Meinhardt (QLD) Pty Ltd
A.B.N. 49 010 014 776

Level 1, 34 Thomas Drive
Chevron Island, Queensland 4217

T: +61 7 5528 6411

Meinhardtgroup.com

11 October 2021

Nambucca Valley Council
PO Box 177
Macksville NSW 2447

RE: Development of Seniors Living and Aged Care Facilities, 24 Coronation Road, Congarinni North, NSW
Site Sewer Management and Water Strategy updated – Rev B

Meinhardt Group was commissioned by Congarinni North Pty Ltd to prepare this Sewer Strategy Review to support the development of the proposed Seniors Living and Aged Care Facilities project at Congarinni North.

The main objective of this memo is to respond to Nambucca Valley Council's concerns and to provide supplementary information to the *Concept Design Report* and demonstrate the suitability of the proposed sewer management for the site and project. This report should be read in conjunction with Meinhardt's Infrastructure Service Assessment and Concept Design Report dated 31 May 2021.

Project Overview

The modified project comprises of a Two Storey Residential Care Facility with 75 beds, 271 self-care detached dwellings and other associated amenities and infrastructure (pools, bowls club, carparks, roads, parks, etc), all within a footprint of around 18 Ha. Current Masterplan is included in Appendix A.

Sewer Strategy Overview

Meinhardt's Infrastructure Service Assessment and Concept Design Report dated 31 May 2021, indicated two feasible options to manage sewer discharge. These are summarised below:

Option 1 – Site discharge through new Council owned sewer pump station at Coronation Road at the vicinity of the site and a new dedicated sewer rising main across the town to discharge into Macksville Sewer Treatment Plan. This option requires extensive amount works and possible the upgrade of the sewer treatment plant, Council has confirmed that this is not the preferred strategy.

Options 2 – On-site privately owned and operated sewer treatment system. Further explanation of this option is included in the sections below. Council has confirmed that this option is their preferred option and requested additional information that is addressed in this report.

Proposed Sewer Management Strategy

In accordance with current layout, it is estimated that the development will create a sewer demand of 955 Equivalent Persons. Given the site topography part of the sewer system will be divided into five catchments.

This will need to be considered when in detail design of the gravity mains, private pumps stations, rising main, Sewer treatment plant and the emergency storage. Refer to Appendix B Schematic Sewer Reticulation Plans.

Gravity Mains – Internal sewer reticulation will be privately owned and maintained. Design and construction will be in accordance with Nambucca Valley Council guidelines and industry standards and specifications. Five separate gravity main system are anticipated. Each catchment will discharge into a pump station.

Pump station – Internal pump stations will be privately owned, maintained and operated. Design and construction will be in accordance with the Sewerage Pumping Code of Australia and supplier standards. Each pump station will be provided of stand-by pumps, emergency pump-out points, alarms, remote controls, and emergency storage with three and a half (3.5) day storage capacity. Emergency storage requirement is further discussed in section below.

Sewer Rising mains – Internal rising mains will be privately owned and maintained. Design and construction will be in accordance with the Sewerage Pumping Code of Australia and supplier standards. It is anticipated that branch sewer rising mains will connected into a main rising line that will discharge into the balance tank at the sewer treatment plant.

Sewer Treatment Plant – The sewer treatment plant will be privately owned, maintained and operated. Effluent from the treatment plant will be Class A to allow safe reuse for irrigation and discharge of excess effluent into the environment as well as domestic use for toilet flashing.

For the purpose of this strategy, the proposed sewer treatment plant for the development is a Hydroflux Epco Roadtrain Ultra. Important to note that alternative on site sewer treatment plants could be considered at detail design stage provided they match or exceed Hydroflux's specifications as shown below. Refer to Appendix C for Hydroflux's proposal and auxiliary documentation.

- ✓ Average Dry Weather Treatment capacity = 171.9 m^3/day (this is 955 EP @ 180L/day/EP)
- ✓ Minimum Peak Dry Weather Treatment capacity = 212 m^3/day. This allows for additional capacity to manage wet weather conditions (rainfall and groundwater infiltration into gravity main)
- ✓ Balance tank size = 50 kL minimum
- ✓ Class A Effluent
- ✓ Modular to allow easy expansion for future growth

Effluent Disposal/Reuse Strategy – the sewer treatment plant is designed to treat 172m^3 of sewerage per day and sludge is 4% of sewage volume by dry weight. Therefore, the site must distribute 172m^3 x 0.96 = 165m^3 of effluent per 24 hour day.

Please note that effluent is Class A water

The effluent from the sewer treatment plant will be managed in the following way:

a. Reuse for toilet flushing, laundries and watering of gardens. A non-potable reticulation main will be provided throughout the development to maximise reuse of non-potable water and reduce potable water demands. Will be designed in safe and secure practice.

   The non-potable demand for toilet flushing will in the order of 30 l/EP/day, this equates to 28.6m^3 per day.

b. Reuse for irrigation of roads verges. Slow drip irrigation pipes along both sides of the roads will be provided. These pipes will be feed from the non-potable water reticulation main.

   The non-potable demand for slow drip irrigation of grassed verges is estimated at 2mm per m^2. The grassed verge is 10,125m^2 (3,375m road length x 3m width). Based on this the demand for irrigation of roads is 20.2m^3 per day.

c. Reuse for irrigation of parks and landscape areas throughout the site. Irrigation lines will be connected the non-potable water reticulation main for manual/automatic irrigation of landscape areas.

The non-potable demand for irrigation of landscape areas is estimated at 3mm per m^2. More than 11,050 m^2 of landscape areas (this excluding road verges, and buffer areas) will be provided throughout the development. Based on this the demand for landscape irrigation is 33,1m^3 /day.

d. Any excess sewer effluent will be disposed of through the implementation of absorption trenches. These absorption trenches will be dug and filled with rocks, sand and sandy soil. They should each be at least 100 m long and have at least 300mm diameter piping. Advise from Ecologist suggest that a 500m long absorption trench will be able to process between 30 to 50m^3/day. The design and construction of the trenches will be done as recommended by the ecologist report. Copy of this report is included in Appendix D for reference.

