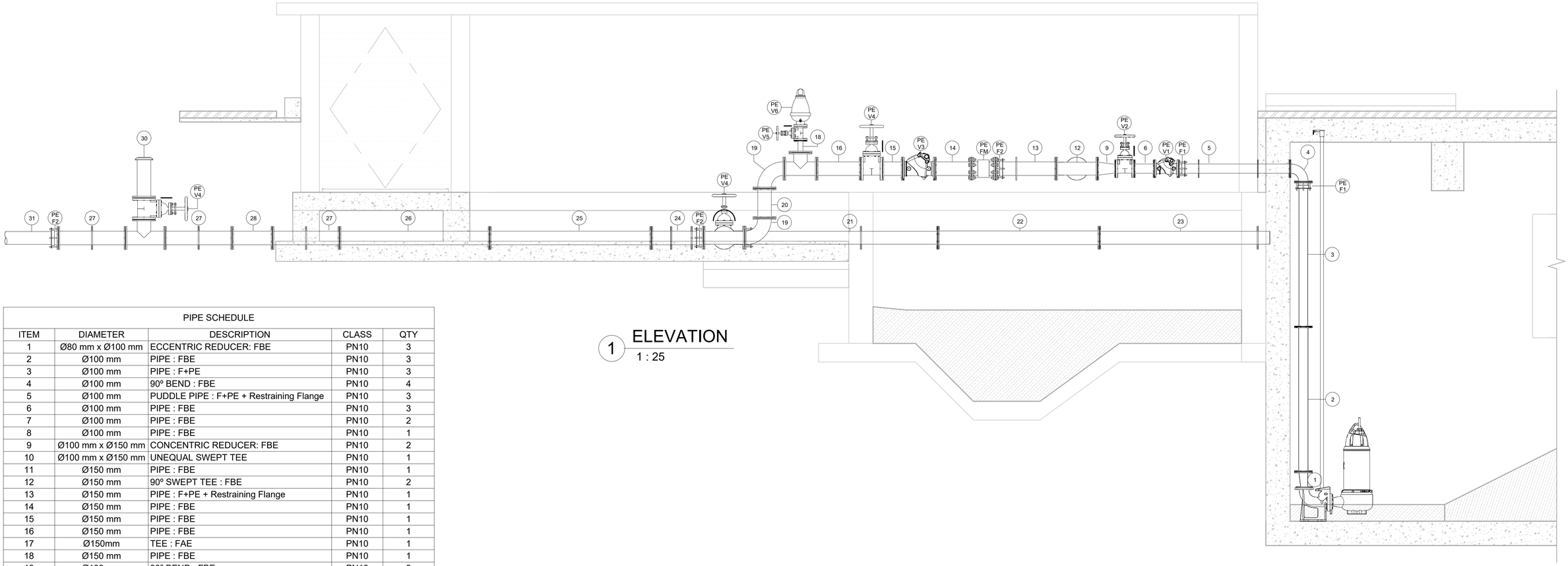
8. ALL WORK TO BE EXECUTED IN ACCORDANCE WITH THE NATIONAL BUILDING REGULATIONS AND THE LOCAL BY-LAWS & REGULATIONS.



1 ELEVATION
1 : 25

PIPE SCHEDULE

ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
1	Ø80 mm x Ø100 mm	ECCENTRIC REDUCER: FBE	PN10	3
2	Ø100 mm	PIPE : FBE	PN10	3
3	Ø100 mm	PIPE : F+PE	PN10	3
4	Ø100 mm	90º BEND : FBE	PN10	4
5	Ø100 mm	PUDDLE PIPE : F+PE + Restraining Flange	PN10	3
6	Ø100 mm	PIPE : FBE	PN10	3
7	Ø100 mm	PIPE : FBE	PN10	2
8	Ø100 mm	PIPE : FBE	PN10	1
9	Ø100 mm x Ø150 mm	CONCENTRIC REDUCER: FBE	PN10	2
10	Ø100 mm x Ø150 mm	UNEQUAL SWEPT TEE	PN10	1
11	Ø150 mm	PIPE : FBE	PN10	1
12	Ø150 mm	90º SWEPT TEE : FBE	PN10	2
13	Ø150 mm	PIPE : F+PE + Restraining Flange	PN10	1
14	Ø150 mm	PIPE : FBE	PN10	1
15	Ø150 mm	PIPE : FBE	PN10	1
16	Ø150 mm	PIPE : FBE	PN10	1
17	Ø150mm	TEE : FAE	PN10	1
18	Ø150 mm	PIPE : FBE	PN10	1
19	Ø100 mm	90º BEND : FBE	PN10	3
20	Ø150 mm	PIPE : FBE	PN10	1
21	Ø150 mm	PUDDLE PIPE : F+PE	PN10	1
22	Ø150 mm	PIPE : FBE	PN10	1
23	Ø150 mm	PUDDLE PIPE : F+PE	PN10	1
24	Ø150 mm	PUDDLE PIPE : F+PE + Restraining Flange	PN10	1
25	Ø150 mm	PIPE : FBE	PN10	1
26	Ø150 mm	PIPE : FBE	PN10	1
27	Ø150 mm	PUDDLE PIPE : FBE	PN10	3
28	Ø150 mm	PIPE : FBE	PN10	1
29	Ø150mm	TEE : FAE	PN10	1
30	Ø150mm	OVER-PUMPING CONNECTION	PN10	1
31	Ø150 mm	PIPE : PBE	PN10	1

EQUIPMENT SCHEDULE

ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PE F1	Ø100 mm	ADAPTOR FLANGE	PN10	6
PE F2	Ø150 mm	ADAPTOR FLANGE	PN10	4
PE FM	Ø150 mm	ELECTROMAGNETIC FLOWMETER : FBE	PN10	1
PE P	N/A	PUMPSET, COMPLETE	N/A	3
PE V1	Ø100 mm	NON-RETURN VALVE	PN10	3
PE V2	Ø100 mm	GATE VALVE	PN10	3
PE V3	Ø150 mm	NON-RETURN VALVE	PN10	1
PE V4	Ø150 mm	GATE VALVE	PN10	3
PE V5	Ø50 mm	GATE VALVE	PN10	1
PE V6	Ø50 mm	AIR RELEASE VALVE	PN10	1

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-12	FOR DETAIL	-	-

TITLE	NAME
DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 0.5 0 1 2
SCALE 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

CLIENT
GEORGE
THE CITY FOR ALL REASONS

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMP STATION 1 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS1-01 (2 OF 3)	A

DRAWING FILE LOCATION / NAME

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A1
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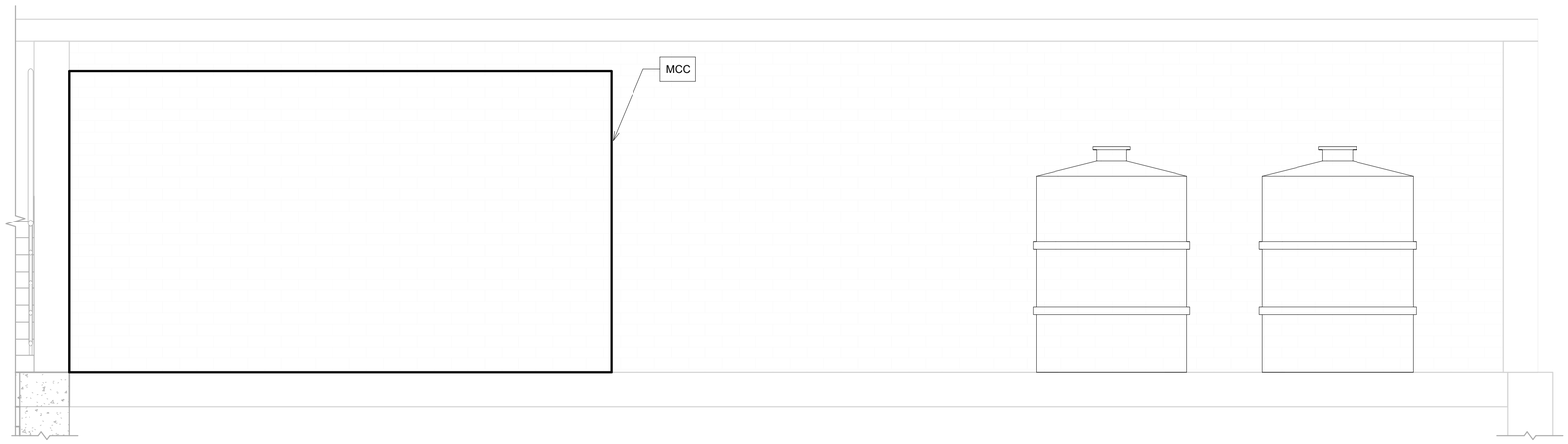
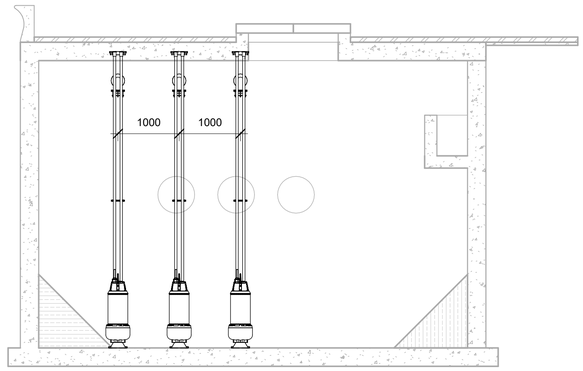
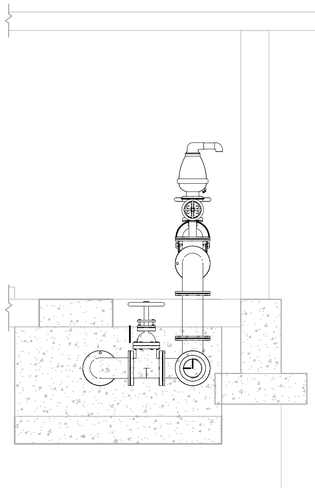


3 MCC AND ODOUR CONTROL
1 : 20



1 PUMPS FRONT SECTION
1 : 50



2 SCOUR RETURN LINE
1 : 25

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-12	FOR DETAIL	-	-
			-	-

TITLE	NAME
DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 — 0.5 0 1 2
SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

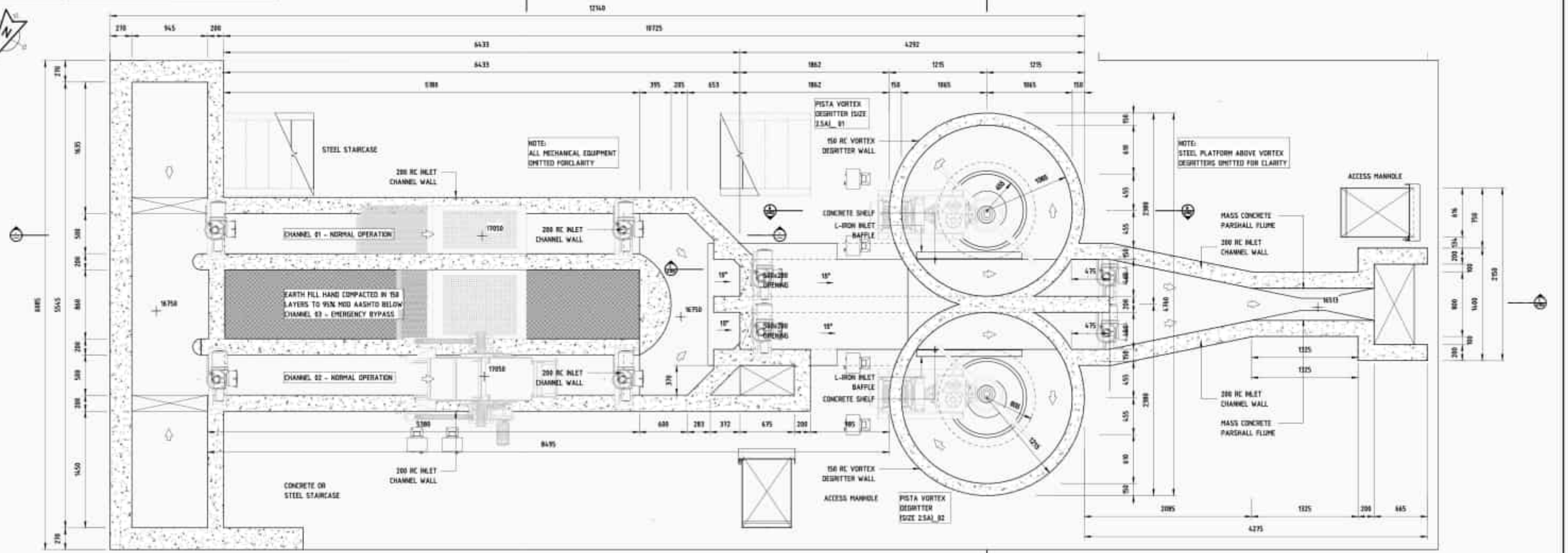
CLIENT
GEORGE
THE CITY FOR ALL REASONS

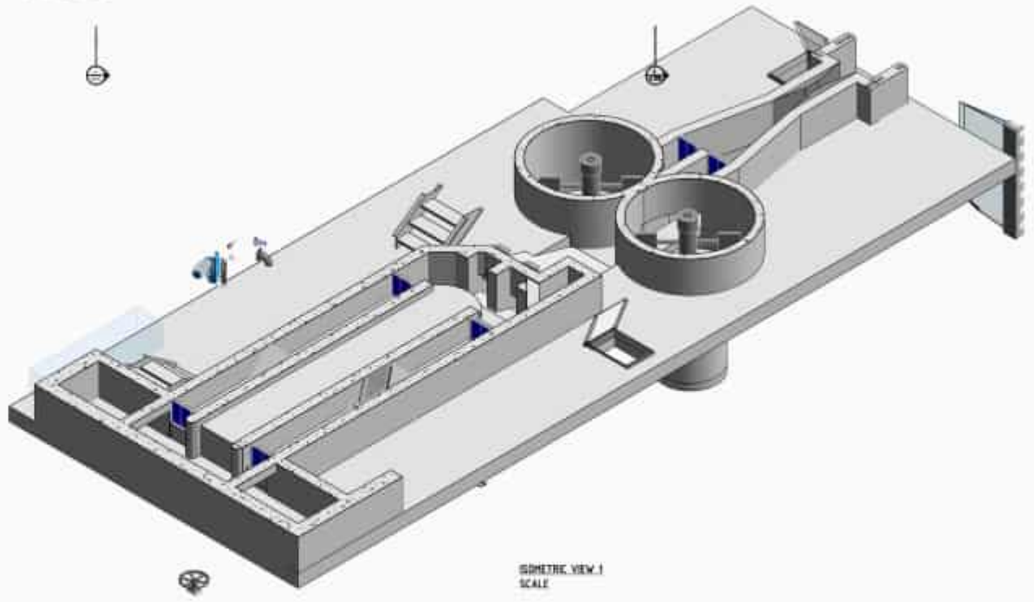
GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMP STATION 1 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS1-01 (3 OF 3)	A

Annexure B PS 4 Drawings

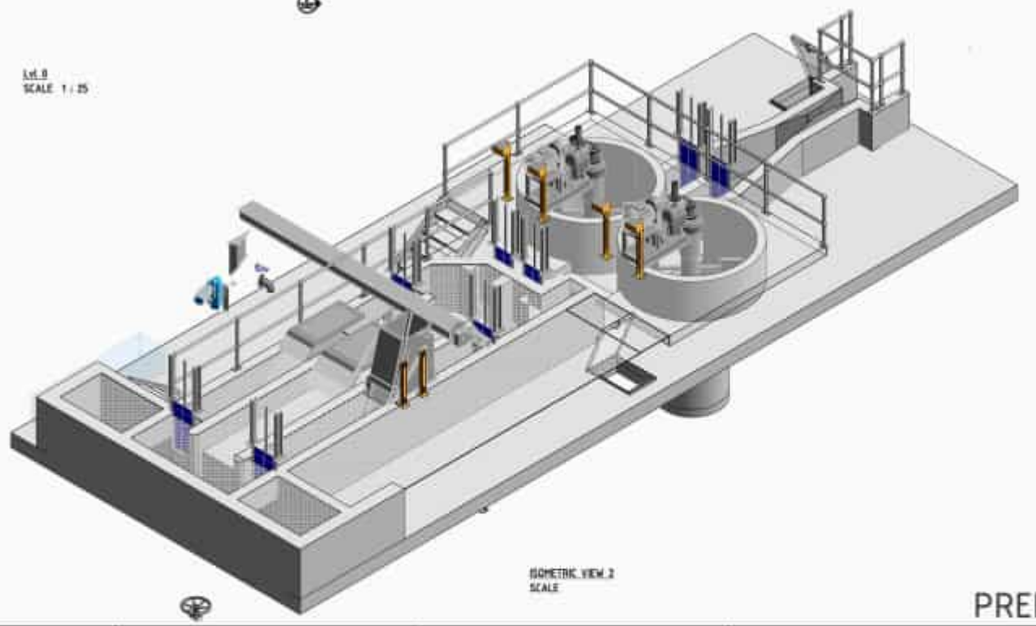
NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.





ISOMETRIC VIEW 1
SCALE

Lvl 0
SCALE 1 : 25



ISOMETRIC VIEW 2
SCALE

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	W/R No	APPROVED
2			-	-
1			-	-

TITLE	NAME
DRAFTER	G. MAHEDI
DRAFTING CHECK	G. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.CRONJE
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED:
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 — 0.5 0 1 2
SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER: SMEC South Africa, Member of the Surbana Jurong Group; SABS ISO 9001

CLIENT: GEORGE

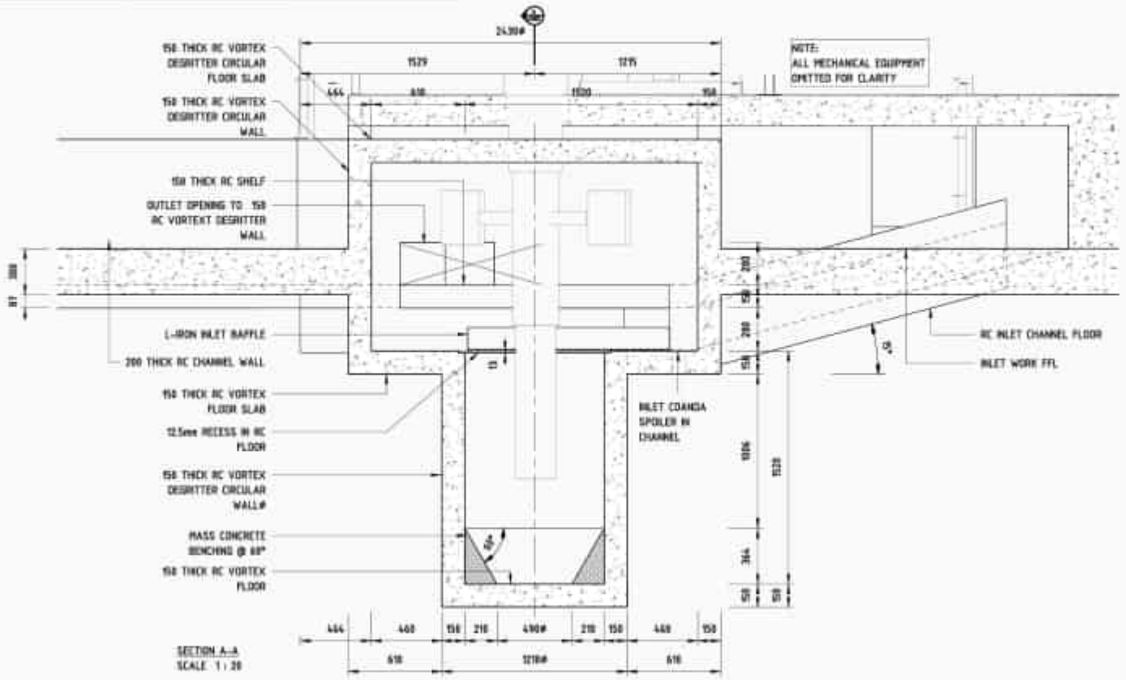
GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION

INLET WORKS PLAN LAYOUT & ISOMETRIC VIEWS

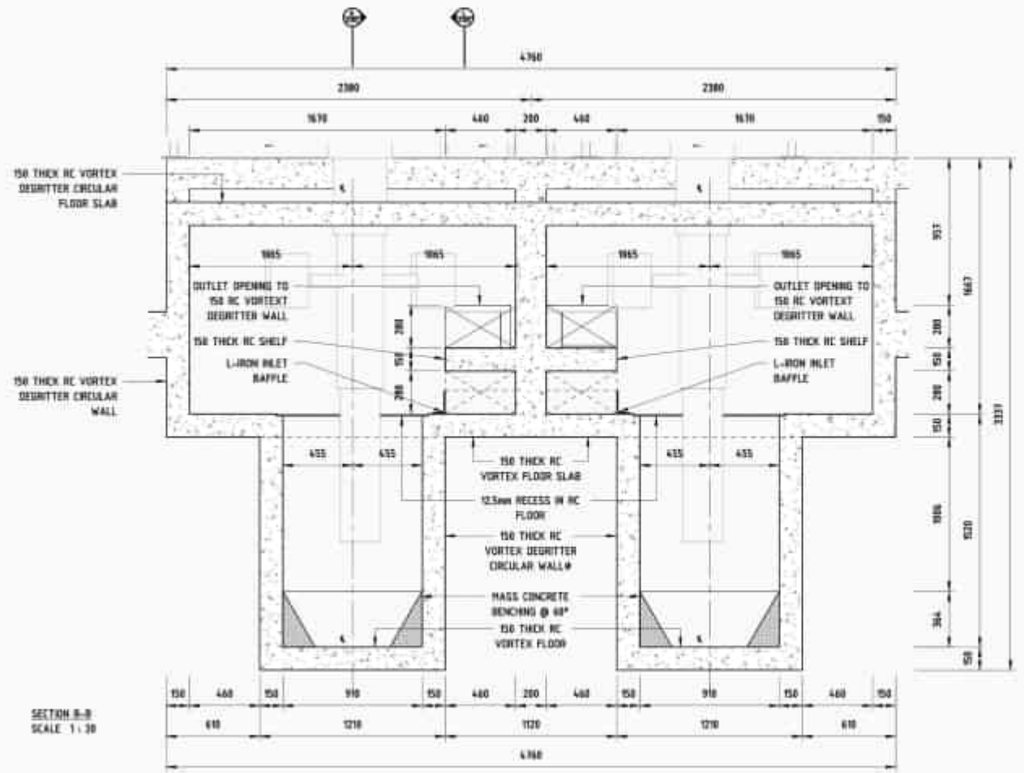
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1924		A101	

PLOT DATE: TIME 12/13/2024 11:03:50 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

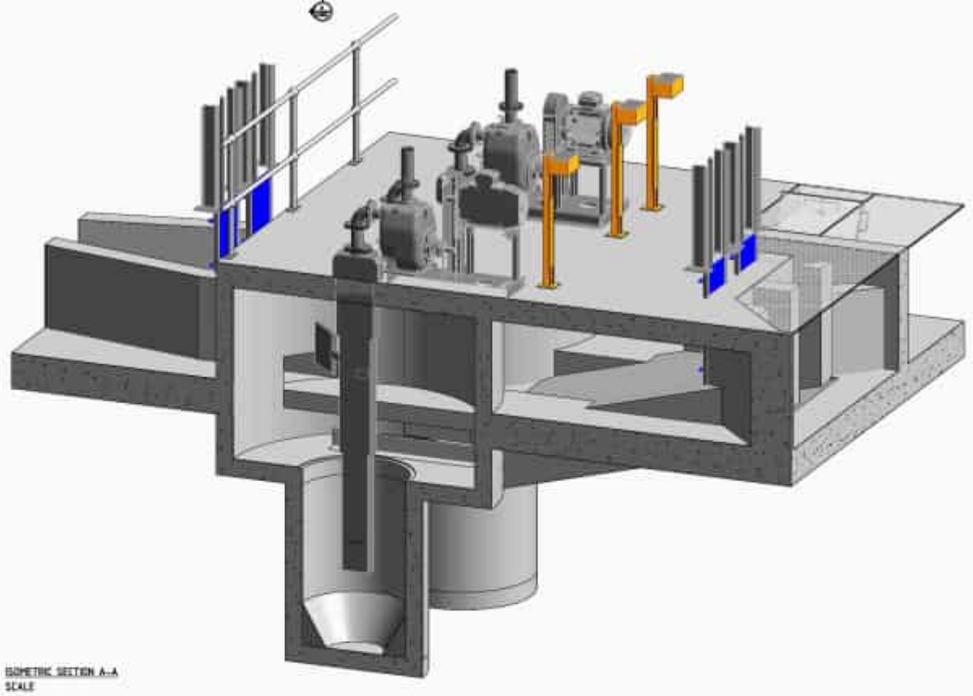
NOTE:
DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.



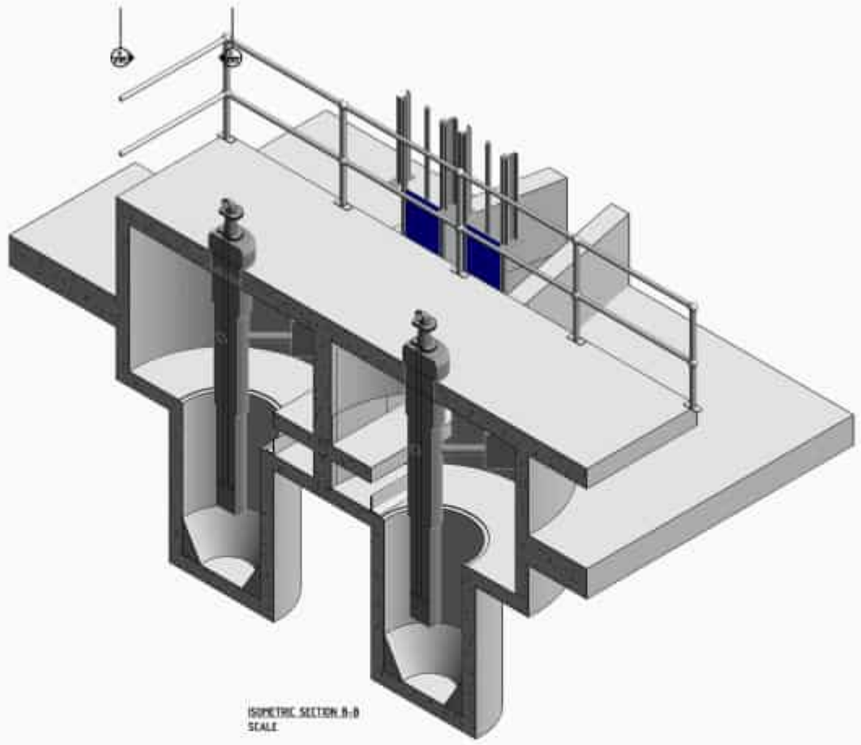
SECTION A-A
SCALE 1 : 20



SECTION B-B
SCALE 1 : 20



ISOMETRIC SECTION A-A
SCALE



ISOMETRIC SECTION B-B
SCALE

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	W/M No	APPROVAL
			-	-
			-	-
			-	-
2				
1				

TITLE	NAME
DRAFTER	G. MAREE
DRAFTING CHECK	G. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.CRONJE
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED:
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 0.5 0 1 2
SCALE 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

CLIENT
GEORGE
THE CITY FOR ALL SEASONS

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION

INLET WORKS SECTION A-A , B-B & ISOMETRIC VIEWS

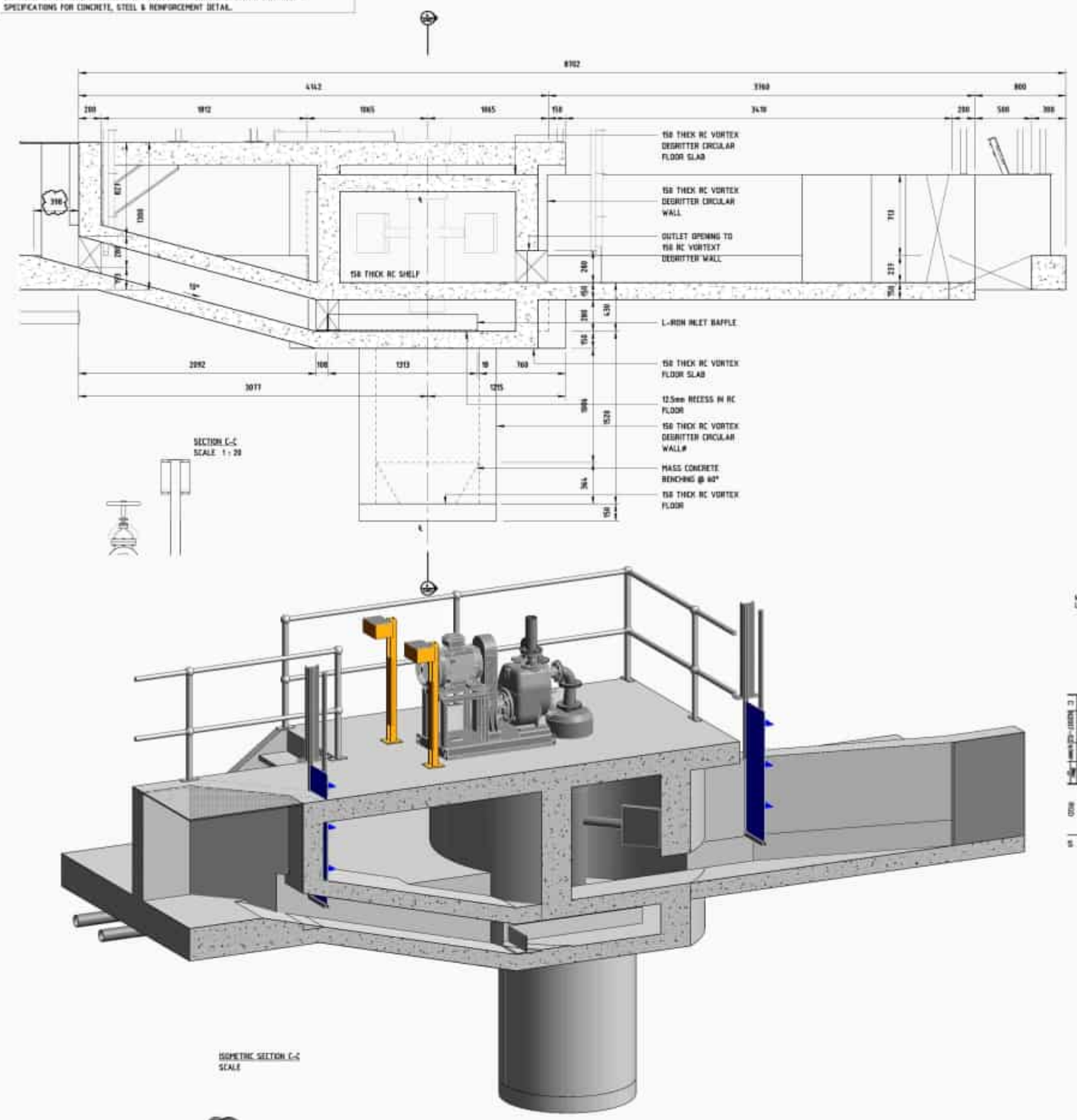
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1924		A102	

PLOT DATE TIME
12/15/2024 11:05:49 AM

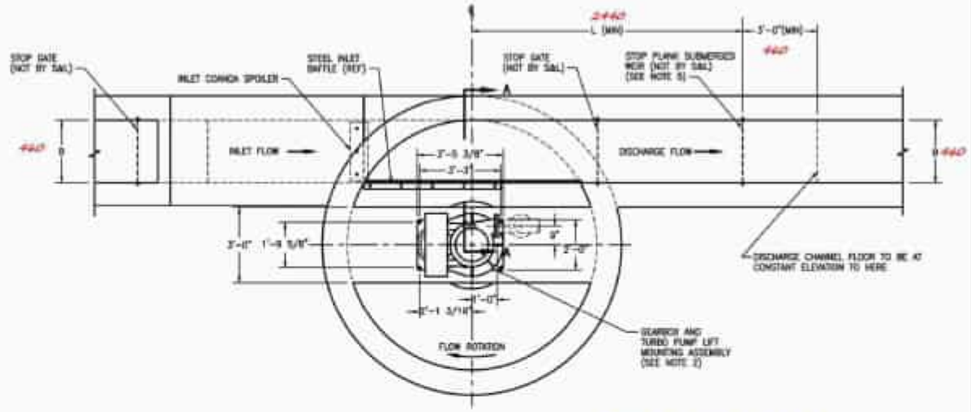
DRAWING FILE LOCATION / NAME

150 mm ON ORIGINAL
A1
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.

