CHAPTER TWELVE: ROADS AND WET SERVICES

12.1 INTRODUCTION

This Chapter of the report presents the preliminary engineering investigation, conducted by Jaco Spies of JJ Spies Civil Engineers, regarding the bulk services and the preliminary design of the access, stormwater, sewer, and water reticulation systems that will serve the proposed citrus orchard development on Scheepers Vlakte Farm.

12.2 SPECIALIST TERMS OF REFERENCE

The terms of reference (ToR) for the Roads and Wet Services Report, as requested by Public Process Consultants, on behalf of the applicant, are stated below:

- In consultation with the project applicant and taking into account the recommendations of the various specialist assessments, the identification and design of additional infrastructure on site, namely:
  - Pre-sort packhouse (~6 500m^2) and turning circle for the delivery/ collection of equipment, crops and fruit including a new entrance road;
  - Logistical services area, comprised of a workshop and storage area, administration area (offices), as well as various staff facilities under roof;
  - Staff housing.
- Estimate the domestic water consumption requirements for the proposed development and indicate the source of domestic water including proposed water supply systems.
- Estimate the domestic effluent load to be created by the development and design an effluent treatment/ storage facility with sufficient capacity to cater for the aforementioned effluent.
- Provide flood control measures that prevent loss of life and significant damage to property due to run-off from major storms and keep excess run-off away from buildings and/ or habitable units as far as practically possible.

Additionally, the level of services provided are in accordance with the Guidelines for Human Settlement Planning and Design, compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology: (2000: Revision August 2003) and other acceptable design specifications.

12.3 SCOPE OF WORK

The scope of this report deals with the collection of data on and adjacent to Portion 7 of the Farm Scheepers Vlakte No. 98, Sundays River Valley Municipality, Eastern Cape, near Addo. It includes the analysis of this data concerning an engineering opinion regarding the availability of bulk services, identification of restraints, further approvals and studies, as well as the preliminary investigation and design of access, storm water, sewer and water reticulation systems to serve the above-mentioned proposed logistical services area.

In particular, this report will focus on the road access and wet services systems that have to serve the proposed logistical services area of ~5ha and comprising of a pre-sort packhouse (6500m²), offices (150m²), workshop (300m²), staff facilities (150m²) and staff housing (5 x 60m²), as well as hardstand areas.

The above information is required for the water supply and foul sewer systems, as well as storm water management plan which will form part of the Final Environmental Impact Assessment Report.

12.4 DATA COLLECTION

12.4.1 Traffic Impact Statement

The Traffic Impact Statement (TIS) was done by Engineering Advice and Services, dated June 2018.

12.4.2 Layout and Survey Details

The proposed layout plan indicating the erf boundaries of the properties and the respective phases of vegetation clearing on Portion 7 of Farm Scheepers Vlakte No. 98, Division Uitenhage, Eastern Cape, near Addo, was obtained from Public Process Consultants.

The preferred layout of the logistical services area on the aforementioned Scheepers Vlakte Farm which will serve the proposed agricultural development, has been confirmed with Mr. R. Niven of San Miguel Fruits SA (Pty) Ltd, representing the applicant, on 4 June 2018.

- Pre-sort Packhouse (6500m²)
- Offices (150m²)
- Workshop (300m²)
- Staff Facilities (150m²)
- Staff Housing (5 x 60m²)
- Tractor/ trailer Off-loading and Receiving Slab
- Dispatch Truck Loading Slab
- Clearedge Sewage Onsite Treatment System
- Stormwater Detention Facilities
- Domestic Water Main Treatment and Storage Facility
- Access Road (east)

The logistical services area is proposed to have a footprint of ~5ha which will include the afore-mentioned structures. Refer to Figure 12.1 (Drawing No. RN/2018-07/AS/01) attached in Annexure A.

12.4.3 Field Records and Observations

The existing tarred R336 (MR471) national road is ~4.5km from the entrance to the site. Access to the site will be possible via the existing tarred DR01983 road and existing gravel MN50077 road. Access to the farm is proposed to be obtained via a private road ~6m wide onto the MN50077 road, ~4km east of the DR01983 road (see Chapter Eight: Traffic Specialist Assessment).

The entrance road to the dispatch area of the logistical services area is located roughly 400m east of the pre-sort packhouse, off the existing Lower Sundays River Water Users Association irrigation canal crossing, abutting the mid-southern boundary of the property.

The levels on the portion of the farm proposed for construction of the logistical services area vary between ~124m and ~113m above Mean Sea Level (MSL). The existing contours for this portion of the farm slope in general with a moderate steep gradient (1:12) from ~124m above Mean Sea Level (MSL) in the north to ~115m above MSL in the south and do have a very flat gradient from east to west.

The existing LSRWUA irrigation canal is located ~88m south of the proposed logistical services area.

The proposed development is situated within an agricultural region which will be irrigated by water provided via the LSRWUA canal system. The 140 000m³ irrigation dam will be situated about 450m west of the proposed logistical services area at an average contour level of ~87m above MSL.

12.4.4 Engineering Geological Report

A detailed engineering geological investigation of the site should be done prior to the detailed design stage of the development. However, based on the secondary desktop studies, soil conditions could in general be described as follows:

- For the most part, the site is blanketed by a layer of loose to moderately dense clayey sand with roots. The topsoil can in general be described as clayey sand with roots.
- The last-mentioned layers are underlain by Alluvium, consisting of red-brown firm to stiff clayey sand or sandy clay.

12.5 ANALYSIS

12.5.1 Methodology

The methodology adopted in analysing an effective design for the wet services system and main access roads for the logistical services area associated with the proposed agricultural development under discussion, consists of the following:

- Establishing acceptable objectives for the proposed access road and wet services systems;
- Determining appropriate design standards for the purpose of analysis and reporting;
- Applying these criteria to the expected post-development conditions to confirm findings and details regarding the proposed design and constructed works.

12.5.2 Acceptable Objectives

- To provide flood control measures that prevent loss of life and significant damage to property due to run-off created during major storm events and to keep excess run-off away from buildings and/ or habitable units, as far as practically possible.
- To provide reasonable access to buildings, effective water supply, effective foul sewer and storm water drainage systems for the health, safety and convenience of the users and to protect property from damage by frequent storms.
- To provide economical facilities and find solutions to accommodate water demand, foul sewer effluent and storm water run-off problems, compatible with the physical and ecological environment and to protect the natural environment against pollution.
- To implement procedures and practices which are consistent with the operating and maintenance standards of the accountable governing bodies and/ or local authorities.