   Two large absorption trenches will be provided. A 700m long trench will be provided along the southern boundary. Another 425m absorption trench will be provided along the fire trail road to the west. Refer to Appendix B Schematic Sewer Reticulation Plans.

   It is anticipated these absorption trenches (1,125m total length) will have sufficient capacity to treat the remaining sewer effluent of 83.1m^3 per day.

Reticulation Pump Stations Emergency Storage – an emergency storage tank will be provided at each pump station. Each emergency storage tank will be sized to hold at least three and a half (3.5) days of dry weather sewer flows. It is considered that three and a half days storage at each pump station will provide sufficient time to complete any repairs at the pump station or at the treatment plant and is in align with general specifications.

In addition to the above, a water balance review was completed to investigate the efficiency of the proposed storage in managing excess wet weather sewer flows during wet weather events. The review used 24 years of historical rainfall information at Coffs Harbour Meteorological Station (BOM station number 590400), located at the east coast, 50 Km north of the site. This is the closest BOM meteorological station, and it is expected it has similar characteristics to Macksville.

The water balance showed that the three and a half (3.5) dry weather storage has sufficient capacity to fully contain assumed rainfall depended inflows equivalent to 1.0% of the catchment runoff.

Rainfall dependent inflows are caused by localised ponding of yard gully pits, illegal stormwater connections, and infiltration caused by defects in sewer pipes and structures.

Standard wet weather peak flow calculations in WSA14 indicate rainfall depended inflows are between 0.4 to 1.65% of the catchment runoff for low and high leakage severity impact (soils and network defects) respectively.

Based on the above and considering the proposed and future developments works will remain under the control of the residential care facility administrator, it is considered the 1% catchment inflow assumption is conservative.

Water balance calculations are included in Appendix E.

Response and clarification of Councils Queries (11 June 2021)

Questions raised by Nambucca Valley Council (NBC), responses by Paul Cobbin (PC) representative of Hydroflux epco (sewer treatment plant representative) and Meinhardt Engineers (ME).

NVC What is the design life of the plant?

PC 25 plus years

NVC How will it be practically staged to scale up with staging of the proposed development?

PC RoadTrain is design to be scalabe over time, clients leave space available adjacent the site for future development. The Ok Tedi Case study attached shows a site upgraded over fifteen years, is currently 37 years old and Hydroflux upgraded the site to modern compliance in 2020.

NVC How easily can it be upgraded / renewed?

PC Hydroflux RoadTrains are circular by design, in other words they are intended for renovation, renewal, relocation and refurbishment.

NVC What role does the supplier play in ongoing servicing and maintenance?

PC The Hydroflux RoadTrain can be serviced by a local plumber following the operation and maintenance manual provided, we are Sydney based for ease of access and the system is made from locally sourced products and skills readily available for the life-time of the system.

ME It is anticipated the residential care facility administrator will enter into a maintenance agreement with the pump supplier or accredited local subcontractor.

NVC What level of operational involvement is required by the development (how many man hours per day/who performs this role)?

PC One manhour per day from the on-site service technician to perform regular house keeping checks, removal of screenings and adjustment of the sludge bag in the skip to allow for the next day's sludge dewatering. Monitoring the chemical makeup system is another monitoring and management task.

ME As noted above, it is anticipated the residential care facility administrator will enter into a maintenance agreement with the pump supplier or accredited local subcontractor. They will be able to monitor (remotely) the status of the plant and coordinate on-site day to day maintenance duties.

NVC What are the licence requirements?

ME We have received advise from the Environmental Protection Authority confirming we do not need a licence to operate the proposed sewage treatment plant, as the process capacity is less than 750 kL per day.

NVC Who does the operator report to?

ME The facility administrator. A communication and monitoring service is available from Hydroflux to assist the operator.

NVC How will the private operator ensure adequate monitoring?

PC The system uses the HyConnect SCADA system with a Human-Machine Interface on the control panel on site and a mobile phone app on the operator's phone. There is also remote capability to monitor from the operator's site office computer and for Hydroflux to connect into the system for adhoc guidance.

ME It is in the interest of the residential care facility administrator to ensure all the facilities are in working order at all time.

NVC Who is responsible when something goes wrong with the infrastructure?

PC The system has a 12-month warranty from time of commissioning, after which time it is the site owner's responsibility to manage maintenance and repairs. However, the Epco

brand has been in operation since 1962 and has always supported it's clients when called upon. Hydroflux Utilities is the aftermarket chemical supply and spare parts business who's role it is to support clients after the project has commissioned into operation.

ME It is anticipated the residential care facility administrator will enter into a maintenance agreement with the pump supplier or accredited local subcontractor.

NVC What happens in the event of a failure in terms of storage and repair response time?

PC The system is designed with duty/ standby pump and blower arrangements throughout such that if one item fails, the system automatically switches to the alternate partner of the pair. The system does not fail if a sensor fails. It is recommended that all plants have generator power backup in the event of external power outages. The system has a fair amount of reserve capacity (hours during peak times) in the event of short-term stoppages. Finally, Hydroflux has it's main office in Sutherland in Sydney and to provide a "next day" response time.

ME The proposed sewer design strategy for the residential care facility is proposing to provide 3.5d day sewerage capacity (emergency storage) at the pump stations. This will allow sufficient time to complete repairs, maintenance and to arrange alternative measures if required. Refer to the initial section of the report for details.

NVC Where is the sludge planned to be disposed? The local tip may not accept it.