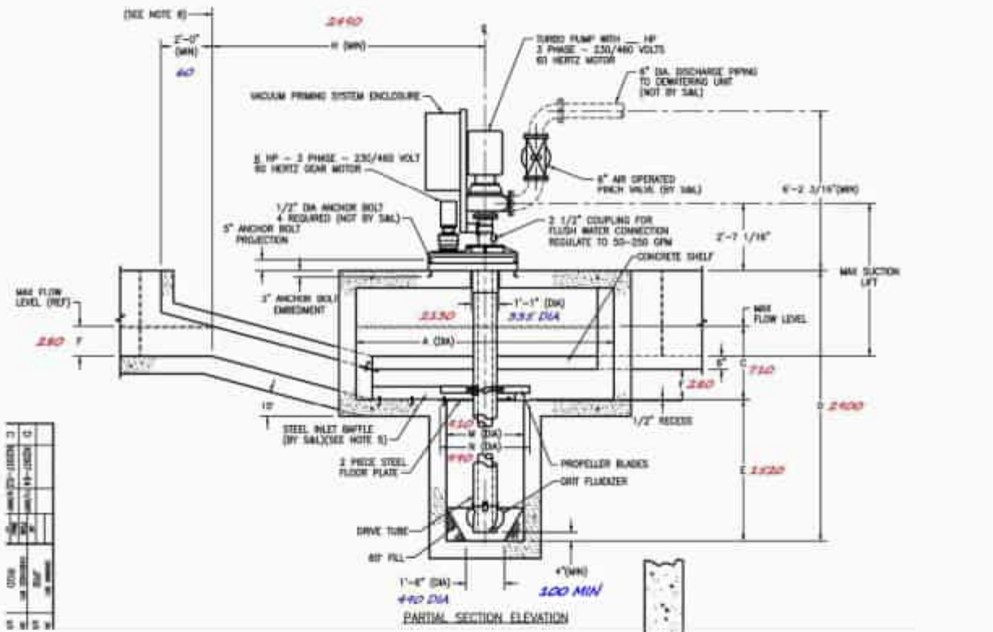


ISOMETRIC SECTION C-C
SCALE



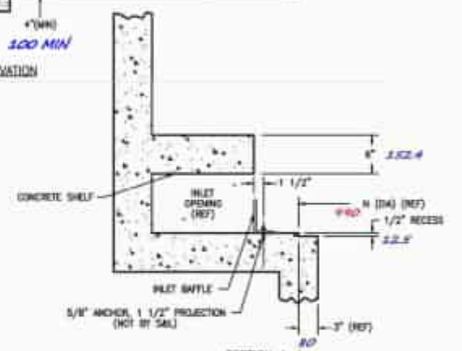
PLAN VIEW

REFERENCE PLAN - MODEL 2.5A



PARTIAL SECTION ELEVATION

REFERENCE SECTION - MODEL 2.5A



SECTION A-A

PRELIMINARY

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WHN No	APPROVAL
2			-	-
1			-	-
			-	-

TITLE	NAME
DRAFTER	G. MAREE
DRAFTING CHECK	G. WHALLEY
DESIGNER	S. FAUSTINO
DESIGN CHECK	G. WHALLEY
PROJECT MANAGER	T.CRONJE
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED:
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT A0 X1 SIZE DRAWING
SCALE 1:1 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 0.5 0 1 2
SCALE 1:100 1 0 1 2 3 4 5

DESIGNER: SMEC Southern Africa, Member of the Surbana Jurong Group; SABS ISO 9001

CLIENT: GEORGE, THE CITY FOR ALL SEASONS

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
INLET WORKS SECTION C-C & ISOMETRIC VIEWS

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1924		A103	

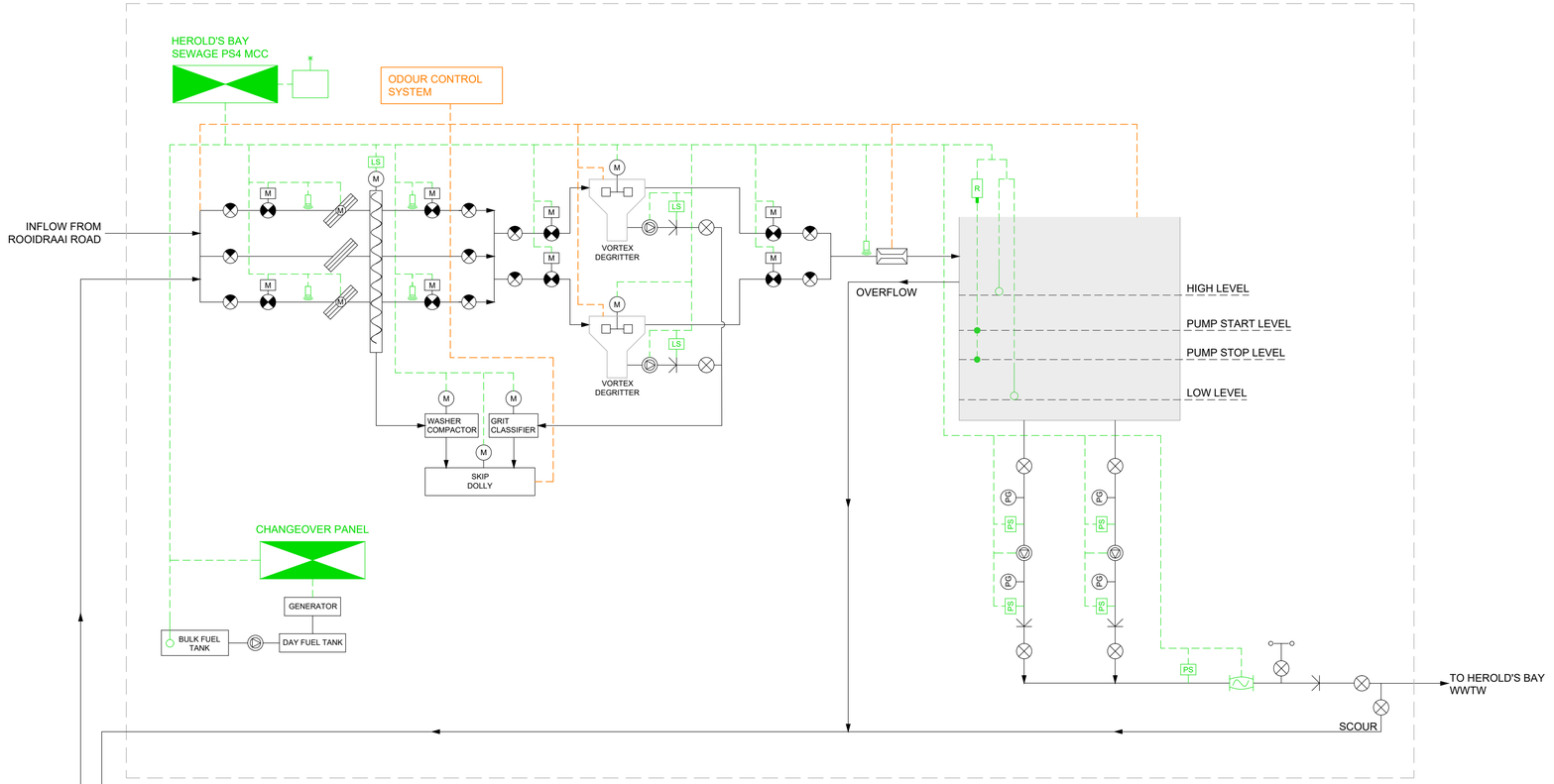
PLOT DATE: THU 12/15/2024 11:05:42 AM
DRAWING FILE LOCATION / NAME
150 mm ON ORIGINAL
A1

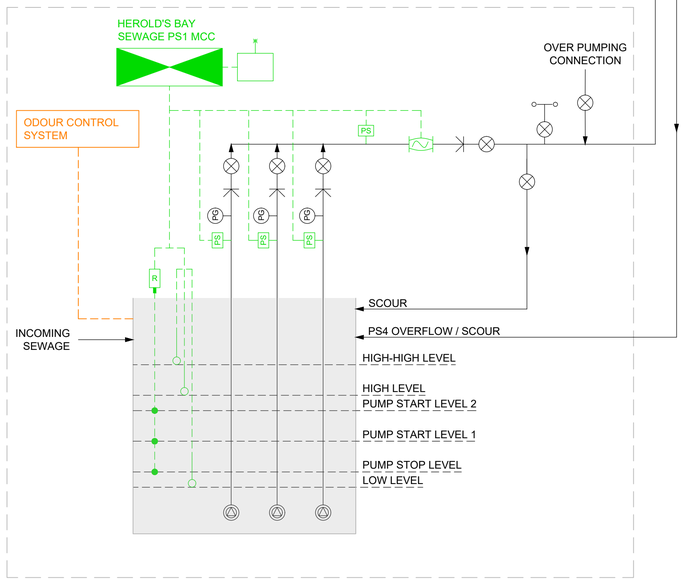
MECHANICAL LEGEND:	
SYMBOL	**DESCRIPTION**
	PUMP/MOTOR SET
	ISOLATING VALVE
	SLUICE GATE
	HAND STOP
	MANUAL BAR RAKE SCREEN
	MECHANICAL SCREEN
	SCREW CONVEYOR
	NON-RETURN VALVE
	AIR RELEASE VALVE
M	MOTORISED COMPONENT
M	ELECTRICAL ACTUATION
	PADDLE DRIVE
PG	PRESSURE GAUGE
	ODOUR CONTROL EXTRACTION

ELECTRICAL LEGEND:	
SYMBOL	**DESCRIPTION**
	MCC / DB
	CHANGEOVER
GENERATOR	GENERATOR

INSTRUMENTATION LEGEND:	
SYMBOL	**DESCRIPTION**
	RADAR LEVEL SENSOR
PS	PRESSURE SENSOR
LS	LIMIT SWITCH
	ULTRASONIC LEVEL SENSOR
	FLOAT LEVEL SWITCH
	TELEMETRY OUTSTATION
	ELECTROMAGNETIC FLOW METER
	SITE COMMUNICATION NETWORK

CIVIL LEGEND:	
SYMBOL	**DESCRIPTION**
	PARSHALL FLUME
	FLOW INDICATION
	VORTEX DEGRITTER
	WET WELL AREA / SUMP AREA





REVISIONS					DESIGNED	T. AUGUSTYN
					CHECKED	T. BRINK
					DRAWN	W. SAPTO
A	09-12-2024	FOR INFORMATION PURPOSES	TA		CHECKED	T. BRINK
NO.	DATE	DESCRIPTION	INITIAL			

SIGNED _____
SMEC South Africa
DATE _____

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PO Box 10633 George 6530
13 Progress St George 6529
e-mail: george@smec.com website: www.smec.com
Tel (044) 873-5029 Fax (044) 873-5086

GEORGE THE CITY FOR ALL REASONS

SIGNED _____
DATE _____

GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION

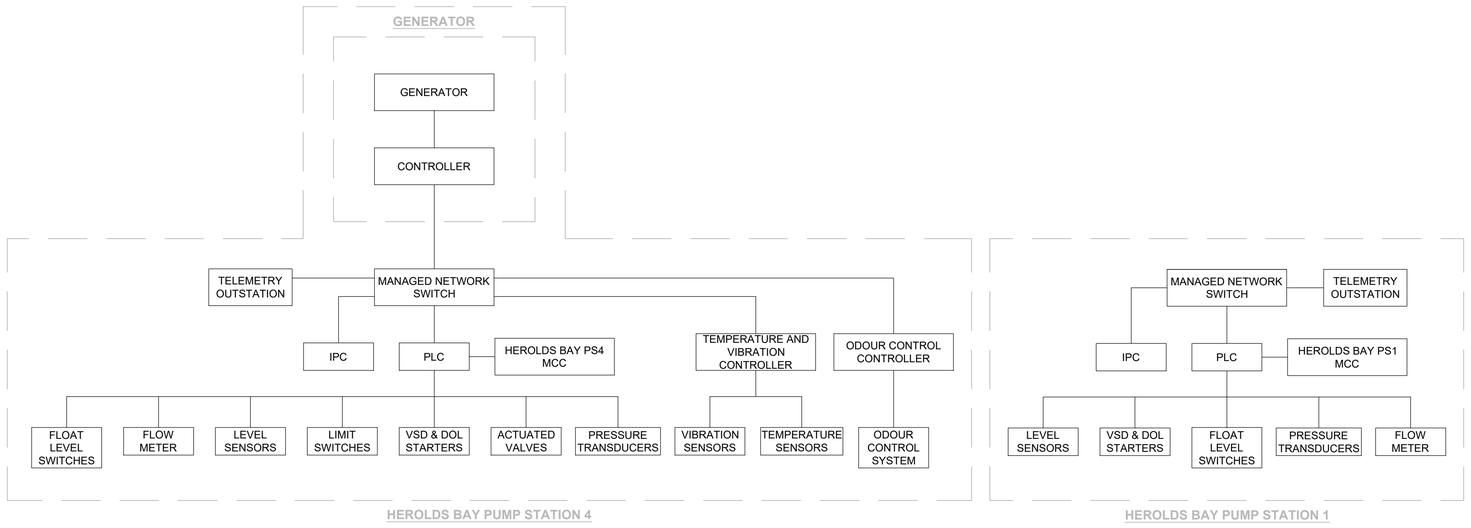
PIPING & INSTRUMENTATION DIAGRAM (P&ID)

SIZE	SCALE
A1	N.T.S

PROJECT DRAWING NUMBER: C1936 - E - GEN - 001

REV	SHEET No.
0	1 OF 1

SCALE BAR 1 : 1000 — 0, 10m, 25m, 50m, 100m



REVISIONS							
					DESIGNED	AB STEENKAMP	
					CHECKED	AB STEENKAMP	
					DRAWN	JD CAROLISSEN	
0	09-12-2024	DETAILED DESIGN	ABS		CHECKED	AB STEENKAMP	
NO.	DATE	DESCRIPTION	INITIAL				

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DATE

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GEORGE THE CITY FOR ALL REASONS

SIGNED

DATE

GEORGE MUNICIPALITY HEROLDS BAY PUMP STATION

PUMP STATION 1 AND PUMP STATION 4 NETWORK ARCHITECTURE DIAGRAM

SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER
C1936 - E - GEN - 002

REV	SHEET No.
0	1st OF 1

SCALE BAR 1 : 1000
100m 50m 25m 10m 0

NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.

NOTE:
1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE ANY WORK IS PUT IN HAND. REFER ANY DISCREPANCIES TO THE ENGINEER.

LEGEND

- EXISTING MV CABLE ROUTING
- EXISTING MV CABLE ROUTING - TO BE REMOVED
- PROPOSED MV CABLE ROUTING
- PROPOSED MV CABLE JOINT
- EXISTING LV CABLE ROUTING
- EXISTING LV CABLE ROUTING - TO BE REMOVED
- PROPOSED LV CABLE ROUTING
- PROPOSED LV CABLE JOINT
- MINIATURE SUBSTATION
- ELECTRICAL KIOSK
- BUILDINGS AND ANNOTATIONS

NEW PS4 BUILDING OUTLINE
TO PB TEL HOK
EXISTING MS SKIMMELKRANS
SPARE LV FEED
EXISTING KIOSK PB KARAVAANPARK
NEW PROPOSED 630 kVA (TBC) MINISUB
TO MS HEROLDSBAAI HOTEL
TO CARAVAN PARK
TO PB OORKANT PAD
TO KERKSAAL
TO MS UITSPANNING
EXISTING STORM WATER INFRASTRUCTURE
PAVED APRON SLOPED AWAY FROM BUILDING
SEWER INLET PIPE FROM ROOIDRAAI ROAD
RE/236
116
Rooidraai Road
ROOIDRAAI ROAD
Skimmelkrans Drive
SKIMMELKRANZ DRIVE
Paving
Parking
STOP

REVISIONS				
0	09-12-2024	DETAILED DESIGN	ABS	
NO.	DATE	DESCRIPTION	INITIAL	

DESIGNED	AB STEENKAMP
CHECKED	AB STEENKAMP
DRAWN	JD CAROLISSEN
CHECKED	AB STEENKAMP

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DATE

GEORGE MUNICIPALITY
HEROLDS BAY PUMP STATION

PUMP STATION 4
EXISTING MV RETICULATION

SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER: C1936 - E - PS4 - 001

REV	SHEET No.
0	1st OF 2

SCALE BAR 1 : 1000 (100m, 50m, 25m, 10m, 0)

NOTE:
- DRAWINGS TO BE READ IN CONJUNCTION WITH PIPE SCHEDULES & SPECIFICATIONS FOR PIPE DETAIL.
- DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL ENGINEERING DRAWINGS & SPECIFICATIONS FOR CONCRETE, STEEL & REINFORCEMENT DETAIL.

NOTE:
1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE ANY WORK IS PUT IN HAND. REFER ANY DISCREPANCIES TO THE ENGINEER.

LEGEND

- EXISTING MV CABLE ROUTING
- EXISTING MV CABLE ROUTING - TO BE REMOVED
- PROPOSED MV CABLE ROUTING
- PROPOSED MV CABLE JOINT
- EXISTING LV CABLE ROUTING
- EXISTING LV CABLE ROUTING - TO BE REMOVED
- PROPOSED LV CABLE ROUTING
- PROPOSED LV CABLE JOINT
- MINIATURE SUBSTATION
- ELECTRICAL KIOSK
- BUILDINGS AND ANNOTATIONS

NEW LV CABLE JOINT BETWEEN NEW AND EXISTING LV CABLE
SEWER INLET PIPE FROM ROOIDRAAI ROAD
SEWER INLET
NEW PS4 BUILDING OUTLINE
EXISTING STORM WATER INFRASTRUCTURE
NEW MV CABLE TO MS UITSPANNING
EXISTING MV CABLE TO MS UITSPANNING TO BE REMOVED
NEW PROPOSED PS4 RISING MAIN
NEW PROPOSED 630 kVA (TBC) MINISUB
TO MS HEROLDSBAAI HOTEL
TO CARAVAN PARK
NEW MV & LV CABLE JOINT BETWEEN NEW AND EXISTING CABLES
NEW LV CABLE TO PB OORKANT PAD IN NEW Ø160 SLEEVE
NEW LV CABLE JOINT BETWEEN NEW AND EXISTING LV CABLE TO KERKSAAL
NEW LV CABLE TO PB OORKANT PAD
ROOIDRAAI ROAD
SKIMMELKRANS DRIVE
RE/230
116
Paving
Parking
STOP

REVISIONS				
0	09-12-2024	DETAILED DESIGN	ABS	
NO.	DATE	DESCRIPTION	INITIAL	

DESIGNED	AB STEENKAMP
CHECKED	AB STEENKAMP
DRAWN	JD CAROLISSEN
CHECKED	AB STEENKAMP

SIGNED
SMEC South Africa
DATE

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DATE

GEORGE MUNICIPALITY
HEROLDS BAY PUMP STATION

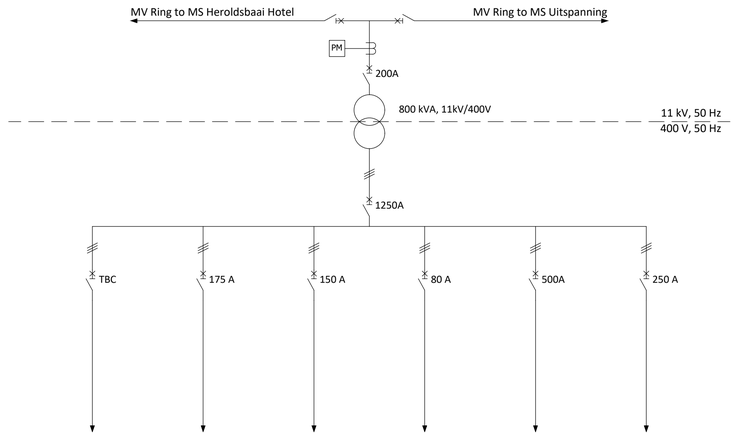
PUMP STATION 4
PROPOSED MV RETICULATION

SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER: C1936 - E - PS4 - 001

REV	SHEET No.
0	2nd OF 2

SCALE BAR 1 : 1000 (100m, 50m, 25m, 10m, 0)



400VAC	400VAC	400VAC	400VAC	400VAC	400VAC
FDR	FDR	FDR	FDR	FDR	FDR
To Rooidraai Rd Feeder	To Caravan Park Kiosk	To PB Oorkant Pad	To Kerksaal	To Herolds Bay PS4 Generator Changeover Switch	Spare Feeder

*TO DRAWING
C1936-E-PS4-003
Sheet 1 of 2

LEGEND:

- Air Circuit Breaker
- Circuit Breaker
- Air Circuit Breaker Bus-coupler
- Bus-coupler
- Isolator
- Mechanical Interlock
- Electrical Interlock
- Key Type Interlock System
- 3p Fuse
- AR Ultra Rapid Semiconductor Fuse
- Phase Indication
- Smart Power Meter
- CT & Ammeter
- Running Hour Meter
- Combined Class 1&2 Surge Arrestor
- Surge Arrestor Class 3
- Power Factor Correction Unit
- Active Harmonic Filter
- Power Transformer
- Control Transformer
- Inline UPS
- Motor Starter:
  DOL: Direct on Line
  FW/REV: Forward Reverse
  SS: Soft Starter
  VSD: Variable Speed Drive
- 3p Contactor
- 3p Contactor Forward / Reverse
- Thermal Overload
- Door Mount Keypad/HMI
- Output Choke (dV/dT)
- 3P Motor
- 3P Motor w Torque Limiter
- 3P Earth Leakage Unit
- Actuator Valve
- Photocell w Contactor
- Emergency Stop
- Local Control Station
- 3P Motor w Heater
- Motorized Mechanically and Electrically Interlocked Changeover Mechanism
- Miniature Substation
- Supply Kiosk
- Emergency Backup Generator
- Transformer

REVISIONS						
				DESIGNED	AB STEENKAMP	
				CHECKED	AB STEENKAMP	
				DRAWN	JD CAROLISSEN	
0	09-12-2024	DETAILED DESIGN	ABS	CHECKED	AB STEENKAMP	
NO.	DATE	DESCRIPTION	INITIAL			

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GEORGE THE CITY FOR ALL REASONS

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GEORGE MUNICIPALITY
HEROLDS BAY PUMP STATION

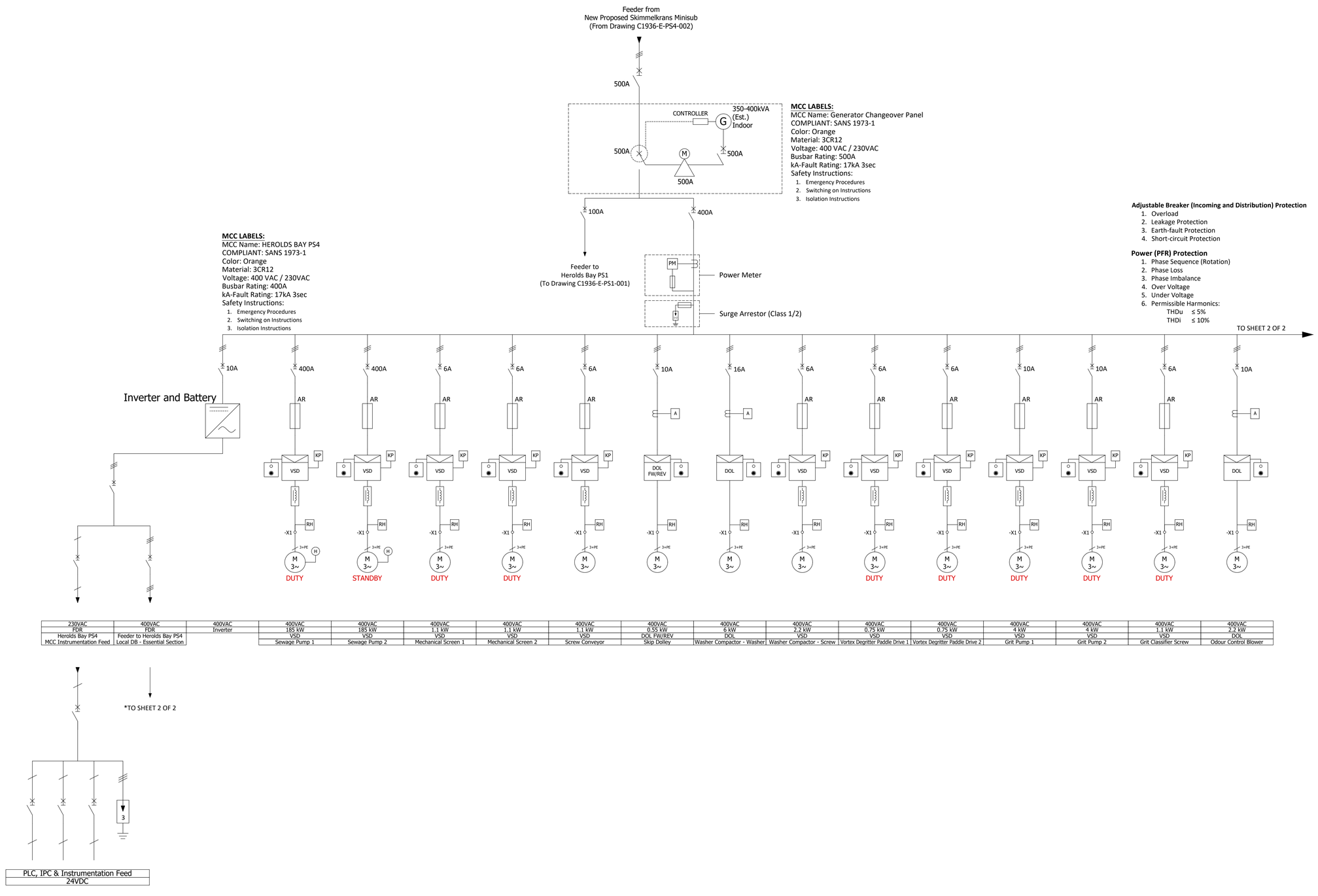
PUMP STATION 4
SKIMMELKRANS MINIATURE SUBSTATION CONFIGURATION

SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER
C1936 - E - PS4 - 002

REV	SHEET No.
0	1st OF 1

SCALE BAR
100m 50m 25m 10m 0
1 : 1000



LEGEND:

- Air Circuit Breaker
- Circuit Breaker
- Air Circuit Breaker Bus-coupler
- Bus-coupler
- Isolator
- Mechanical Interlock
- Electrical Interlock
- Key Type Interlock System
- 3p Fuse
- AR Ultra Rapid Semiconductor Fuse
- Phase Indication
- Smart Power Meter
- CT & Ammeter
- Running Hour Meter
- Combined Class 1&2 Surge Arrestor
- Surge Arrestor Class 3
- Power Factor Correction Unit
- Active Harmonic Filter
- Power Transformer
- Control Transformer
- Inline UPS
- Motor Starter:
  DOL: Direct on Line
  FW/REV: Forward Reverse
  SS: Soft Starter
  VSD: Variable Speed Drive
- 3p Contactor
- 3p Contactor Forward / Reverse
- Thermal Overload
- Door Mount Keypad/HMI
- Output Choke (dV/dT)
- 3P Motor
- 3P Motor w Torque Limiter
- 3P Earth Leakage Unit
- Actuator Valve
- Photocell w Contactor
- Emergency Stop
- Local Control Station
- 3P Motor w Heater
- Motorized Mechanically and Electrically Interlocked Changeover Mechanism
- Miniature Substation
- Supply Kiosk
- Emergency Backup Generator

REVISIONS						
				DESIGNED	AB STEENKAMP	
				CHECKED	AB STEENKAMP	
				DRAWN	JD CAROLISSEN	
0	09-12-2024	DETAILED DESIGN	ABS	CHECKED	AB STEENKAMP	
NO.	DATE	DESCRIPTION	INITIAL			

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GEORGE THE CITY FOR ALL REASONS

SIGNED
DATE

GEORGE MUNICIPALITY
HEROLDS BAY PUMP STATION

PUMP STATION 1 AND PUMP STATION 4
ELECTRICAL SINGLE LINE DIAGRAM

SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER
C1936 - E - PS4 - 003

REV	SHEET No.
0	1st OF 2

SCALE BAR 1 : 1000
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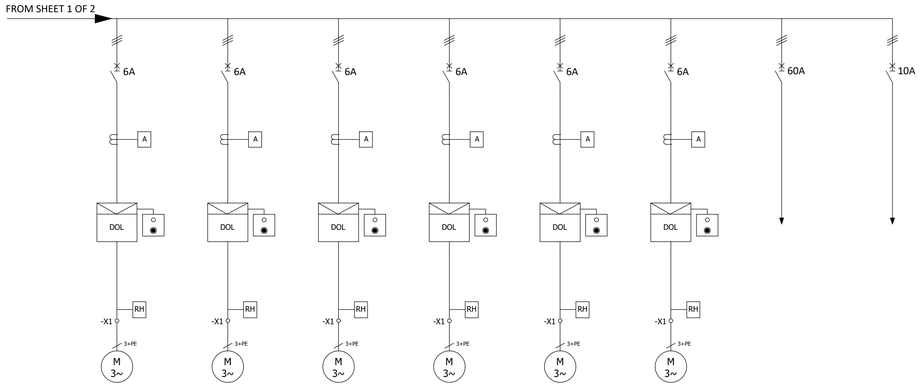
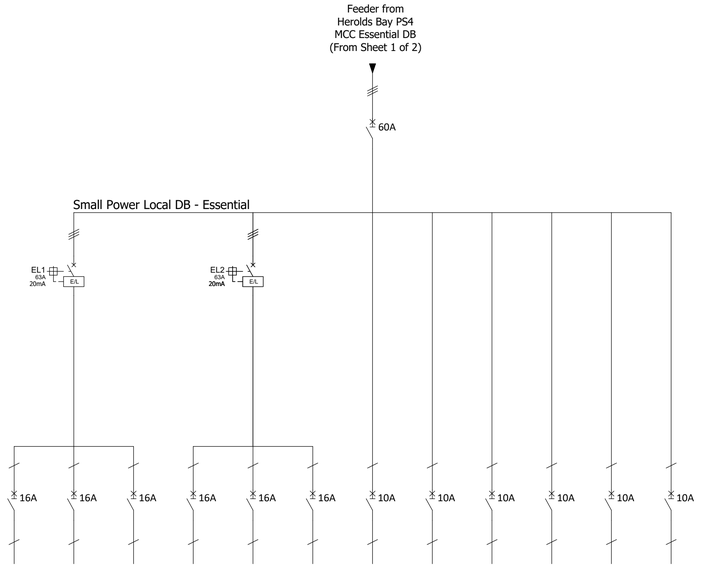
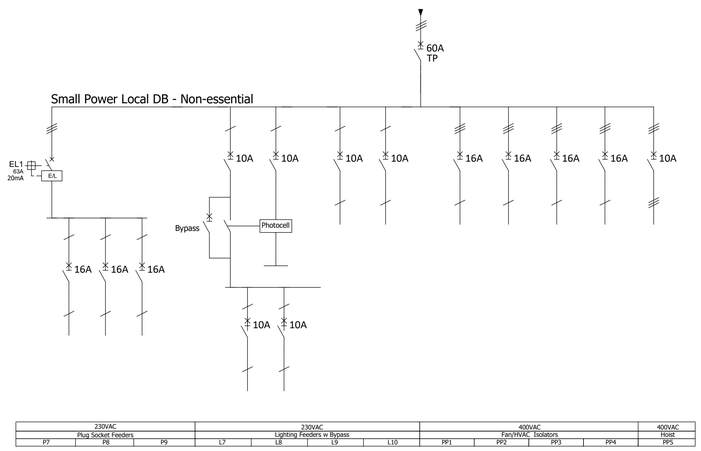


400VAC	400VAC	400VAC	400VAC	400VAC	400VAC	400VAC	400VAC
0.37 kW	0.37 kW	0.37 kW	0.37 kW	1.5 kW	1.5 kW	FDR	FDR
DOL	DOL	DOL	DOL	DOL	DOL	Feeder to Herolds Bay PS4	Feeder to Herolds Bay PS4
Ventilation Fan 1	Ventilation Fan 2	Ventilation Fan 3	Ventilation Fan 4	Seepage Pump 1	Seepage Pump 2	Local Non-essential DB	Actuated Valves



230VAC	230VAC
Plug Socket Feeders	Lighting Feeders - Indoor Lights
P1 P2 P3 P4 P5 P6	P1 P2 P3 P4 P5 P6



230VAC	230VAC	400VAC	400VAC
Plug Socket Feeders	Lighting Feeders w Bypass	Fan/HVAC Isolators	Hoist
P7 P8 P9	L7 L8 L9 L10	PP1 PP2 PP3 PP4	PP5

LEGEND:

- Air Circuit Breaker
- Circuit Breaker
- Air Circuit Breaker Bus-coupler
- Bus-coupler
- Isolator
- Mechanical Interlock
- Electrical Interlock
- Key Type Interlock System
- 3p Fuse
- AR Ultra Rapid Semiconductor Fuse
- Phase Indication
- Smart Power Meter
- CT & Ammeter
- Running Hour Meter
- Combined Class 1&2 Surge Arrestor
- Surge Arrestor Class 3
- Power Factor Correction Unit
- Active Harmonic Filter
- Power Transformer
- Control Transformer
- Inline UPS
- Motor Starter:
  DOL: Direct on Line
  FW/REV: Forward Reverse
  SS: Soft Starter
  VSD: Variable Speed Drive
- 3p Contactor
- 3p Contactor Forward / Reverse
- Thermal Overload
- Door Mount Keypad/HMI
- Output Choke (dV/dT)
- 3P Motor
- 3P Motor w Torque Limiter
- 3P Earth Leakage Unit
- Actuator Valve
- Photocell w Contactor
- Emergency Stop
- Local Control Station
- 3P Motor w Heater
- Motorized Mechanically and Electrically Interlocked Changeover Mechanism
- Miniature Substation
- Supply Kiosk
- Emergency Backup Generator

REVISIONS						
					DESIGNED	AB STEENKAMP
					CHECKED	AB STEENKAMP
					DRAWN	JD CAROLISSEN
0	09-12-2024	DETAILED DESIGN	ABS		CHECKED	AB STEENKAMP
NO.	DATE	DESCRIPTION	INITIAL			

SIGNED

SMEC South Africa

DATE

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GEORGE
THE CITY FOR ALL REASONS

SIGNED

DATE

GEORGE MUNICIPALITY
HEROLDS BAY PUMP STATION

PUMP STATION 1 AND PUMP STATION 4
ELECTRICAL SINGLE LINE DIAGRAM

SIZE	SCALE
A1	N.T.S.

PROJECT DRAWING NUMBER
C1924 - E - PS4 - 003

REV	SHEET No.
0	2nd OF 2

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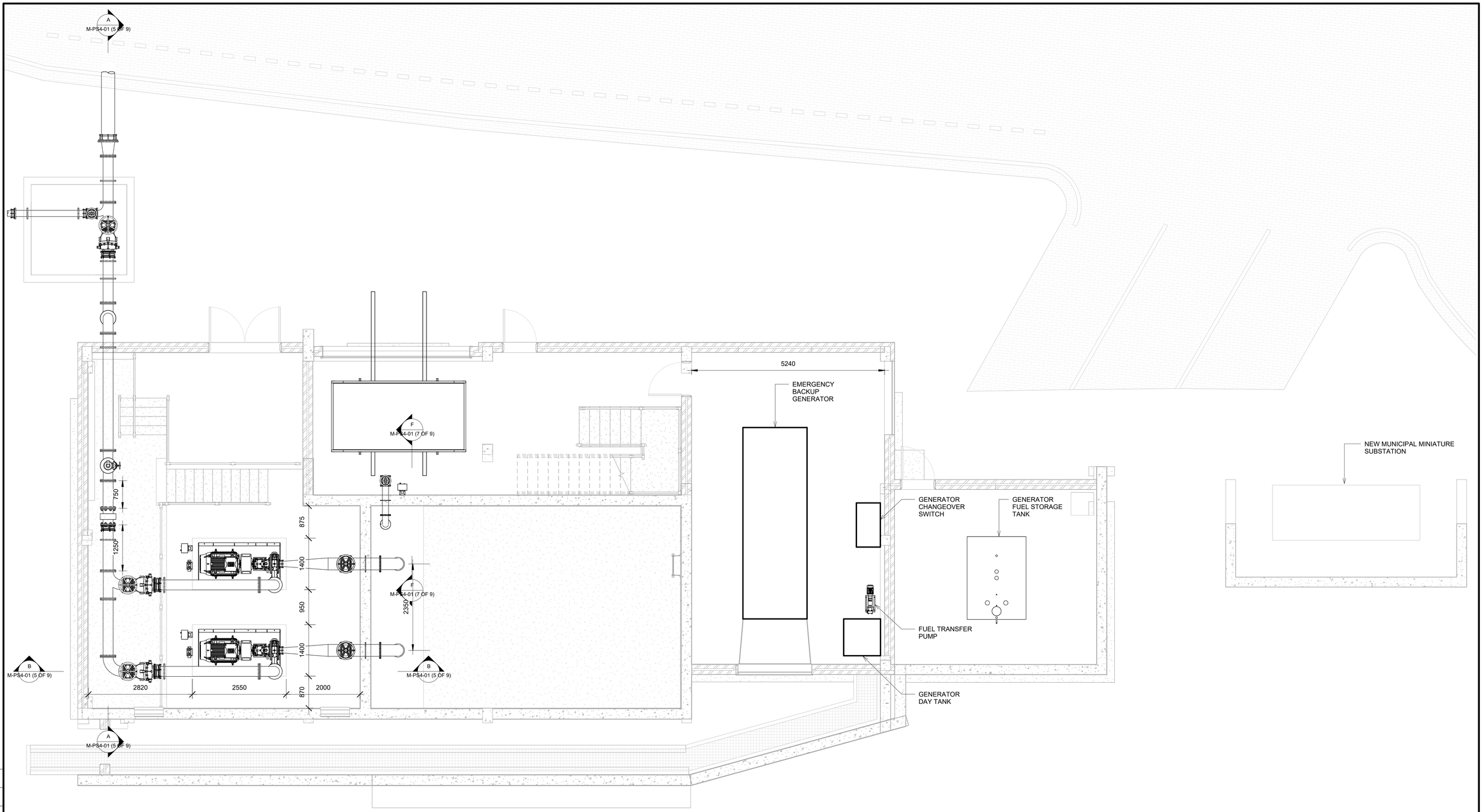
PLOT DATE TIME
2024/12/12 15:47:08

DRAWING FILE LOCATION / NAME



1 GROUND FLOOR - SITE LAYOUT
1 : 50

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-02	FOR DETAIL	-	-

TITLE	NAME
DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 — 0.5 0 1 2
SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER
SMEC South Africa
Member of the Surbana Jurong Group
SABS ISO 9001

CLIENT
GEORGE
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GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (1 OF 9)	A

150 mm ON ORIGINAL
A1
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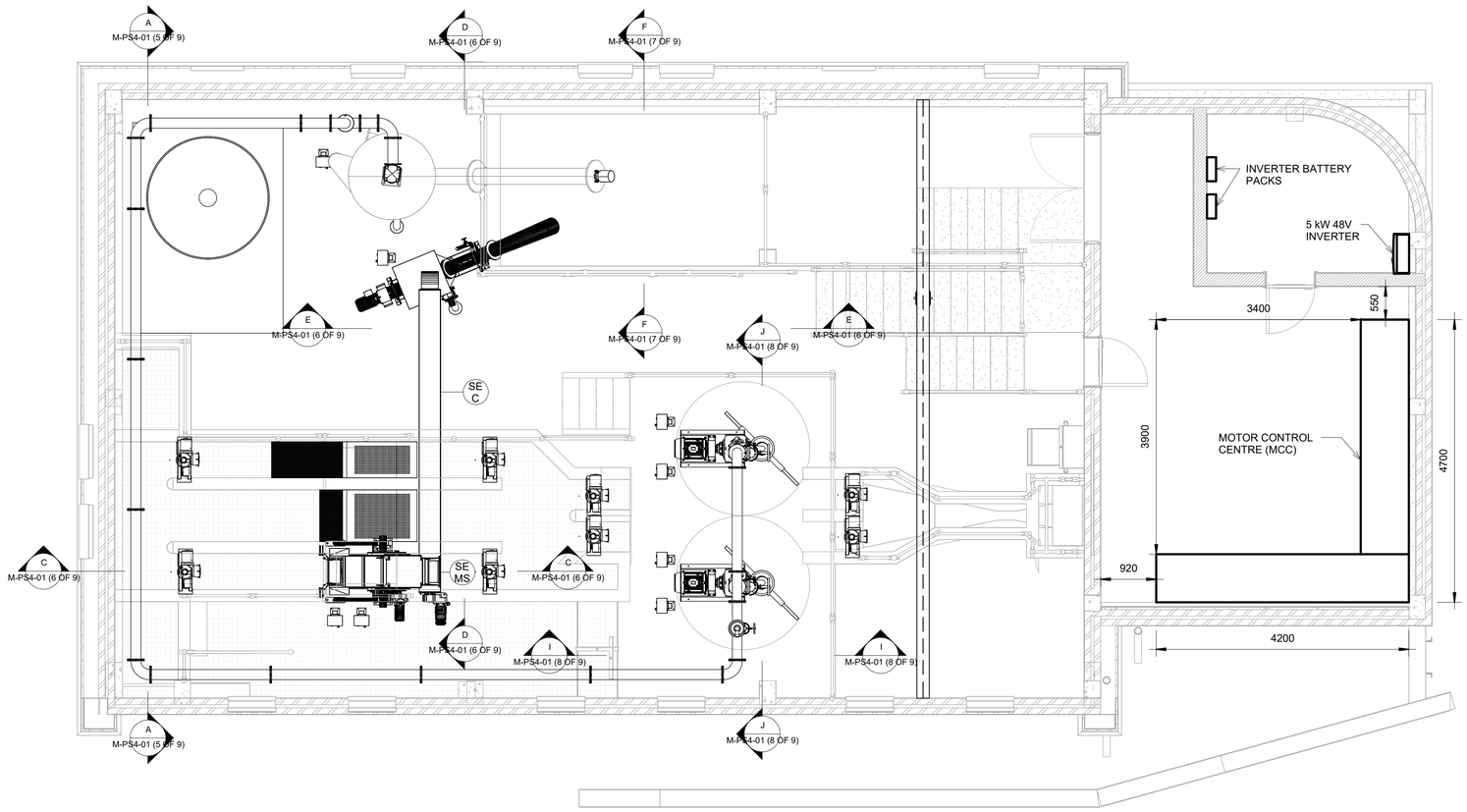
PLOT DATE TIME
2024/12/12 15:47:25



2 1st FLOOR - SITE LAYOUT

1 : 50

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-02	FOR DETAIL	-	-

DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED

ENGINEER: .....