12.5.3 Appropriate Design Standards

A balance must be achieved between the objectives, optimal land use and economic viability of the development. The following design standards have been considered in preparation of this report:

- A compromise between the Guidelines for the provision of Engineering Services as published by the Department of Community Development 1983 (Blue Book), Guidelines for the Provision of Engineering Services and Amenities In Residential Townships Development issued by The South African Housing Advisory Council 1994 (“old” Red Book) and Guidelines for Human Settlement Planning and Design compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology: (2000: Revision August 2003) (“new” Red Book).
- The Guidelines for the Geometric design of Urban arterial roads (UTG1, 1986), TRH4 Specifications: Structural Design of Inter-urban and Rural road pavements, TRH17 Geometric design of Rural roads and other accepted specifications as indicated, have generally been

adopted as a basis for the design of the roads, water supply, sewer and storm water control systems.

- In accordance with the recommendations from the Hydrological Research Unit (HRU) of the University of the Witwatersrand : HRU report No. 1/72 -Design Flood Determination in S.A. and HRU report No. 2/78 – Additional information and improvements to Depth - Duration - Frequency diagram the so-called Rational Method has been used to determine the run-off for the relative small catchment areas on and near the proposed development on Portion 7 of the Farm Scheepersvlakte No. 98, Sundays River Valley Municipality in the Eastern Cape Province near Addo.
- Intensity/ Duration/ Frequency Curves for 100; 50 down to the 5 and 2-year recurrence intervals for the area have been used in preliminary calculations.
- DWAF (2001) White Paper on basic Household Sanitation. Department of Water Affairs & Forestry, September.
- Xu, Y and Braune, E (1998). A guideline for groundwater protection for the community water supply and sanitation programme. Department of Water Affairs & Forestry, Pretoria.
- Gazette No. 26187, Government Notice, DWAF, No. 399, 26 March 2004: Table B1: Effluent Treatment Standards

12.6 INVESTIGATION AND PRELIMINARY DESIGN

12.6.1 Roads - Access

Access to the proposed logistical services area will be via the tarred R336 national road (MR471), as well as along an existing tarred DR01983 road and existing gravel MN50077 road. Access is proposed to be obtained via an existing private road ~6m wide onto the MN50077 road, ~4km east of the DR01983 road, as indicated in the Traffic Impact Assessment (TIA) which was prepared by Engineering Advice and Services (Pty) Ltd for this assessment (see Chapter Eight). Access to the site and logistical services area will be provided via the existing LSRWUA canal crossing located near the mid-southern boundary of the Farm. Refer to Figure 12.1 (Drawing No. RN/2018-07/AS/01) attached in Annexure A.

The existing private road (~6m wide) and access point will require widening in order to accommodate the interlink trucks which will travel to and from the farm during the harvest season. Coordinated servitudes regarding the right of way will have to be registered to accommodate access to the respective areas of the proposed development.

12.6.2 Roads - Structural

The structural design of the roads and main internal hardstand areas will have to be done in accordance with the TRH4 Specifications: Structural design of inter-urban and rural road pavements are subject to the conditions as indicated in the geo-technical report.

The structural layer works of the main internal roads have been preliminarily designed to accommodate the repetitive axle loads associated with post-development light vehicles, tractor and trailers and heavy interlink trucks.

The preliminary structural layer works consist of selected 150mm in-situ sandy clay material compacted to 98% Modified American Association of State Highway Traffic Officials (MOD AASHTO) density, 150mm to 300mm selected G7 material compacted to 92% MOD AASHTO density, (classification in accordance with TRH 14: Guidelines for Road Construction Materials), 150mm G5 Sub-base compacted to 95% MOD AASHTO density, 25mm sand and can also be paved with a

80mm interlocking concrete paving block (35MPa crushing strength) complete with cement infill with an 80mm high mountable kerb or sunken kerb on the sides of the road subject to the storm water design considerations.

The preliminary structural layer works of the off-loading and loading areas consist of selected 150mm in-situ sandy clay material compacted to 98% Modified American Association of State Highway Traffic Officials (MOD AASHTO) density, 150mm selected G7 material compacted to 92% MOD AASHTO density, (classification in accordance with TRH 14: Guidelines for Road Construction Materials), 150mm G5 Sub-base compacted to 95% MOD AASHTO and 150mm deep 35MPa concrete hardstand slab.

In areas where the California Bearing Ratio (CBR) of the in-situ material would be lower than 3% at 90% MOD AASHTO density (especially wet conditions), an additional layer of 250mm to 350mm crushed overburden material compacted to 98% MOD AASHTO density could be specified.

12.6.3 Roads – Geometric Design

If required, the coordinated horizontal alignment of the existing intersections directly related to the proposed development will have to be amended and designed in accordance with the guidelines as indicated in the approved TIA report.

The preferred upgraded width of the access road near the main intersections with the MN50077, as well as the entrance to the development should be at least 8m wide.

The internal radii of the circulation areas around and near the pre-sort packhouse shall preferably be 18m or wider, as far as practically possible, to accommodate the effective flow of heavy vehicle traffic.

Subject to the responsible design of the earthworks, layer works and external concrete hardstand areas, the final gradients shall preferably have a gradient between 1:300 and 1:70 to accommodate the safe handling and temporary storage of crates.

As far as practically possible, the vertical alignment of the roads will have to be done in accordance with the aforementioned Guidelines (see section 12.5.3 above).

Considering the topography of the site, the road on the northern side of the pre-sort packhouse will be designed to convey the run-off from the upstream catchment area to the piped stormwater system. The off-loading and loading area, as well as the hardstand area around the pre-sort packhouse will be designed to direct the surface run-off to the stormwater catch pits and detention ponds proposed to the south of the logistical services area. The abovementioned design approach will ensure that the proposed logistical services area drains the stormwater in a detained and distributed way to the lower-lying areas.

Based on our experience and in accordance with the available topographical data for the site, maximum and minimum longitudinal vertical gradients on the road should vary in general between 5% and 0,5% (absolute minimum 0,4%) respectively with a cross fall gradient of 2,0% to 2,5%.