PC Hydroflux Epco suggest that to address the concern relating to disposal of dry cake waste, we will switch out the sludge dewatering solution for a sludge thickening solution. Sludge thickening involves increasing the thickness of the liquid sludge which ultimately reduces the liquid carting volume.

Raw liquid sludge volume for the proposed STP is 6m^3/day, however, though application of a sludge thickening process, the RoadTrain system will reduce output and required cartage to 6m^3/week.

A local mobile pumping contractor will attend site once per week (or otherwise when necessary, via arrangement) to remove the thickened liquid sludge generated for disposal to the Kempsey Sewage Treatment Plant. All Clean Septic Pty Ltd of Macksville has a 10m^3 capacity pump truck and regularly performs sludge carting in the region, and has confirmed it is able to cart the thickened liquid sludge to the Kempsey STP. All Clean Septic is registered with Nambucca Council and adjacent LGAs. The company experience includes truck stops and service stations, Council sites and State government contracts such as schools and emergency service sites, including work as a licensed plumbing contractor for same.

MC The residential care facilities administrator would have to enter into a disposal agreement with an approved facility and a third-party transport contractor.

NVC What is the required irrigation area for the maximum loading taking into account slope, water table, soil type and rainfall? Calculations required.

PC The site is designed to treat 175m^3 of sewage per day and sludge is 4% of sewage volume by dry weight. Therefore, the site must distribute 170,000 x 0.96 = 168.8m^3 of effluent per 24 hour day.

ME The quality of the effluent (Class A) produced by the proposed sewer treatment plant is suitable for irrigation as well as domestic use. Refer to the previous sections of the report for additional details on the proposed sewer effluent management strategy.

NVC Where these irrigation or evapotranspiration areas will be. Council will require a concept plan which shows these areas and any required reserve area.

ME Refer to the previous sections of the report for additional details on the proposed sewer effluent management strategy.

NVC How is the volume of treated water irrigated during periods of extended wet weather?

PC Standard STP design accounts for 3 x average dry weather flow (ADWF) capacity through the plant. This condition is referred to a peak wet weather flow (PWWF).

ME The proposed sewer management strategy for the site includes emergency storage tanks at the pump station. These tanks (with a combined volume of 3.5 days of dry weather flow) buffers wet weather flows to allow the sewer treatment plant to catch up without exceeding the treatment capacity. Refer to beginning of the report for further details.

NVC How is the operation and emergency response to the plant affected by flood events?

ME The plant will be located above the 1% AEP flood line. The plant will not be affected by flooding of any source. Refer to Appendix B for Schematic Sewer Reticulation Plans.

NVC What are the physical dimensions of the plant including all ancillary tanks, access and fencing required to service the entire development?

PC The overall STP site footprint is 25 meters x 14.5m

ME Additional details are shown on the Schematic Sewer Reticulation Plans included in Appendix B.

NVC What are the visual impacts of the plant? Plans required.

PC See attached case studies for concepts relating to amenity. It would be best to apply some landscaping to the site. The plant itself is approximately 3m tall. Often a soil mound of 1 or two meters surrounding the site with bushy shrub like natives such as bottle brush and lilly pilly on the mound are typical of coastal sites.

ME The proposed plant is located more than 4m below ground level of the closest residential unit. Refer to Schematic Sewer Reticulation Plans included in Appendix B.

NVC What are the odour impacts of the plant?

PC The system will be equipped with odour control. The odour control system comprises aluminium covers over the tanks where appropriate, pipework and vacuum blower to remove the odour containing air and a carbon filtration odour scrubbing unit.

ME In addition to the above, the lant is located more than 70m away from the closest residential unit.

NVC Are there any examples of a plant being used in the same application i.e. coastal residential development of this size? Resorts / mining are a bit different in that they have the resources to put into operation and maintenance.

PC On the contrary. Resorts and mines tend to ignore their plants because it's just that black box at the back end of the site. Miners focus on digging things out of the ground and resorts focus on guests. We have often been to mining clients who don't know where their existing STP is on their site, only to find it chugging along hidden out of site. We find retirement villages and similar small sites tend to look after their plant's better because there is a dedicated staff member. 140+ installation list attached.

NVC The scale of the development is not insignificant. The privately operated plant would service a large number of dwellings and an aged care facility. What is the annual

operating cost and how will the aged care facility provide the technical, financial and organisational capacity to operate, maintain and plan for renewal of the plant?

PC The onsite maintenance engineer would adopt operation of the plant as part of their regular duties. The cost to operate the plant is approximately $44,000 Annually excluding operator, the majority of which is in chemical consumption.

NVC What is the proposed arrangement should, for whatever reason, the operator of the site only partially complete development or become insolvent and abandon the completed site?

PC The plant can be on-sold. We have seen a number of these incidents over time. However the site will require an STP for the life of the site whatever the reuse of the buildings. Hydroflux would continue to offer support to future owners of the site whom-ever that may be. We have experienced such conditions during mergers and acquisitions of sites whereby the new owner requires an update and introduction to the asset as well as refresher training on-site. In 60 plus years of Epco plants on sites we have seen most contingencies over time.

Water Supply Strategy Clarification

Water supply strategy for the development is as described on sections 7 of Meinhardt's Infrastructure Service Assessment and Concept Design Report dated 31 May 2021. Further investigation will be required to confirm if booster pumps and/or onsite storage reservoir will be required to provide adequate level of service to the development.

Indicative locations for reservoir and booster pumps are shown in Water Reticulation Layout Plan Sheet 1 of 2 (SK7434) included in Attachment B.

We trust this report (and supplementary documentation) provides Nambucca Valley Council sufficient information to demonstrate the onsite sewer management strategy proposed for the Residential Care Facilities project is acceptable and is in line with State and National guidelines and industry practices.

Should you wish to discuss further any aspect related to this report, please do not hesitate to contact us.