PR ENG NR: .....

SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING

SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05

SCALE 1:50 — 0.5 0 1 2

SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER

SMEC South Africa
Member of the Surbana Jurong Group

SABS ISO 9001

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GEORGE MUNICIPALITY

HEROLD'S BAY PUMP STATION

PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (2 OF 9)	A

A1
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PLOT DATE TIME
2024/12/12 15:46:50

DRAWING FILE LOCATION / NAME

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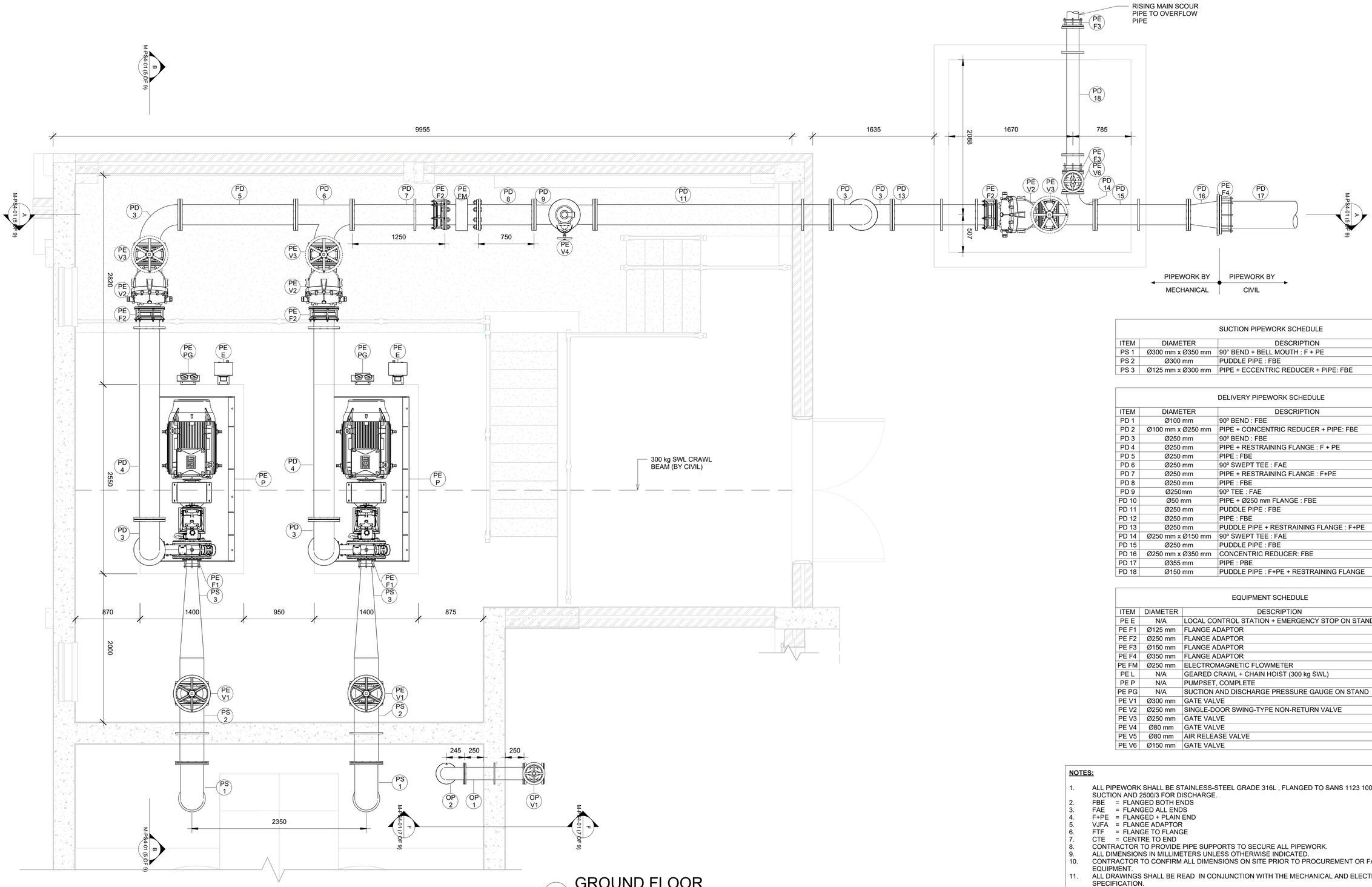

3 GROUND FLOOR
1 : 25

SUCTION PIPEWORK SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PS 1	Ø300 mm x Ø350 mm	90° BEND + BELL MOUTH : F + PE	PN10	2
PS 2	Ø300 mm	PUDDLE PIPE : FBE	PN10	2
PS 3	Ø125 mm x Ø300 mm	PIPE + ECCENTRIC REDUCER + PIPE: FBE	PN10	2

DELIVERY PIPEWORK SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PD 1	Ø100 mm	90º BEND : FBE	PN25	2
PD 2	Ø100 mm x Ø250 mm	PIPE + CONCENTRIC REDUCER + PIPE: FBE	PN25	2
PD 3	Ø250 mm	90º BEND : FBE	PN25	5
PD 4	Ø250 mm	PIPE + RESTRAINING FLANGE : F + PE	PN25	2
PD 5	Ø250 mm	PIPE : FBE	PN25	1
PD 6	Ø250 mm	90º SWEPT TEE : FAE	PN25	1
PD 7	Ø250 mm	PIPE + RESTRAINING FLANGE : F+PE	PN25	1
PD 8	Ø250 mm	PIPE : FBE	PN25	1
PD 9	Ø250mm	90º TEE : FAE	PN25	1
PD 10	Ø50 mm	PIPE + Ø250 mm FLANGE : FBE	PN25	1
PD 11	Ø250 mm	PUDDLE PIPE : FBE	PN25	1
PD 12	Ø250 mm	PIPE : FBE	PN25	1
PD 13	Ø250 mm	PUDDLE PIPE + RESTRAINING FLANGE : F+PE	PN25	1
PD 14	Ø250 mm x Ø150 mm	90º SWEPT TEE : FAE	PN25	1
PD 15	Ø250 mm	PUDDLE PIPE : FBE	PN25	1
PD 16	Ø250 mm x Ø350 mm	CONCENTRIC REDUCER: FBE	PN25	1
PD 17	Ø355 mm	PIPE : PBE	PN25	2
PD 18	Ø150 mm	PUDDLE PIPE : F+PE + RESTRAINING FLANGE	PN25	1

EQUIPMENT SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PE E	N/A	LOCAL CONTROL STATION + EMERGENCY STOP ON STAND	N/A	2
PE F1	Ø125 mm	FLANGE ADAPTOR	PN10	2
PE F2	Ø250 mm	FLANGE ADAPTOR	PN25	4
PE F3	Ø150 mm	FLANGE ADAPTOR	PN25	2
PE F4	Ø350 mm	FLANGE ADAPTOR	PN25	1
PE FM	Ø250 mm	ELECTROMAGNETIC FLOWMETER	PN25	1
PE L	N/A	GEARED CRAWL + CHAIN HOIST (300 kg SWL)	N/A	1
PE P	N/A	PUMPSET, COMPLETE	N/A	2
PE PG	N/A	SUCTION AND DISCHARGE PRESSURE GAUGE ON STAND	N/A	2
PE V1	Ø300 mm	GATE VALVE	PN10	2
PE V2	Ø250 mm	SINGLE-DOOR SWING-TYPE NON-RETURN VALVE	PN25	3
PE V3	Ø250 mm	GATE VALVE	PN25	3
PE V4	Ø80 mm	GATE VALVE	PN25	1
PE V5	Ø80 mm	AIR RELEASE VALVE	PN25	1
PE V6	Ø150 mm	GATE VALVE	PN25	1

NOTES:

1. ALL PIPEWORK SHALL BE STAINLESS-STEEL GRADE 316L , FLANGED TO SANS 1123 1000/3 FOR SUCTION AND 2500/3 FOR DISCHARGE.
2. FBE = FLANGED BOTH ENDS
3. FAE = FLANGED ALL ENDS
4. F+PE = FLANGED + PLAIN END
5. VJFA = FLANGE ADAPTOR
6. FTF = FLANGE TO FLANGE
7. CTE = CENTRE TO END
8. CONTRACTOR TO PROVIDE PIPE SUPPORTS TO SECURE ALL PIPEWORK.
9. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE INDICATED.
10. CONTRACTOR TO CONFIRM ALL DIMENSIONS ON SITE PRIOR TO PROCUREMENT OR FABRICATION OF EQUIPMENT.
11. ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MECHANICAL AND ELECTRICAL SPECIFICATION.
12. ALL BUILDING AND STRUCTURAL DETAIL IS ONLY FOR ILLUSTRATIVE PURPOSES. THE APPLICABLE CIVIL AND STRUCTURAL DRAWINGS SHALL GOVERN.

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-02	FOR DETAIL	-	-

TITLE	NAME
DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED

ENGINEER: .....

PR ENG NR: .....

SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING

SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05

SCALE 1:50 — 0.5 0 1 2

SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER

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Member of the Surbana Jurong Group

SABS ISO 9001

CLIENT

GEORGE
THE CITY FOR ALL REASONS

GEORGE MUNICIPALITY

HEROLD'S BAY PUMP STATION

PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (3 OF 9)	A

PLOT DATE TIME
2024/12/12 15:46:59

DRAWING FILE LOCATION / NAME

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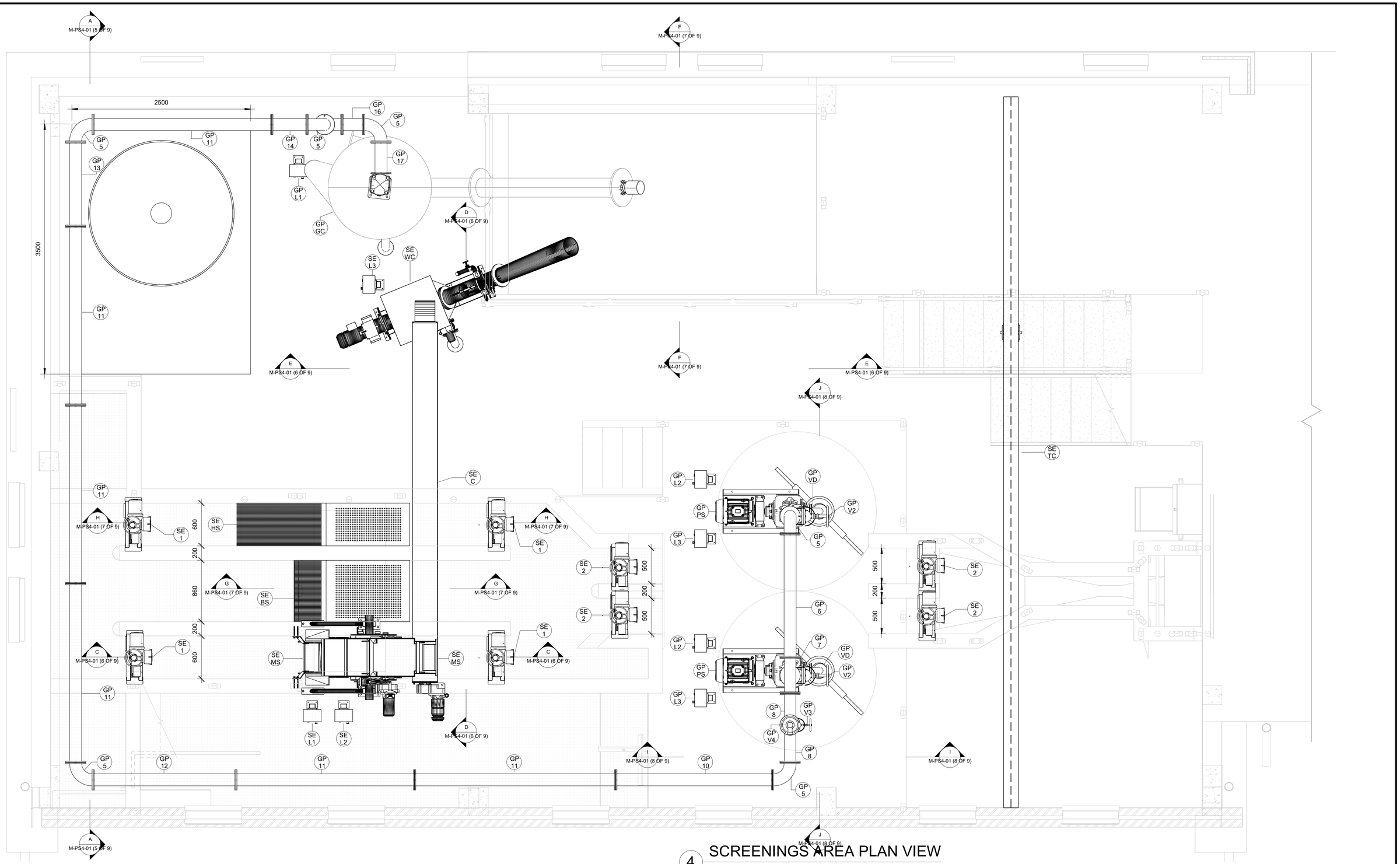
A1



4 SCREENINGS AREA PLAN VIEW

1 : 25

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL	TITLE	NAME
			-	-	DRAFTER	D. ADAMS
			-	-	DRAFTING CHECK	T. BRINK
			-	-	DESIGNER	T. AUGUSTYN
					DESIGN CHECK	A. STEENKAMP
2					PROJECT MANAGER	
1	2024-12-02	FOR DETAIL			PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED

ENGINEER: .....

PR ENG NR: .....

SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING

SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05

SCALE 1:50 — 0.5 0 1 2

SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER

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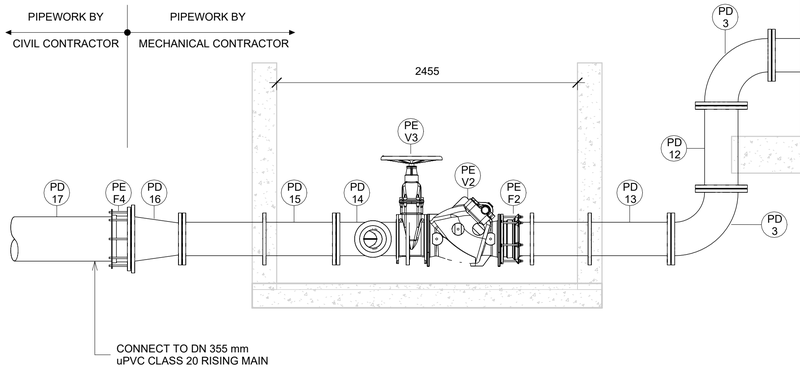
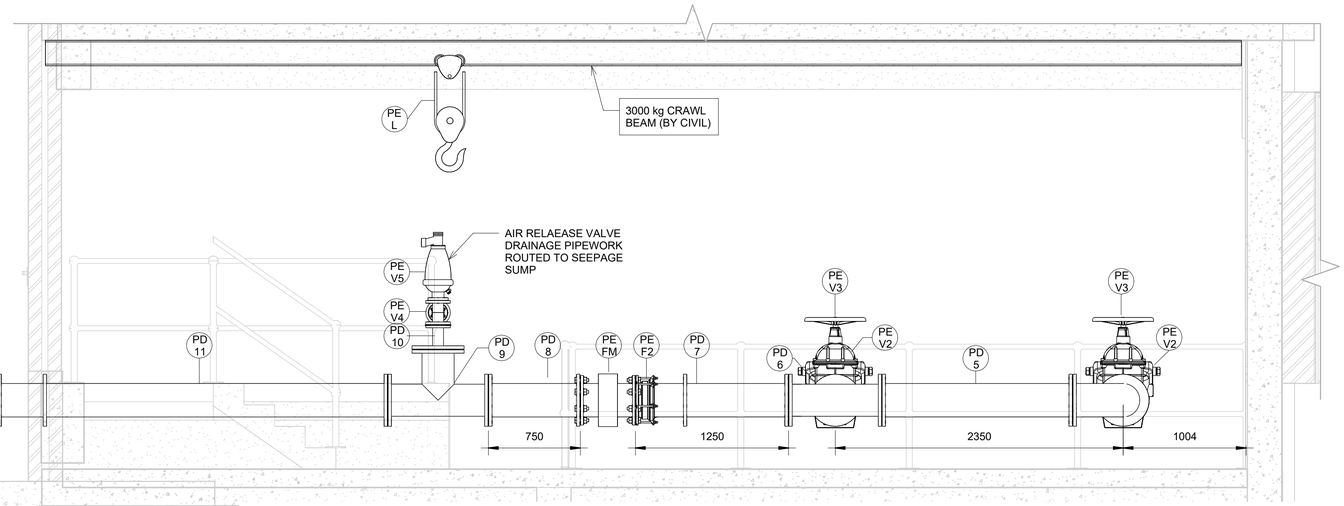
HEROLD'S BAY PUMP STATION

PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

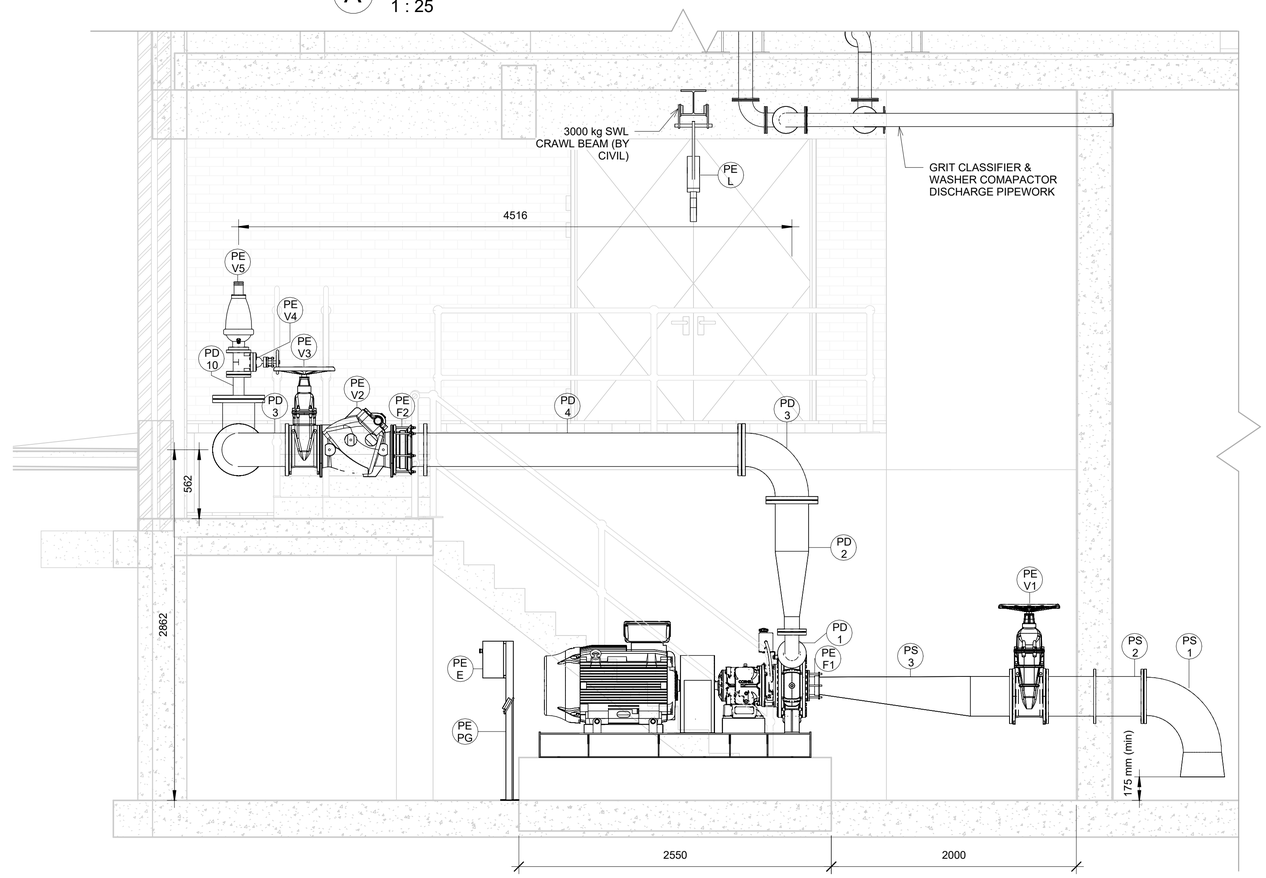
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (4 OF 9)	A

PLOT DATE TIME
2024/12/12 15:46:44





A Discharge Manifold
1 : 25



B Pump Room Elevation
1 : 25

DETAIL

SUCTION PIPEWORK SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PS 1	Ø300 mm x Ø350 mm	90° BEND + BELL MOUTH : F + PE	PN10	2
PS 2	Ø300 mm	PUDDLE PIPE : FBE	PN10	2
PS 3	Ø125 mm x Ø300 mm	PIPE + ECCENTRIC REDUCER + PIPE: FBE	PN10	2

DELIVERY PIPEWORK SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PD 1	Ø100 mm	90º BEND : FBE	PN25	2
PD 2	Ø100 mm x Ø250 mm	PIPE + CONCENTRIC REDUCER + PIPE: FBE	PN25	2
PD 3	Ø250 mm	90º BEND : FBE	PN25	5
PD 4	Ø250 mm	PIPE + RESTRAINING FLANGE : F + PE	PN25	2
PD 5	Ø250 mm	PIPE : FBE	PN25	1
PD 6	Ø250 mm	90º SWEPT TEE : FAE	PN25	1
PD 7	Ø250 mm	PIPE + RESTRAINING FLANGE : F+PE	PN25	1
PD 8	Ø250 mm	PIPE : FBE	PN25	1
PD 9	Ø250mm	90º TEE : FAE	PN25	1
PD 10	Ø50 mm	PIPE + Ø250 mm FLANGE : FBE	PN25	1
PD 11	Ø250 mm	PUDDLE PIPE : FBE	PN25	1
PD 12	Ø250 mm	PIPE : FBE	PN25	1
PD 13	Ø250 mm	PUDDLE PIPE + RESTRAINING FLANGE : F+PE	PN25	1
PD 14	Ø250 mm x Ø150 mm	90º SWEPT TEE : FAE	PN25	1
PD 15	Ø250 mm	PUDDLE PIPE : FBE	PN25	1
PD 16	Ø250 mm x Ø350 mm	CONCENTRIC REDUCER: FBE	PN25	1
PD 17	Ø355 mm	PIPE : PBE	PN25	2
PD 18	Ø150 mm	PUDDLE PIPE : F+PE + RESTRAINING FLANGE	PN25	1

EQUIPMENT SCHEDULE				
ITEM	DIAMETER	DESCRIPTION	CLASS	QTY
PE E	N/A	LOCAL CONTROL STATION + EMERGENCY STOP ON STAND	N/A	2
PE F1	Ø125 mm	FLANGE ADAPTOR	PN10	2
PE F2	Ø250 mm	FLANGE ADAPTOR	PN25	4
PE F3	Ø150 mm	FLANGE ADAPTOR	PN25	2
PE F4	Ø350 mm	FLANGE ADAPTOR	PN25	1
PE FM	Ø250 mm	ELECTROMAGNETIC FLOWMETER	PN25	1
PE L	N/A	GEARED CRAWL + CHAIN HOIST (300 kg SWL)	N/A	1
PE P	N/A	PUMPSET, COMPLETE	N/A	2
PE PG	N/A	SUCTION AND DISCHARGE PRESSURE GAUGE ON STAND	N/A	2
PE V1	Ø300 mm	GATE VALVE	PN10	2
PE V2	Ø250 mm	SINGLE-DOOR SWING-TYPE NON-RETURN VALVE	PN25	3
PE V3	Ø250 mm	GATE VALVE	PN25	3
PE V4	Ø80 mm	GATE VALVE	PN25	1
PE V5	Ø80 mm	AIR RELEASE VALVE	PN25	1
PE V6	Ø150 mm	GATE VALVE	PN25	1

DRAWING FILE LOCATION / NAME

150 mm ON ORIGINAL

A1

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
			-	-
			-	-
			-	-
2				
1	2024-12-02	FOR DETAIL		

DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED

ENGINEER: .....

PR ENG NR: .....

SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING

SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05

SCALE 1:50 — 0.5 0 1 2

SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER

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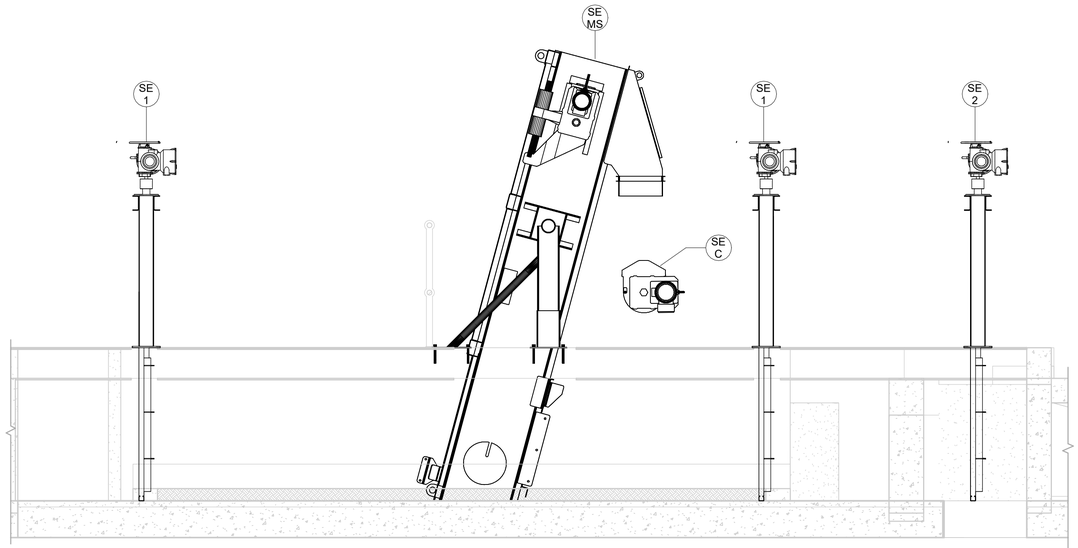
HEROLD'S BAY PUMP STATION

PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

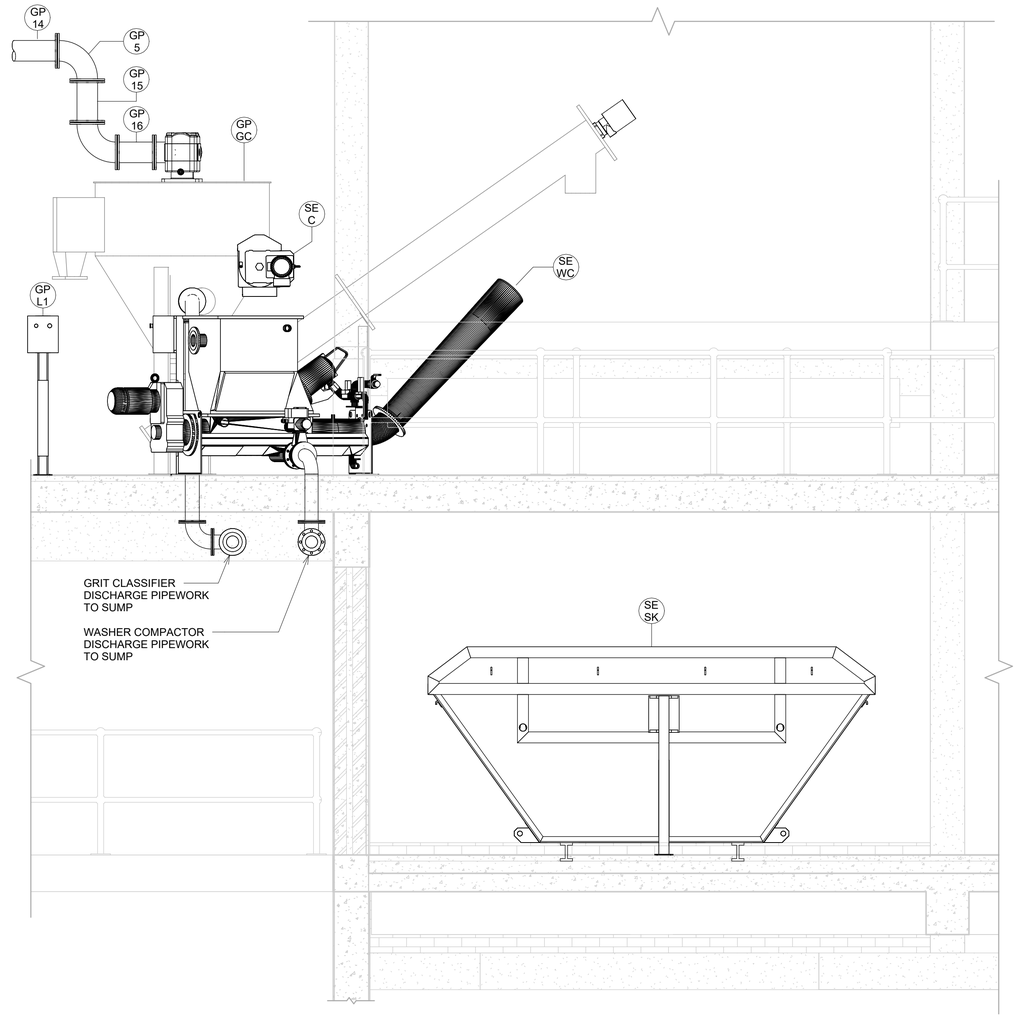
PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (5 OF 9)	A

PLOT DATE TIME
2024/12/12 15:47:15

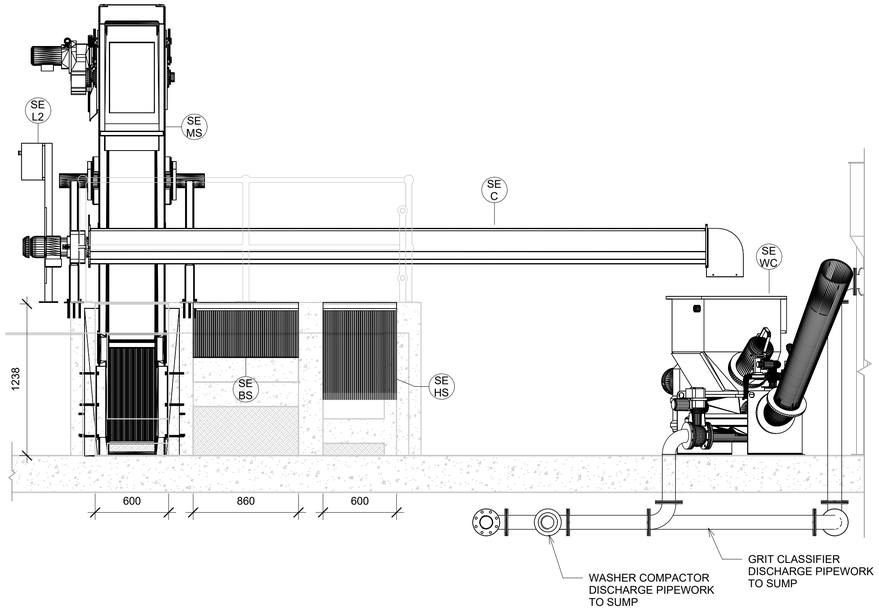
SCREENING EQUIPMENT SCHEDULE		
ITEM	DESCRIPTION	QTY
SE 1	SLUICE GATE	4
SE 2	SLUICE GATE FOR 500mm WIDE CHANNEL	4
SE BS	BYPASS MANUAL RAKE BAR SCREEN	1
SE C	SCREW CONVEYOR	1
SE HS	MANUAL RAKE BAR SCREEN	1
SE L1	MECHANICAL SCREEN LOCAL CONTROL STATION + EMERGENCY STOP	1
SE L2	SCREW CONVEYOR LOCAL CONTROL STATION + EMERGENCY STOP	1
SE L3	WASHER COMPACTOR LOCAL CONTROL STATION + EMERGENCY STOP	1
SE L4	SKIP DOLLY LOCAL CONTROL STATION + EMERGENCY STOP	1
SE MS	MULTI-RAKE MECHANICAL BAR SCREEN	1
SE SK	SKIP	1
SE TC	1 TON SWL TRAVELING CRANE	1
SE WC	WASHER COMPACTOR	1



C MECHANICAL SCREENING SECTION
1 : 25



E Screening Equipment - Side
1 : 25



D SCREENING EQUIPMENT SECTION
1 : 25

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL	TITLE	NAME
			-	-	DRAFTER	D. ADAMS
			-	-	DRAFTING CHECK	T. BRINK
			-	-	DESIGNER	T. AUGUSTYN
					DESIGN CHECK	A. STEENKAMP
2					PROJECT MANAGER	
1	2024-12-02	FOR DETAIL			PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 0.5 0 1 2
SCALE 1:100 1 0 1 2 3 4 5

DESIGNER
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HEROLD'S BAY PUMP STATION
PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (6 OF 9)	A

DRAWING FILE LOCATION / NAME
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A1
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PLOT DATE TIME
2024/12/12 15:47:19