12.6.4 Stormwater System

The objective during the conceptual and detailed stormwater design stage shall be to retard and discharge the storm water in a distributed way, as far as practical possible. Refer to Figure 12.2 (Drawing No. RN/2018-07/RS/01) in Annexure A.

Based on our preliminary design considerations, the following practical stormwater control mechanisms have been proposed:

- Design and construct the proposed main access road from the LSRWUA canal crossing to the loading area so as not to concentrate stormwater but rather to accommodate stormwater sheet flow in accordance with the natural topography, as far as practically possible.
- Design and construct the roads within the logistical services area, as well as the loading and off-loading area to convey stormwater to the piped stormwater system which will drain to the three (3) proposed detention ponds SR1, SR2 and SR3, located along the southern boundary of the logistical services area. The stormwater pipe diameters will not exceed 375mm.
- In order to reduce the volume of stormwater, intercept stormwater from the roofed areas and convey it to rainwater storage tanks near the buildings. The surplus stormwater from the roofs will be conveyed by means of the proposed storm water system to the aforementioned detention ponds.
- Intercept and convey the stormwater from all the open hardstand areas associated with the logistical services area and convey it to the storm water detention ponds SR1, SR2 and SR3, as far as practically possible.
- Detain and/ or discharge the stormwater from the primary stormwater ponds in accordance with the applicable regulations and design guidelines.
- Subject to the detailed design of earthworks, operational areas/ roads and the stormwater system, the formed surface areas on and near the logistical services area shall be designed to also act as shallow stormwater channels under minor storms and emergency overland flow routes during or after major storm conditions, where necessary.
- The general resultant longitudinal gradients of the formed surface areas on and near the logistical services area shall be designed to direct the surface stormwater flow to the stormwater detention ponds, as far as practically possible.
- The stormwater detention ponds SR1, SR2 and SR3 will mainly detain the intercepted stormwater from the hardstand and roofed areas of the site in order to ensure that the post-development flow leaving the site will be similar or less than the pre-development flows and simultaneously replenish the underground water sources.
- The stormwater detention ponds SR1, SR2 and SR3 shall be designed to retain post-development major design storm intercepted flows up to a maximum 1 in 100-year recurrence intervals and release up to a maximum of a 1 in 5-year recurrence interval run-off near the southern edge of the logistical services area.
- In accordance with our design considerations and preliminary calculations, the stormwater detention ponds SR1, SR2 and SR3 will have effective storage capacities of 760m³, 640m³ and 682m³ respectively and approximate footprints of 800m^2, 700m^2 and 760m^2 respectively.
- Due to the partial sedimentation process that occurs under lower flow velocities in the detention ponds, as well as the biological breakdown of contaminants by sun energy and oxidation, the quality of the intercepted run-off can be improved prior to discharge.
- It is also recommended to establish indigenous drought-resistant ground cover in the detention pond areas, the disturbed cut and fill areas and the verges of the constructed hard stand and road areas to limit the transportation of sediment in these affected areas by water or wind (and associated erosion).

- The gradient of constructed embankments shall not be steeper than 1 in 3 (preferable 1 in 4) to enable the establishment of vegetation and soil stability under wet conditions, as far as practically possible.
- Rehabilitate all open areas with indigenous groundcover and vegetation, subject to the input of a specialist. First priority shall be given to areas adjacent to and near the proposed access road and hardstand area of the logistical services area.
- Erosion protection measures consisting of semi-rigid Gabion/ Reno mattress/ geo-textile structures and the establishment of effective groundcover should be used, subject to practical design considerations in areas where concentrated storm water could cause erosion.

12.6.5 Water Supply System

Water rights of 5 850 000m³ per annum have been allocated by the Department of Water and Sanitation for agricultural purposes on Portion 7 of the Farm Scheepers Vlakte No. 98. This is sufficient water to irrigate a minimum of 650ha of citrus orchards (900mm/ ha/ year). However, it is anticipated that not all of the canal water allocation will be required to be utilized for irrigation purposes and therefore a portion thereof will be available for domestic purposes, subject to the approval of the LSRWUA.

Water will be provided for irrigation purposes from the Lower Sundays River Water Users Association (LSRWUA) via the existing canal system located adjacent to the southern boundary of the property. The proposed 140 000m³ irrigation dam will be situated about 450m west of the proposed logistical services area, at an average contour level of ~87m above MSL.

The logistical services area will, inter alia, consist of the following facilities which will require water supply:

- Pre-sort packhouse (6500m²)
- Offices (150m²)
- Workshop (300m²)
- Staff facilities (150m²)
- Staff housing (5 x 60m²)

In accordance with our preliminary calculations, the Average Daily Demand (ADD) of personnel at the logistical services area during the packing season per working day will be 39 000 litres per day (**39m³ per day**). The annual average daily demand during the packing season will be 30.2m³ per calendar day and 906m³ per calendar month.

Based on the available rainfall figures (period 1970 – 2014), the average rainfall for the area is 39,53mm per month but can also vary between 22,1mm per month up to 53,2mm per month. Considering the lowest and highest recorded monthly rainfall figures over the past 45 years, available roof area and a waste factor of 30% with regards to the roof rainwater harvesting system, the *roof rainwater can act as a secondary domestic water supply subject to effective disinfectant treatment where necessary.* It is recommended to install a 5 000 litre tank at each staff house and 18 x 10 000 litre tanks next to the pre-sort packhouse, which is proposed to have a roof area of 6500m².

The use of water can also be *saved* by using water saving products for example:

- Water saving toilets (capacity 6 litres and less) with a dual-flush valve.
- Water saving taps with spray cartridges.

The applicant will have to design and install a *water treatment system to utilise irrigation water from the LSRWUA canal system for domestic purposes as the primary water supply***,** especially during the packing season. Subject to the re-registration for a change in water use and approval by the LSRWUA, the applicant will be allowed to use a portion of his water quota for domestic purposes. The applicant will be liable to treat the raw water on site to the required standards in order to be able to utilize the water for drinking purposes and domestic use.

Given that irrigation water supply from the LSRWUA canal system is not continuous, but rather on a weekly basis, it is recommended to design and construct a dual chamber reservoir on site, with an effective storage capacity of 350kl (350m³), to accommodate the treatment and effective supply of water for domestic and drinking purposes (with particular reference to abnormal low rainfall seasons). The raw water can be pumped via a 63mm diameter HDPE pumping main from the 140 000m³ irrigation dam to the mentioned 350m³ reservoir. The water treatment plant next to the aforementioned reservoir will have a capacity of 60kl.