Yours faithfully

MEINHARDT URBAN

Juan Castro (RPEQ 19428)

Associate Director – Civil

Encl. Appendix A: Development Masterplan Layout Plan

Appendix B: Schematic Sewer and Water Reticulation Plans

Appendix C: Hydroflux epco – Sewer Treatment Plan Proposal

Appendix D: Ecologist Report - Methodologies for waste water (gray water) removal at Coronation Drive, North Congarinni, via Macksville, NSW

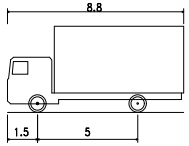
Appendix E: Wet Weather Flow / Emergency Storage Water balance

Appendix A: Development Masterplan Layout Plan

Appendix B: Schematic Sewer and Water Reticulation Plans

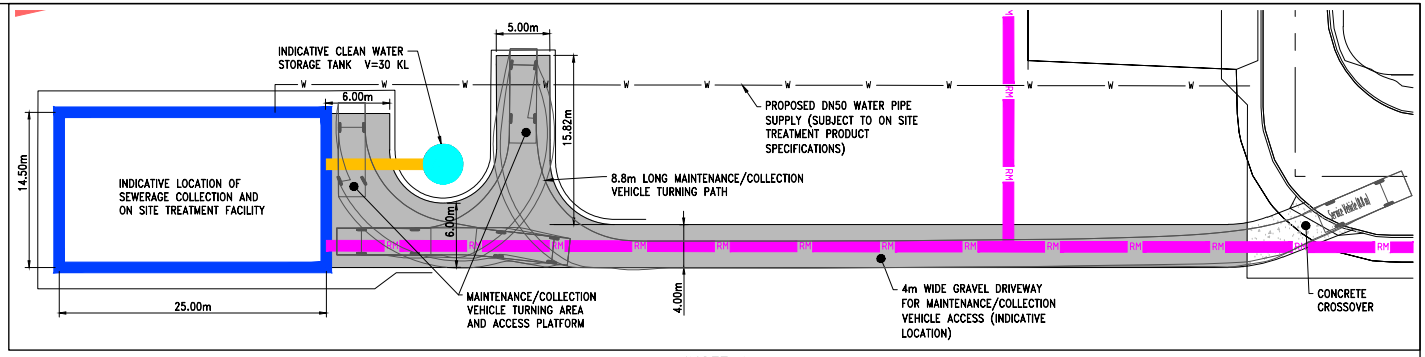
LEGEND

- FINISHED SURFACE CONTOURS
- NOMINAL KERB LINE
- EXISTING SEWER
- ø150 GRAVITY SEWER
- ø150 RISING MAIN
- RETAINING WALL
- EXISTING STORMWATER
- EXISTING WATER
- EXISTING ELECTRICAL
- PMF FLOOD LEVEL RL10.00 LINE
- LIMIT OF WORKS
- ABSORPTION TRENCH