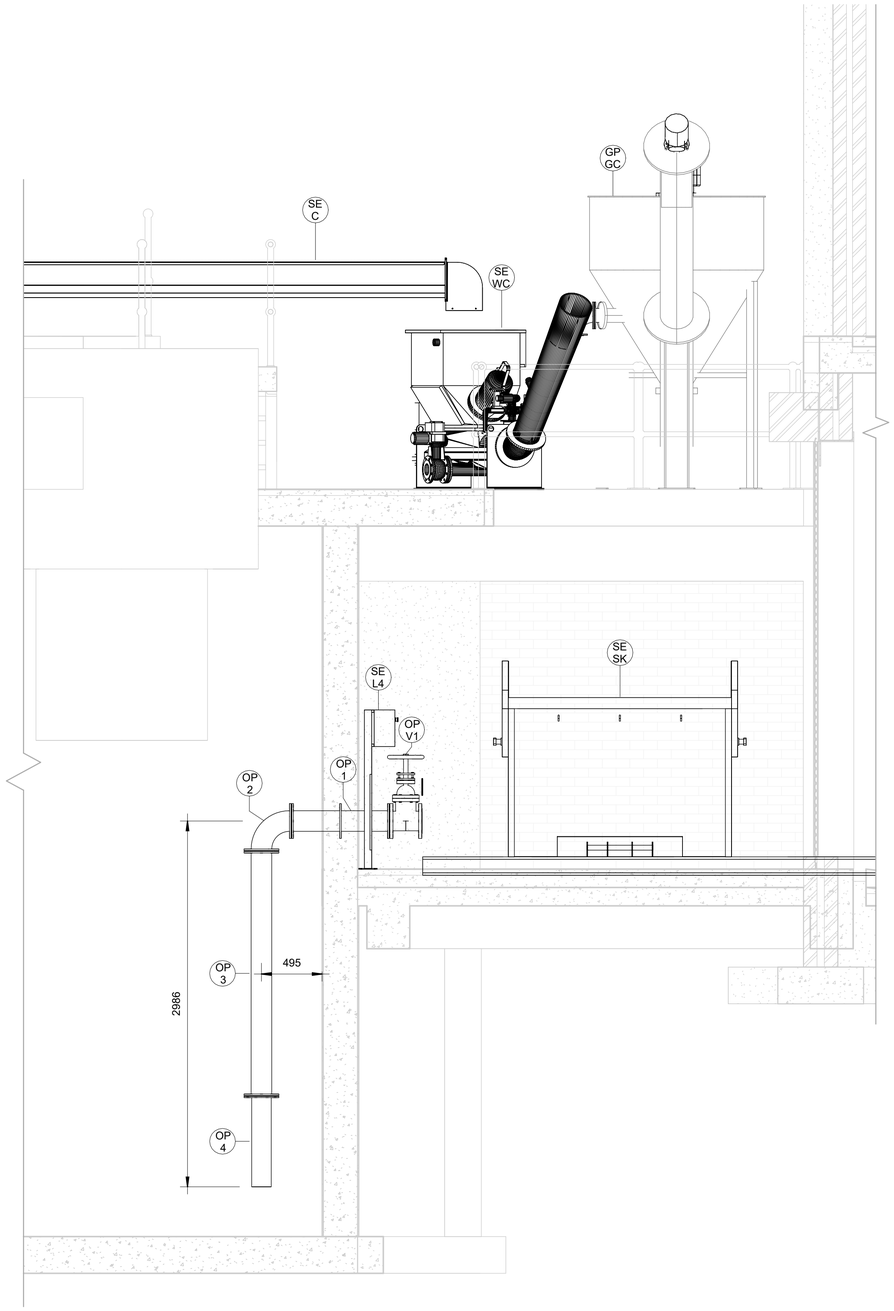
DRAWING FILE LOCATION / NAME

150 mm ON ORIGINAL

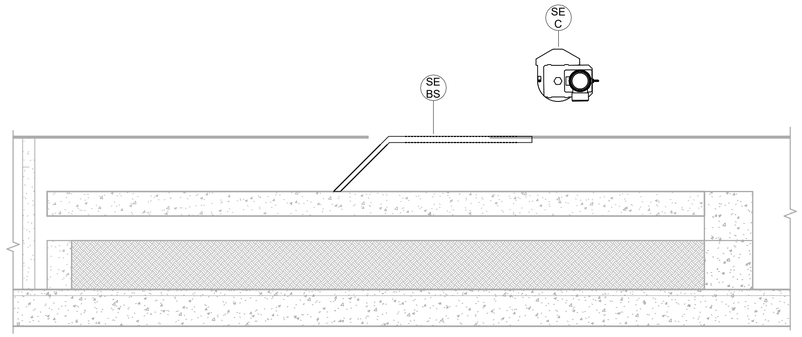
A1

SCREENING EQUIPMENT SCHEDULE		
ITEM	DESCRIPTION	QTY
SE 1	SLUICE GATE	4
SE 2	SLUICE GATE FOR 500mm WIDE CHANNEL	4
SE BS	BYPASS MANUAL RAKE BAR SCREEN	1
SE C	SCREW CONVEYOR	1
SE HS	MANUAL RAKE BAR SCREEN	1
SE L1	MECHANICAL SCREEN LOCAL CONTROL STATION + EMERGENCY STOP	1
SE L2	SCREW CONVEYOR LOCAL CONTROL STATION + EMERGENCY STOP	1
SE L3	WASHER COMPACTOR LOCAL CONTROL STATION + EMERGENCY STOP	1
SE L4	SKIP DOLLY LOCAL CONTROL STATION + EMERGENCY STOP	1
SE MS	MULTI-RAKE MECHANICAL BAR SCREEN	1
SE SK	SKIP	1
SE TC	1 TON SWL TRAVELING CRANE	1
SE WC	WASHER COMPACTOR	1

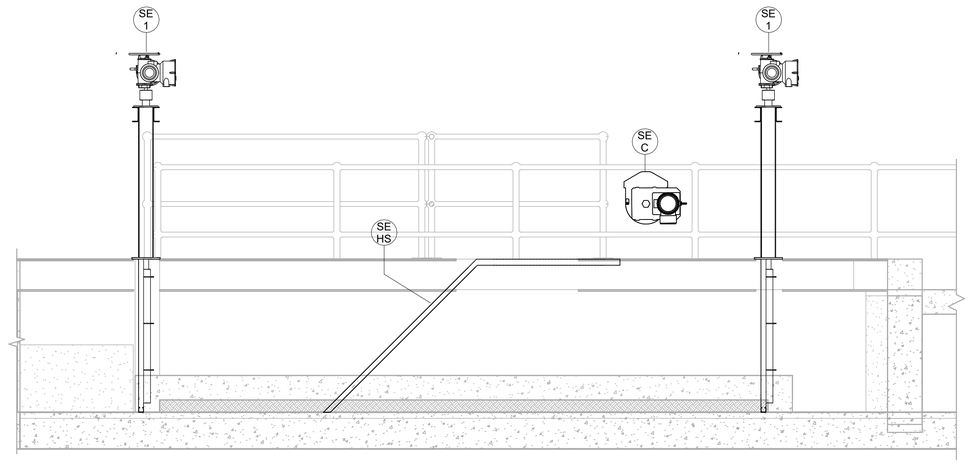
OVER-PUMPING PIPE SCHEDULE				
ITEM	Diameter	DESCRIPTION	CLASS	QTY
OP 1	Ø150mm	PUDDLE PIPE : FBE	PN10	1
OP 2	Ø150 mm	90° BEND : FBE	PN10	1
OP 3	Ø150 mm	PIPE : FBE	PN10	1
OP 4	Ø150 mm	PIPE : F+PE	PN10	1
OP V1	Ø150 mm	GATE VALVE	PN10	1



F OVER PUMPING CONNECTION
1 : 25



G BYPASS CHANNEL SECTION
1 : 25



H STAND-BY CHANNEL SECTION
1 : 25

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-02	FOR DETAIL	-	-
			-	-

DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 — 0.5 0 1 2
SCALE 1:100 — 1 0 1 2 3 4 5

DESIGNER
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GEORGE MUNICIPALITY
HEROLD'S BAY PUMP STATION
PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (7 OF 9)	A

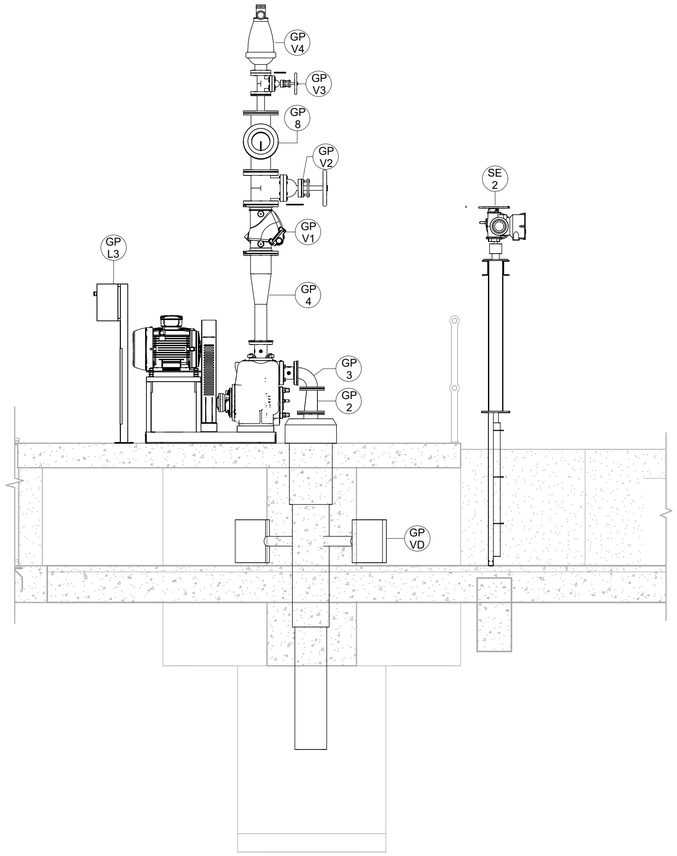
PLOT DATE TIME
2024/12/12 15:47:02

DRAWING FILE LOCATION / NAME

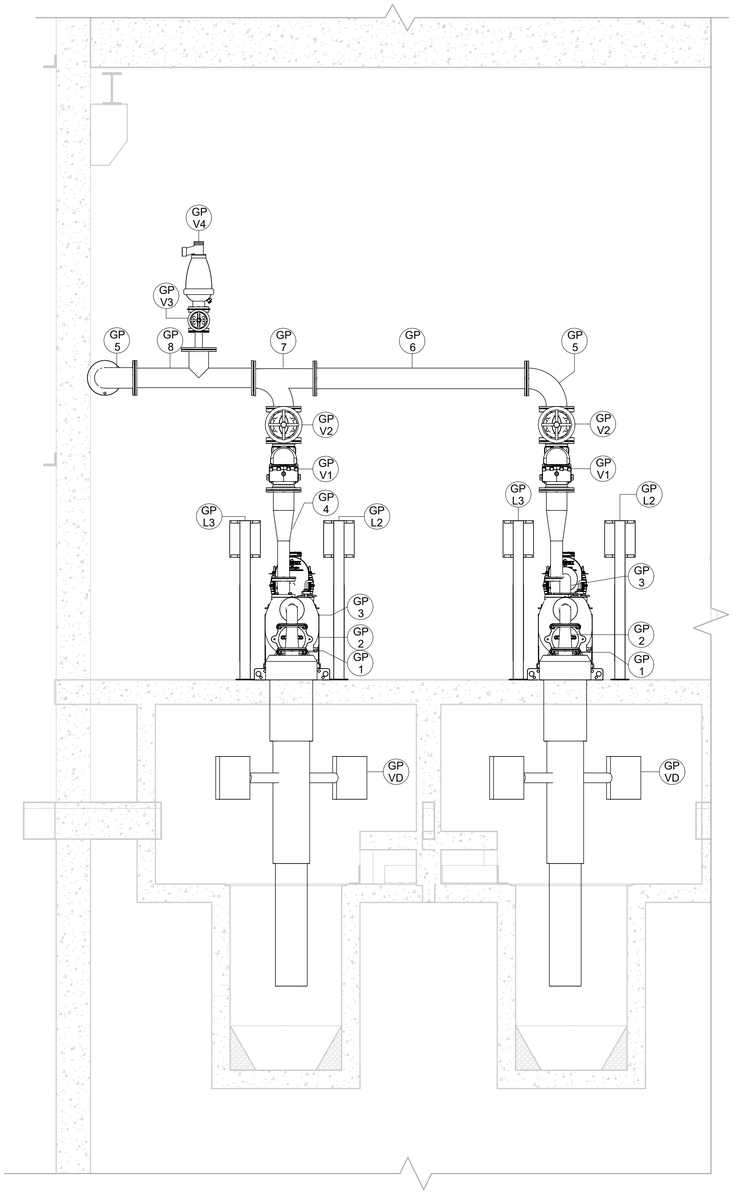
150 mm ON ORIGINAL

A1

GRIT EQUIPMENT SCHEDULE		
ITEM	DESCRIPTION	QTY
GP 1	PIPE : FBE	5
GP 2	ECCENTRIC REDUCER: FBE	2
GP 3	90º BEND : FBE	8
GP 4	PIPE + CONCENTRIC REDUCER + PIPE: FBE	2
GP 5	90º BEND : FBE	7
GP 6	PIPE : FBE	1
GP 7	90º SWEPT TEE : FAE	1
GP 8	Ø150 mm TEE : FAE	1
GP 9	PIPE : FBE	1
GP 10	PIPE : FBE	1
GP 11	PIPE : FBE	6
GP 12	PIPE : FBE	1
GP 13	PIPE : FBE	1
GP 14	PIPE : FBE	1
GP 15	PIPE : FBE	1
GP 16	PIPE : FBE	1
GP 17	PIPE : FBE	1
GP GC	GRIT CLASSIFIER	1
GP L1	GRIT CLASSFIER LOCAL CONTROL STATION + EMERGENCY STOP	1
GP L2	GRIT PUMP LOCAL CONTROL STATION + EMERGENCY STOP	2
GP L3	PADDLE DRIVE LOCAL CONTROL STATION + EMERGENCY STOP	2
GP PS	GRIT PUMPSET, COMPLETE	2
GP V1	SINGLE DOOR SWING TYPE NRV	2
GP V2	GATE VALVE	2
GP V3	GATE VALVE	1
GP V4	AIR RELEASE VALVE	1
GP VD	VORTEX DEGRITTER & PADDLE DRIVE SYSTEM	2



I Grit Pump Section
1 : 25



J Grit Pumps Front View
1 : 25

DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-02	FOR DETAIL	-	-

TITLE	NAME
DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED

ENGINEER: .....

PR ENG NR: .....

SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING

SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05

SCALE 1:50 — 0.5 0 1 2

SCALE 1:100 — 1 0 1 2 3 4 5

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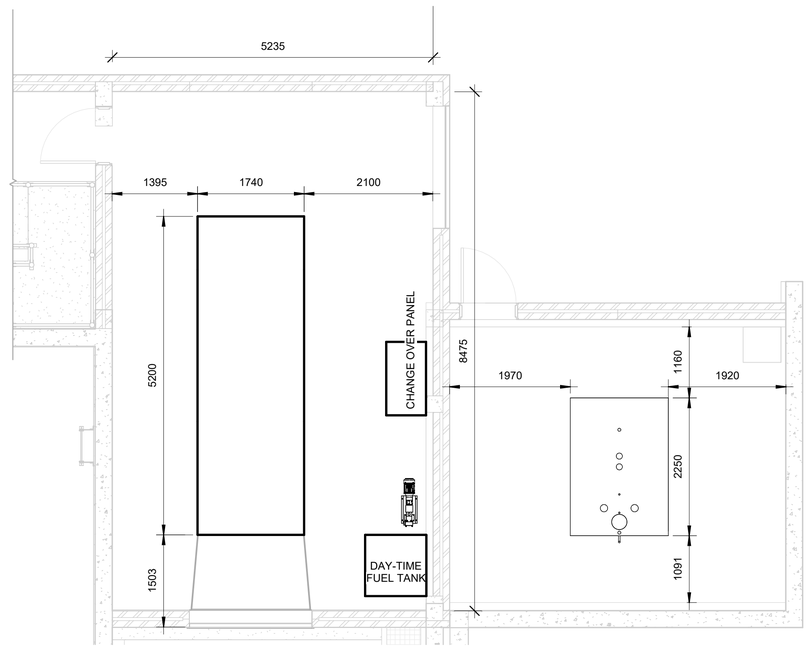
HEROLD'S BAY PUMP STATION

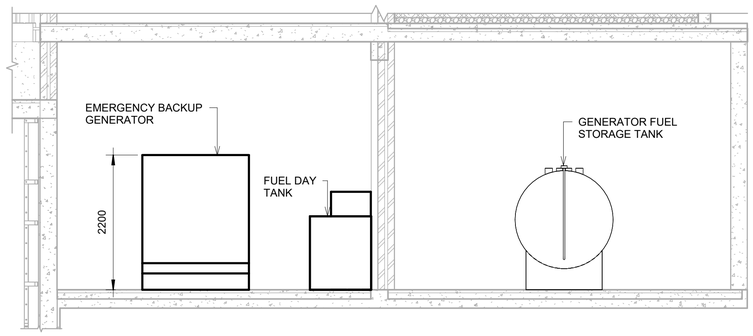
PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (8 OF 9)	A

PLOT DATE TIME
2024/12/12 15:47:17



K GROUND FLOOR - GENERATOR ROOM
1 : 50



L Emergency Generator Elevation
1 : 50

DRAWING FILE LOCATION / NAME

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A1
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DETAIL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No	APPROVAL
2			-	-
1	2024-12-05	FOR DETAIL	-	-

TITLE	NAME
DRAFTER	D. ADAMS
DRAFTING CHECK	T. BRINK
DESIGNER	T. AUGUSTYN
DESIGN CHECK	A. STEENKAMP
PROJECT MANAGER	
PROJECT DIRECTOR	T.CRONJE

DRAWING APPROVED
ENGINEER: .....
PR ENG NR: .....
SIGNATURE: .....

SCALES AT AN A1 SIZE DRAWING
SCALE 1:1 — 0.01 0 0.01 0.02 0.03 0.04 0.05
SCALE 1:50 — 0.5 0 1 2
SCALE 1:100 — 1 0 1 2 3 4 5

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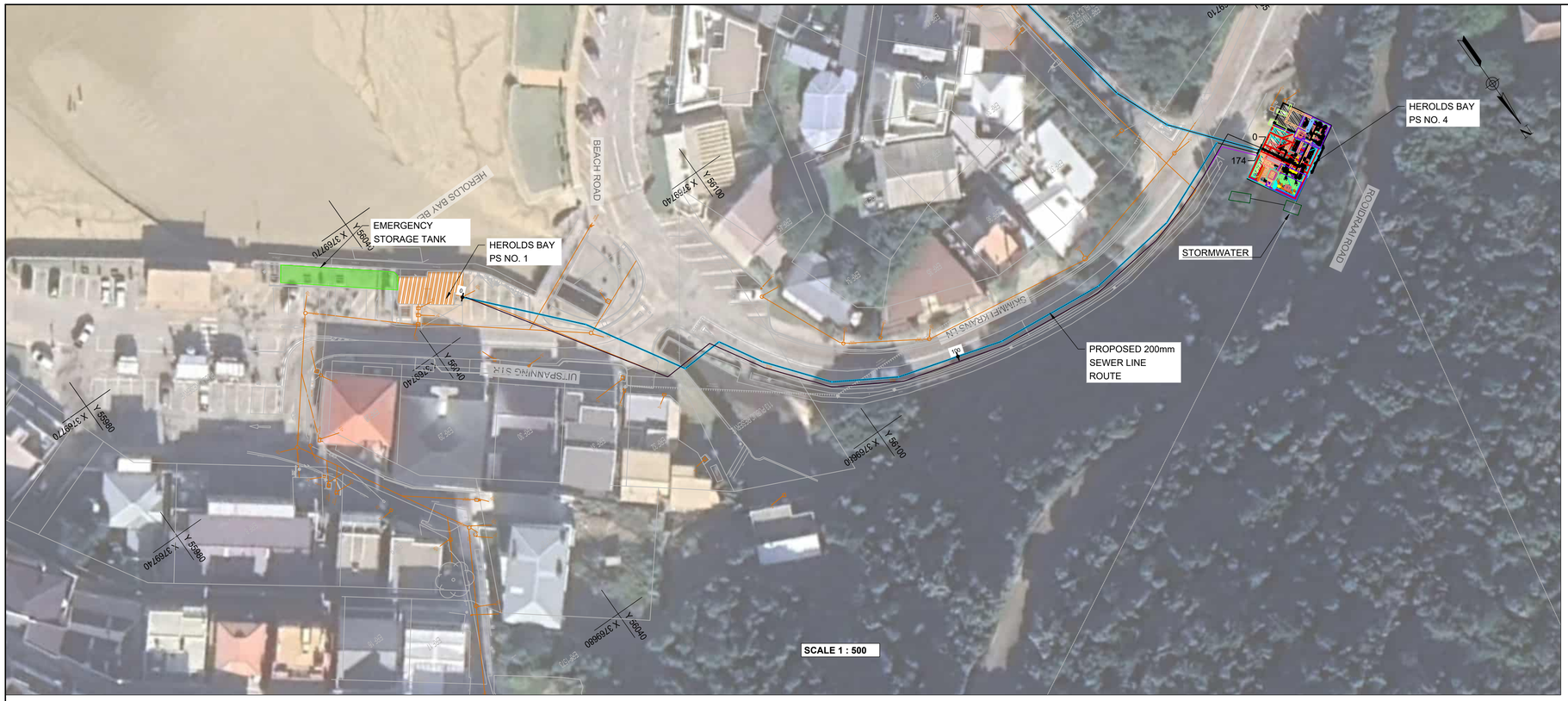
HEROLD'S BAY PUMP STATION
PUMP STATION 4 MECHANICAL AND ELECTRICAL EQUIPMENT LAYOUT

PROJECT NO.	PHASE	DRAWING NUMBER	REVISION
C1936	DETAIL DESIGN	M-PS4-01 (9 OF 9)	A

Annexure C Rising Main Drawings

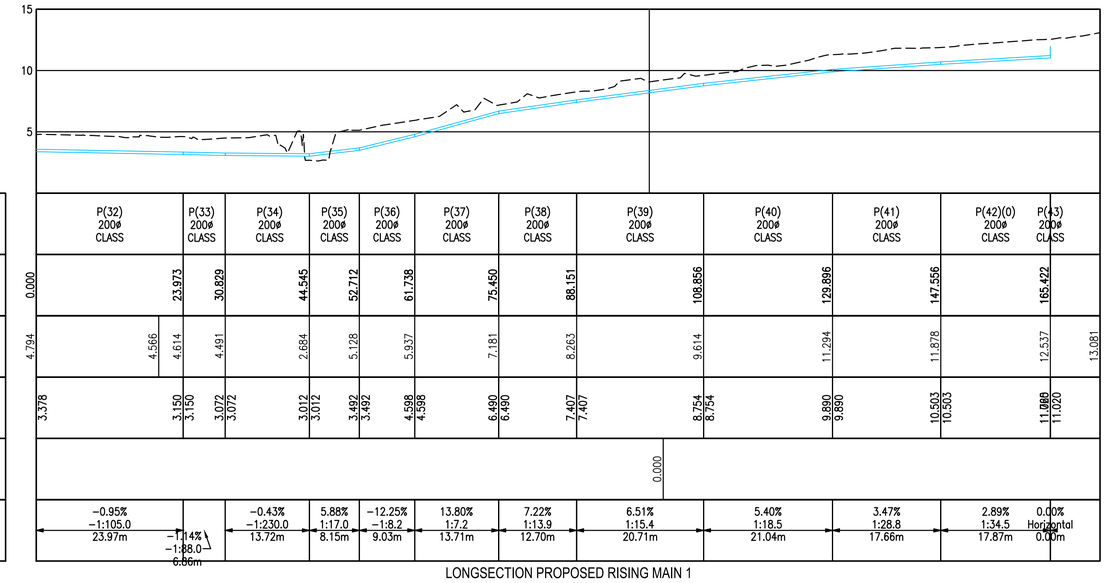
NOTE:
1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE ANY WORK IS PUT IN HAND. REFER ANY DISCREPANCIES TO THE ENGINEER.



SEWER RISING MAIN PIPE TABLE				
NAME	SIZE	LENGTH	SLOPE	MATERIAL
P(32)	200 mm	24.0 m	-0.95%	uPVC
P(33)	200 mm	6.9 m	-1.14%	uPVC
P(34)	200 mm	13.7 m	-0.43%	uPVC
P(35)	200 mm	8.2 m	5.88%	uPVC
P(36)	200 mm	9.0 m	-12.25%	uPVC
P(37)	200 mm	13.7 m	13.80%	uPVC
P(38)	200 mm	12.7 m	7.22%	uPVC
P(39)	200 mm	20.7 m	6.51%	uPVC
P(40)	200 mm	21.0 m	5.40%	uPVC
P(41)	200 mm	17.7 m	3.47%	uPVC
P(42)(0)	200 mm	17.9 m	2.89%	uPVC
P(43)	200 mm	0.0 m	0.00%	uPVC

NGL
PIPE
SCALES:
Horizontal 1:500
Vertical 1:250

DATUM 0.000



LONGSECTION PROPOSED RISING MAIN 1
FROM 0.000 TO 173.527

LEGEND:
- FIRE HYDRANT/ MARKER
- TREE
- GATE
- LAMP POLE
- WATER METER/ WATER VALVES
- TELEPHONE POLE
- ROCK OUTCROP
- BENCH MARKS
- ELECTRICITY BOX
- EXISTING SEWERLINE
- EXISTING MANHOLE
- EXISTING MANHOLE
- STORMWATER
- PROPOSED RISING PIPELINE
- SERVITUDE 4m WIDE
- EMERGENCY STORAGE TANK

FOR DISCUSSION

REVISIONS				
NO.	DATE	DESCRIPTION	INITIAL	
0B	07-07-2023	FOR DISCUSSION	WA	

DESIGNED	T CRONJE
CHECKED	J HOUGH
DRAWN	M GQWETHA
CHECKED	W ANNANDALE

SIGNED
SMEC South Africa
DATE

smec an ESS company
PO Box 10633, George 6530 | 13 Progress St, George 6529
e-mail: george@smec.com | Tel (044) 873-5029
website: www.smec.com | Fax (044) 873-5086

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SIGNED
George Municipality
DATE

Upgrading of Herolds Bay Pumpstation

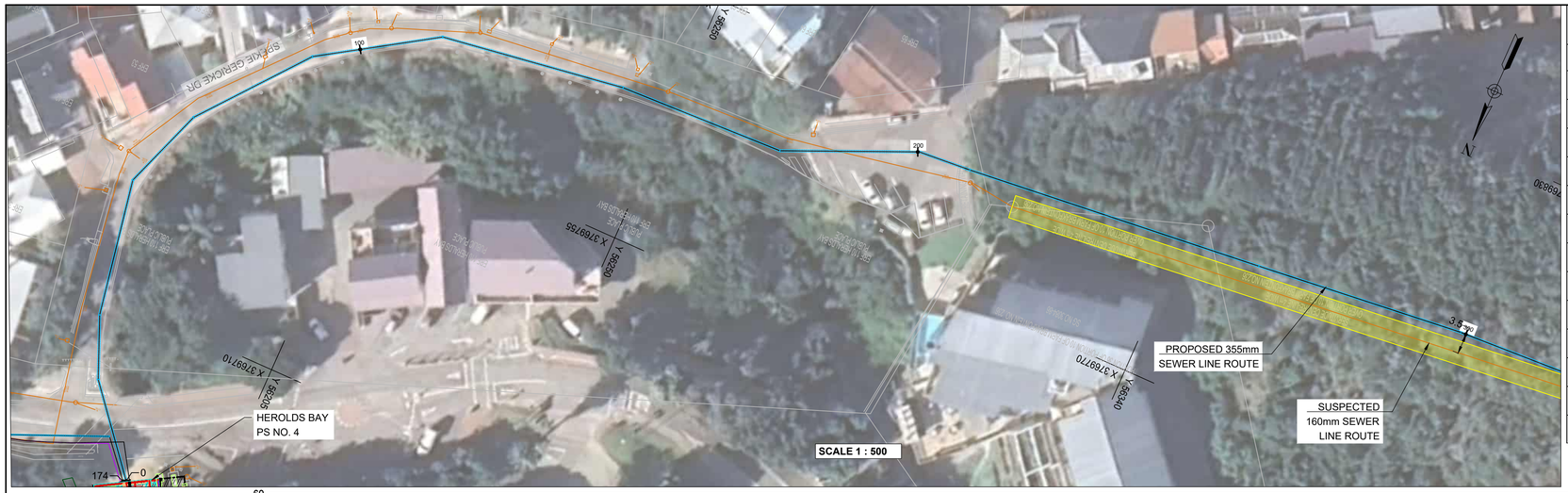
Sewer Rising Main From Herolds Bay PS No. 1 to Herolds Bay PS No. 4 SV 0 to SV 171

SIZE	SCALE
A1	AS SHOWN

PROJECT DRAWING NUMBER: C1936 - 520 - 001

REV	SHEET No.
OB	01 OF 05

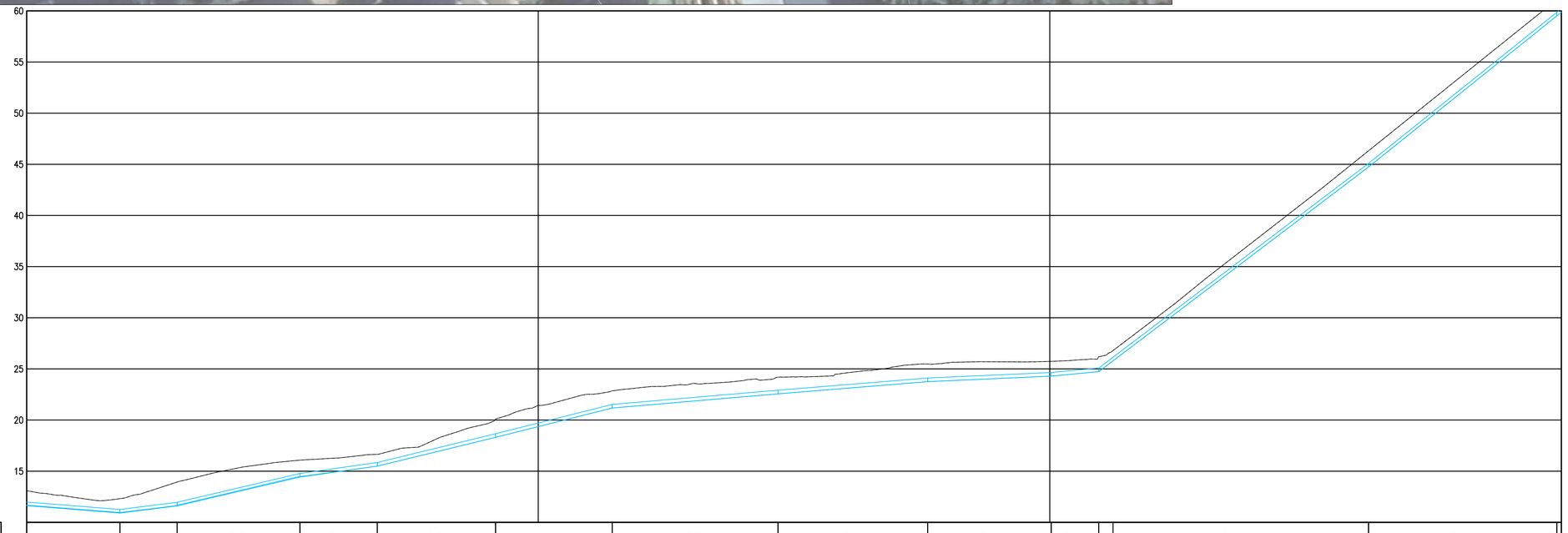
SCALE BAR 1 : 1000: 0, 10m, 25m, 50m, 100m



SEWER RISING MAIN PIPE TABLE

NAME	SIZE	LENGTH	SLOPE	MATERIAL
P(1)	355 mm	18.2 m	-3.97%	uPVC
P(2)	355 mm	11.2 m	6.26%	uPVC
P(3)	355 mm	24.0 m	11.73%	uPVC
P(4)	355 mm	15.1 m	7.09%	uPVC
P(5)	355 mm	23.1 m	12.18%	uPVC
P(6)	355 mm	22.8 m	12.58%	uPVC
P(7)	355 mm	32.4 m	4.27%	uPVC
P(8)	355 mm	29.3 m	4.07%	uPVC
P(9)	355 mm	24.1 m	2.23%	uPVC
P(10)	355 mm	9.3 m	4.72%	uPVC
P(11)	355 mm	52.7 m	37.95%	uPVC
P(12)	355 mm	36.8 m	40.13%	uPVC
P(13)	355 mm	27.3 m	40.48%	uPVC

NOTE:
1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE ANY WORK IS PUT IN HAND. REFER ANY DISCREPANCIES TO THE ENGINEER.



NGL ——— - ———
PIPE ═══

SCALES:
Horizontal 1:500
Vertical 1:250

DATUM 10.000

REFERENCE	P(1) 355ø CLASS	P(2) 355ø CLASS	P(3) 355ø CLASS	P(4) 355ø CLASS	P(5) 355ø CLASS	P(6) 355ø CLASS	P(7) 355ø CLASS	P(8) 355ø CLASS	P(9) 355ø CLASS	P(10) 355ø CLASS	P(11) 355ø CLASS	P(12) 355ø CLASS	P(13) 355ø CLASS
DISTANCE (m)	0.000 / 18.223	29.409	53.422	68.541	91.645	114.452	146.879	176.137	200.280	209.581	262.293	299.106	326.406
GROUND LEVEL	13.079 / 12.318	13.939	16.078	16.645	20.057	22.851	24.184	25.476	25.736	26.182	46.315	61.000	
PIPE INVERT LEVEL	11.626 / 10.904	10.904 / 11.604	11.604 / 14.420	14.420 / 15.492	15.493 / 18.306	18.306 / 21.175	21.175 / 22.561	22.561 / 23.753	23.753 / 24.291	24.291 / 24.730	24.730 / 44.733	44.733 / 50.506	50.506 / 58.560
DEPTH TO INVERT	1.400 / 1.361	2.238	1.625	1.152	1.751	1.676	1.623	1.723	1.446	1.453	1.582	1.602	
SLOPE / LENGTH	−3.97% −1:25.2 18.22m	6.26% 1:16.0 11.19m	11.73% 1:8.5 24.01m	7.09% 1:14.1 15.12m	12.18% 1:8.2 23.10m	12.58% 1:7.9 22.81m	4.27% 1:23.4 32.43m	4.07% 1:24.5 29.26m	2.23% 1:44.9 24.14m	4.72% 1:21.2 9.30m	37.95% 1:2.6 52.71m	40.13% 1:2.5 36.81m	40.48% 1:2.5 27.35m

LONGSECTION PROPOSED RISING MAIN 2
FROM 0.000 TO 300.000

LEGEND:
- FIRE HYDRANT/ MARKER
- TREE
- GATE
- LAMP POLE
- WATER METER/ WATER VALVES
- TELEPHONE POLE
- ROCK OUTCROP
- BENCH MARKS
- ELECTRICITY BOX
- EXISTING SEWERLINE
- EXISTING MANHOLE
- EXISTING MANHOLE
- STORMWATER
- PROPOSED RISING PIPELINE
- SERVITUDE 4m WIDE

FOR DISCUSSION

REVISIONS				
0B	07-07-2023	FOR DISCUSSION	WA	
NO.	DATE	DESCRIPTION	INITIAL	

DESIGNED	T CRONJE
CHECKED	J HOUGH
DRAWN	M GQWETHA
CHECKED	W ANNANDALE

SIGNED
SMEC South Africa
DATE

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SIGNED
George Municipality
DATE

Upgrading of Herolds Bay Pumpstation

Sewer Rising Main from Herolds Bay PS No. 4 to Existing WWTW SV 0 to SV 300

SIZE	SCALE
A1	AS SHOWN

PROJECT DRAWING NUMBER
C1936 - 520 - 002

REV	SHEET No.
OB	02 OF 05

SCALE BAR 1 : 1000
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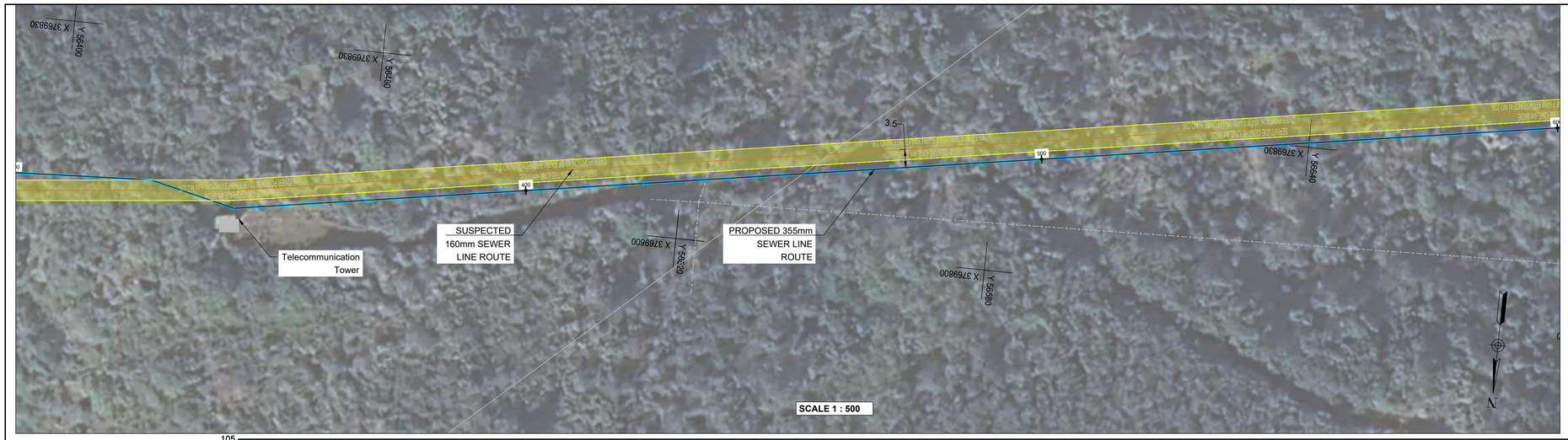
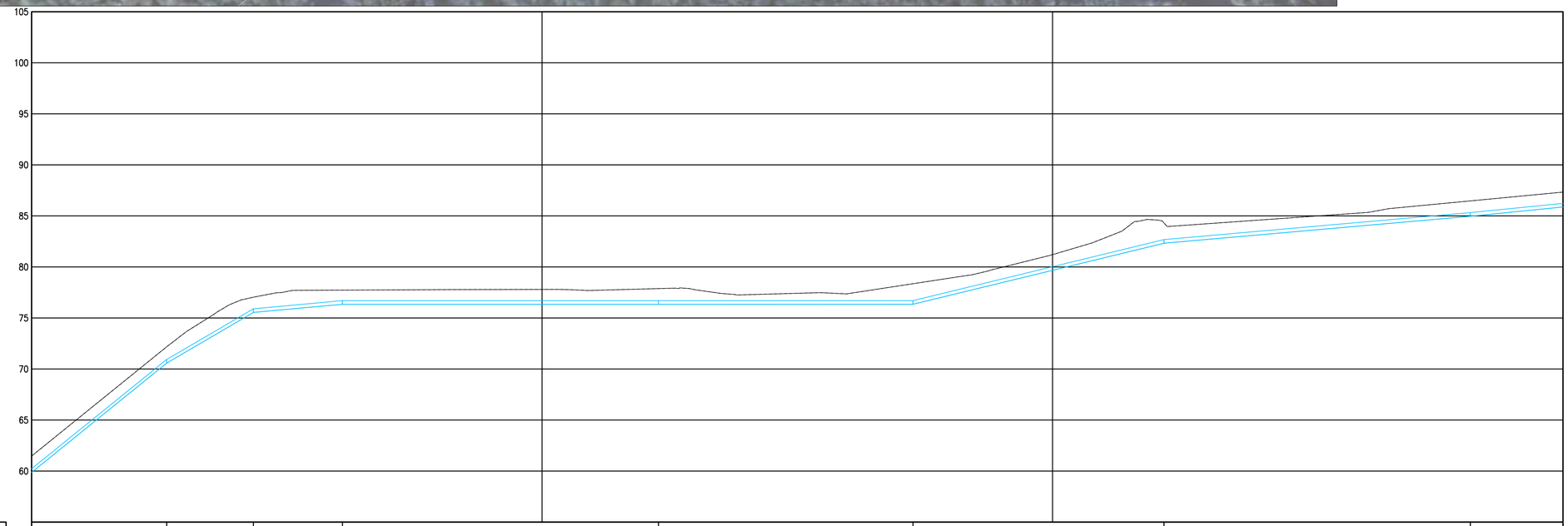


NOTE:
1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE ANY WORK IS PUT IN HAND. REFER ANY DISCREPANCIES TO THE ENGINEER.