The dual chamber reservoir must also be designed to act as a sedimentation facility that would form part of the water pre-treatment system.

The 60kl water treatment system will have to be designed and constructed, subject to the outcome of the test results on the raw irrigation water. The on-site water treatment system should consist of a screen filter, sedimentation facility, filter system, chlorinator and storage tanks combined with a booster pump system to ensure adequate supply to the required design standards.

In order to handle the worst-case scenario concerning suspended solids, clay, sand et cetera, the on-site water treatment process, as designed by a specialist, could include the following:

- Pumping from the storage reservoir through a manual screen or a Bell series self-cleaning electric screen filter.
- Mixing tank regarding dosing with flocculation additive and pH adjustment.
- Sedimentation/ flocculation tank.
- Automatic flushing sand filter depending on quality of flocculated water.
- 5 Micron cartridge filter and accurate dosing of chlorine dioxide by means of a dosing pump and flow meter.
- Storage tank with raised outlets.
- Duty and standby booster pump system including diaphragm pressure tank.

One should be able to accommodate the on-site water treatment plant including the 350m³ reservoir on a total footprint of 35m x 45m (1 575m^2) depending on the type of storage reservoir.

In order to accommodate the required minimum residual head pressure of 150kPa under instantaneous peak demand conditions and to accommodate a fire flow of 25 litres per second**,** it is recommended to install an elevated 3m high platform with water tanks with an effective fire storage capacity of 30kl combined with a FH, non-return valve and fire booster connection to the looped reticulation main. With the aid of the pump system of the fire brigade, the additional 30kl of stored water on site can be used as an *interim measure* to boost the water reticulation/ fire hydrant flow under conditions of fire. The fire hydrants will be the pedestal type unless otherwise specified by the Chief Fire Officer of the Sundays River Valley Municipality.

The main internal reticulation will mainly consist of a 110mm diameter PVC-U Class 12 piped connection to the site and a looped reticulation mainly consisting of 110mm diameter PVC-U pipelines Class 12 in accordance with SANS 966: 1998 Part 1 specifications and laid in accordance

with SANS 1200 LB. The completed water reticulation will be tested under a minimum pressure of 1800kPa in accordance with SANS 1200 L.

Refer to Figure 12.3 (Drawing No. RN/2018-07/W/01) attached in Annexure A for the proposed water supply system.

The design and supply of a sprinkler system regarding the fire protection of the pre-sort packhouse structure does not form part of this report. If required, the mentioned investigation has to be done by a specialist.

12.6.6 Foul Sewer System

The Average Dry Weather Flow (ADWF) of the logistical services area on the Farm has been calculated to be **25.1m³ per working day** for the 330 factory workers (165 workers working a double shift) and 24 permanent personnel during the packing season.

The preferred option to treat the domestic effluent under post-development conditions is the Clearedge Sewage Onsite Treatment System or similar foul sewer treatment system, as approved by the Sundays River Valley Municipality. The location to construct the foul sewer treatment plant is proposed to be ~200m west of the pre-sort packhouse. The treatment plant will have a daily throughput capacity of 25.1m^3. Refer to Figure 12.4 (Drawing No. RN/2018-07/FS/01) attached in Annexure A. The foul sewer treatment plant will require an area of 10m x 20m (200m^2) and the maturation pond will have a footprint of 441m^2 (21m x 21m) and a storage capacity of 377m^3 (x 0.86m deep).

Considering the topography of the site, it is recommended to drain the domestic effluent to a communal septic tank which will be located just preceding the treatment plant.

The main internal waterborne gravity sewers have to be designed to accommodate the peak wet weather design flows. In accordance with our preliminary design calculations, the gravity sewers will mainly be 160mm diameter Class 400kPa PVC-U pipes: SANS 1601 Type 1 specification to convey the effluent from the houses, office, ablution facilities and workshop area to the afore-mentioned communal septic tank. Refer to Figure 12.4 (Drawing No. RN/2018-07/FS/01) attached in Annexure A.

The sewer pumping main from the private pump station will mainly consist of a 110mm diameter PVC-U Class 9 SANS 966 pipeline and will convey the domestic sewer effluent from the communal septic tank/ buffer tank to the onsite foul sewer treatment plant to be situated west of the logistical services area.

The sewer pump (duty and standby pump to alternate) to pump the effluent from the communal septic tank to the buffer tank at the treatment plant will be installed in a 1800mm diameter precast concrete pump chamber. All precast concrete elements to conform to SANS 677, SANS 1294 and SANS 1200 GE specifications. In addition, the internal skin of the chamber including the soffit of the sump roof slab will be painted with two coats of epoxy tar to prevent corrosion of the sump structure. All steelwork to be hot dipped galvanized.

The pumping system will have to be designed to accommodate a discharge rate of 7.6 l/s that will allow the required self-cleansing velocity of more than 0,75 m/s and to accommodate the required peak wet weather flow of 7.6 l/s as per our preliminary calculations. The longitudinal gradients of the

gravity sewers will have to be designed to accommodate the peak wet weather flows, as well as so as to maintain minimum self- cleansing velocities higher than 0,7 m/s. All main internal sewers and manholes have to be constructed in accordance with SANS 1200 LD, SANS 1200 LB and Municipal Standards and Specifications.

The mentioned Clearedge Onsite Sewage Treatment System has been installed inter alia at the following developments in South Africa:

Royalston Estate, Port Elizabeth in 2014
Sardinia Bay Estate, Port Elizabeth in 2012
Gleneagles Estate, East London in 2009
Toulon Game Lodge, Kruger in 2008
Shoprite, Hluhluwe in 2008
Milkwood Estate, KZN in 2008
Engen 1 – stops, Tugela North and South bound in 2008
Umzumbe High School, Hibberdene in 2008
Ocean View industrial complex, Blythedale in 2007
Legends Golf Estate, Polokwane in 2007
Katberg Golf Estate, Eastern Cape in 2007
Samola Golf Estate, Western Cape in 2007
National Ports Authority, Durban Port in 2007
Bulwer low cost housing Scheme, Bulwer in 2005
Selbourne Golf Estate in 1996

In layman's terms, the operation of the closed onsite Clearedge Sewage Treatment System can be summarized as follows:

Refer to Figure 12.5 (Drawing No. RN/2018-07/BP/01) attached in Annexure A.