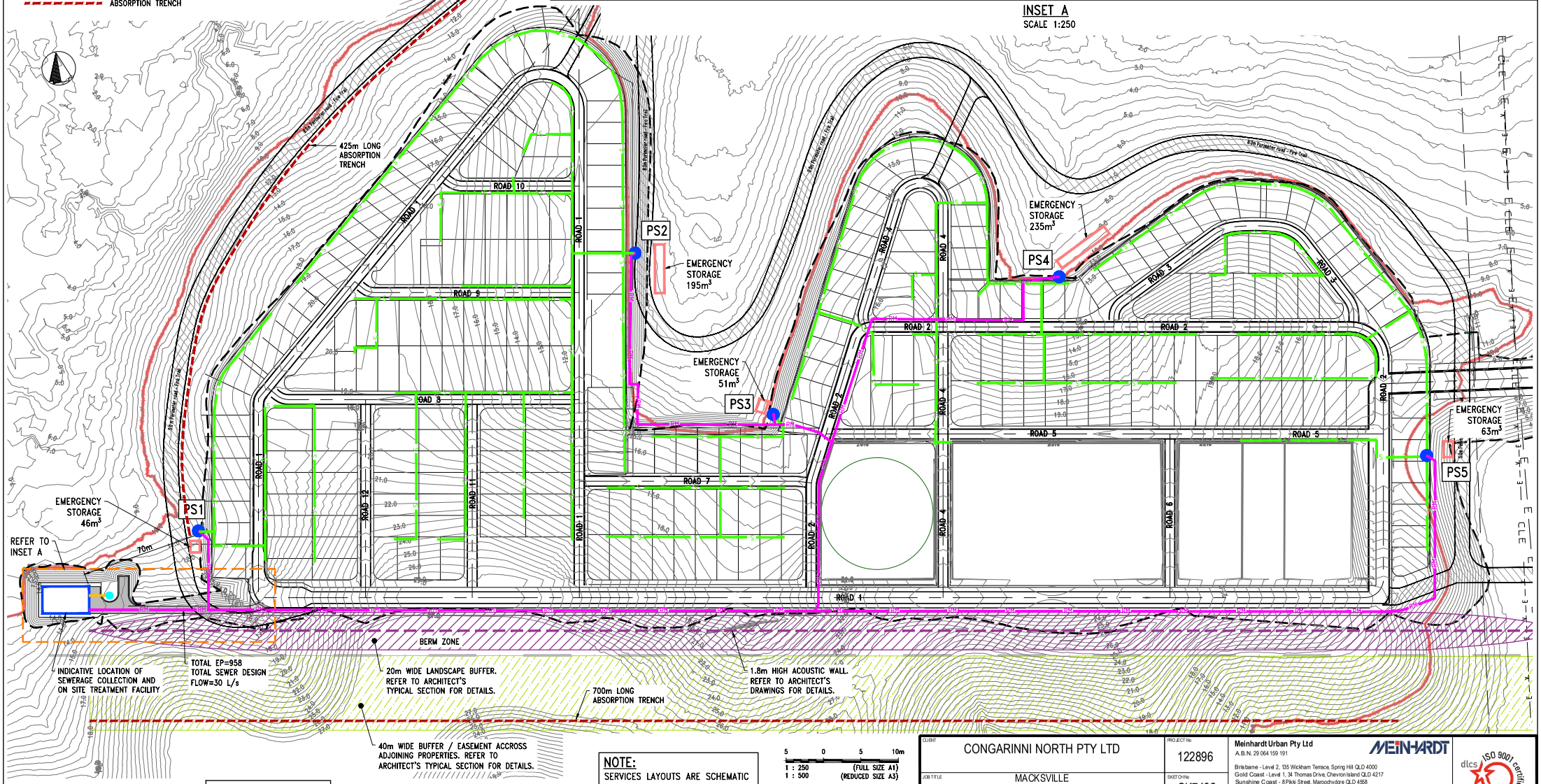


Service Vehicle (8.8 m)

Overall Length	8.800m
Overall Width	2.500m
Overall Body Height	4.300m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	12.500m



INSET A
SCALE 1:250



UPDATED ROAD/LOT LAYOUT SUBJECT TO ARCHITECT'S AMENDED LAYOUT DESIGN

NOTE:
SERVICES LAYOUTS ARE SCHEMATIC ONLY AND SUBJECT TO DETAILED DESIGN AND AUTHORITY APPROVALS

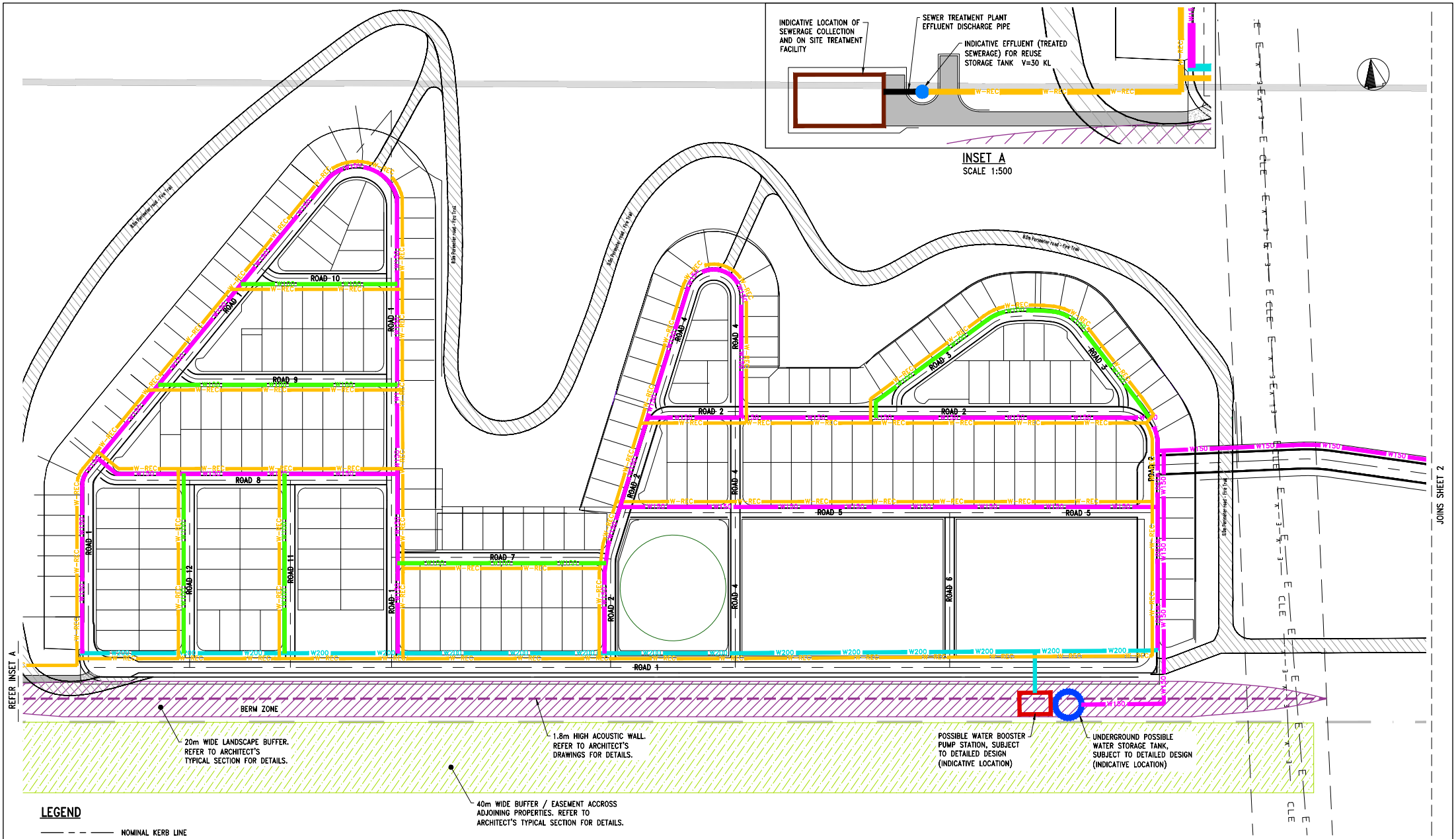
5 0 5 10m
1 : 250 (FULL SIZE A1)
1 : 500 (REDUCED SIZE A3)

10 0 10 20 30 40 50m
1 : 1000 (FULL SIZE A1)
1 : 2000 (REDUCED SIZE A3)