SEWER RISING MAIN PIPE TABLE

NAME	SIZE	LENGTH	SLOPE	MATERIAL
P(13)	355 mm	27.3 m	40.48%	uPVC
P(14)	355 mm	17.0 m	29.23%	uPVC
P(15)	355 mm	17.4 m	4.57%	uPVC
P(16)	355 mm	61.9 m	0.00%	uPVC
P(17)	355 mm	49.9 m	0.00%	uPVC
P(18)	355 mm	49.2 m	12.17%	uPVC
P(19)	355 mm	60.0 m	4.40%	uPVC
P(20)	355 mm	23.5 m	5.00%	uPVC



NGL — - —
PIPE ═══

SCALES:
Horizontal 1:500
Vertical 1:250

DATUM 55.000

REFERENCE		P(13) 355ø CLASS	P(14) 355ø CLASS	P(15) 355ø CLASS	P(16) 355ø CLASS	P(17) 355ø CLASS	P(18) 355ø CLASS	P(19) 355ø CLASS	P(20) 355ø CLASS
DISTANCE (m)	299.106	326.453	343.446	360.888	422.797	472.653	521.825	581.835	605.350
GROUND LEVEL		72.173	77.036		77.877	78.354	84.314	86.469	
PIPE INVERT LEVEL	59.506	70.576	75.543	76.341	76.341	76.341	82.324	84.965	86.141
	70.576	70.576	75.543	76.341	76.341	76.341	82.324	84.965	
DEPTH TO INVERT	1.602	1.597	1.493	1.385	1.536	2.013	1.990	1.504	1.459
SLOPE / LENGTH		40.48% 1:2.5 27.35m	29.23% 1:3.4 16.99m	4.57% 1:21.9 17.44m	0.00% Horizontal 61.91m	0.00% 1:110311.6 49.86m	12.17% 1:8.2 49.17m	4.40% 1:22.7 60.01m	5.00% 1:20.0 23.52m

LEGEND:
- FIRE HYDRANT/ MARKER
- TREE
- GATE
- LAMP POLE
- WATER METER/ WATER VALVES
- TELEPHONE POLE
- ROCK OUTCROP
- BENCH MARKS
- ELECTRICITY BOX
- EXISTING SEWERLINE
- EXISTING MANHOLE
- EXISTING MANHOLE
- STORMWATER
- PROPOSED RISING PIPELINE
- SERVITUDE 4m WIDE

LONGSECTION PROPOSED RISING MAIN 2
FROM 300.000 TO 600.000

FOR DISCUSSION

REVISIONS				
0B	07-07-2023	FOR DISCUSSION	WA	
NO.	DATE	DESCRIPTION	INITIAL	

DESIGNED	T CRONJE
CHECKED	J HOUGH
DRAWN	M GQWETHA
CHECKED	W ANNANDALE

SIGNED _____ SMEC South Africa
DATE _____

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SIGNED _____ George Municipality
DATE _____

Upgrading of Herolds Bay Pumpstation

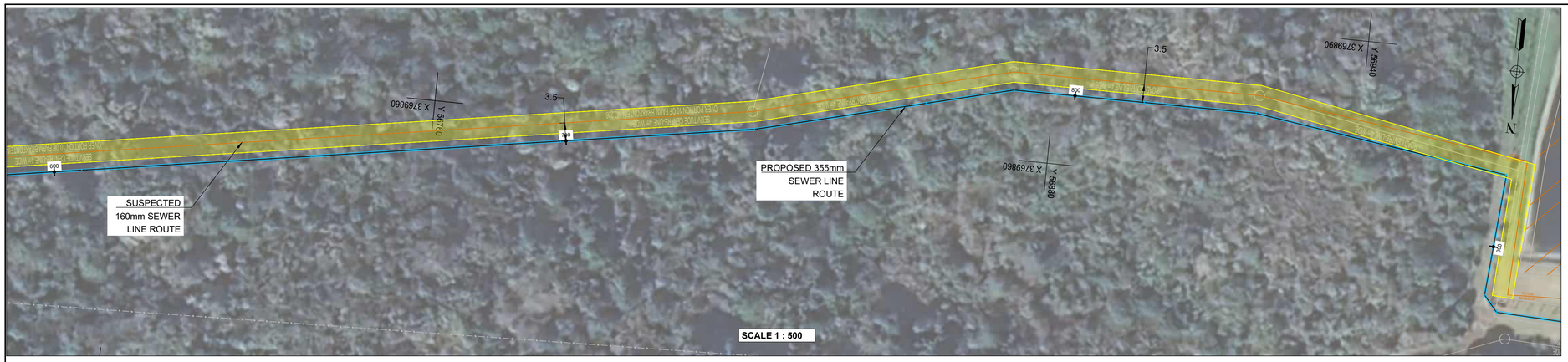
Sewer Rising Main from Herolds Bay PS No. 4 to Existing WWTW SV 300 to SV 600

SIZE	SCALE
A1	AS SHOWN

PROJECT DRAWING NUMBER: C1936 - 520 - 003

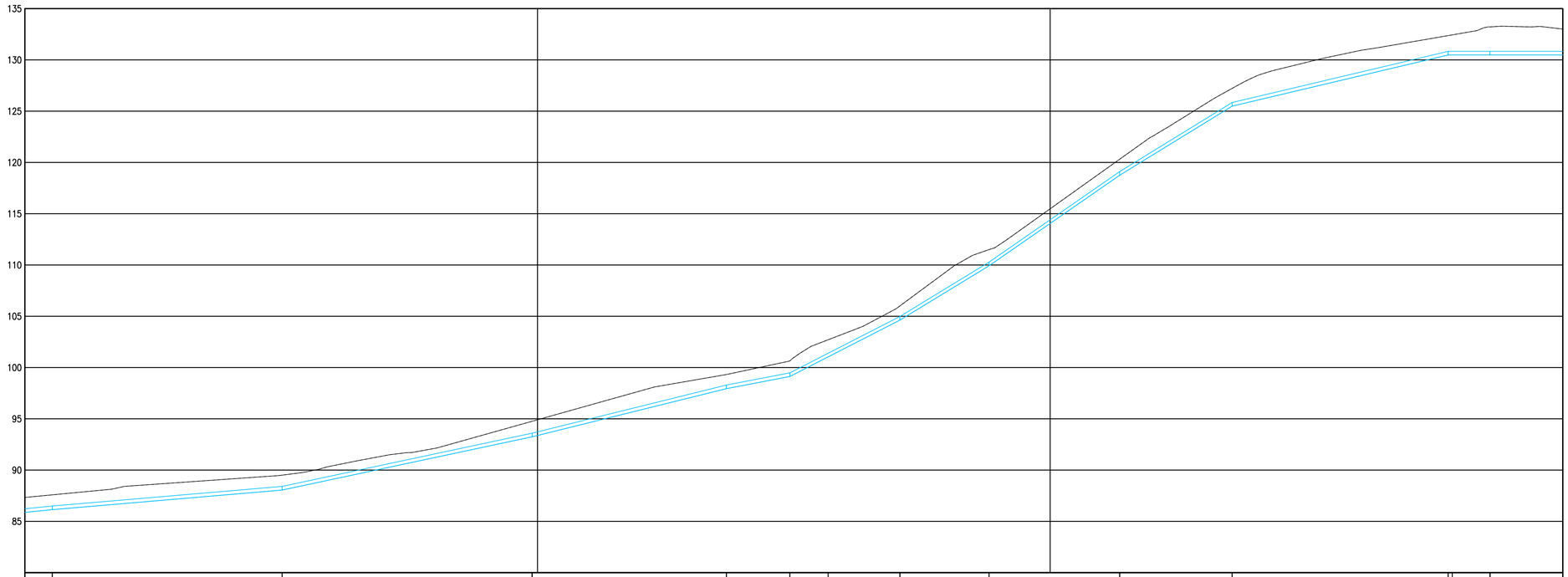
REV	SHEET No.
OB	03 OF 05

SCALE BAR 1 : 1000
100m 50m 25m 10m 0



SEWER RISING MAIN PIPE TABLE

NAME	SIZE	LENGTH	SLOPE	MATERIAL
P(20)	355 mm	23.5 m	5.00%	uPVC
P(21)	355 mm	44.8 m	4.26%	uPVC
P(22)	355 mm	48.8 m	10.64%	uPVC
P(23)	355 mm	37.9 m	12.39%	uPVC
P(24)	355 mm	12.4 m	9.60%	uPVC
P(25)	355 mm	21.5 m	25.61%	uPVC
P(26)	355 mm	17.4 m	30.48%	uPVC
P(27)	355 mm	25.5 m	34.64%	uPVC
P(28)	355 mm	21.9 m	30.71%	uPVC
P(29)	355 mm	42.1 m	11.84%	uPVC
P(30)	355 mm	8.2 m	0.00%	uPVC



NGL ——— – ———
PIPE ═══

SCALES:
Horizontal 1:500
Vertical 1:250

DATUM 80.000

		P(20) 355ø CLASS	P(21) 355ø CLASS	P(22) 355ø CLASS	P(23) 355ø CLASS	P(24) 355ø CLASS	P(25) 355ø CLASS	P(26) 355ø CLASS	P(27) 355ø CLASS	P(28) 355ø CLASS	P(29) 355ø CLASS	P(30) 355ø CLASS	P(31) 355ø CLASS
REFERENCE													
DISTANCE (m)	581.835	605.350	650.183	698.946	736.852	749.225	770.691	788.088	813.560	835.501	877.637	885.797	909.576
GROUND LEVEL		87.655	94.759	99.319	100.648	111.502	127.222	132.369	133.216				
PIPE INVERT LEVEL	84.965 86.14	86.141	88.053 88.053	93.244 93.244	97.939 97.939	99.126 99.126	104.624 104.624	109.926 109.926	118.750 118.750	125.489 125.489	130.479 130.479	130.479 130.479	130.479
DEPTH TO INVERT	1.459	1.445	1.454	1.516	1.381	1.521	1.384	1.576	1.565	1.733	1.890	2.737	2.525
SLOPE / LENGTH		5.00% 1:20.0 23.52m	4.26% 1:23.4 44.83m	10.64% 1:9.4 48.76m	12.39% 1:8.1 37.91m	9.60% 1:10.4 12.37m	25.61% 1:3.9 21.47m	30.48% 1:3.3 17.40m	34.64% 1:2.9 25.47m	30.71% 1:3.3 21.94m	11.84% 1:8.4 42.14m	0.00% Horizontal 8.16m	0.00% Horizontal 23.78m

LONGSECTION PROPOSED RISING MAIN 2
FROM 600.000 TO 900.000

LEGEND:

- FIRE HYDRANT/ MARKER
- TREE
- GATE
- LAMP POLE
- WATER METER/ WATER VALVES
- TELEPHONE POLE
- ROCK OUTCROP
- BENCH MARKS
- ELECTRICITY BOX
- EXISTING SEWERLINE
- EXISTING MANHOLE
- EXISTING MANHOLE
- STORMWATER
- PROPOSED RISING PIPELINE
- SERVITUDE 4m WIDE
- EMERGENCY STORAGE TANK

NOTE:
1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE ANY WORK IS PUT IN HAND. REFER ANY DISCREPANCIES TO THE ENGINEER.

FOR DISCUSSION

SCALE BAR 1 : 1000
100m 50m 25m 10m 0

REVISIONS				
0B	07-07-2023	FOR DISCUSSION	WA	
NO.	DATE	DESCRIPTION	INITIAL	

DESIGNED	T CRONJE
CHECKED	J HOUGH
DRAWN	M GQWETHA
CHECKED	W ANNANDALE

SIGNED _____
SMEC South Africa
DATE _____

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SIGNED _____
George Municipality
DATE _____

Upgrading of Herolds Bay Pumpstation

Sewer Rising Main from Herolds Bay PS No. 4 to Existing WWTW SV 600 to SV 900

SIZE	SCALE
A1	AS SHOWN

PROJECT DRAWING NUMBER: C1936 - 520 - 004

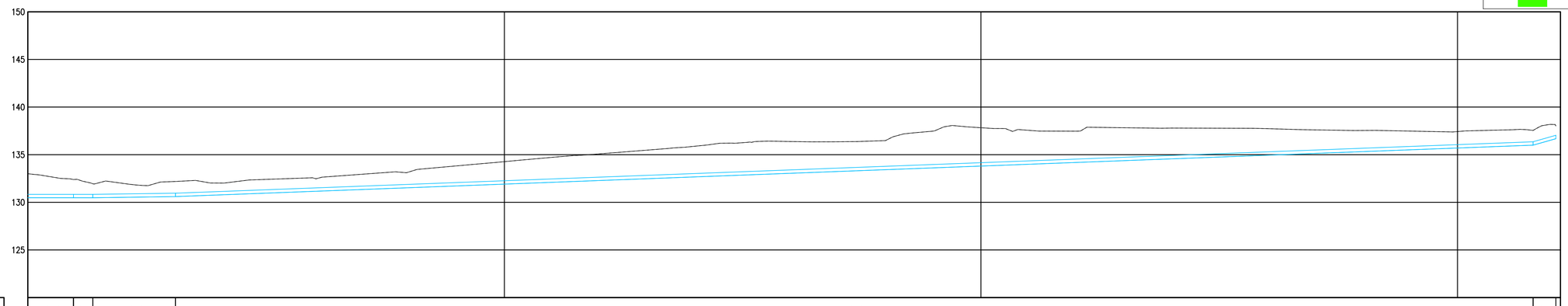
REV	SHEET No.
OB	04 OF 05

SEWER RISING MAIN PIPE TABLE

NAME	SIZE	LENGTH	SLOPE	MATERIAL
P(31)	355 mm	23.8 m	0.00%	uPVC
P(32)	355 mm	4.1 m	-0.01%	uPVC
P(33)	355 mm	17.3 m	0.71%	uPVC
P(34)	355 mm	284.9 m	1.90%	uPVC
P(37)	355 mm	4.8 m	14.25%	uPVC

LEGEND:

- FIRE HYDRANT/ MARKER
- TREE
- GATE
- LAMP POLE
- WATER METER/ WATER VALVES
- TELEPHONE POLE
- ROCK OUTCROP
- BENCH MARKS
- ELECTRICITY BOX
- EXISTING SEWERLINE
- EXISTING MANHOLE
- EXISTING MANHOLE
- STORMWATER
- PROPOSED RISING PIPELINE
- SERVITUDE 4m WIDE
- EMERGENCY STORAGE TANK



REFERENCE		P(31) 355ø CLASS	P(32) 355ø CLASS	P(33) 355ø CLASS	P(34) 355ø CLASS	P(37) 355ø CLASS
DISTANCE (m)	885.797	909.576	913.631	930.977	1215.858	1220.646
GROUND LEVEL		132.394	131.941	132.186	137.548	138.017
PIPE INVERT LEVEL	130.479	130.479 / 130.479	130.479 / 130.479	130.479	136.601 / 136.601	136.001 / 136.684
DEPTH TO INVERT	2.525	1.915	1.470	1.585	1.547	1.343
SLOPE / LENGTH		0.00% Horizontal 23.78m	-0.01% 1:1333.0 4.06m	0.71% 1:141.1 17.31m	1.90% 1:52.8 284.88m	4.25% 1:7.0 4.79m

LONGSECTION PROPOSED RISING MAIN 2
FROM 900.000 TO 1221.608

NOTE:
1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE ANY WORK IS PUT IN HAND. REFER ANY DISCREPANCIES TO THE ENGINEER.

FOR DISCUSSION

REVISIONS				
0B	07-07-2023	FOR DISCUSSION	WA
NO.	DATE	DESCRIPTION	INITIAL

DESIGNED	B BARTLETT
CHECKED	J HOUGH
DRAWN	M GQWETHA
CHECKED	W ANNANDALE

SIGNED
SMEC South Africa
DATE

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SIGNED
George Municipality
DATE

Upgrading of Herolds Bay Pumpstation

Sewer Rising Main From Herolds Bay PS No. 4 to Exisiting WWTW SV 900 to SV 1227

SIZE	SCALE
A1	AS SHOWN

PROJECT DRAWING NUMBER: C1936 - 520 - 005

REV	SHEET No.
AB	05 OF 05

SCALE BAR: 100m, 50m, 25m, 10m, 0 — 1 : 1000

Annexure D Architectural Design Report

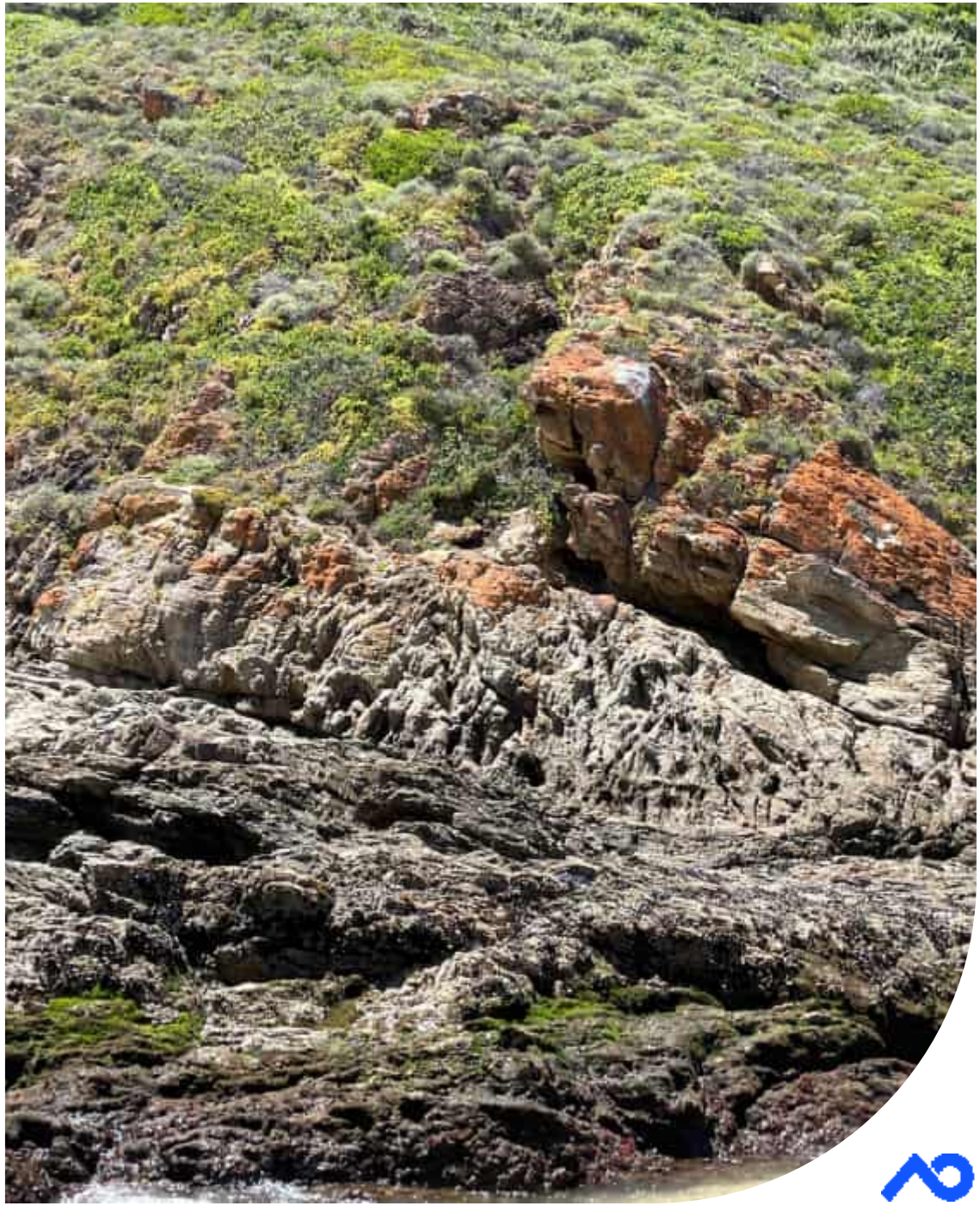
HEROLDS BAY ARCHI TECTURAL & URBAN CONCEPT

Upgrading of Herolds Bay Sewer Pumpstation no.1 and Associated Rising Maim

Prepared For: George Municipality

Client Reference No. T/ING/010/2020

ANNEXURE - D

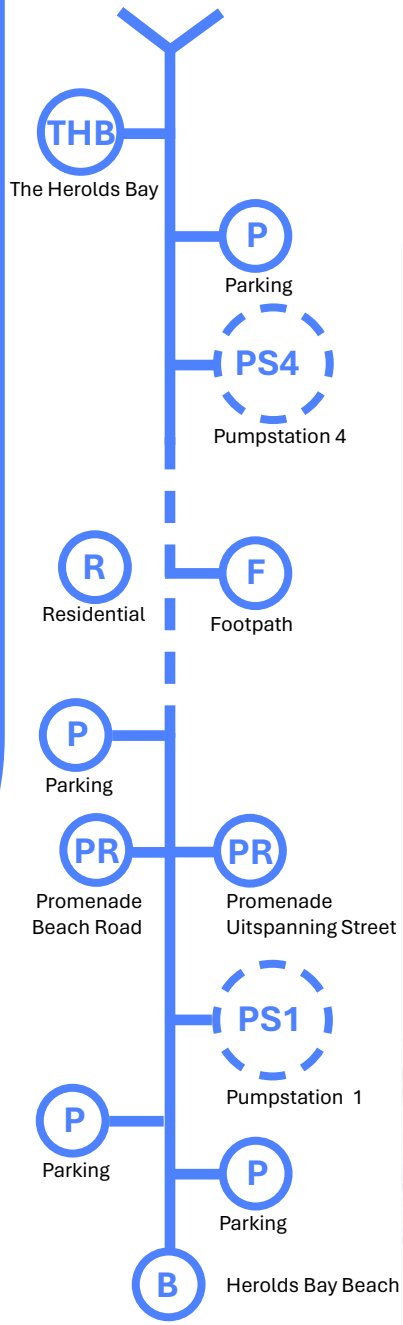


Content

Herolds Bay

Locality Plan

Designated for integration with the existing PS1 Pump Station, situated on Uitspanning Street to the north-east of the Herolds Bay promenade, as well as the proposed PS4 Pump Station, located within walking distance of PS1 along Skimmelkrans Lane, connected by an existing pedestrian pathway. While the positioning of both pump stations imposes on the surrounding residential and public landscapes, the unique site constraints and topographical contours characteristic of Herolds Bay necessitate the utilization of these locations.

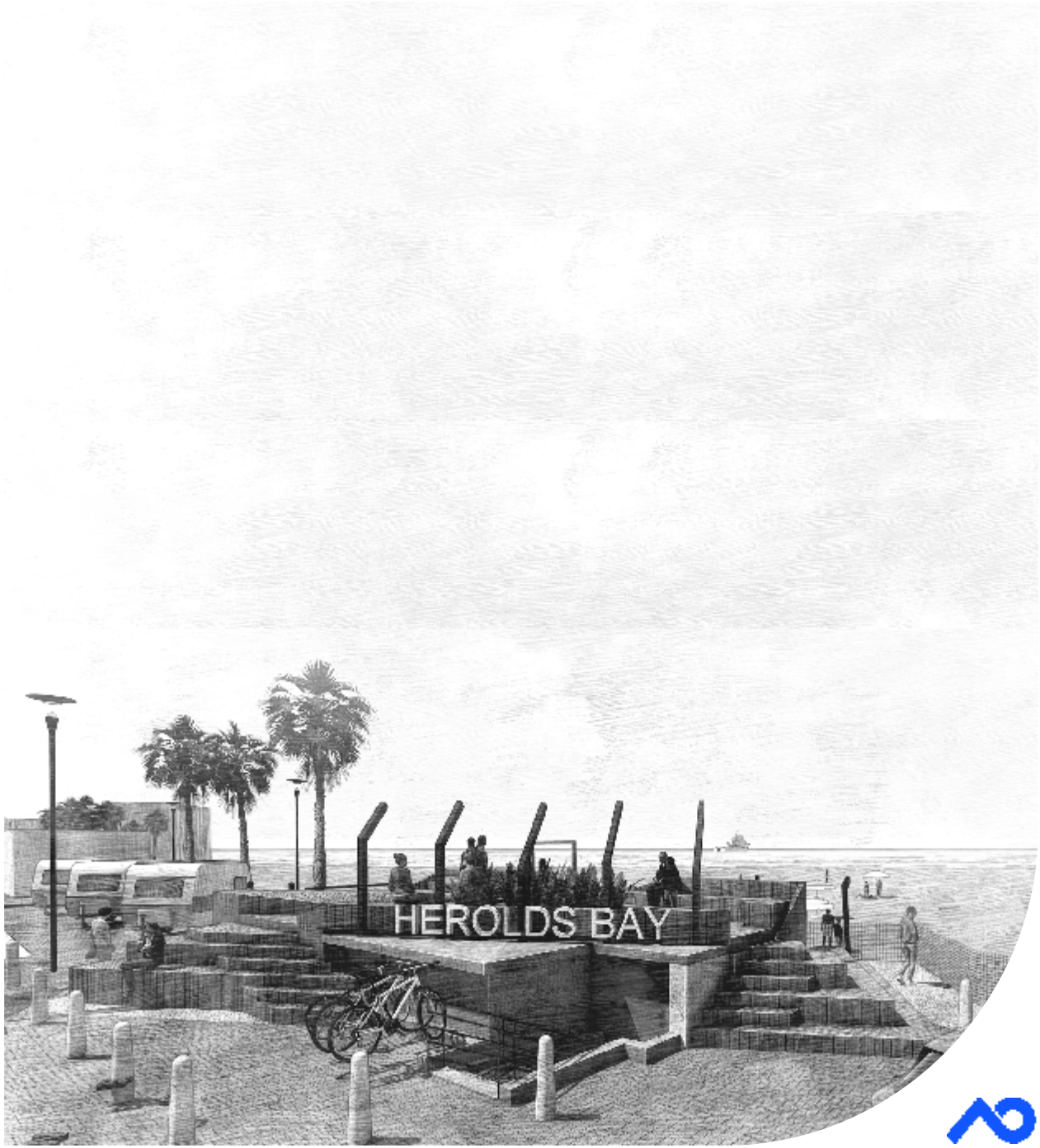


Locality Plan

F	Foot-	PS4	Pumpstation 4
B	Herolds Bay	PR	Promenade
P	Park-	R	Residen-
PS1	Pumpsta-	THB	The Herolds

HEROLDS BAY PS1

ARCHITECTURAL

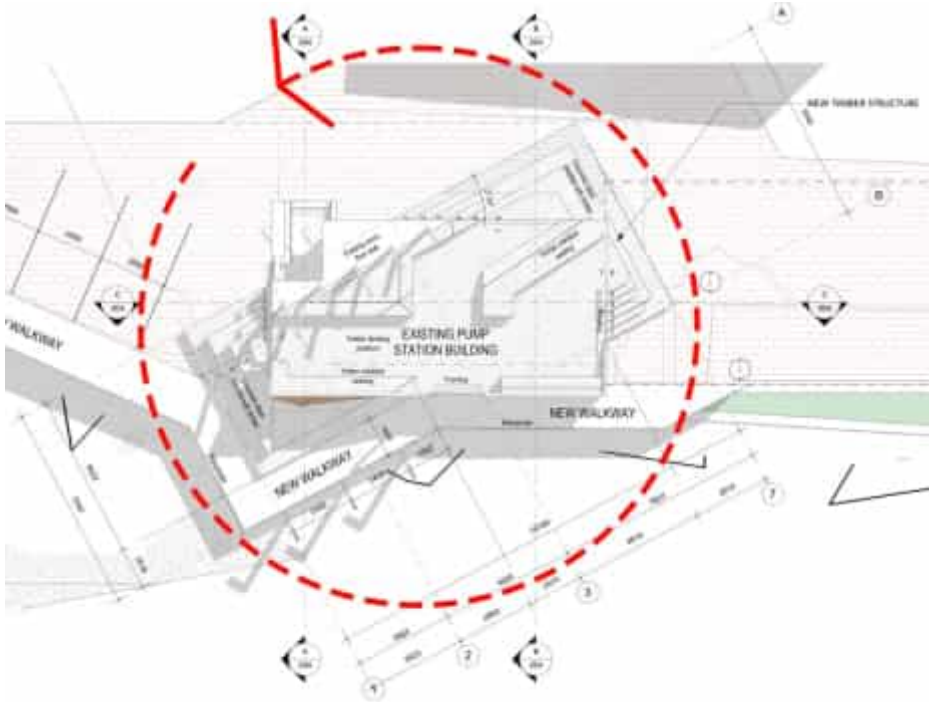


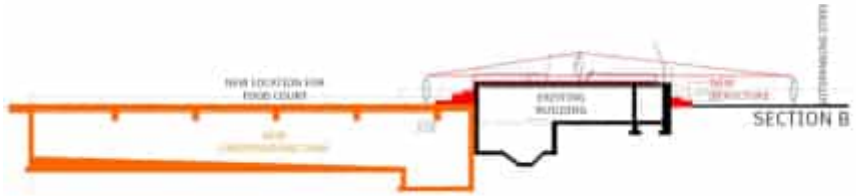
Prepared For: George Municipality

Client Reference No. T/ING/010/2020

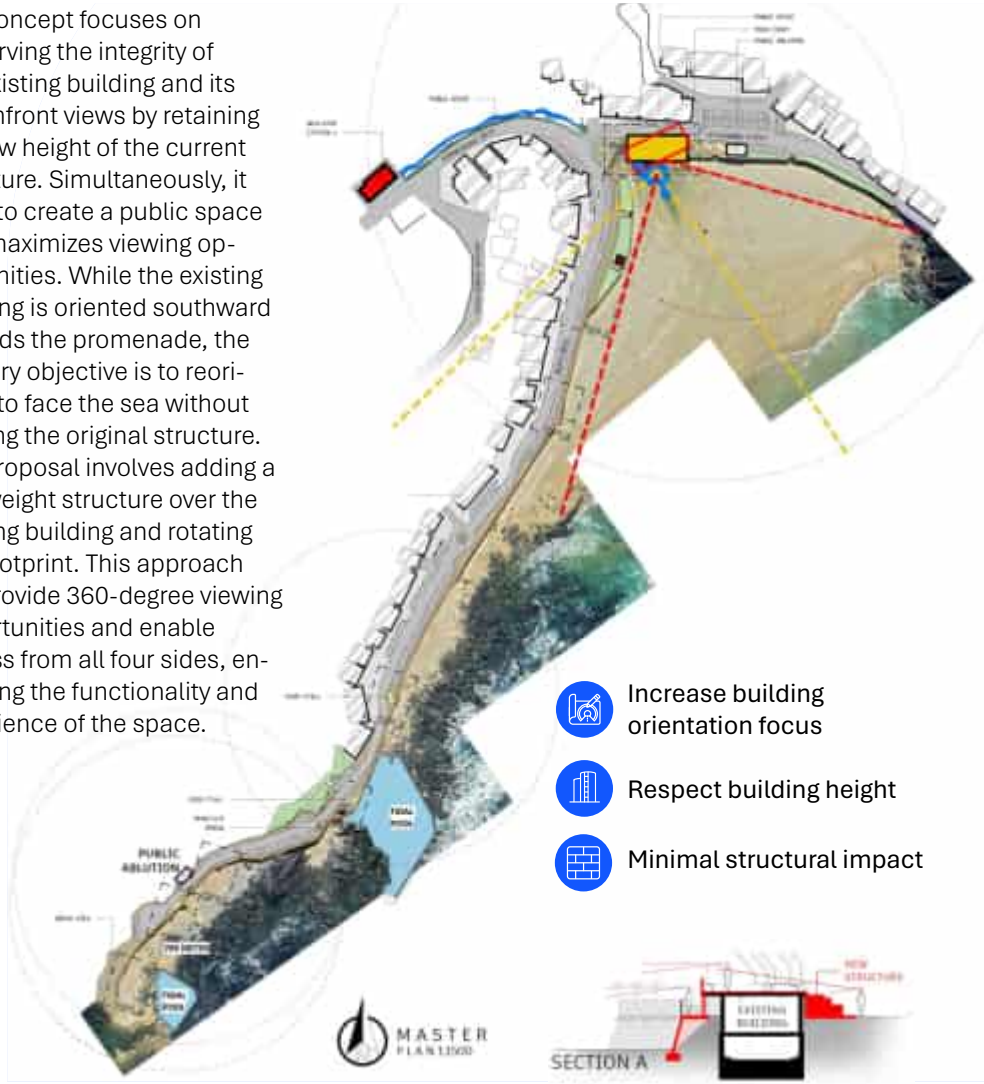
ANNEXURE - D

PS1 - Concept
Building Context & Form Giving

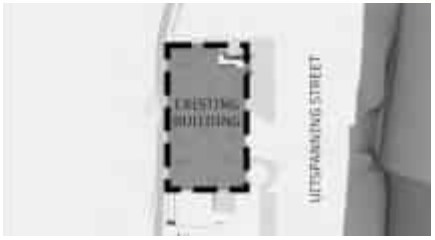




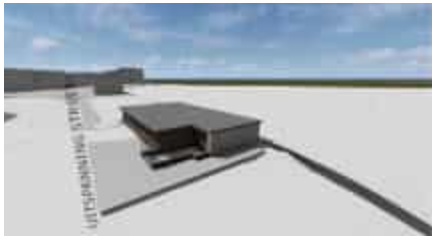
The concept focuses on preserving the integrity of the existing building and its beachfront views by retaining the low height of the current structure. Simultaneously, it aims to create a public space that maximizes viewing opportunities. While the existing building is oriented southward towards the promenade, the primary objective is to reorient it to face the sea without altering the original structure. The proposal involves adding a lightweight structure over the existing building and rotating the footprint. This approach will provide 360-degree viewing opportunities and enable access from all four sides, enhancing the functionality and experience of the space.