The effluent (grey and black water) from the gravity reticulation system will be received by a "communal" three-chamber septic tank with a minimum 24-hour design load capacity at the onsite treatment plant. The overflow (grey water) from the first chamber will gravitate to the second and third chambers of the communal septic tank.

Based on our preliminary calculations, the effective capacity of the "communal" septic tank which would serve the full development of the logistical services area shall be 26m³ or 26kl (approximate size of 5m x 5m x 1,8m deep depending on inlet depth).

Most of the bigger suspended solids will be contained and be broken down by anaerobic and aerobic action in the first chamber of the "communal' septic tank. The clearer effluent overflow from the third chamber will be pumped to the bioreactors. The sewage effluent will move through the media where aerobic bacteria in a submerged fixed-film will break down the organic matter to more stable levels with the addition of air (higher concentration of dissolved oxygen) supply under pressure.

The treated overflow from the bioreactor(s) will be discharged to the clarifier(s) where the sludge will be settled out, drained and be returned to the first chamber of the "communal' septic tank. The clear treated effluent from the top part in the clarifier will be conveyed to the chlorine contact tank to disinfect the clear treated effluent.

In order to keep the maintenance as simple as possible, the Etatron DLX series (wall mounted) & DLXB series (foot mounted) solenoid dosing pumps with the electronic flow sensor and level probe, will not be recommended to control the dosage of Chlorine in the contact tank. Instead of the solenoid driven dosing pump, an in-line chlorinator as developed by Klorman or Clearedge will be used to

supply chlorine under controlled conditions to the effluent in the contact tank. The inline chlorinator consists of a spring-loaded cartridge filled with slow release chlorine tablets. The clear effluent will flow over the lower part of the spring-loaded cartridge where the flow in the pipeline between the clarifier and the contact tank can be adjusted to control the contact area between the slow release chlorine pills and the effluent to release the correct dosage of chlorine to disinfect the effluent to the required standards. In order to address the concern about the required levels of free chlorine residual in the final effluent, it is recommended that the applicable chlorine test in the final effluent from the contact tank should be done initially on a daily basis and to adjust the flow over the inline chlorinator accordingly if necessary. The treated effluent will thereafter be directed to the maturation pond.

However, it is also recommended to design and construct a maturation pond which will also act as an *irrigation/ emergency retention ponding* system at the foul sewer batch plant. The irrigation/ emergency retention pond has to be designed and constructed to allow a minimum of 4 days retention time to ensure the *final effluent is free from any chlorine residual,* which could occur under isolated overdosing conditions. In case of extreme unforeseen package plant breakdowns, we recommend that the irrigation/ emergency retention pond system should also be designed to accommodate the inflow up to **15 days x ADWF** that can be re-circulated to the “communal” septic tank if necessary to limit the risk of possible contamination of underground water sources.

The irrigation/ emergency retention pond shall be constructed with a plastic-lined base covered with a 300mm clay layer to avoid percolation to lower lying ground layers. The approximate size of the maturation pond (irrigation/ emergency retention pond) proposed to cater for the full development of the logistical services area should be 21m x 21m x 0.86m deep (441m^2 /377m^3).

The grassed embankment areas (marked in purple) which will be irrigated with the treated effluent, is more than 11 400m² (1.1ha). Considering 2% losses due to evaporation, the irrigation rate has been calculated to be much *less than 3mm per calendar day* which is acceptable from an irrigation perspective. The irrigation of the grassed open spaces with the treated effluent should optimize the usage of water under post-development conditions.

It is also recommended to supply the batch plant with a mobile independent diesel generator in case of power failures.

In order to make 99,9% sure that fatty stuff and fine soil particles would not interfere with the effective working of the Clearedge Package Plant over the medium and long term, it has been recommended to design the communal septic tank with 3 chambers. This precautionary measure will limit the risk of blockages in the media of the bioreactors and also bring down the required Chemical Oxygen Demand in the effluent which is conveyed to the bioreactors.

In order to monitor the effective working of the Clearedge Package Plant system in combination with the irrigation/ emergency retention pond, it is recommended to have samples of the final treated water tested on a bi-weekly basis by the laboratory of the Nelson Mandela Bay Municipality: Port Elizabeth over the first 3 months or other independent laboratory as dictated by the Sundays River Valley Municipality.

The Applicant, or appointed representatives of the proposed development will be accountable for the effective maintenance of the on-site foul sewer treatment system. and must enter into a maintenance agreement (subject to the approval of the Sundays River Valley Municipality) with a competent contractor to maintain the on-site foul sewer treatment system.

The design proposal to treat and accommodate the foul sewer effluent generated under post-development conditions will prevent the pollution of ground or surface water and save water as far as practically possible.

12.7 RESOURCE PROTECTION AND WATER USE AUTHORISATION

In accordance with our best knowledge, it is essential to obtain the permission from The Department of Water and Sanitation (DWS) and/ or the LSRWUA regarding the following activities:

- On-site treatment of irrigation water for domestic purposes.
- Rain water collection activities e.g. roof-collected water tanks.

12.8 CONCLUSION

A cautious approach in the conceptual design of the roads and stormwater, sewer and water systems has been adopted.

In strict adherence to the detailed design and execution of earthworks, roads and wet services systems as indicated in this report, we are convinced that the proposed logistical services area of the agricultural development on Portion 7 of the Farm Scheepers Vlakte No. 98, Division Uitenhage, Eastern Cape, Addo, can be serviced effectively from a civil engineering perspective.