CLIENT: CONGARINNI NORTH PTY LTD
PROJECT No: 122896
JOB TITLE: MACKSVILLE
24 CORONATION ROAD CONGARINNI NRTH
SKETCH No: SK7432
DRAWING TITLE: SEWERAGE RETICULATION LAYOUT SHEET 1 OF 2
REV: F
DATE: 07/10/2021

Meinhardt Urban Pty Ltd
A.B.N. 29 064 159 191
Brisbane - Level 2, 135 Wickham Terrace, Spring Hill QLD 4000
Gold Coast - Level 1, 34 Thomas Drive, Chevron Island QLD 4217
Sunshine Coast - 8 Pikki Street, Marcoochydore QLD 4558
Postal PO Box 2293, Southport QLD 4215
T: +61 7 5528 6411
F: +61 7 5528 6422
info@meinhardgroup.com
http://www.meinhardgroup.com

MEINHARDT
dlcs ISO 9001 certified



LEGEND

- NOMINAL KERB LINE
- W200 — ø200 WATER MAIN
- W150 — ø150 WATER MAIN
- W100 — ø100 WATER MAIN
- W-REC — ø100 RECYCLED WATER MAIN
- RETAINING WALL
- S — S — EXISTING SEWER
- SW — SW — EXISTING STORMWATER
- W — W — EXISTING WATER
- E — E — E — EXISTING ELECTRICAL

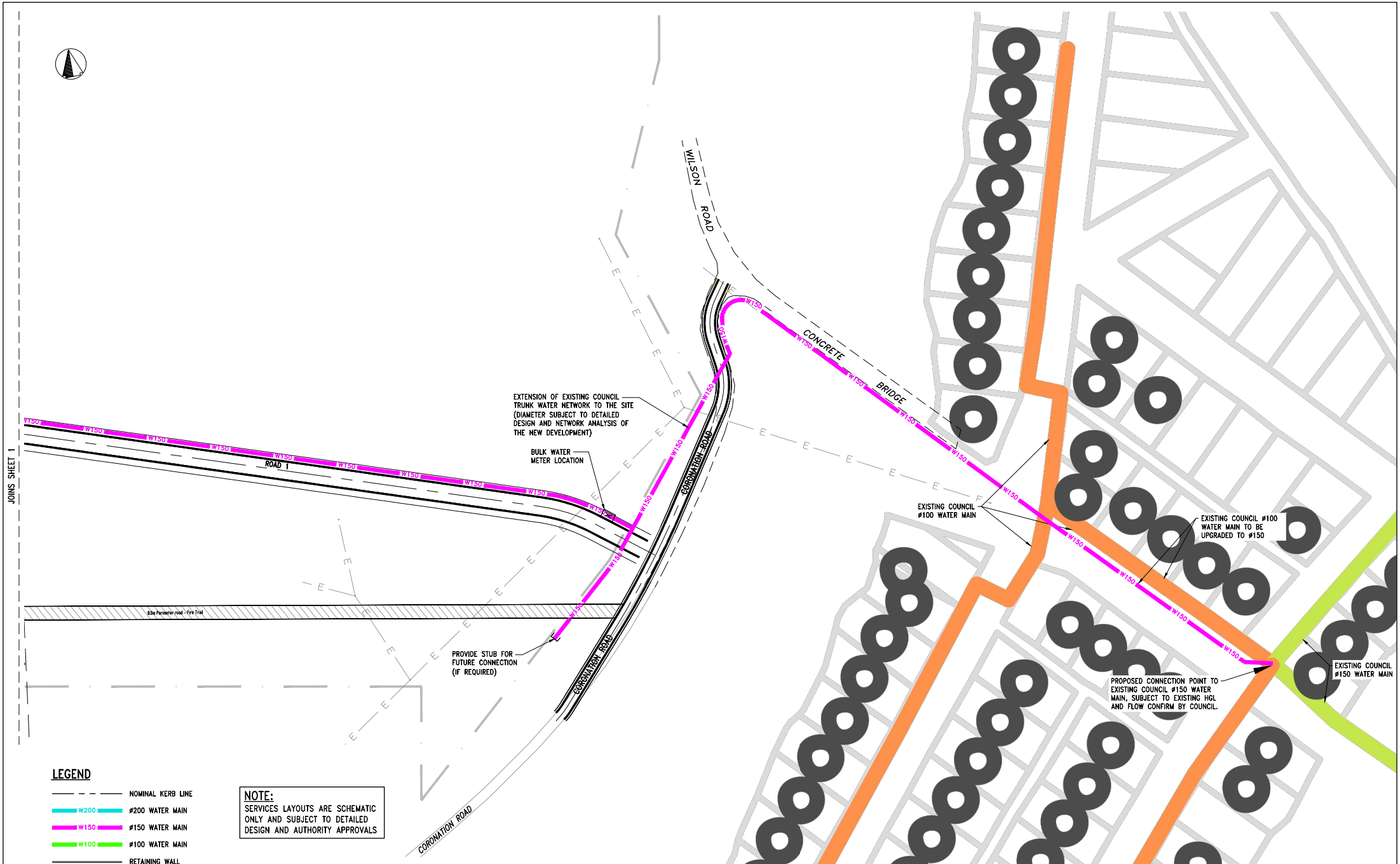
NOTE:
SERVICES LAYOUTS ARE SCHEMATIC ONLY AND SUBJECT TO DETAILED DESIGN AND AUTHORITY APPROVALS

UPDATED ROAD/LOT LAYOUT SUBJECT TO ARCHITECT'S AMENDED LAYOUT DESIGN

10 0 10 20 30 40 50m
1 : 1000 (FULL SIZE A1)
1 : 2000 (REDUCED SIZE A3)

CLIENT	CONGARINNI NORTH PTY LTD
JOB TITLE	MACKSVILLE 24 CORONATION ROAD CONGARINNI NRTH
DRAWING TITLE	WATER RETICULATION LAYOUT SHEET 1 OF 2
PROJECT No	122896
SKETCH No	SK7434
REV	C
DATE	07/10/2021