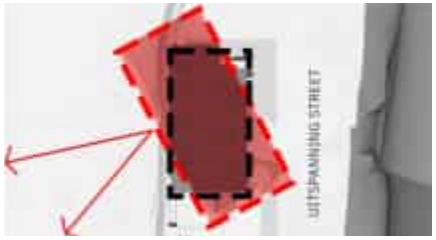
- Increase building orientation focus
- Respect building height
- Minimal structural impact



Existing pump station 1 - Plan View



Existing pump station 1 - 3D View

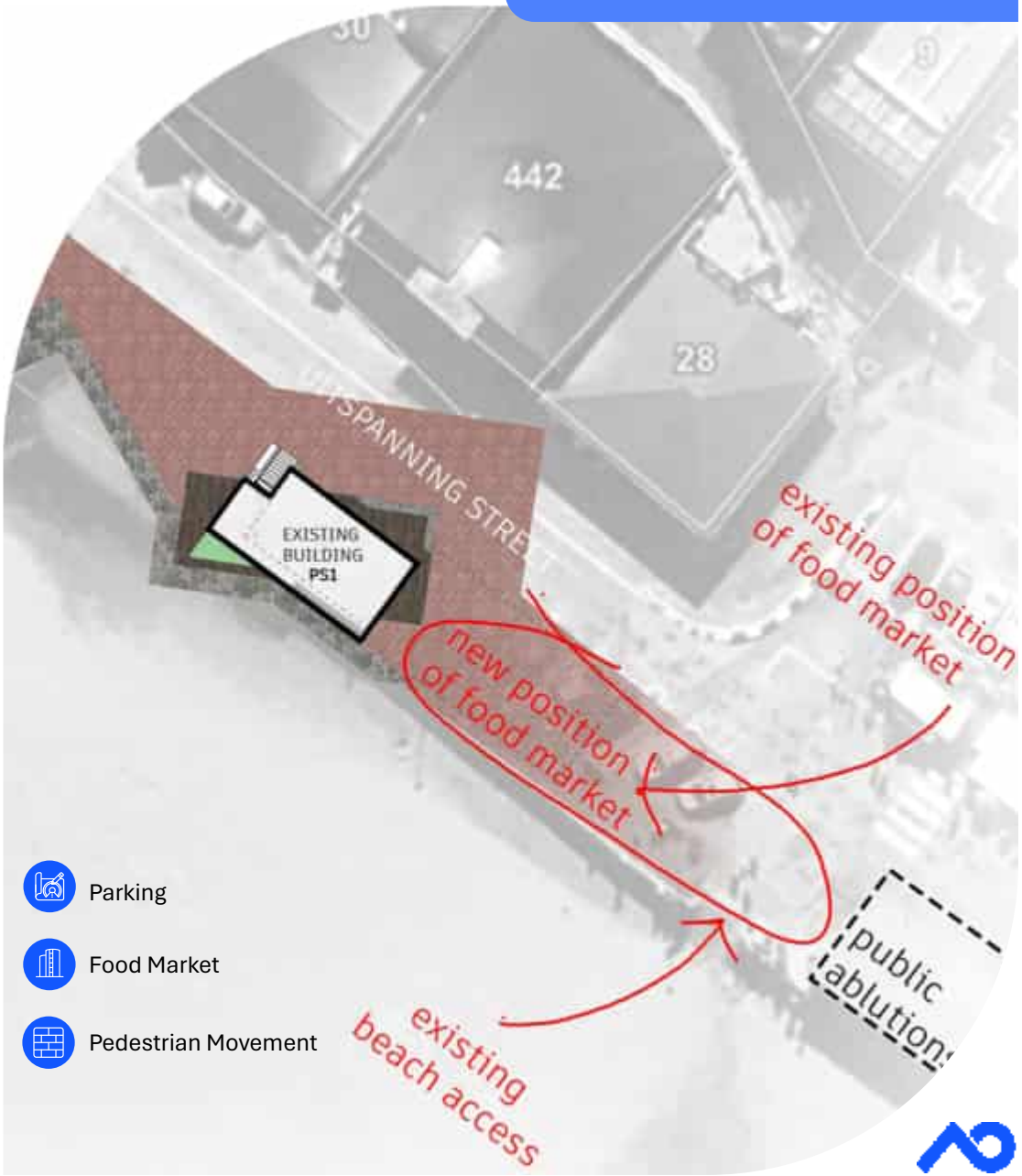


Proposed new work to existing pump station 1 - Plan View

Proposed new work to existing pump station 1 - 3D View

PS1 - Site Limitations

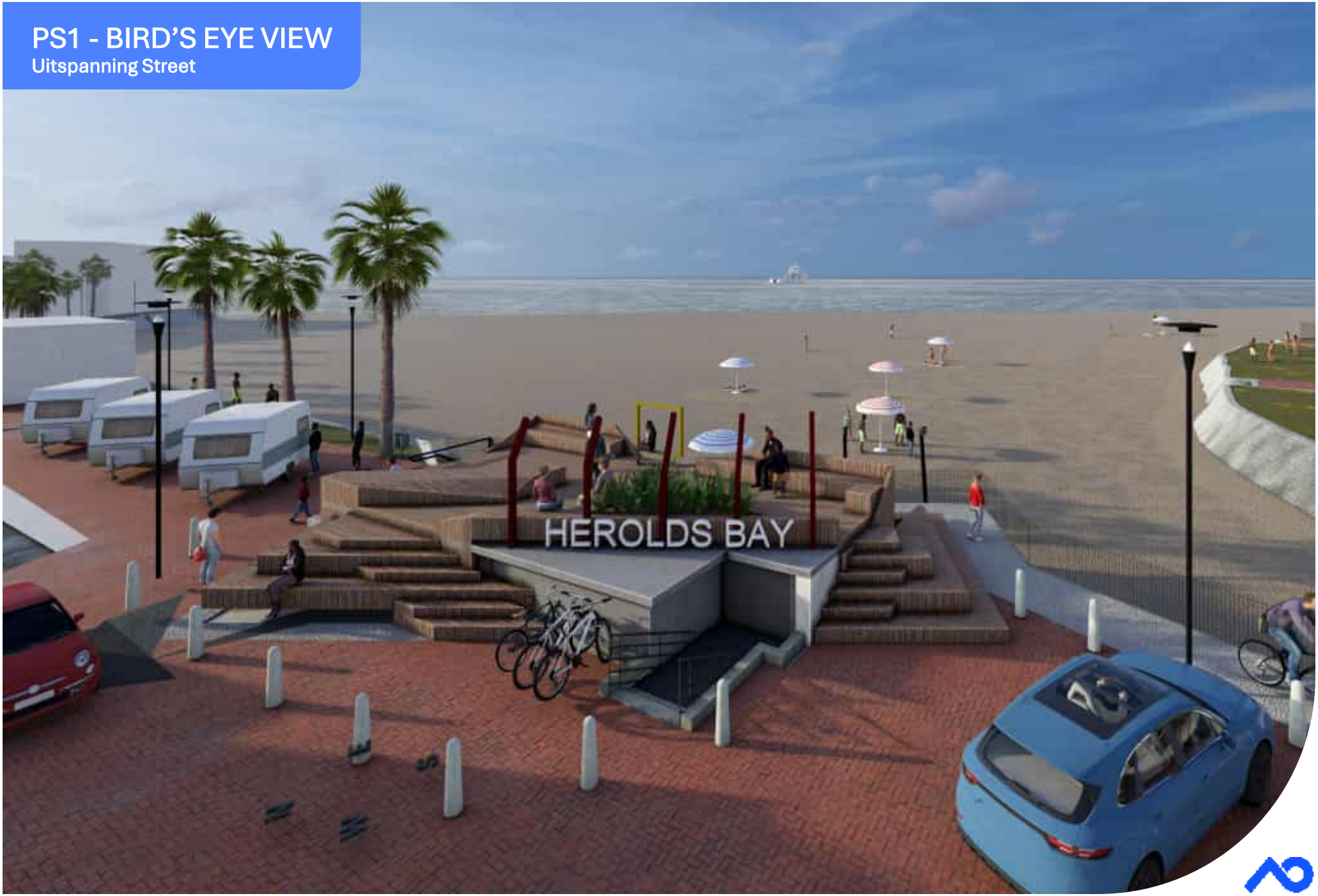
The existing structure not only disrupts the natural flow of the landscape, creating a physical and visual barrier that forces pedestrians onto the street, but it also undermines the potential of the area as a cohesive, pedestrian-friendly public space. By forming a significant break in the promenade, it interrupts the continuity and accessibility of the public beachfront, detracting from the opportunity to establish a seamless and inviting pedestrian experience. This disconnection limits the full potential of Herolds Bay as a vibrant, accessible destination that prioritizes pedestrian safety and fosters active engagement with its natural beauty and public amenities. Transforming this space into a unified, pedestrian-oriented promenade would enhance its role as a functional and attractive public space, solidifying its status as a premier beachfront destination.



PS1 - IRD'S EYE VIEW
Pedestrian Circulation

The proposed concept seeks to resolve the pedestrian safety challenges posed by the existing structure by introducing multiple pathways that navigate around it, enhancing accessibility and connectivity. Beyond its functional improvements, the design will serve as a dynamic public space, fostering opportunities for community interaction, social gatherings, and scenic viewing. The addition will integrate seamlessly into the landscape while standing out as an iconic architectural feature, reinforcing Herolds Bay's identity and enhancing its appeal as a distinctive tourist destination. Furthermore, it will form a critical link within the promenade, uniting the previously disrupted flow and replacing the existing barrier with a cohesive and inviting element that enhances the pedestrian experience.

PS1 - BIRD'S EYE VIEW
Uitspanning Street



PS1 - Estimated Building Cost

smec | engineering positive change

C1936 -HEROLDS BAY PS1

PUMP STATION - PS1 UPGRADE

09 DECEMBER 2024

PROJECT COST SUMMARY

PUMP STATION – UNDERGROUND TANK			
NEW PUMP STATION		R	3 500 425
SUB-TOTAL		R	**3 500 425**
CONTINGECIES	**12%**	R	420 051
PRELIMINARIES	**15%**	R	525 064
OHS		R	60 000
SUB-TOTAL		R	**4 505 540**
VAT	15%	R	675 831
ESTIMATED TOTAL COST PART A (incl VAT)		R	**5 181 371**
ARCHITECTURAL PROPOSED UPGRADING			
PROPOSED UPGRADING AT PS.1		R	1 613 300
SUB-TOTAL		R	**1 613 300**
CONTINGECIES	**12%**	R	193 596
PRELIMINARIES	**15%**	R	241 995
OHS		R	25 000
SUB-TOTAL		R	**2 073 891**
VAT	15%	R	311 084
ESTIMATED TOTAL BUILDING COST PART A (incl VAT)		R	**2 384 975**

HEROLDS BAY PS4

ARCHITECTURAL

Prepared For: George Municipality

Client Reference No. T/ING/010/2020

ANNEXURE - D

PS4 - SKIMMELKKRANS

STREET VIEW I South Elevation

PS4 - SKIMMELKRANS

STREET VIEW I Southwest Elevation

PS4 - BIRD’S EYE VIEW

FIRST FLOOR PLAN

PS4 - Form & Concept

Building Context & Form Giving

a. Curve
b. Bio-Roof
c. Setback
d. Terracing
e. Overhang
f. Repetition

The design concept focuses on deconstructing the traditional form of a service building to integrate seamlessly into a residential landscape. By echoing residential elements, forms, and proportions, the building is scaled down to harmonize with its surroundings. This approach introduces softer features and a careful selection of materials (A,B,C,D,E & F) creating a structure that feels more cohesive within its context while reducing its perceived scale.

Incorporating unexpected forms and features for a service building helps create an illusion that softens its functional purpose, allowing it to blend seamlessly into a residential context. This approach enhances the building's presence, making it feel like a welcome addition rather than an imposition within the surrounding environment.

The design incorporates a green roof (F) over the bulk fuel storage area, which extends the site's natural vegetation and merges with the existing sloped backdrop. This feature not only reduces the building's visual impact but also harmonizes it with the surrounding landscape by utilizing the site's natural elements. The green roof, along with the external walls of the fuel tank room, will serve a dual purpose: functioning as the building's envelope while also acting as a retaining wall, further embedding the structure into its context.

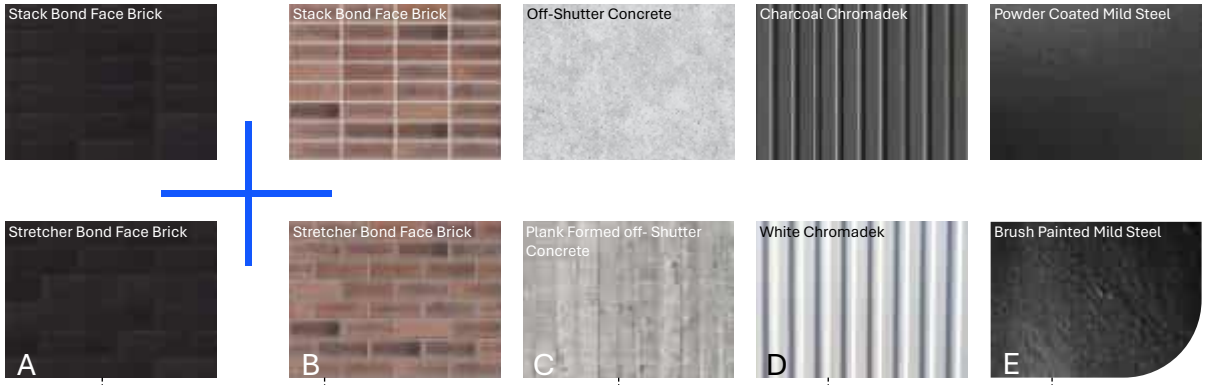
PS4 - Green Roof

Site Context & Form Giving

PS4 - Material Palette

Environment Footprint

The selection of materials considers the environmental context of the location and maintenance-free principles. Incorporating sustainable materials and energy-efficient designs helps minimize the environmental impact of infrastructure buildings, supporting sustainability and resilience.



A) Black brick satin FBX I Corrobrick or similar approved

B) Wild weat travertine FBX I Corrobrick or similar approved

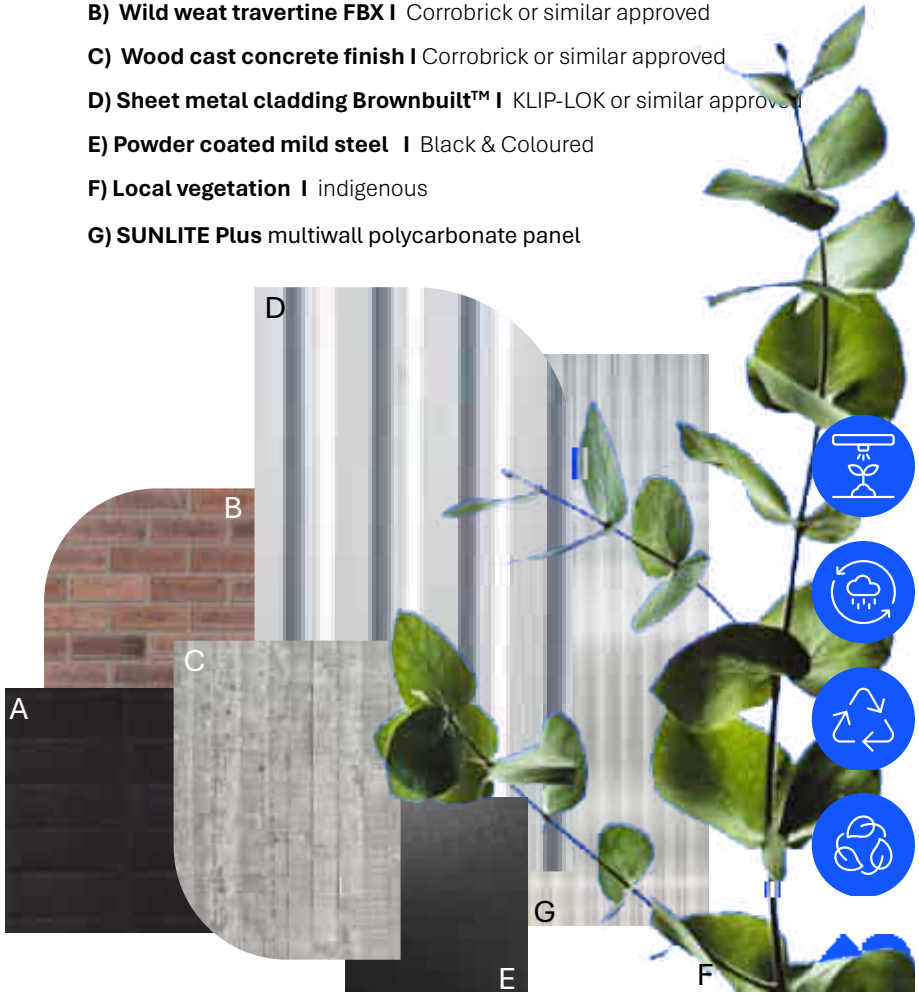
C) Wood cast concrete finish I Corrobrick or similar approved

D) Sheet metal cladding Brownbuilt™ I KLIP-LOK or similar approved

E) Powder coated mild steel I Black & Coloured

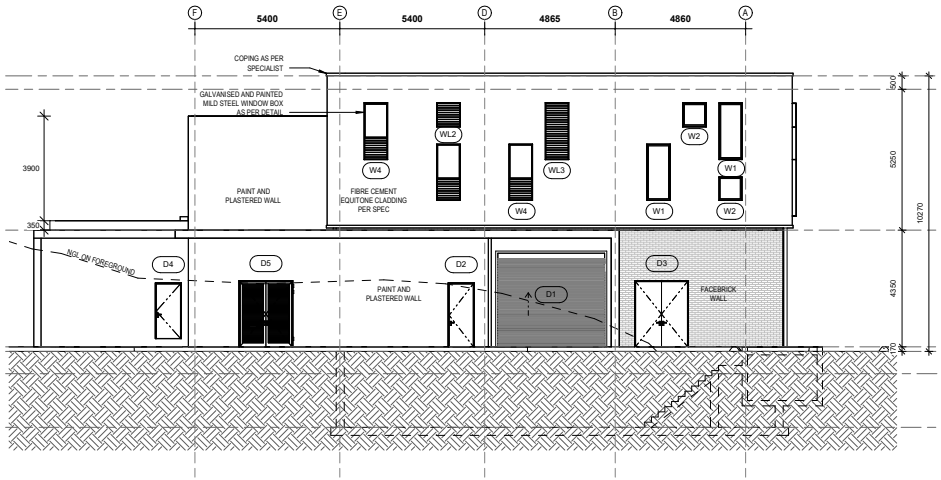
F) Local vegetation I indigenous

G) SUNLITE Plus multiwall polycarbonate panel



PS4 - Material Options

Side Cladding



2 NORTH ELEVATION
1 : 100

SUNLITE Plus multiwall polycarbonate infill panel (G)

Benefits
Rigid, impact-resistant, UV protected and lightweight, SUNLITE optimizes daylight and energy efficiency

PS4 - Colour Palette

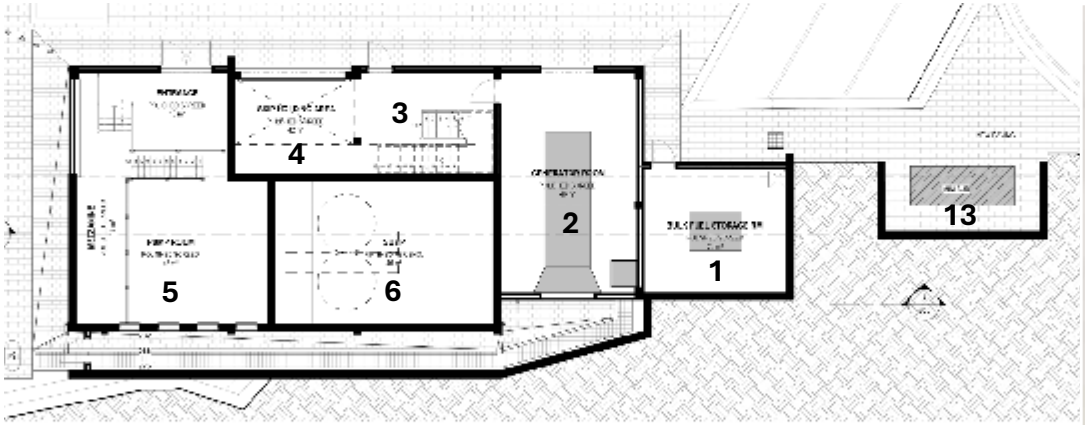
Identity

Color can be introduced in key design elements to reflect cultural, heritage, historical, or contextual identities, adding depth and meaning to the building. Alternatively, color can simply bring a playful or humorous character to the facade, enlivening its appearance and adding a unique, engaging touch.

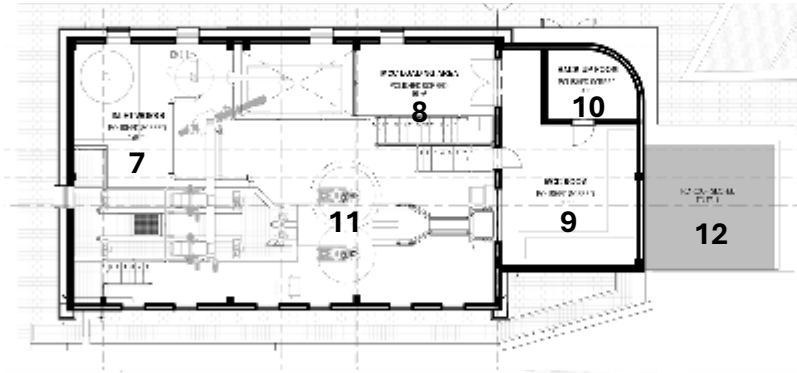
By incorporating natural lighting, open spaces, and intuitive wayfinding systems, architects can design environments that feel welcoming and are easy to navigate. This human-centered approach ensures that infrastructure buildings meet the needs of diverse users, enriching their overall experience.

PS4 - Pump Station Plans

Technical Documentation

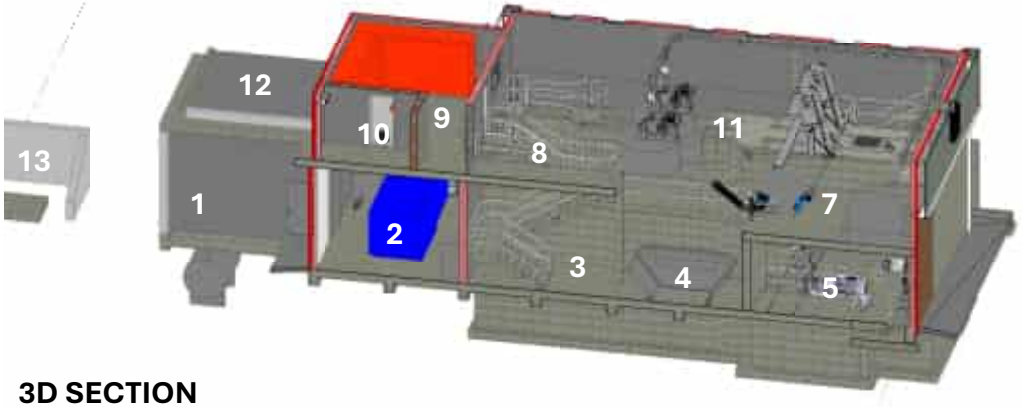


GROUND FLOOR PLAN
not to scale



FIRST FLOOR PLAN
not to scale

1. Bulk Fuel Store Room
2. Generator Room
3. Stair Lobby
4. Skip Holding Area
5. Pump Room
6. Sump
7. Intel Works
8. MCC Loading Area
9. MCC Room
10. Back-Up Room
11.
12. Green Roof
13. Mini SUB



3D SECTION
not to scale

PS4 - Estimated Building Cost

smec | engineering positive change

C1936 -HEROLDS BAY PS4

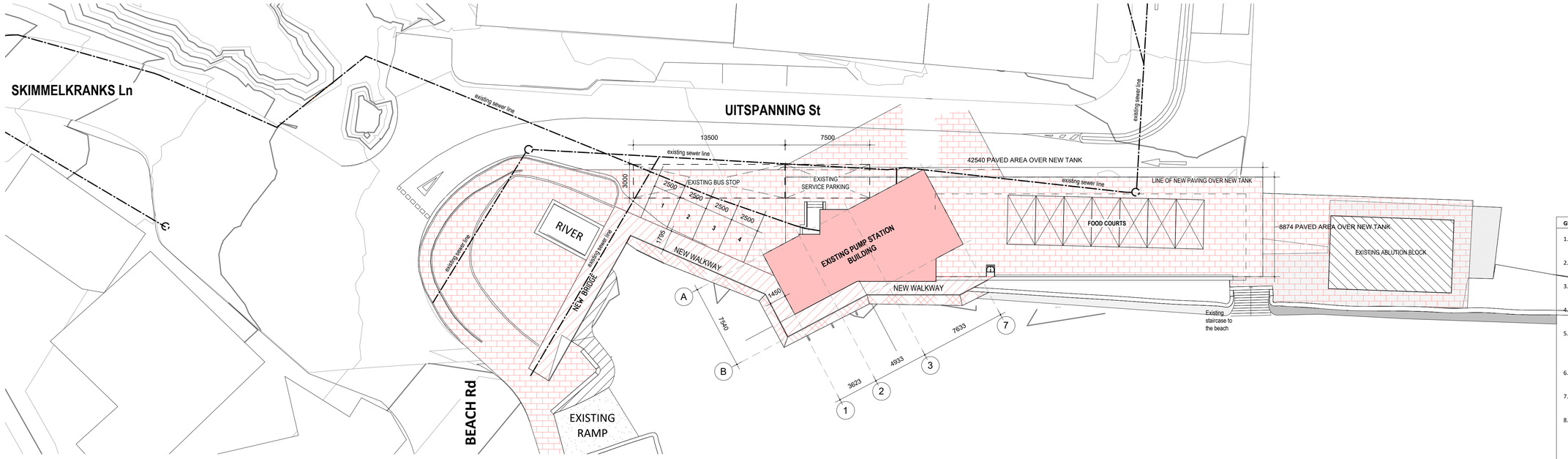
NEW PUMP STATION PS4

09 DECEMBER 2024

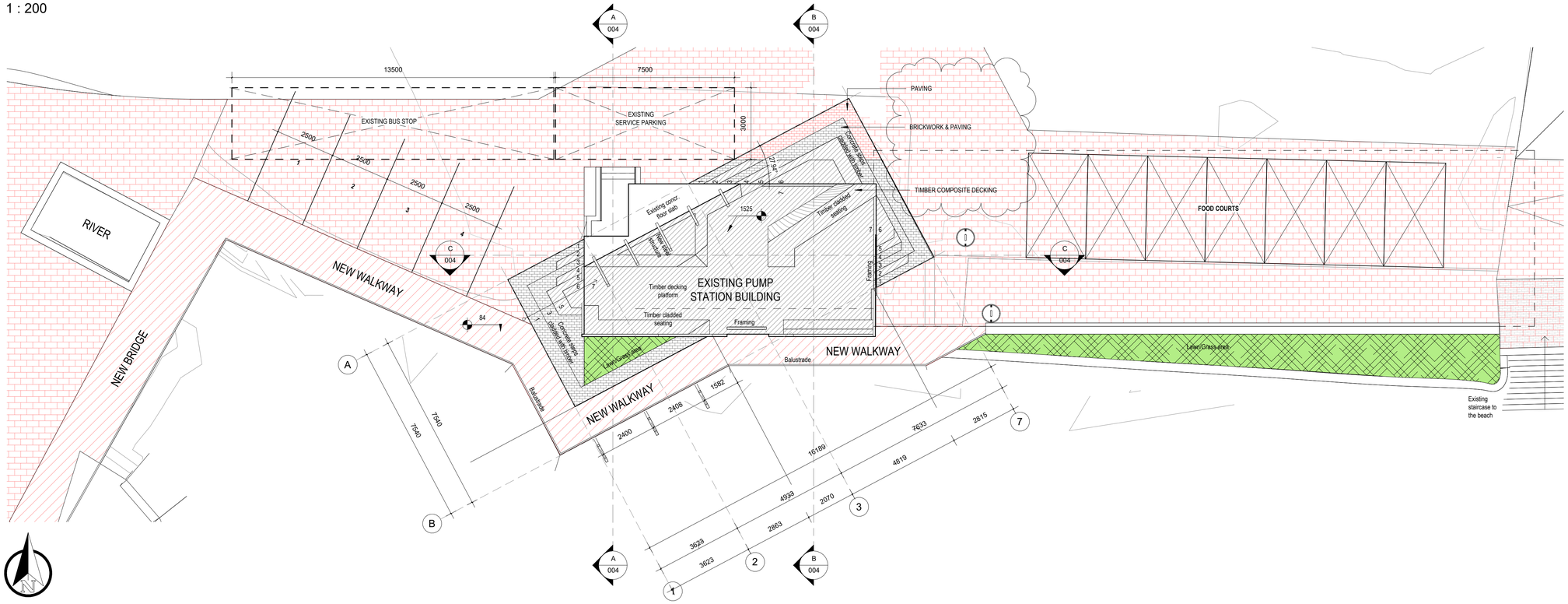
PROJECT COST SUMMARY

A	ESTIMATED BUILDING COST			
A.1	PUMP STATION 4 - EXCLUDING CIVIL WORK		R	9 340 642
	SUB-TOTAL		R	**9 340 642**
	PRELIMINARIES	**15%**	R	1 401 096
	CHS		R	125 000
	SUB-TOTAL		R	**10 866 738**
	VAT	15%	R	1 630 011
	ESTIMATED TOTAL BUILDING COST PART A (incl VAT)		R	**12 496 749**

Annexure E Architectural Drawings PS 1



1 SITE PLAN
1 : 200



2 ROOR PLAN
1 : 100
EXISTING RAMP

10m 100m

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9. GLAZING NOTES:
   ALL GLAZING TO COMPLY WITH PART N OF SANS 10400-2011
10. STAIR & BALUSTRADE NOTES:
    BALUSTRADE, HANDRAILS, HEIGHTS, AND OPENINGS TO COMPLY WITH PARTS M & D OF SANS 10400-2011
    BASIC STAIR NOTES:
    MAX 200mm RISER MIN 250mm TREAD
    BALUSTRADES 1.0m HIGH WITH NO GAP MORE THAN 100mm

    IF THE STAIRCASE FORMS PART OF AN ESCAPE ROUTE IT IS TO COMPLY WITH PART M OF SANS 10400-2011
11. DEMOLITION WORK:
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    WATER CONNECTIONS TO FITTINGS:

    15mm DIA TO WHB, WC AND SHOWERS
    20mm DIA TO GEYSER
    25mm DIA TO FHR

    ALL VENT PIPES TO DISCHARGE TO EXTERNAL AIR INTO 50mm DIA WASTE PIPE REQUIRE A 75mm DIA SLEEVE.
    110mm DIA WASTE PIPE REQUIRE A 150mm DIA SLEEVE.
    ALL NEW SEWER LINES TO RUN IN THE CEILING VOID OF THE FLOOR BELOW.