12.9 ANNEXURE A

12.9.1 Layout Drawings

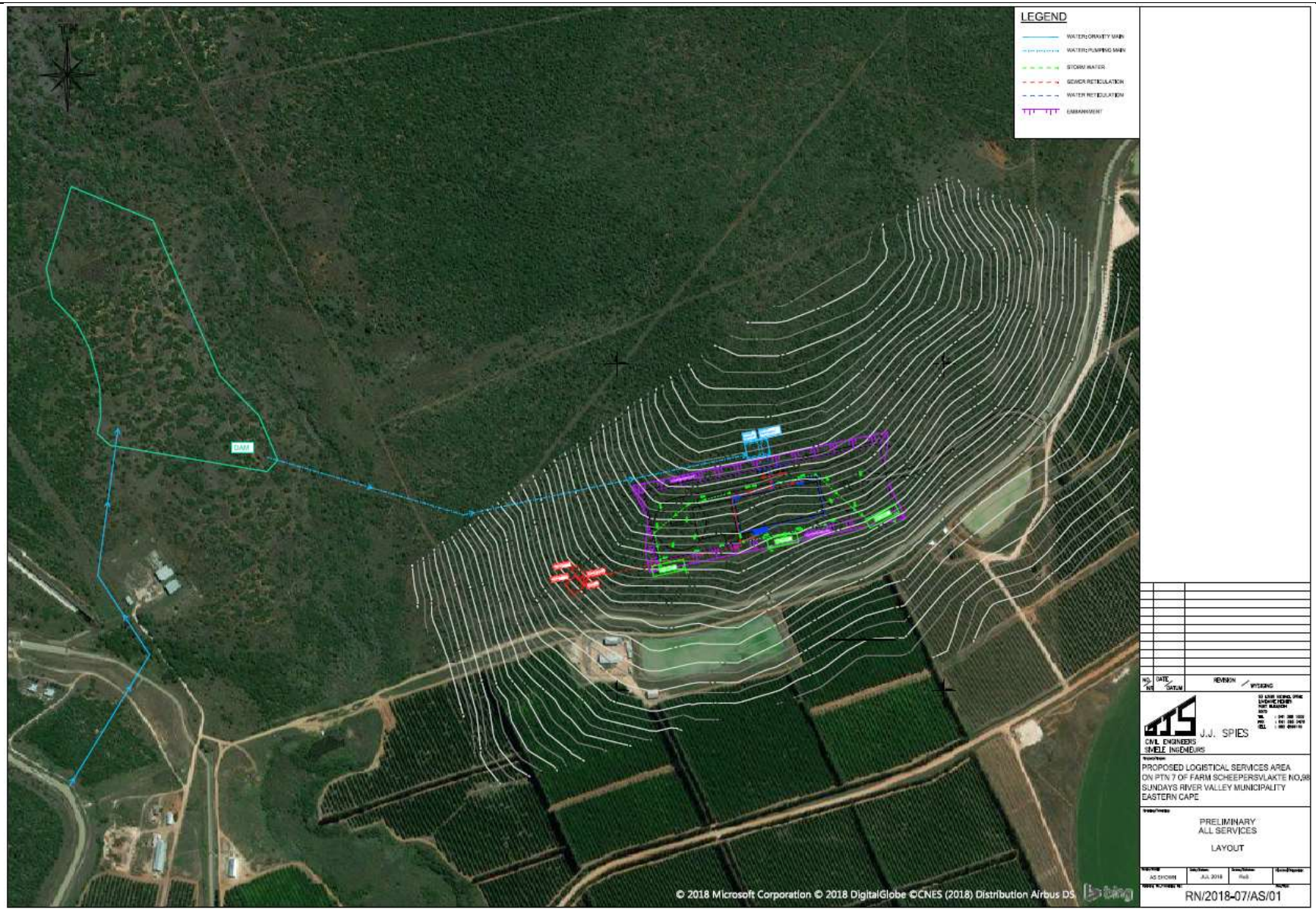

Figure 12.1: Drawing no. RN/2018-07/AS/01

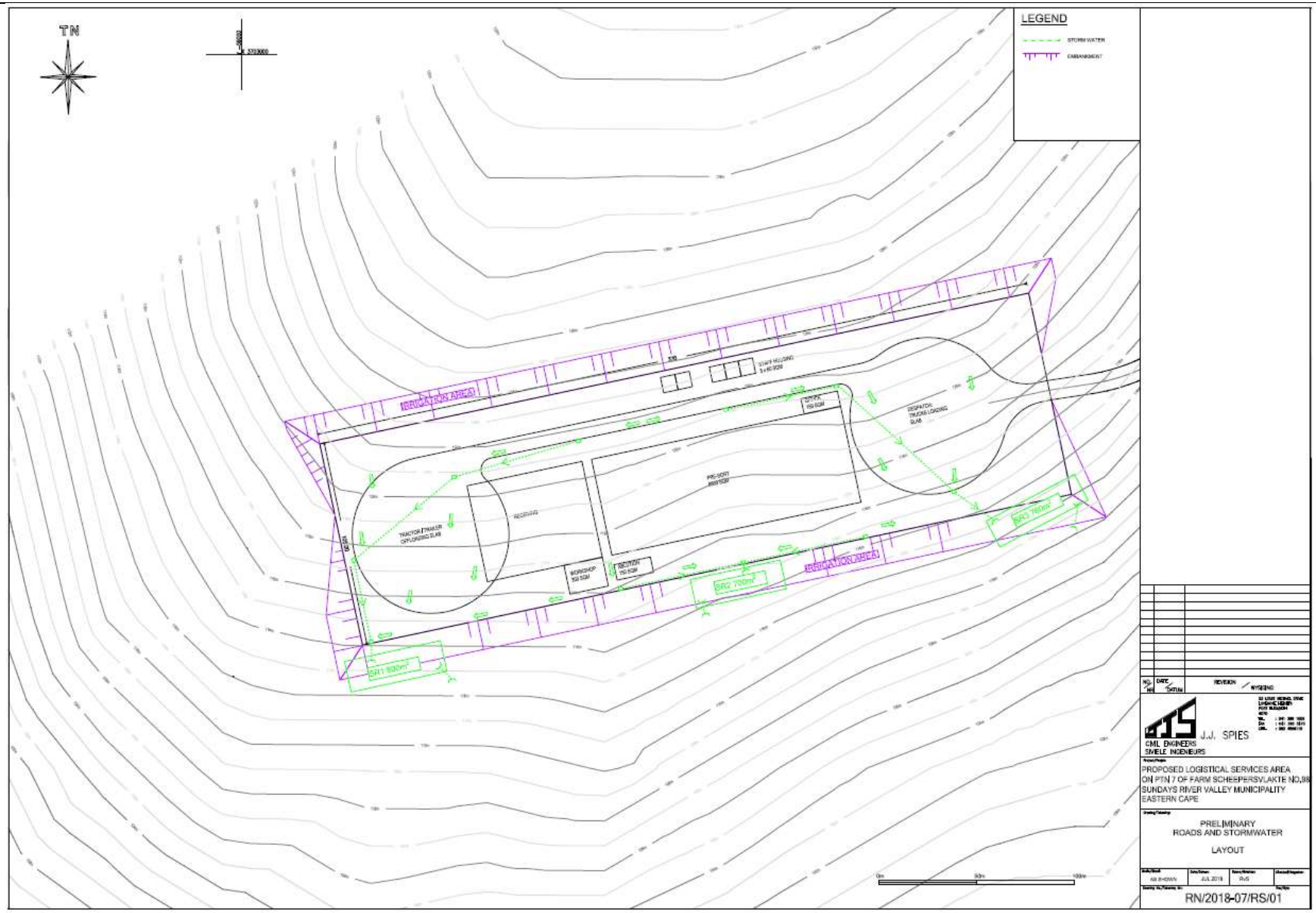

Figure 12.2: Drawing no. RN/2018-07/RS/01.