Meinhardt Urban Pty Ltd
A.B.N. 29 064 159 191
Brisbane - Level 2, 135 Wickham Terrace, Spring Hill QLD 4000
Gold Coast - Level 1, 34 Thomas Drive, Chevron Island QLD 4217
Sunshine Coast - 8 Pikki Street, Maroochydore QLD 4558
Postal PO Box 2293, Southport QLD 4215
T: +61 7 5528 6411
F: +61 7 5528 6422
info@meinhardgroup.com
http://www.meinhardgroup.com



LEGEND

- NOMINAL KERB LINE
- W200 — ø200 WATER MAIN
- W150 — ø150 WATER MAIN
- W100 — ø100 WATER MAIN
- RETAINING WALL
- -S---S--- EXISTING SEWER
- -SW---SW--- EXISTING STORMWATER
- -W---W--- EXISTING WATER
- —E—E—E— EXISTING ELECTRICAL
- LIMIT OF WORKS

NOTE:
SERVICES LAYOUTS ARE SCHEMATIC ONLY AND SUBJECT TO DETAILED DESIGN AND AUTHORITY APPROVALS

NOTE:
PART OF THIS DRAWING IS REPRODUCED FROM "NAMBUCCA SHIRE COUNCIL – NAMBUCCA WATER SERVICING STRATEGY, EXISTING & FUTURE SYSYTEM ANALYSIS, DRAFT – MAY 2014, PROJECT No: 3882, DRAWING EXHIBIT 3C, FILENAME: Ex –03", WITH INFORMATION ADDED BY MEINHARDT.

10 0 10 20 30 40 50m
1 : 1000 (FULL SIZE A1)
1 : 2000 (REDUCED SIZE A3)

CLIENT: CONGARINNI NORTH PTY LTD		PROJECT No: 122896	Meinhardt Urban Pty Ltd A.B.N. 29 064 159 191 Brisbane - Level 2, 135 Wickham Terrace, Spring Hill QLD 4000 Gold Coast - Level 1, 34 Thomas Drive, Chevron Island QLD 4217 Sunshine Coast - 8 Pikki Street, Maroochydore QLD 4558 Postal PO Box 2293, Southport QLD 4215 T: +61 7 5528 6411 F: +61 7 5528 6422 info@meinhardtgroup.com http://www.meinhardtgroup.com © Copyright
JOB TITLE: MACKSVILLE 24 CORONATION ROAD CONGARINNI NRTH		SKETCH No: SK7435	
DRAWING TITLE: WATER RETICULATION LAYOUT SHEET 2 OF 2		REV: C DATE: 07/10/2021	

Appendix C: Hydroflux epco – Sewer Treatment Plan Proposal

Hydroflux Epco Pty Ltd
Level 26, 44 Market Street
Sydney, NSW 2000
t: +61 2 9089 8833
f: +61 2 9089 8830

1st July 2021

Meinhardt Group

Attention: Johann Moutan
By Email: Johann.Mouton@meinhardtgroup.com

Re: Nambucca Retirement Village STP

Hi Johann,

On the following pages you will find details around the Hydroflux proposal for the sewage treatment plant (STP) needs of the Nambucca retirement village site.

Section three is a specific response section answering council's questions from early June,

This proposal is budgetary by nature as you are currently in DA round with council. We look forward to providing further detail such as formal 3D proposed site layouts when the project progresses to further rounds.

I am happy to do a formal presentation to yourself and or council at such time as you consider the opportunity appropriate.

I look forward to talking to you further about this opportunity.

Best Regards,

Paul Cobbin | General Manager Epco Products
Hydroflux Epco Pty Ltd

HYDROFLUX epco

Sydney | Melbourne | Brisbane | Portsmouth | Suva | Auckland

2021
PROJECT PROPOSAL

CONTENTS

1 PROPOSAL SUMMARY

This budget proposal is for the design, manufacture and supply of a 175m^3/d packaged sewage plant capable of treating sewage from the Nambucca Retirement village.

The Hydroflux Epco Roadtrain® package plant range has been in operation in 140+ installations across 7 countries since 1966. In every instance the robust nature of the Hydroflux Epco package plant has performed above expectation over a sustainable period of time.

Clients can be assured that our team provides the highest level of package plant technical expertise within Australia and PNG, from design, fabrication, sizing, commissioning and refurbishment.

The entire system is fully fabricated in Australia. In the case of this project Brisbane will be the fabrication location.

2 ROADTRAIN BENEFITS

The EPCO packaged Roadtrain provides a number of process and design advantages, these are summarised as follows:

- **Large Installation Base** — Over 140 Hydroflux Epco Roadtrain® package plants are in operation in municipal and industrial wastewater treatment plants. The business has 50+ years expertise in package plant design.
- **Robust Configuration** — Roadtrain® is specifically designed for remote and regional location sites – typically mine sites, resorts and small rural communities.
- **Tank Design** — The range includes several configurations in bolted or welded design.
- **Modular** — Allows simple expansion of the treatment facility for future growth
- **Adaptable** — Able to be configured for the treatment process most applicable to the project at hand.
- **Pellet Chlorine System** — Simple maintenance free chlorination system. Other types can be offered if required (liquid/gas chlorine or UV)
- **Material of Construction** — A painted mild steel construction for robustness. It has a life expectancy in excess of 30 years with several examples exceeding 35 years.

  Ok Tedi case study attached show sustainable long term application in harsh conditions.

3 Council Questions

The following is a series of responses to council's original queries on 11/6/2021. All these questions are provide within this document but have been answered directly in this section as well.

- What is the design life of the plant?
  - 25 plus years

- How will it be practically staged to scale up with staging of the proposed development?
  - RoadTrain is design to be scalabe over time, clients leave space available adjacent the site for future development. The Ok Tedi Case study attached shows a site upgraded over fifteen years, is currently 37 years old and Hydroflux upgraded the site to modern compliance in 2020.