    FOR PLUMBING AND DRAINAGE LAYOUT PLANS AND CROSS SECTIONS REFER TO REGISTERED WET SERVICES ENGINEERS DRAWINGS FOR RATIONAL DESIGN DRAWINGS. ALL STROM WATER TO BE COLLECTED AND DRAINED TO COMPLY WITH PART P OF SANS 10400-2010 AND DRAIN TO MUNICIPAL STORM WATER DRAINAGE SYSTEM TO ENGINEERS DETAILS.
13. STRUCTURAL:
    ALL REINFORCED CONCRETE WORK AND RETAINING WALLS TO BE STRICTLY IN ACCORDANCE WITH REGISTERED STRUCTURAL ENGINEERS DETAILS AND SPECIFICATIONS.
14. MECHANICAL VENTILATION & LIGHTING:
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    IN ACCORDANCE WITH REGISTERED MECHANICAL ENGINEERS DRAWINGS AND REGISTERED ELECTRICAL ENGINEERS DRAWINGS
    ALL ARTIFICIAL LIGHTING TO COMPLY
14. SANS 10400XA
    a. WALLS:
       NON-MASONRY WALL WILL HAVE 'R' VALUE AS PROVIDED. SANS10400-XA -4.4.3.1)
       DOUBLE SKIN MASONRY WITH PLASTER INSIDE OR RENDER OUTSIDE COMPLIES SINGLE LEAFE MIN. 140mm WITH PLASTER INSIDE AND RENDER OUTSIDE COMPLIES. (SANS 10400-XA - 4.4.3.2)
       OTHER MASONRY WALLS WILL HAVE 'R' VALUE OF 0.35
       SANS 10400XA-4.4.3.3
    b. FENESTRATION:
       AIR LEAKAGE SHALL NOT EXCEED 2L/s/m2 FENESTRATION AREA; 0.306L/s/m2 FIXED GLAZING AND 5L/s/m2 REVOLVING/SWING DOORS
       SANS 10400-XA- 4.4.1.1
       FENESTRATION MORE THAN 15% TO NETT FLOOR AREA PER STOREY THEN SANS 10400-XA 4.4.4.2
       FENESTRATION UP TO 15% OF FLOOR NET AREA PER STOREY THEN SANS 10400-XA 4.4.4.1
       SOLAR HEAT GAIN AND HEAT CONDUCTANCE TO COMPLY WITH SANS 204 -4.3.4

FOR INFORMATION

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PO BOX 72927,
WESTDENE, BLOEMFONTEIN, 9301
WEBSITE: www.smec.com
TEL: 051 411 8700
FAX: 012 803 7943
SABS ISO 9001

CLIENT

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		01/04/22
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE 01/04/22

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS1

DRAWING DESCRIPTION
HEROLDS BAY PUMP S1
SITE LAYOUT

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	As indicated	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
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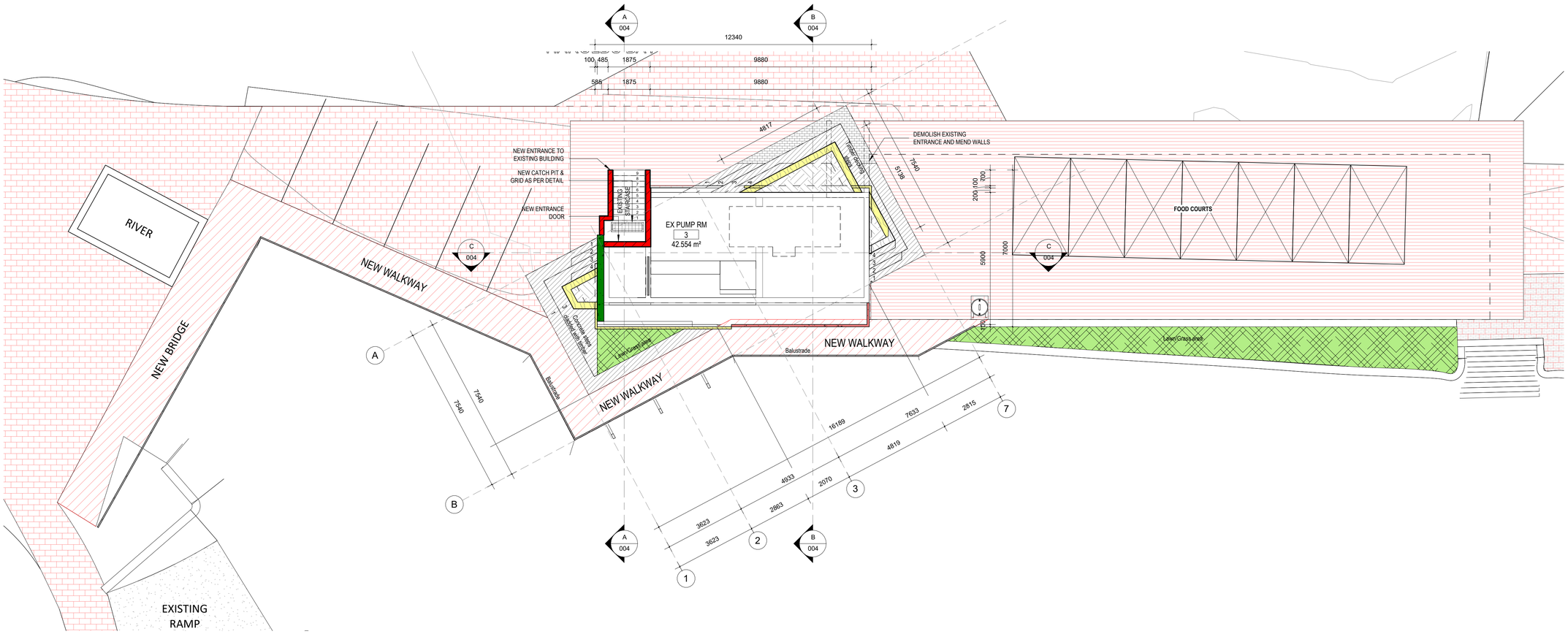

1 EXISTING PS FLOOR PLAN
1 : 100

1m 10m

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       SANS 10400XA-4.4.3.3
    b. FENESTRATION:
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       0.306L/s/m2 FIXED GLAZING AND 5L/s/m2 REVOLVING/SWING DOORS
       SANS 10400-XA- 4.4.1.1
       FENESTRATION MORE THAN 15% TO NETT FLOOR AREA PER STOREY
       THEN SANS 10400-XA 4.4.4.2
       FENESTRATION UP TO 15% OF FLOOR NET AREA PER STOREY
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WEBSITE: www.smec.com
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FAX: 012 803 7943

CLIENT

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		04/04/22
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE 04/04/22

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS1

DRAWING DESCRIPTION
HEROLDS BAY PUMP S1
FLOOR PLAN

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 100	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
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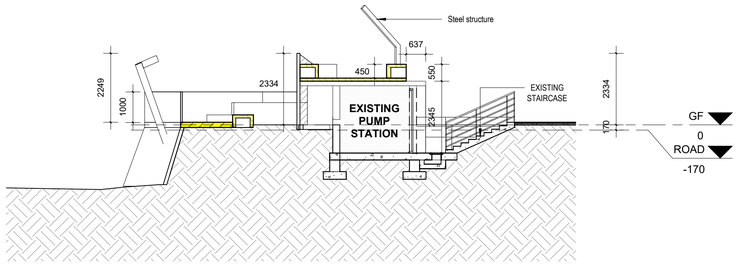

A SECTION A-A
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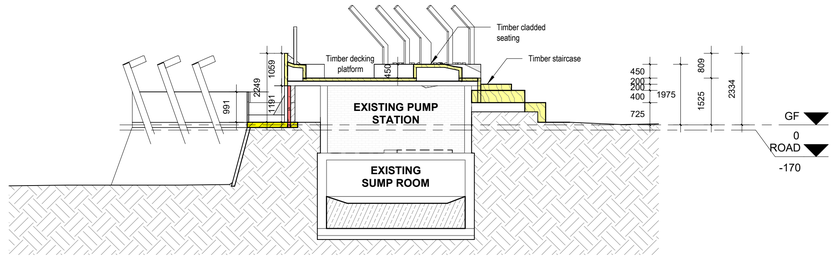

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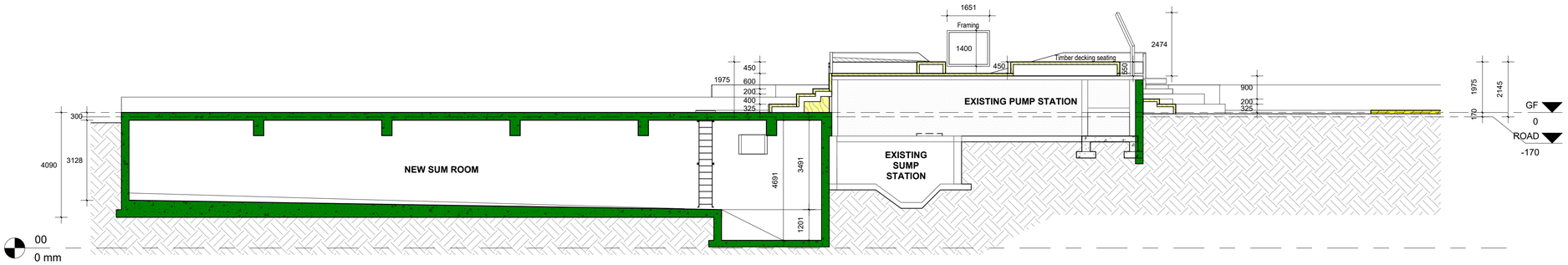

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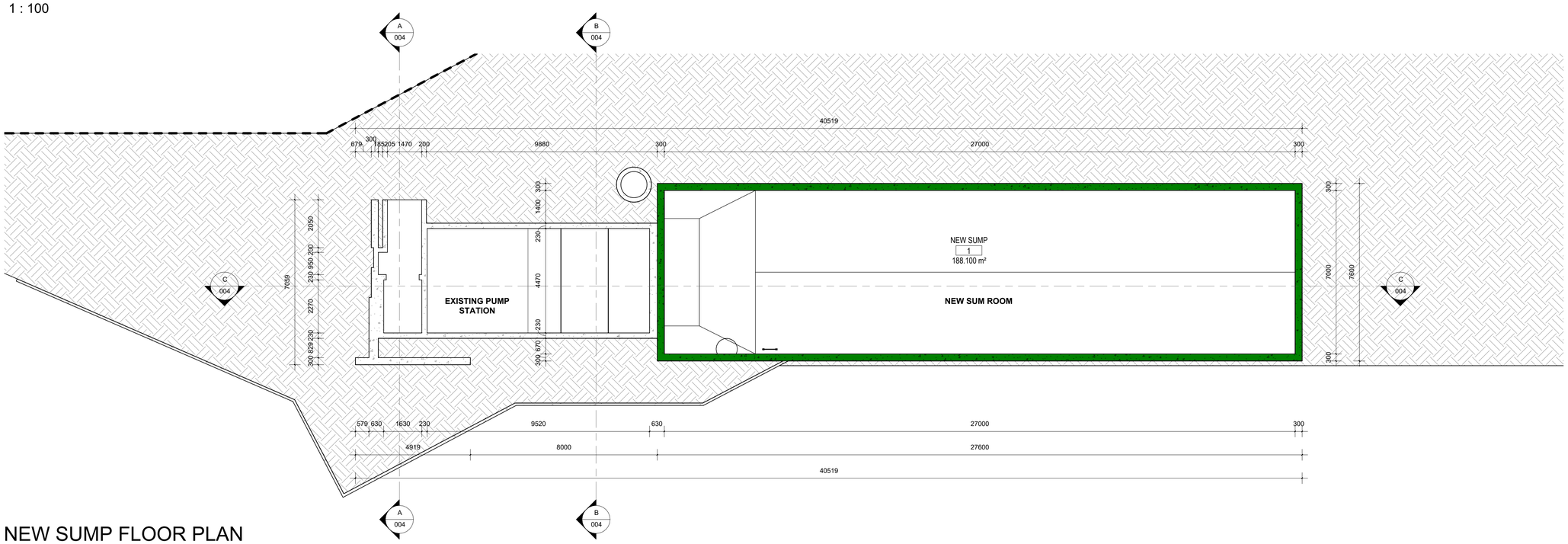

4 NEW SUMP FLOOR PLAN
1 : 100

1m 5m

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12. PLUMBING & DRAINAGE:
    ALL PLUMBING TO COMPLY WITH PART P OF THE SANS10400-2011

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    20mm DIA TO GEYSER
    25mm DIA TO FHR

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    110mm DIA WASTE PIPE REQUIRE A 150mm DIA SLEEVE.
    ALL NEW SEWER LINES TO RUN IN THE CEILING VOID OF THE FLOOR BELOW.

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14. SANS 10400XA
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       OTHER MASONRY WALLS WILL HAVE 'R' VALUE OF 0.35
       SANS 10400XA-4.4.3.3
    b. FENESTRATION:
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       FENESTRATION MORE THAN 15% TO NETT FLOOR AREA PER STOREY THEN SANS 10400-XA 4.4.4.2
       FENESTRATION UP TO 15% OF FLOOR NET AREA PER STOREY THEN SANS 10400-XA 4.4.4.1
       SOLAR HEAT GAIN AND HEAT CONDUCTANCE TO COMPLY WITH SANS 204 -4.3.4

FOR INFORMATION

23 SECOND AVENUE, WESTDENE
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CLIENT

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		04/04/22
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE 04/04/22

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS1

DRAWING DESCRIPTION
HEROLDS BAY PUMP S1
SECTIONS

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 100	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
C1936-SMEC-01-ARC-DRG-004	A

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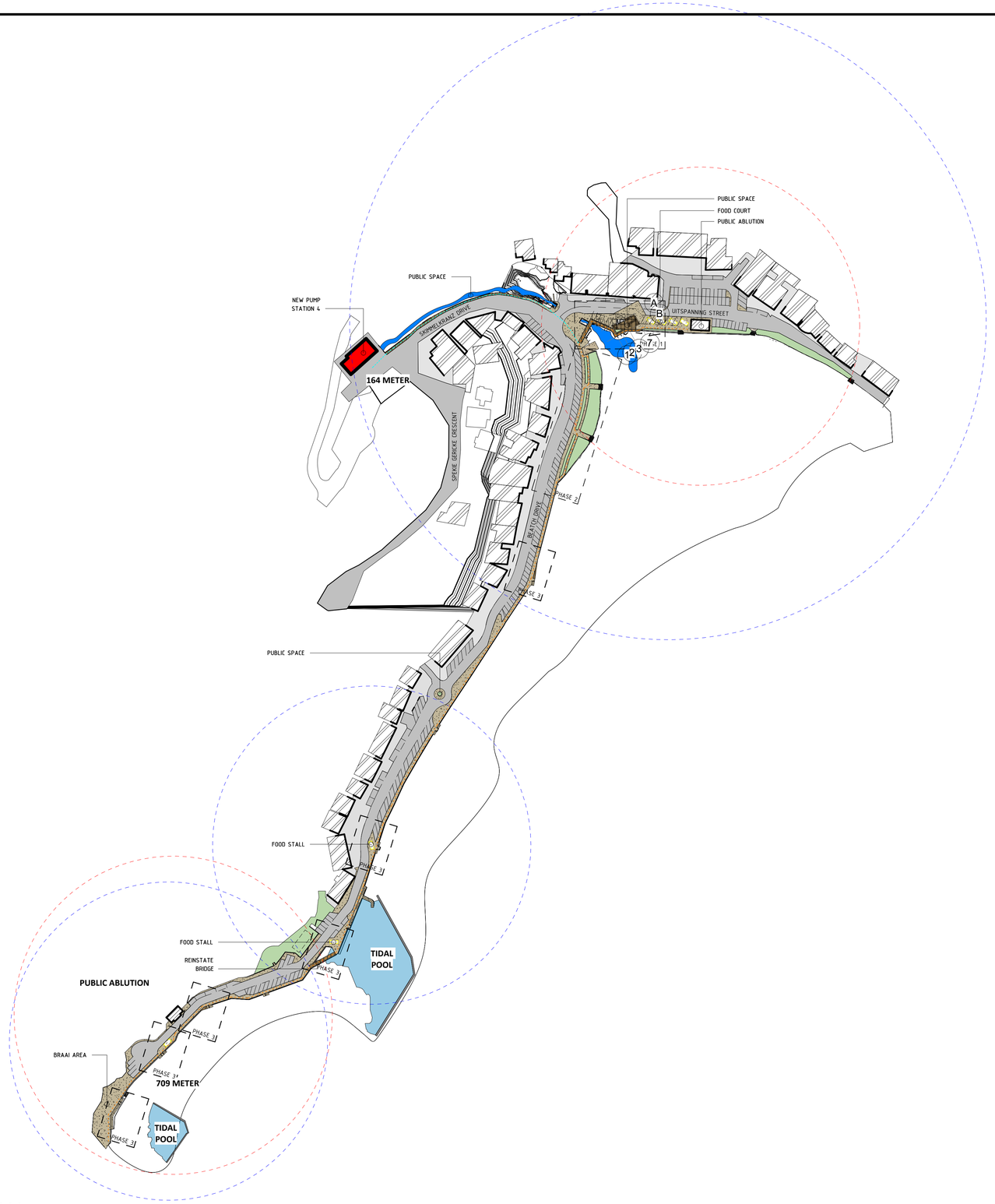

1 L.01.B - MASTER PLAN

1 : 1500

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    MAX 200mm RISER MIN 250mm TREAD
    BALUSTRADES 1.0m HIGH WITH NO GAP MORE THAN 100mm

    IF THE STAIRCASE FORMS PART OF AN ESCAPE ROUTE IT IS TO COMPLY WITH PART M OF SANS 10400-2011
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CLIENT

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		01/04/22
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ 01/04/22 DATE

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS1

DRAWING DESCRIPTION
HEROLDS BAY PUMP S1
MASTER PLAN

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 1500	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
C1936-SMEC-01-ARC-DRG-007	A

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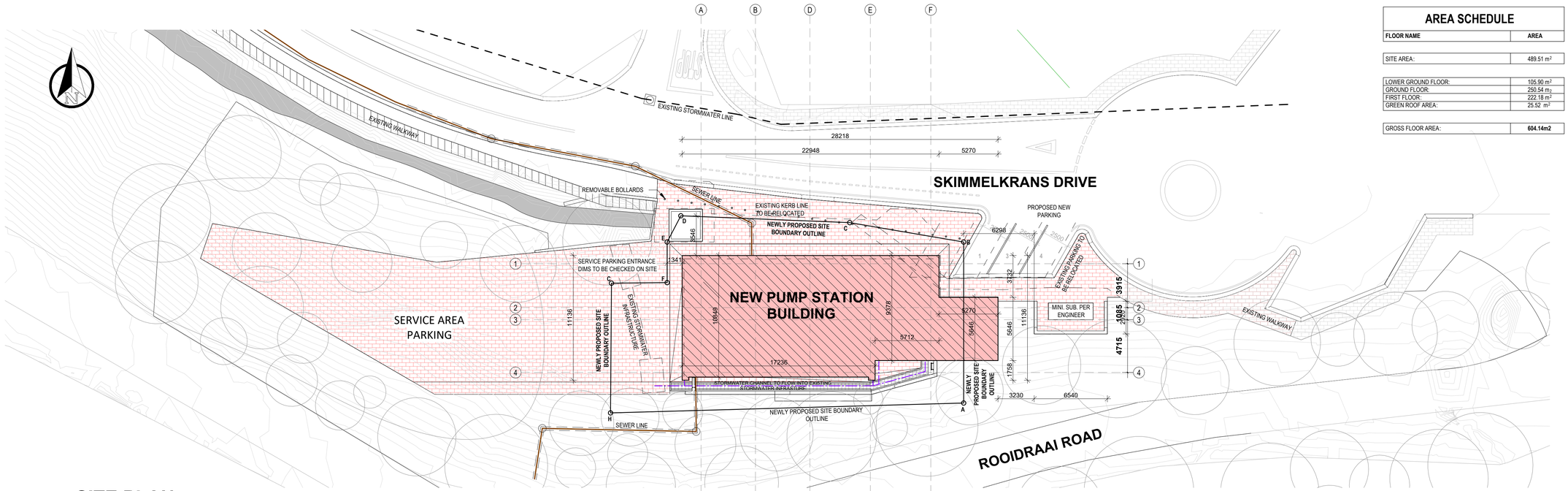
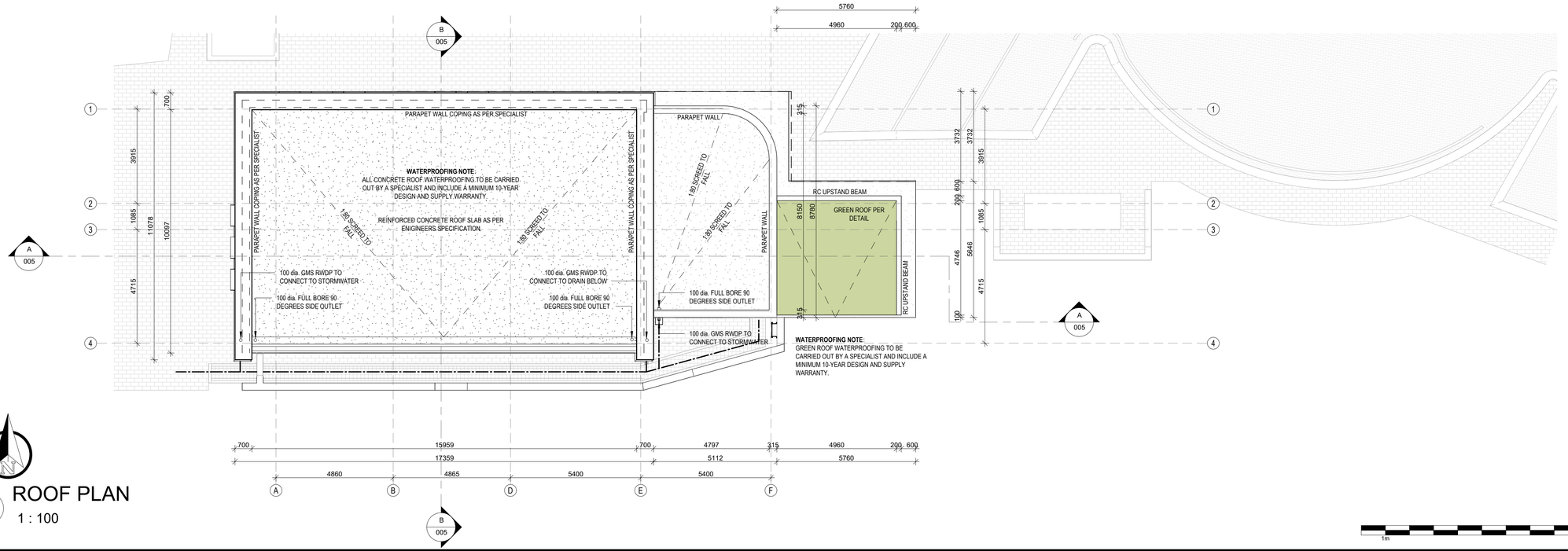
Annexure F Architectural Drawings PS 4



1 SITE PLAN
1 : 200

STORMWATER NOTE:
ALL STORMWATER AS PER ENGINEER SPECIFICATIONS.

RETAINING NOTE:
ALL RETAINING AS PER ENGINEER SPECIFICATIONS.



2 ROOF PLAN
1 : 100

1m 10m

AREA SCHEDULE

FLOOR NAME	AREA
SITE AREA:	489.51 m²
LOWER GROUND FLOOR:	105.90 m²
GROUND FLOOR:	250.54 m²
FIRST FLOOR:	222.18 m²
GREEN ROOF AREA:	25.52 m²
GROSS FLOOR AREA:	**604.14m2**

ROOM SCHEDULE

FLOOR NAME	AREA	FLOOR FINISH
LOWER GROUND FLOOR		
PUMP ROOM	43 m²	POLISHED SCREED
SUMP	46 m²	FINISHED PER ENG.
	89 m²	
GROUND FLOOR LEVEL		
BULK FUEL STORAGE RM.	26 m²	POLISHED SCREED
ENTRANCE	13 m²	POLISHED SCREED
GENERATOR ROOM	46 m²	POLISHED SCREED
MEZZANINE	19 m²	POLISHED SCREED
SKIP HOLDING AREA	41 m²	POLISHED SCREED
	145 m²	
FIRST FLOOR LEVEL		
BACK-UP ROOM	8 m²	POLISHED SCREED
INLET WORKS	127 m²	POLISHED SCREED
MCC LOADING AREA	15 m²	POLISHED SCREED
MCC ROOM	33 m²	POLISHED SCREED
	183 m²	
NET FLOOR AREA	417 m²	

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CLIENT
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71 York Street,
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George
6530

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION
B	19/11/24	INFORMATION
C	26/11/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE _____

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS4

DRAWING DESCRIPTION
HEROLDS BAY PUMP S4
SITE LAYOUT

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	As indicated	A1

DRAWING NUMBER
PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE: C1936-SMEC-CD-ARC-DRG-001 REV C

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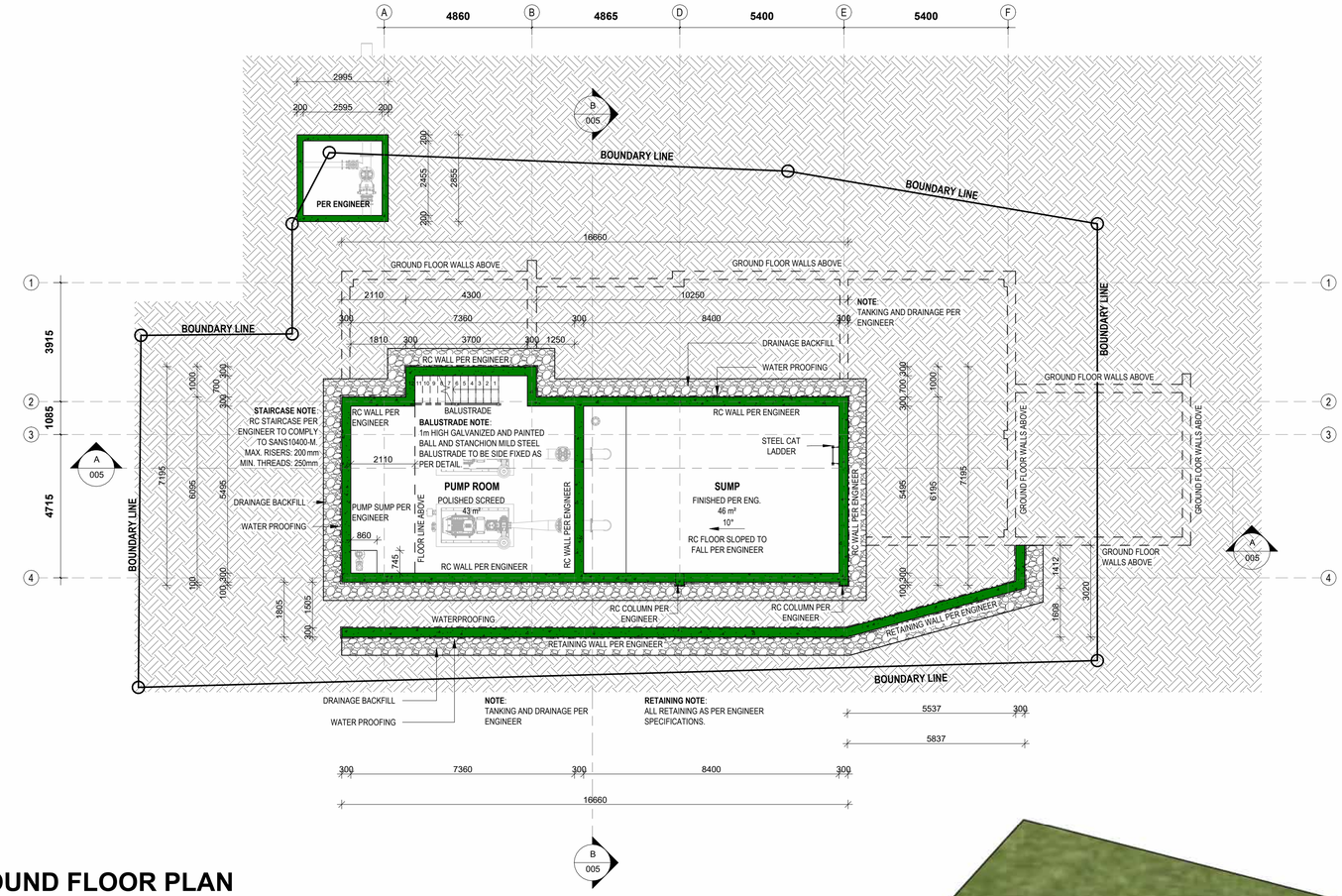
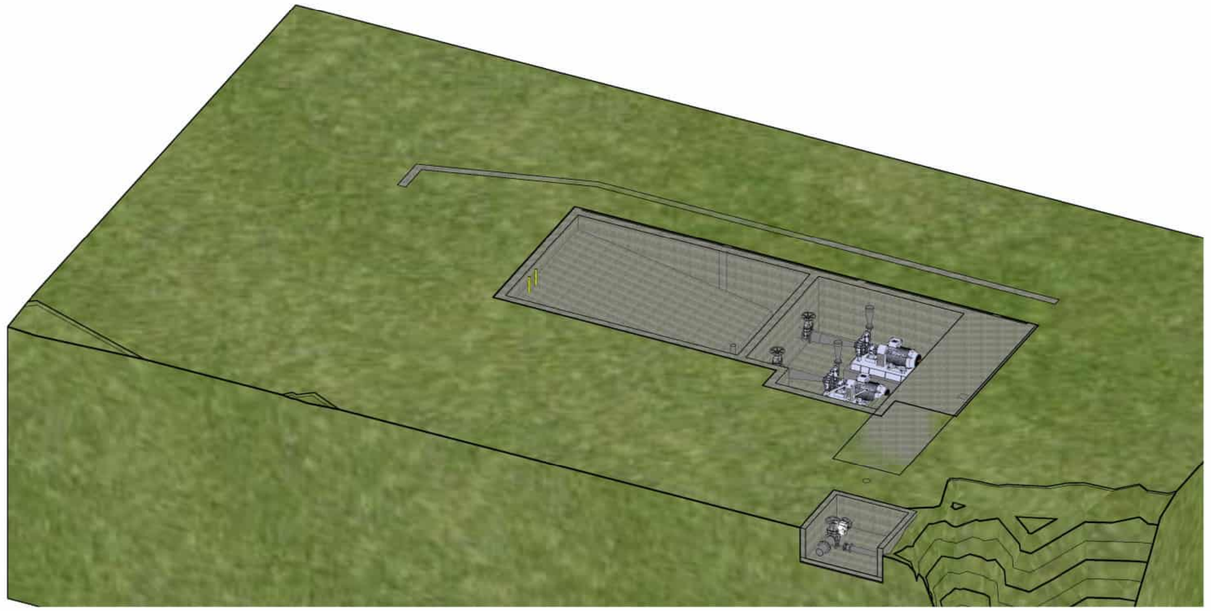


1 LOWER GROUND FLOOR PLAN

1 : 100



2 3D LOWER GROUND

1m 10m

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APPROVALS	NAME	DATE
DRAFTING CHECKED BY		
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION
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C	26/11/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE _____

CLIENT _____ DATE _____

PROJECT: C1936-HEROLDS BAY PS4

DRAWING DESCRIPTION: HEROLDS BAY PUMP S4
LOWER GROUND FLOOR PLAN

DESIGNED	DRAWN	CHECKED
LG	Author	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 100	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
C1936-SMEC-CD-ARC-DRG-002	C

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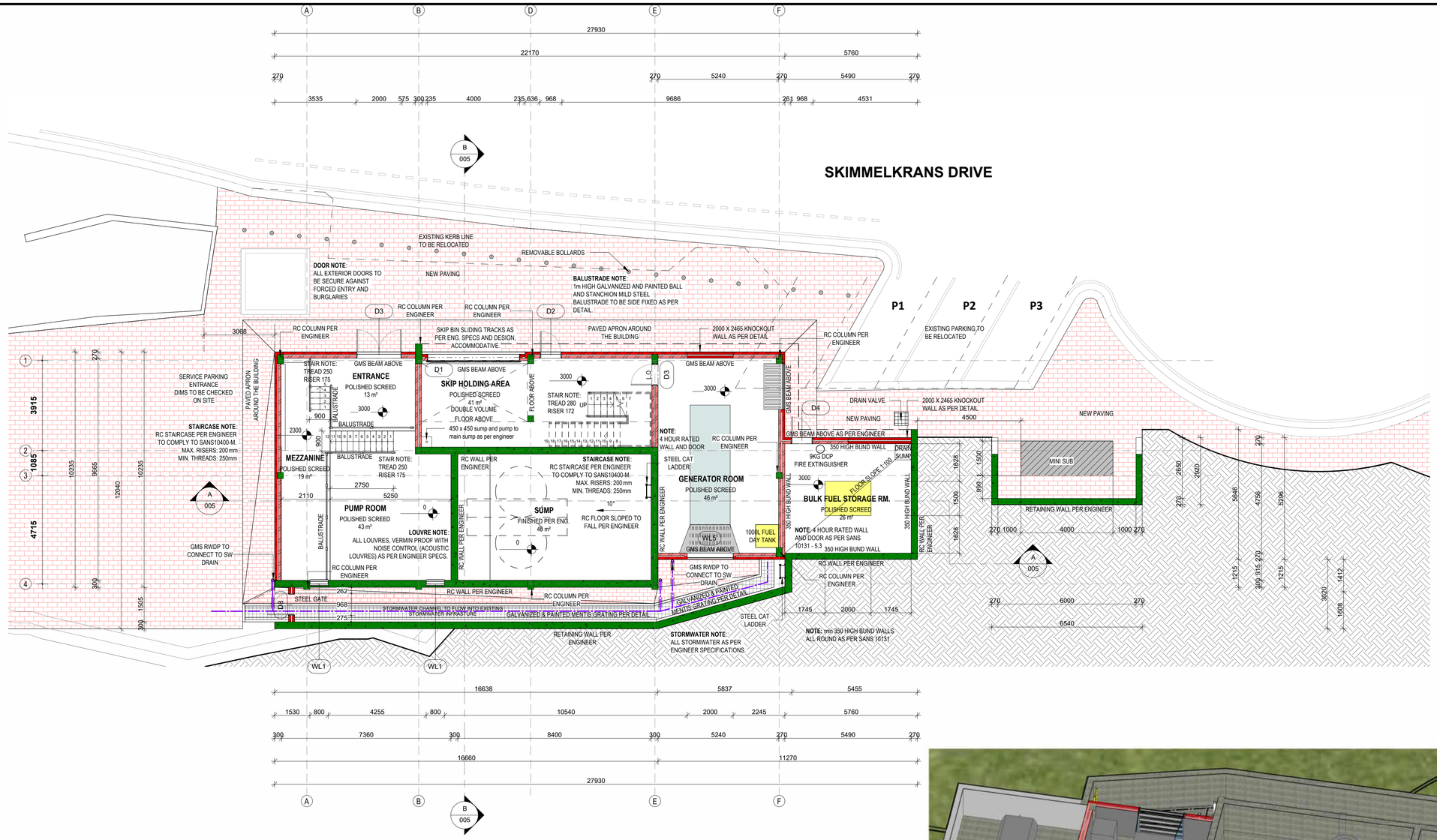
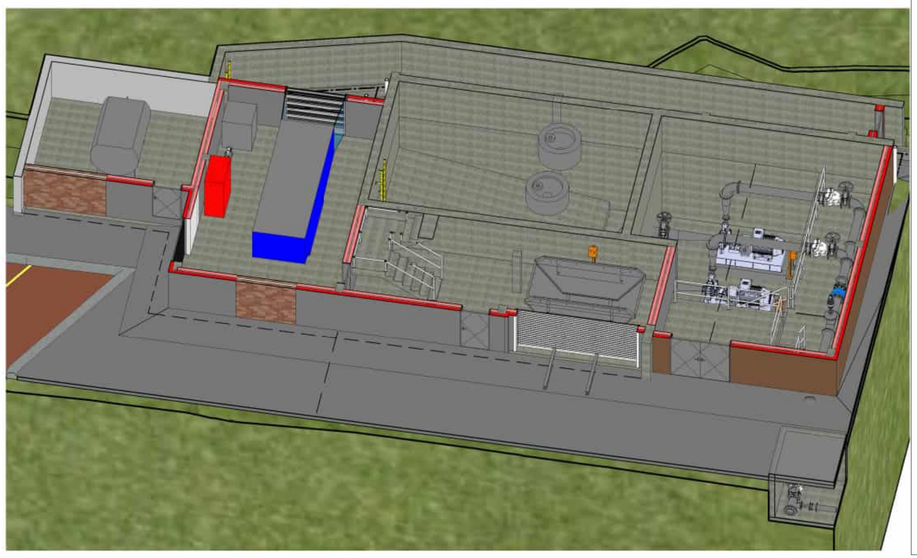


1 GROUND FLOOR PLAN

1 : 100



2 3D - GROUND FLOOR LEVEL

1m 10m

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    BASIC STAIR NOTES:
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    BALUSTRADES 1.0m HIGH WITH NO GAP MORE THAN 100mm

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    b. FENESTRATION:
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       SOLAR HEAT GAIN AND HEAT CONDUCTANCE TO COMPLY WITH SANS 204 -4.3.4

FOR INFORMATION

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TEL: 051 411 8700
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SABS ISO 9001

CLIENT

GEORGE MUNICIPALITY

71 York Street,
PO Box 19
George
6530

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION
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C	26/11/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE _____

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS4

DRAWING DESCRIPTION
HEROLDS BAY PUMP S4
GROUND FLOOR PLAN

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 100	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
C1936-SMEC-CD-ARC-DRG-003	C

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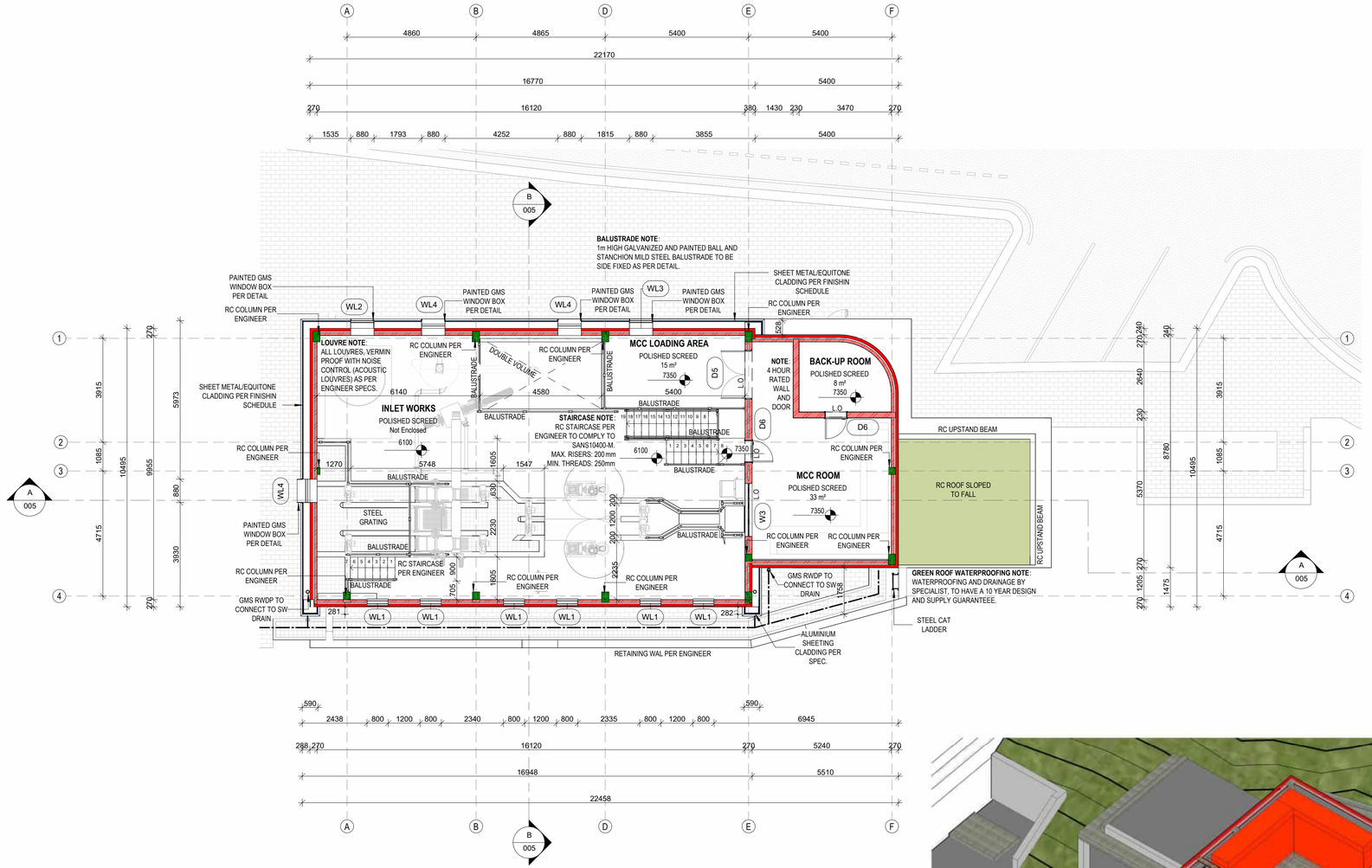
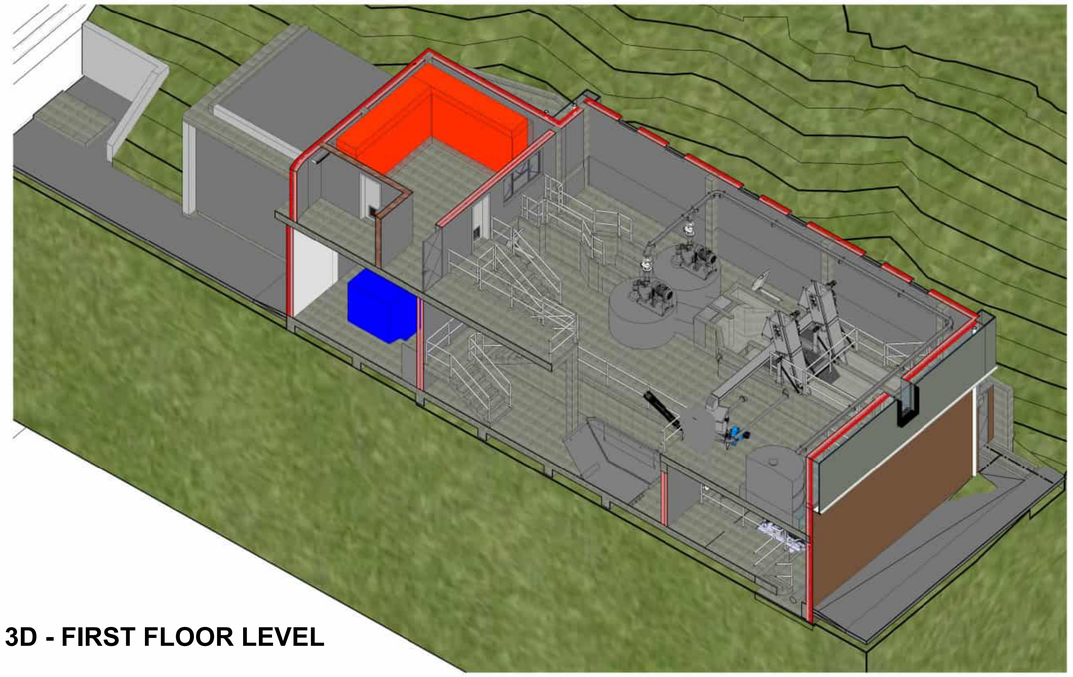