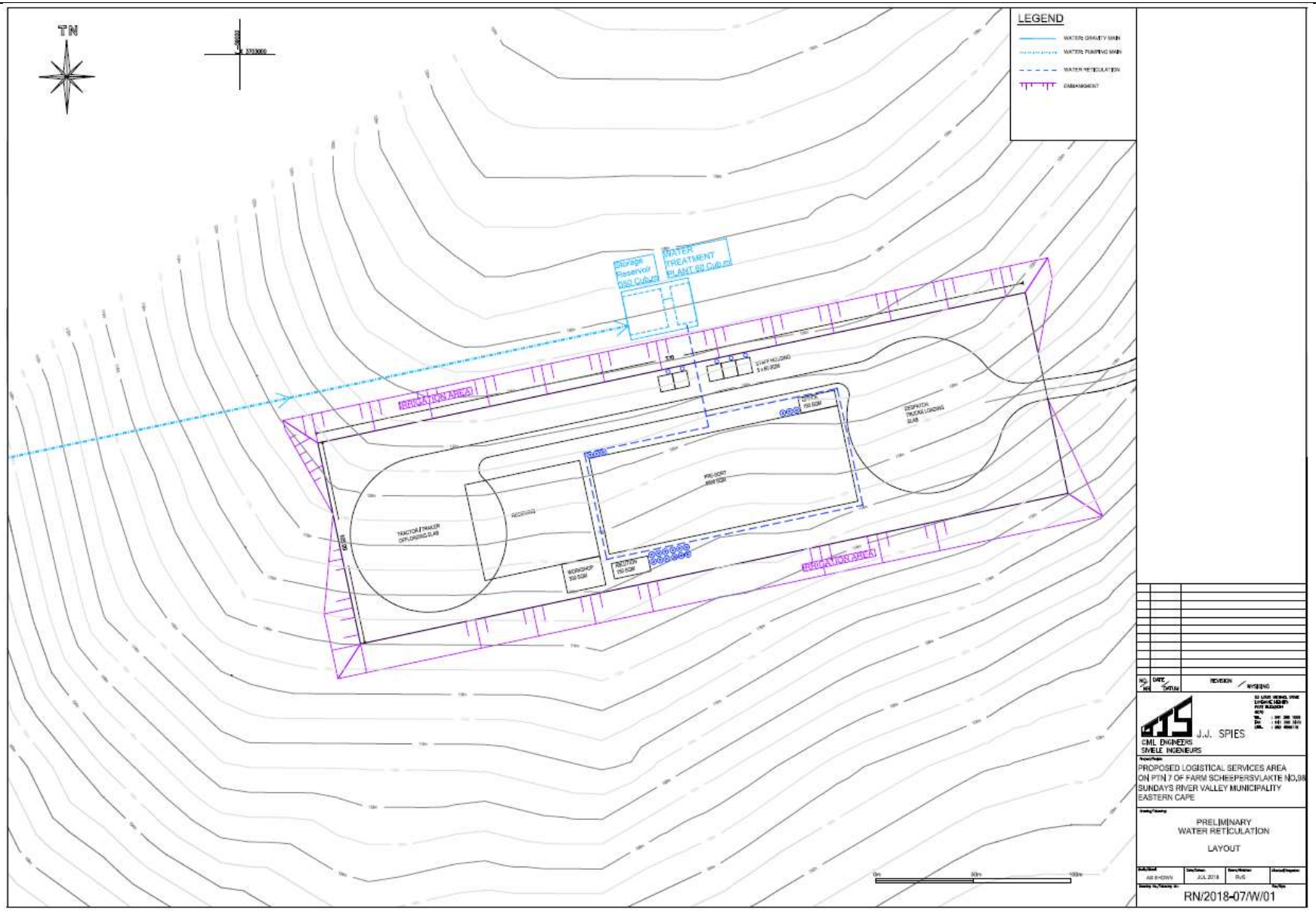

Figure 12.3: Drawing no. RN/2018-07/W/01.