1 FIRST FLOOR PLAN

1 : 100



2 3D - FIRST FLOOR LEVEL

1m 10m

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CLIENT

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71 York Street,
PO Box 19
George
6530

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION
B	19/11/24	INFORMATION
C	26/11/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE _____

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS4

DRAWING DESCRIPTION
HEROLDS BAY PUMP S4
FIRST FLOOR PLAN

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 100	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
C1936-SMEC-CD-ARC-DRG-004	C

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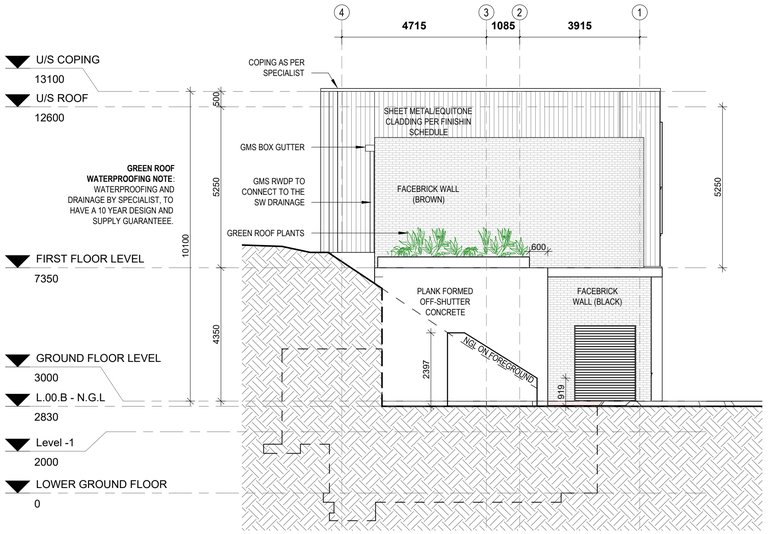
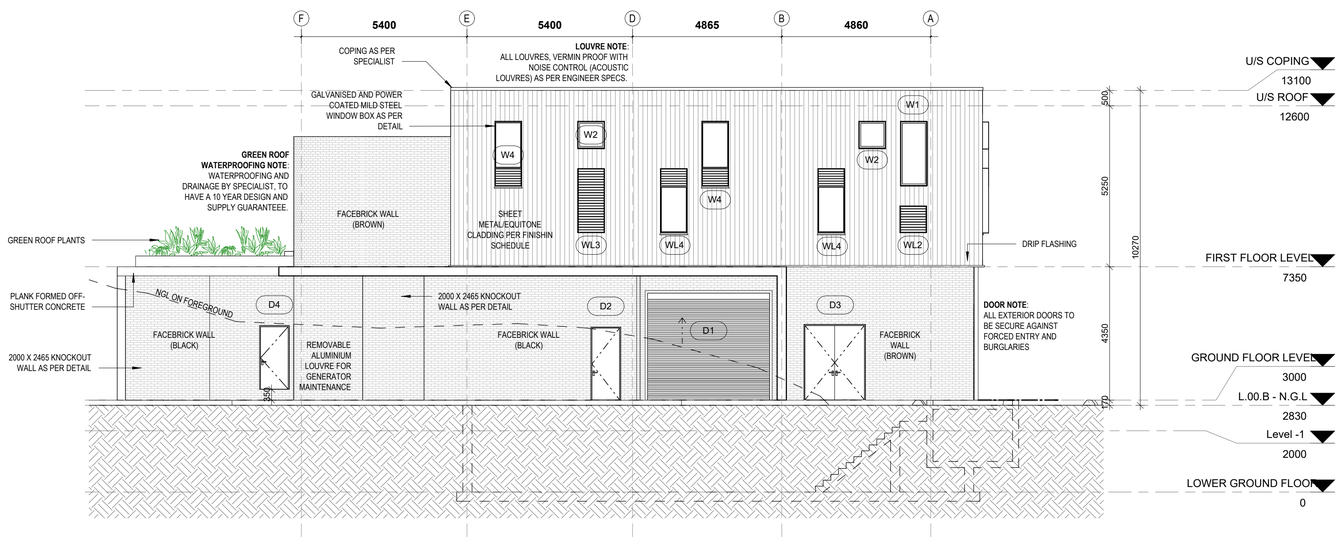


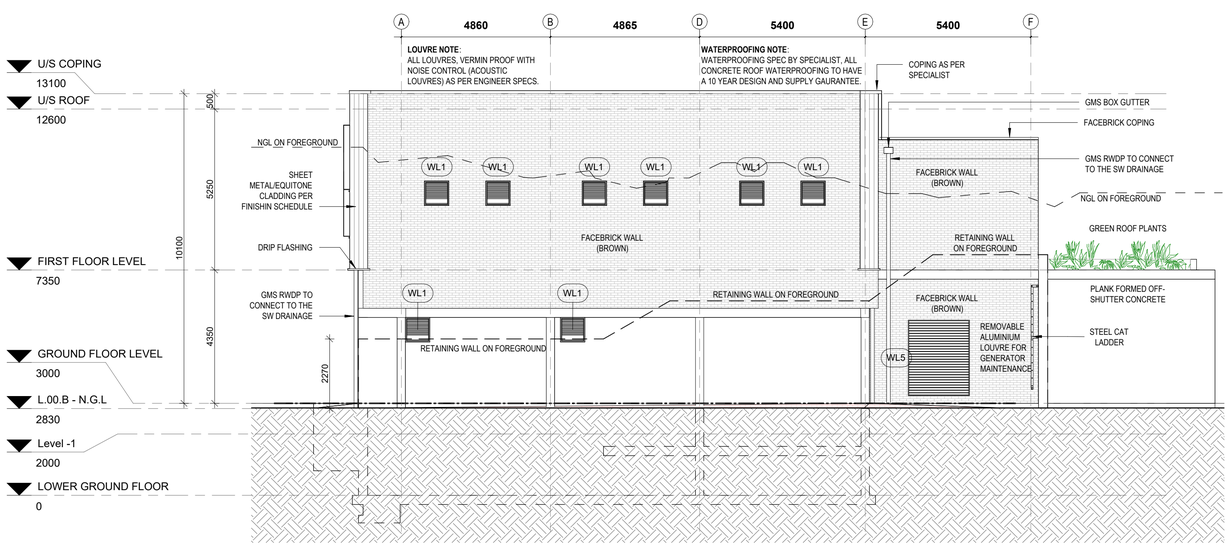
1 EAST ELEVATION

1 : 100



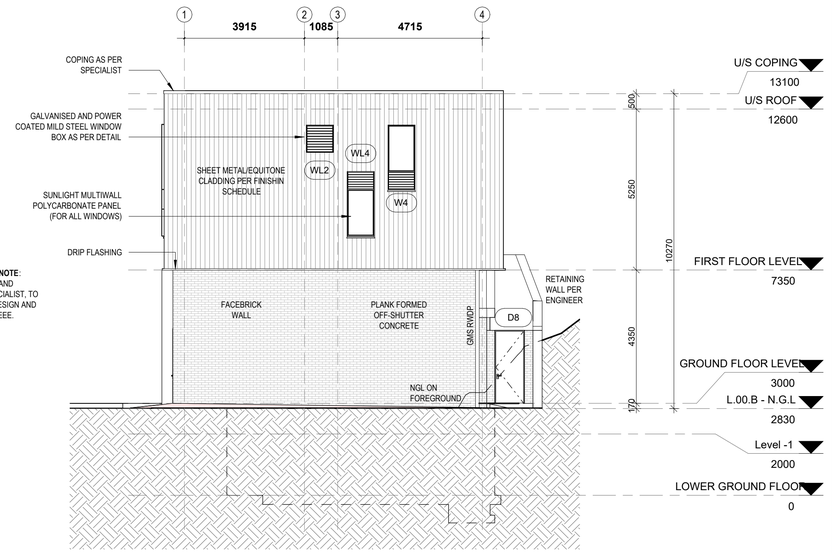
2 NORTH ELEVATION

1 : 100



3 SOUTH ELEVATION

1 : 100



4 WEST ELEVATION

1 : 100

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DRAFTING CHECKED BY		
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REVISION SCHEDULE		
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REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE _____

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS4

DRAWING DESCRIPTION
HEROLDS BAY PUMP S4
ELEVATIONS

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 100	A1

DRAWING NUMBER

PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
C1936-SMEC-CD-ARC-DRG-006	C

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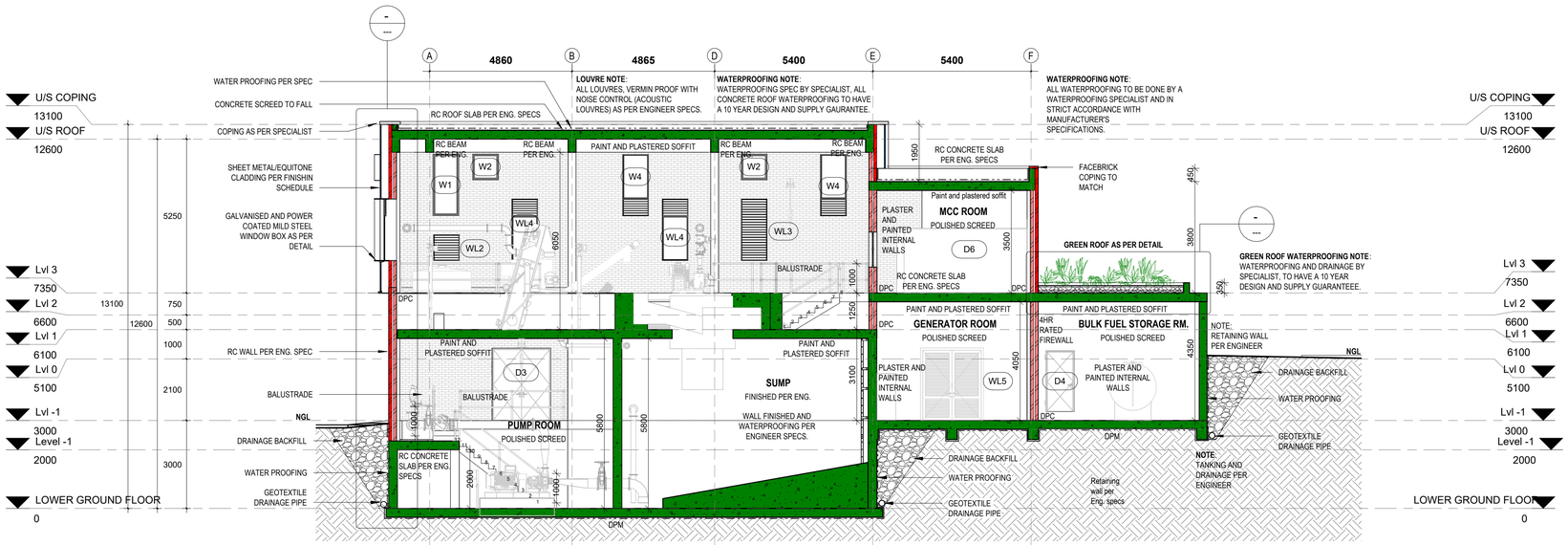

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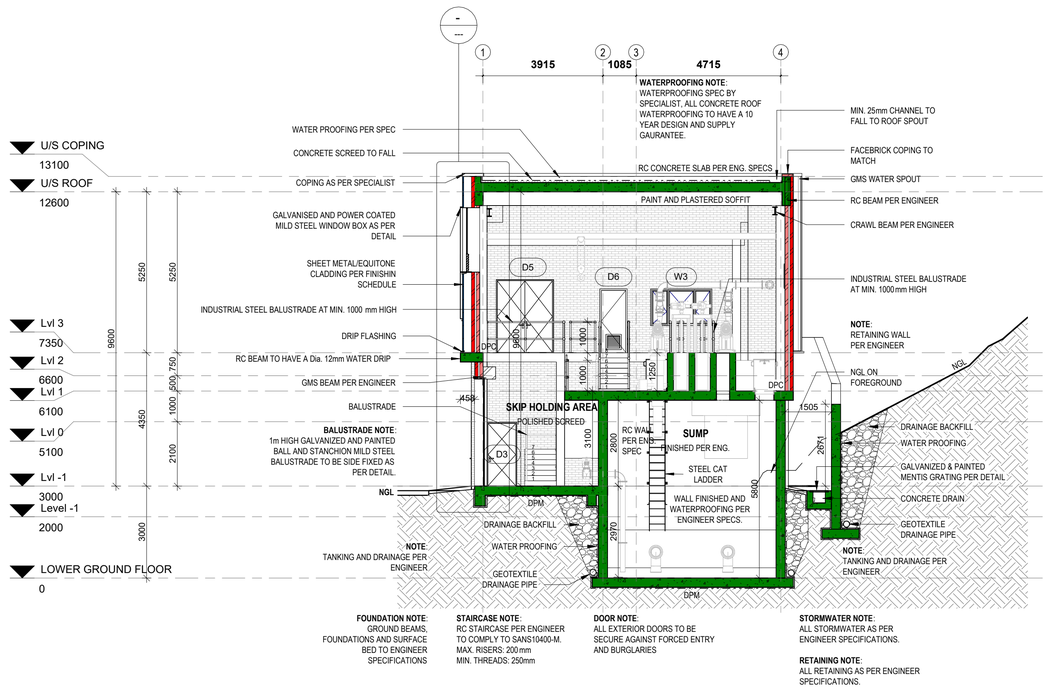
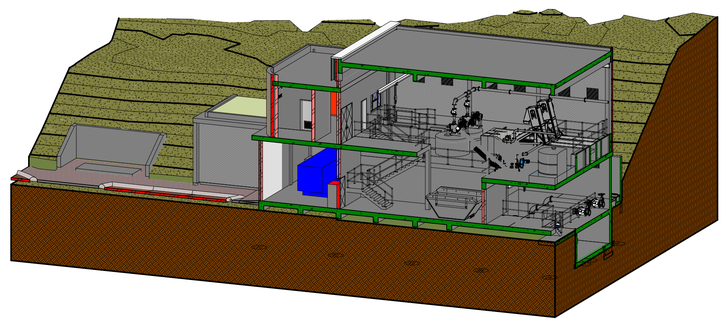


B Section B-B
1 : 100



1 3D - SECTION

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    a. WALLS:
       NON-MASONRY WALL WILL HAVE 'R' VALUE AS PROVIDED. SANS10400-XA -4.4.3.1)
       DOUBLE SKIN MASONRY WITH PLASTER INSIDE OR RENDER OUTSIDE COMPLIES SINGLE LEAFE MIN. 140mm WITH PLASTER INSIDE AND RENDER OUTSIDE COMPLIES. (SANS 10400-XA - 4.4.3.2)
       OTHER MASONRY WALLS WILL HAVE 'R' VALUE OF 0.35
       SANS 10400XA-4.4.3.3

    b. FENESTRATION:
       AIR LEAKAGE SHALL NOT EXCEED 2L/s/m2 FENESTRATION AREA; 0.306L/s/m2 FIXED GLAZING AND 5L/s/m2 REVOLVING/SWING DOORS
       SANS 10400-XA- 4.4.1.1
       FENESTRATION MORE THAN 15% TO NETT FLOOR AREA PER STOREY THEN SANS 10400-XA 4.4.4.2
       FENESTRATION UP TO 15% OF FLOOR NET AREA PER STOREY THEN SANS 10400-XA 4.4.4.1
       SOLAR HEAT GAIN AND HEAT CONDUCTANCE TO COMPLY WITH SANS 204 -4.3.4

FOR INFORMATION

SJ smec
23 SECOND AVENUE, WESTDENE
PO BOX 72927,
WESTDENE, BLOEMFONTEIN, 9301
WEBSITE: www.smec.com
TEL: 051 411 8700
FAX: 012 803 7943
SABS ISO 9001

CLIENT
GEORGE MUNICIPALITY
71 York Street,
PO Box 19
George
6530

APPROVALS	NAME	DATE
DRAFTING CHECKED BY		
DESIGNED BY		
DESIGN CHECKED BY		
APPROVED BY		

REVISION SCHEDULE		
NO.	DATE	REVISION DESCRIPTION
A	11/10/24	INFORMATION
B	19/11/24	INFORMATION
C	26/11/24	INFORMATION

REFERENCE DRAWINGS	
DRAWING NO.	DESCRIPTION

PR. ARCH _____ PR ARCH no. _____ DATE _____

CLIENT _____ DATE _____

PROJECT
C1936-HEROLDS BAY PS4

DRAWING DESCRIPTION
HEROLDS BAY PUMP S4 SECTIONS

DESIGNED	DRAWN	CHECKED
LG	NJS	LG
REV DATE	SCALE	ORIGINAL SIZE
	1 : 100	A1

DRAWING NUMBER

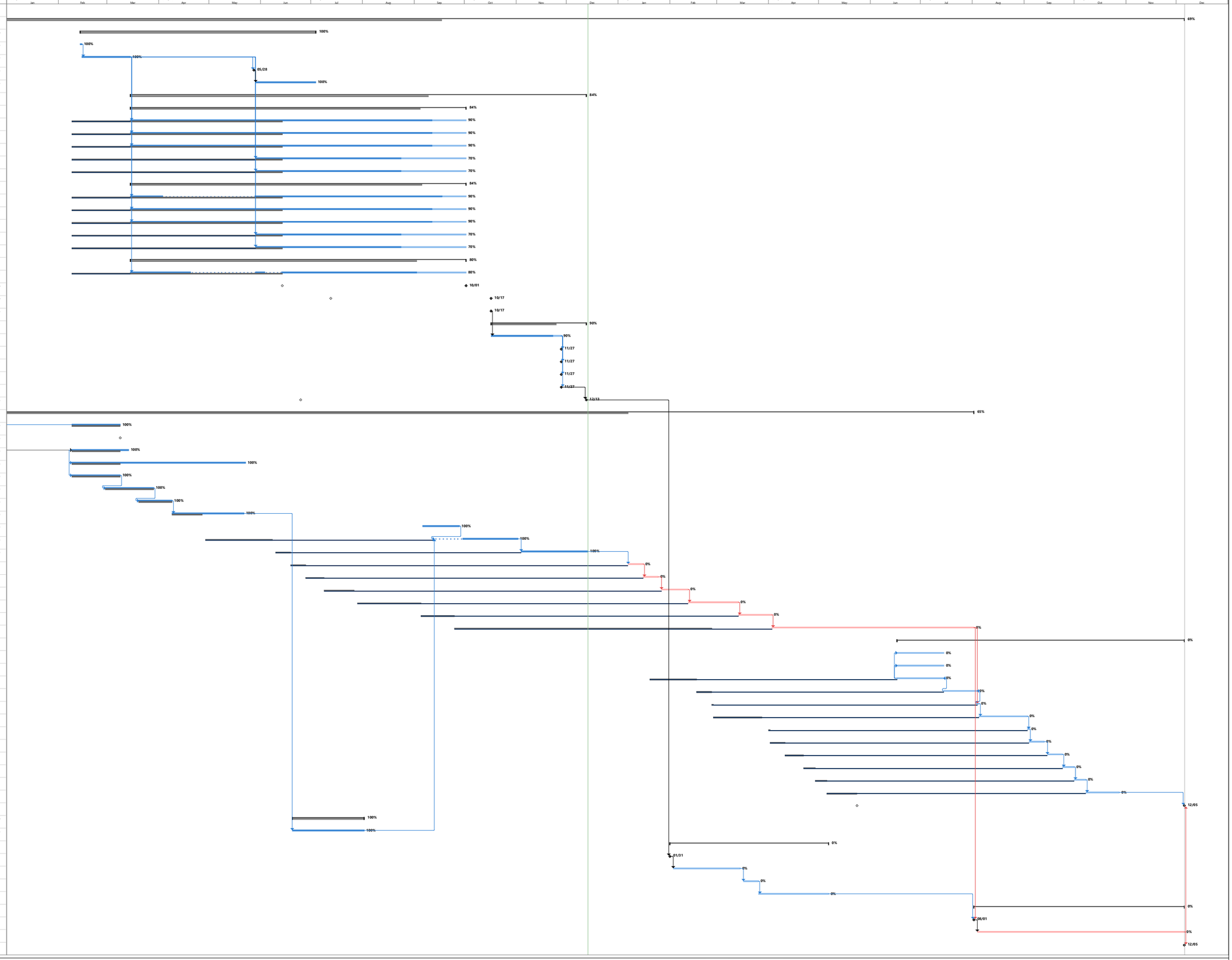
PROJECT - AUTHOR - PHASE - DISCIPLINE - TYPE - SEQUENCE	REV
C1936-SMEC-CD-ARC-DRG-005	C

2024/12/02 11:44:44

Annexure G Programme

C1936_Herolds Bay PS_20241213.mpp

ID	Task Mode	Task Name	Duration	Start	Finish	% Complete
1						
2		**Herolds Bay PS**	**596 days**	**Wed 23/08/02**	**Fri 25/12/05**	**69%**
3		**Preliminary Design**	**101 days**	**Wed 24/02/14**	**Wed 24/07/03**	**100%**
4		Submit report revision 1	1 day	Wed 24/02/14	Wed 24/02/14	100%
5		Client approval	21 days	Thu 24/02/15	Thu 24/03/14	100%
6		Submit report revision 2	0 days	Tue 24/05/28	Tue 24/05/28	100%
7		Client Approval (Stage Complete)	26 days	Wed 24/05/29	Wed 24/07/03	100%
8		**Detail Design Phase**	**195 days**	**Fri 24/03/15**	**Fri 24/12/13**	**84%**
9		**PS 1**	**143 days**	**Fri 24/03/15**	**Tue 24/10/01**	**84%**
10		Civil	143 days	Fri 24/03/15	Tue 24/10/01	90%
11		Electrical	143 days	Fri 24/03/15	Tue 24/10/01	90%
12		Mechnical	143 days	Fri 24/03/15	Tue 24/10/01	90%
13		Structural	90 days	Wed 24/05/29	Tue 24/10/01	70%
14		Building (Renovation)	90 days	Wed 24/05/29	Tue 24/10/01	70%
15		**PS 4**	**143 days**	**Fri 24/03/15**	**Tue 24/10/01**	**84%**
16		Civil	104 days	Fri 24/03/15	Tue 24/10/01	90%
17		Electrical	143 days	Fri 24/03/15	Tue 24/10/01	90%
18		Mechnical	143 days	Fri 24/03/15	Tue 24/10/01	90%
19		Structural	90 days	Wed 24/05/29	Tue 24/10/01	70%
20		Building (Architectural)	90 days	Wed 24/05/29	Tue 24/10/01	70%
21		**Pipeline**	**143 days**	**Fri 24/03/15**	**Tue 24/10/01**	**80%**
22		Civil	108 days	Fri 24/03/15	Tue 24/10/01	80%
23		**Deliverables (internal review)**	**0 days**	**Tue 24/10/01**	**Tue 24/10/01**	**100%**
25		**Client (Interaction & deliverables)**	**0 days**	**Thu 24/10/17**	**Thu 24/10/17**	**100%**
26		Design Workshop	0 days	Thu 24/10/17	Thu 24/10/17	100%
27		**Deliverables**	**41 days**	**Thu 24/10/17**	**Fri 24/12/13**	**90%**
28		Finalise Designs	30 days	Thu 24/10/17	Wed 24/11/27	90%
29		Design Report	0 days	Wed 24/11/27	Wed 24/11/27	90%
30		Drawings	0 days	Wed 24/11/27	Wed 24/11/27	90%
31		BOQ	0 days	Wed 24/11/27	Wed 24/11/27	90%
32		Cost Estimate	0 days	Wed 24/11/27	Wed 24/11/27	90%
33		Submit Design Report to Client Rev 0	0 days	Fri 24/12/13	Fri 24/12/13	100%
34		**Environmental**	**506 days**	**Wed 23/08/02**	**Fri 25/08/01**	**65%**
35		Receive engineers report and drawings	21 days	Fri 24/02/09	Fri 24/03/08	100%
36		Sumitt notice of intent	0 days	Wed 23/08/02	Wed 23/08/02	100%
37		Specialist conduct assesment	24 days	Fri 24/02/09	Wed 24/03/13	100%
38		Compile a database of Potential I&Aps	74 days	Fri 24/02/09	Wed 24/05/22	100%
39		Incorporate of Specialist assesments	21 days	Fri 24/02/09	Fri 24/03/08	100%
40		Compilation of the draft BAR report	21 days	Thu 24/02/29	Thu 24/03/28	100%
41		Compile EMPr	14 days	Wed 24/03/20	Mon 24/04/08	100%
42		Draft BAR & EMPr internal and client review	31 days	Tue 24/04/09	Tue 24/05/21	100%
43		Draft BAR & EMPr internal and client review (2nd)	16 days	Fri 24/09/06	Fri 24/09/27	100%
44		Draft BAR for 30 day Pre App PP	25 days	Fri 24/09/13	Fri 24/11/01	100%
45		Compile Comments and Response tables	30 days	Mon 24/11/04	Fri 24/12/13	100%
46		Client to check responses in C&R tables	7 days	Tue 25/01/07	Wed 25/01/15	0%
47		Submit application to the DEADP	7 days	Thu 25/01/16	Fri 25/01/24	0%
48		Receive correspondence from DEADP	12 days	Mon 25/01/27	Tue 25/02/11	0%
49		Second round of PP on BAR	22 days	Wed 25/02/12	Thu 25/03/13	0%
50		Compile and submit final BAR to DEADP	14 days	Fri 25/03/14	Wed 25/04/02	0%
51		Awaiting for Authorisation	87 days	Thu 25/04/03	Fri 25/08/01	0%
52		**Procurement**	**124 days**	**Tue 25/06/17**	**Fri 25/12/05**	**0%**
53		Prepare Tender Drawings	20 days	Tue 25/06/17	Mon 25/07/14	0%
54		Specification	20 days	Tue 25/06/17	Mon 25/07/14	0%
55		Prepare Tender Document	20 days	Tue 25/06/17	Tue 25/07/15	0%
56		Client Approval	14 days	Tue 25/07/15	Mon 25/08/04	0%
57		Bid Spec Meeting	1 day	Mon 25/08/04	Mon 25/08/04	0%
58		Tender Advertisement	21 days	Tue 25/08/05	Tue 25/09/02	0%
59		Tender Closing Date	1 day	Wed 25/09/03	Wed 25/09/03	0%
60		Tender Evaluation Client	7 days	Thu 25/09/04	Fri 25/09/12	0%
61		Tender Evaluation SMEC	7 days	Mon 25/09/15	Tue 25/09/23	0%
62		Bid Evaluation Committee	5 days	Wed 25/09/24	Tue 25/09/30	0%
63		Bid Adjudication Committee	5 days	Wed 25/10/01	Tue 25/10/07	0%
64		Appeal period commences	14 days	Wed 25/10/08	Mon 25/10/27	0%
65		Appointment of Contractor	0 days	Fri 25/12/05	Fri 25/12/05	0%
66		**Delays**	**31 days**	**Thu 24/06/20**	**Thu 24/08/01**	**100%**
67		Erf 116	31 days	Thu 24/06/20	Thu 24/08/01	100%
68		**Building Plan Submission**	**67 days**	**Fri 25/01/31**	**Tue 25/05/06**	**0%**
69		Submit Building Plan Application	0 days	Fri 25/01/31	Fri 25/01/31	0%
70		Comments from GM	30 days	Mon 25/02/03	Fri 25/03/14	0%
71		Re-Submitt	7 days	Mon 25/03/17	Tue 25/03/25	0%
72		Approval	30 days	Wed 25/03/26	Tue 25/05/06	0%
73		**DAFF - Department of Forestry & Fisheries**	**90 days**	**Fri 25/08/01**	**Fri 25/12/05**	**0%**
74		Submit Permit	0 days	Fri 25/08/01	Fri 25/08/01	0%
75		Approval Period	90 days	Mon 25/08/04	Fri 25/12/05	0%
76		Received Permit	0 days	Fri 25/12/05	Fri 25/12/05	0%



Critical | Critical Split | Critical Progress | Task | Split | Task Progress | Manual Task | Start-only | Finish-only | Duration-only | Baseline | Baseline Split | Baseline Milestone | Milestone | Summary Progress | Summary | Manual Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Deadline | Slippage

Annexure H Professional Fees Cashflow

PROFESSIONAL CASHFLOW

Date	Basic Professional Fee (Total)	Inception	Concept and Viability	Design Development	Documentation and Procurement	Contract Administration and Inspection	Close-Out	Geotech	Survey	Environmental	Environmental (Specialist)	Construction Monitoring	ECO	QS	Architect	Total (Excl Vat)	Cumulative (Excl Vat)	
Oct-22	R 125 153.03	*R 125 153.03*	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R 125 153.03	R 125 153.03	Actual
Nov-22	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 125 153.03	
Dec-22	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 125 153.03	
Jan-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 125 153.03	
Feb-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 125 153.03	
Mar-23	R 31 288.26	R -	*R 31 288.26*	R -	R -	R -	R -	R -	*R 56 300.00*	R -	R -	R -	R -			R 87 588.26	R 212 741.29	
Apr-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 212 741.29	
May-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 212 741.29	
Jun-23	R 469 323.86	R -	*R 469 323.86*	R -	R -	R -	R -	*R 137 518.00*	R -	R -	R -	R -	R -			R 606 841.86	R 819 583.15	
Jul-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 819 583.15	
Aug-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 819 583.15	
Sep-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 819 583.15	
Oct-23	R -	R -	R -	R -	R -	R -	R -	*R 66 975.00*	R -	*R 45 000.00*	*R 84 512.75*	R -	R -			R 196 487.75	R 1 016 070.90	
Nov-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 016 070.90	
Dec-23	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 016 070.90	
Jan-24	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 016 070.90	
Feb-24	R -	R -	-	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 016 070.90	
Mar-24	R 156 441.28	R -	*R 93 864.77*	*R 62 576.51*	R -	R -	R -	R -	R -	R -	*R 39 842.25*	R -	R -			R 196 283.53	R 1 212 354.43	
Apr-24	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 212 354.43	
May-24	R -	R -	R -		R -	R -	R -	R -	*R 25 250.00*	*R 27 500.00*	*R 55 247.85*	R -	R -			R 107 997.85	R 1 320 352.28	
Jun-24	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 320 352.28	
Jul-24	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 320 352.28	
Aug-24	R 125 153.04	R -	*R 31 288.26*	*R 93 864.78*	R -	R -	R -	R -	R -	R -	R -	R -	R -			R 125 153.04	R 1 445 505.32	
Sep-24	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -			R -	R 1 445 505.32	
Oct-24	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 1 445 505.32	
Nov-24	R 845 827.60	*R 54 661.03*	*R 273 305.14*	*R 517 861.43*	R -	R -	R -	R -	R -	R -	R -	R -	R -	*R -*	*R 57 088.80*	R 902 916.40	R 2 348 421.72	
Dec-24	R -	R -	R -	R -	R -	R -	R -	R -	R -		R -	R -	R -		R -	R -	R 2 348 421.72	Forecast
Jan-25	R 112 383.78	R -	R -	*R 112 383.78*	R -	R -	R -	R -	R -	*R 27 500.00*	R -	R -	R -	*R 40 000.00*	*R 45 070.11*	R 224 953.89	R 2 573 375.61	
Feb-25	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	*R 66 000.00*	R -	R 66 000.00	R 2 639 375.61	
Mar-25	R -	R -	R -	R -	R -	R -	R -	R -	R -	*R 35 000.00*	R -	R -	R -	R -	*R 120 186.95*	R 155 186.95	R 2 794 562.56	
Apr-25	R 2 193 388.69	*R 189 182.26*	*R 945 911.32*	*R 1 058 295.11*	R -	R -	R -	R -	R -	R -	R -	R -	R -	*R 31 000.00*	R -	R 2 224 388.69	R 5 018 951.25	
May-25	R -	R -	R -		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 5 018 951.25	
Jun-25	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 5 018 951.25	
Jul-25	R 461 245.40	R -	R -	R -	*R 461 245.40*	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 461 245.40	R 5 480 196.65	
Aug-25	R 461 245.40	R -	R -	R -	*R 461 245.40*	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 461 245.40	R 5 941 442.05	
Sep-25	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 5 941 442.05	
Oct-25	R 461 245.40	R -	R -	R -	*R 461 245.40*	R -	R -	R -	R -	R -	R -	R -	R -	R -	*R 60 093.48*	R 521 338.88	R 6 462 780.93	
Nov-25	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	*R 120 186.95*	R 120 186.95	R 6 582 967.88	
Dec-25	R 461 245.41	R -	R -	R -	R 461 245.41	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 461 245.41	R 7 044 213.29	
Jan-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 7 275 031.25	
Feb-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 7 505 849.21	
Mar-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 7 736 667.16	
Apr-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 7 967 485.12	
May-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 8 198 303.07	
Jun-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 8 429 121.03	
Jul-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 8 659 938.98	
Aug-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 8 890 756.94	
Sep-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 9 121 574.90	
Oct-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 9 352 392.85	
Nov-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 9 583 210.81	
Dec-26	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 9 814 028.76	
Jan-27	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 10 044 846.72	
Feb-27	R 73 799.26	R -	R -	R -	R -	*R 73 799.26*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 817.96	R 10 275 664.67	
Mar-27	R 73 799.32	R -	R -	R -	R -	*R 73 799.32*	R -	R -	R -	R -	R -	*R 130 000.00*	*R 15 000.00*	R -	*R 12 018.70*	R 230 818.02	R 10 506 482.69	
Apr-27	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 10 506 482.69	
May-27	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 10 506 482.69	
Jun-27	R 368 996.32	R -	R -	R -	R -	R -	R -	R -	*R 368 996.32*	R -	R -	R -	R -	R -	*R 18 028.04*	R 387 024.36	R 10 893 507.05	
Jul-27	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 10 893 507.05	
Aug-27	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -	R 10 893 507.05	
Total	R 7 379 926.44	R 368 996.32	R 1 844 981.61	R 1 844 981.61	R 1 844 981.61	R 1 106 988.96	R 368 996.32	R 204 493.00	R 81 550.00	R 135 000.00	R 179 602.85	R 1 950 000.00	R 225 000.00	R 137 000.00	R 600 934.76	R 10 893 507.05		
Budget	R 7 379 926.45	R 368 996.32	R 1 844 981.61	R 1 844 981.61	R 1 844 981.61	R 1 106 988.97	R 368 996.32	R 204 493.00	R 56 300.00	R 180 000.00	R 374 445.00	R 1 950 000.00	R 225 000.00	R 137 000.00	R 600 934.76	R 11 108 099.21		
Diff	-R 0.01	-R 0.00	-R 0.00	-R 0.00	R 0.00	-R 0.00	-R 0.00	R -	R 25 250.00	-R 45 000.00	-R 194 842.15	R -	R -	R -	R -	-R 214 592.16		