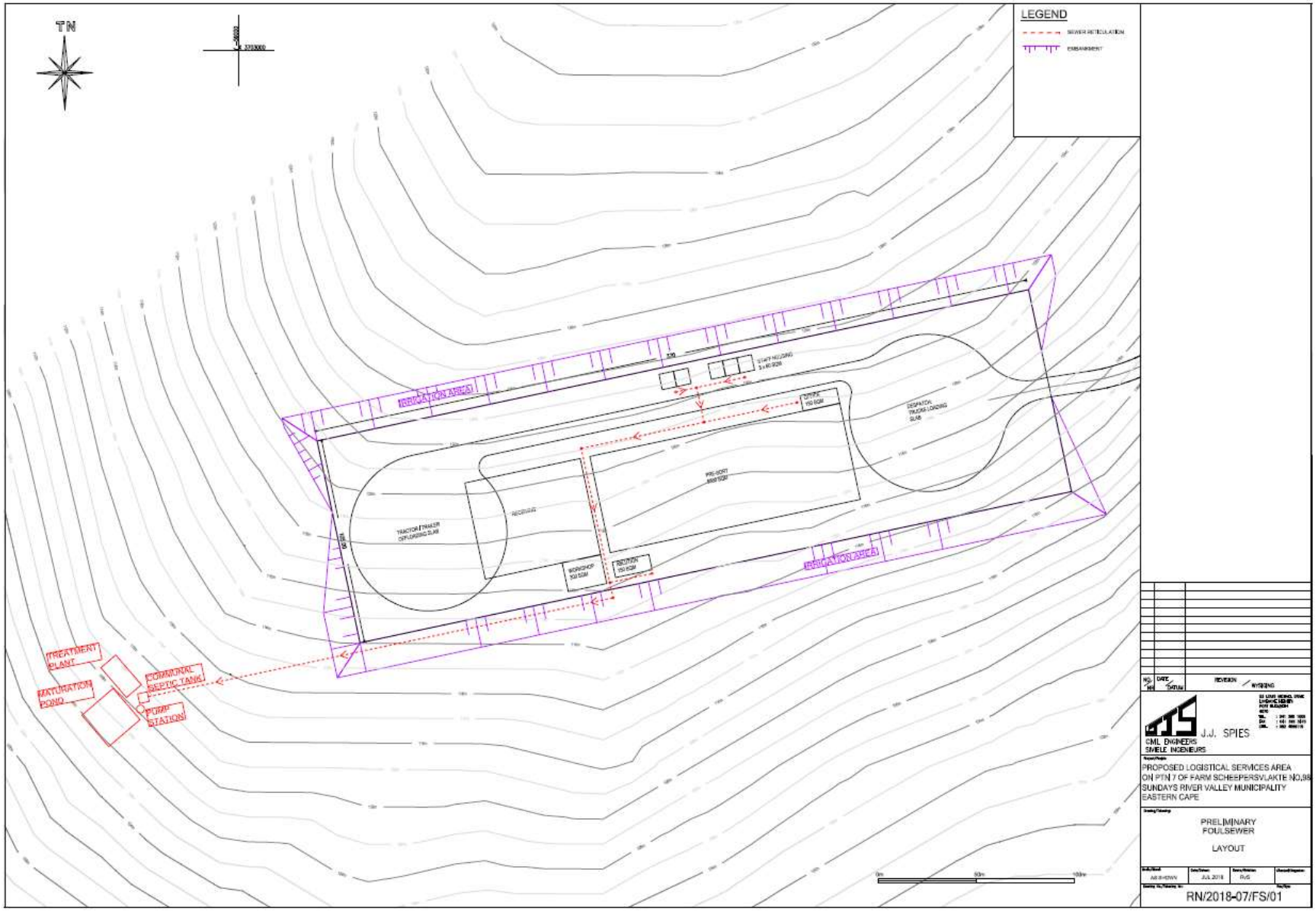

Figure 12.4: Drawing no. RN/2018-07/FS/01.

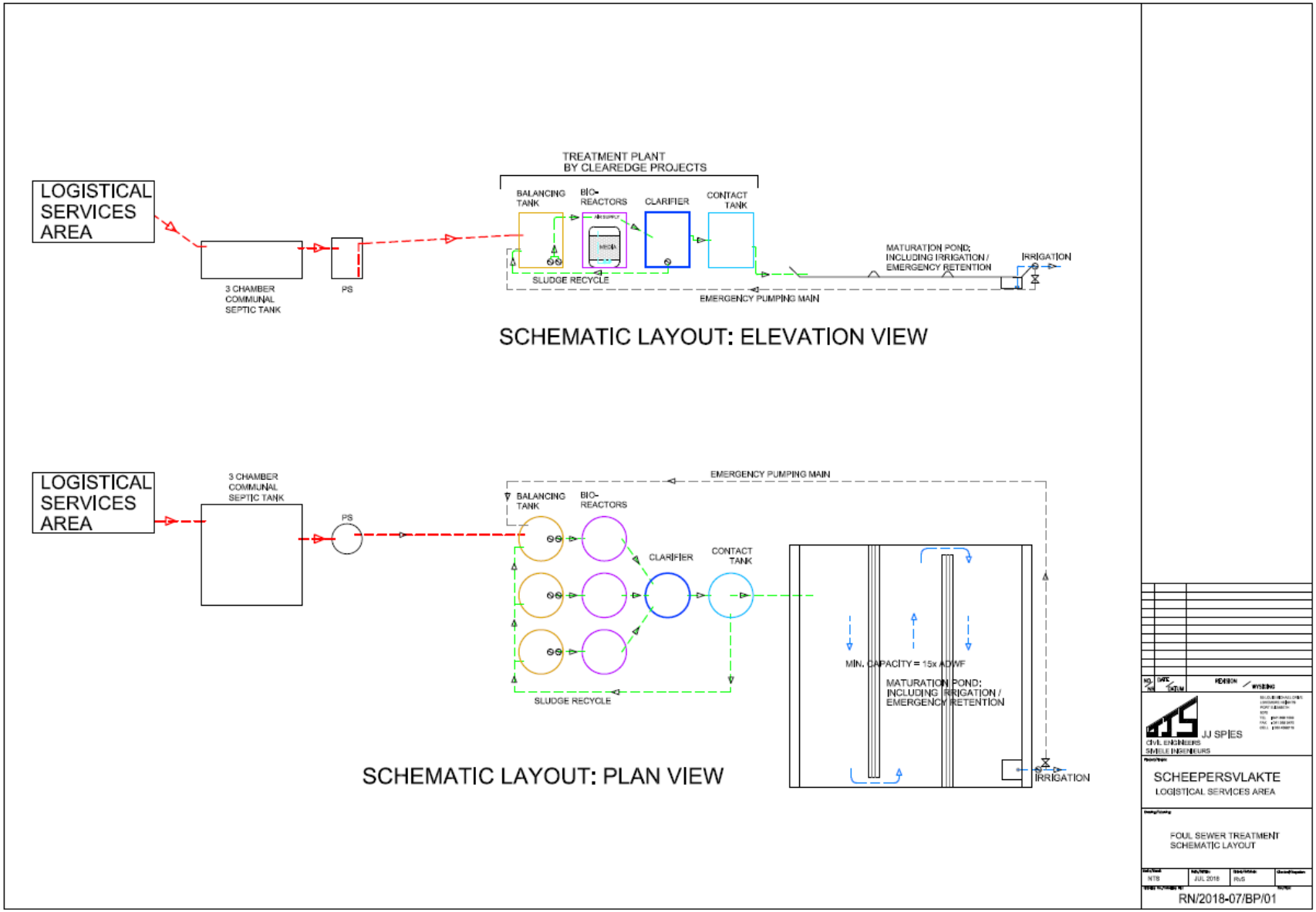

Figure 12.5: Drawing no. RN/2018-07/BP/01.