- How easily can it be upgraded / renewed?
  - Hydroflux RoadTrains are circular by design, in other words they are intended for renovation, renewal, relocation and refurbishment.

- What role does the supplier play in ongoing servicing and maintenance?
  - The Hydroflux RoadTrain can be serviced by a local plumber following the operation and maintenance manual provided, we are Sydney based for ease of access and the system is made from locally sourced products and skills readily available for the life-time of the system.

- What level of operational involvement is required by the development (how many man hours per day/ who performs this role)?
  - One manhour per day from the on-site service technician to perform regular house keeping checks, removal of screenings and adjustment of the sludge bag in the skip to allow for the next day's sludge dewatering. Monitoring the chemical makeup system is another monitoring and management task.

- What are the licence requirements?
  - The site owner is required to hold a discharge license to the discharge level intended approved for the site by the environmental protection agency of the state jurisdiction.

- Who does the operator report to?
  - The site owner.
  - A communication and monitoring service is available from Hydroflux to assist the operator.

- How will the private operator ensure adequate monitoring?
  - The system uses the HyConnect SCADA system with a Human-Machine Interface on the control panel on site and a mobile phone app on the operator's phone. There is also remote capability to monitor from the operator's site office computer and for Hydroflux to connect into the system for adhoc guidance.

- Who is responsible when something goes wrong with the infrastructure?
    - The system has a 12-month warranty from time of commissioning, after which time it is the site owner's responsibility to manage maintenance and repairs. However, the Epco brand has been in operation since 1962 and has always supported it's clients when called upon. Hydroflux Utilities is the aftermarket chemical supply and spare parts business who's role it is to support clients after the project has commissioned into operation.

- What happens in the event of a failure in terms of storage and repair response time?
    - The system is designed with duty/ standby pump and blower arrangements throughout such that if one item fails, the system automatically switches to the alternate partner of the pair. The system does not fail if a sensor fails. It is recommended that all plants have generator power backup in the event of external power outages. The system has a fair amount of reserve capacity (hours during peak times) in the event of short-term stoppages. Finally, Hydroflux has it's main office in Sutherland in Sydney and to provide a "next day" response time.

- Where is the sludge planned to be disposed? The local tip may not accept it.
    - The Hydroflux RoadTrain system has sludge dewatering and bagging (big continuous sausage) for collecting the daily volume of 80 kg of dewatered sludge extruding from the process on a 24-hour basis. The sludge sausage will be loaded into a skip daily and is to be disposed of off-site once a week or fortnight in a skip. The sludge is termed to be "dry cake" with a moisture content of around 20% by volume after the bagging process. The disposal of such sludge is the responsibility of the site owner.

- What is the required irrigation area for the maximum loading taking into account slope, water table, soil type and rainfall? Calculations required.
    - The site is designed to treat 175m^3 of sewage per day and sludge is 4% of sewage volume by dry weight. Therefore, the site must distribute 175,000 x 0.96 = 168.8m^3 of effluent per 24 hour day. Irrigation design by others.

- Where these irrigation or evapotranspiration areas will be. Council will require a concept plan which shows these areas and any required reserve area.
    - Deferred to others.

- How is the volume of treated water irrigated during periods of extended wet weather?
    - Standard STP design accounts for 3 x average dry weather flow (ADWF) capacity through the plant. This condition is referred to a peak wet weather flow (PWWF). Distribution of the increased flow is by others.

- How is the operation and emergency response to the plant affected by flood events?
    - It is best to place the system above the 100 year flood level.

- What are the physical dimensions of the plant including all ancillary tanks, access and fencing required to service the entire development?
    - The overall STP site footprint is 25 meters x 14.5m

- What are the visual impacts of the plant? Plans required. –
    - See attached case studies for concepts relating to amenity. It would be best to apply some landscaping to the site. The plant itself is approximately 3m tall. Often a soil mound of 1 or two meters surrounding the site with bushy shrub like natives such as bottle brush and lilly pilly on the mound are typical of coastal sites.

- What are the odour impacts of the plant?
    - The system will be equipped with odour control. The odour control system comprises aluminium covers over the tanks where appropriate, pipework and vacuum blower to remove the odour containing air and a carbon filtration odour scrubbing unit.
    - Are there any examples of a plant being used in the same application i.e. coastal residential development of this size? Resorts / mining are a bit different in that they have the resources to put into operation and maintenance. On the contrary. Resorts and mines tend to ignore their plants because it's just that black box at the back end of the site. Miners focus on digging things out of the ground and resorts focus on guests. We have often been to mining clients who don't know where their existing STP is on their site, only to find it chugging along hidden out of site. We find retirement villages and similar small sites tend to look after their plant's better because there is a dedicated staff member. 140+ installation list attached.

- The scale of the development is not insignificant. The privately operated plant would service a large number of dwellings and an aged care facility. What is the annual operating cost and how will the aged care facility provide the technical, financial and organisational capacity to operate, maintain and plan for renewal of the plant?
    - The onsite maintenance engineer would adopt operation of the plant as part of their regular duties. The cost to operate the plant is approximately $44,000, the majority of which is in chemical consumption

- What is the proposed arrangement should, for whatever reason, the operator of the site only partially complete development or become insolvent and abandon the completed site?

    - The plant can be on-sold. We have seen a number of these incidents over time. How-ever the site will require an STP for the life of the site whatever the reuse of the buildings. Hydroflux would continue to offer support to future owners of the site whom-ever that may be. We have experienced such conditions during mergers and acquisitions of sites where-by the new owner requires an update and introduction to the asset as well as refresher training on-site. In 60 plus years of Epco plants on sites we have seen most contingencies over time.

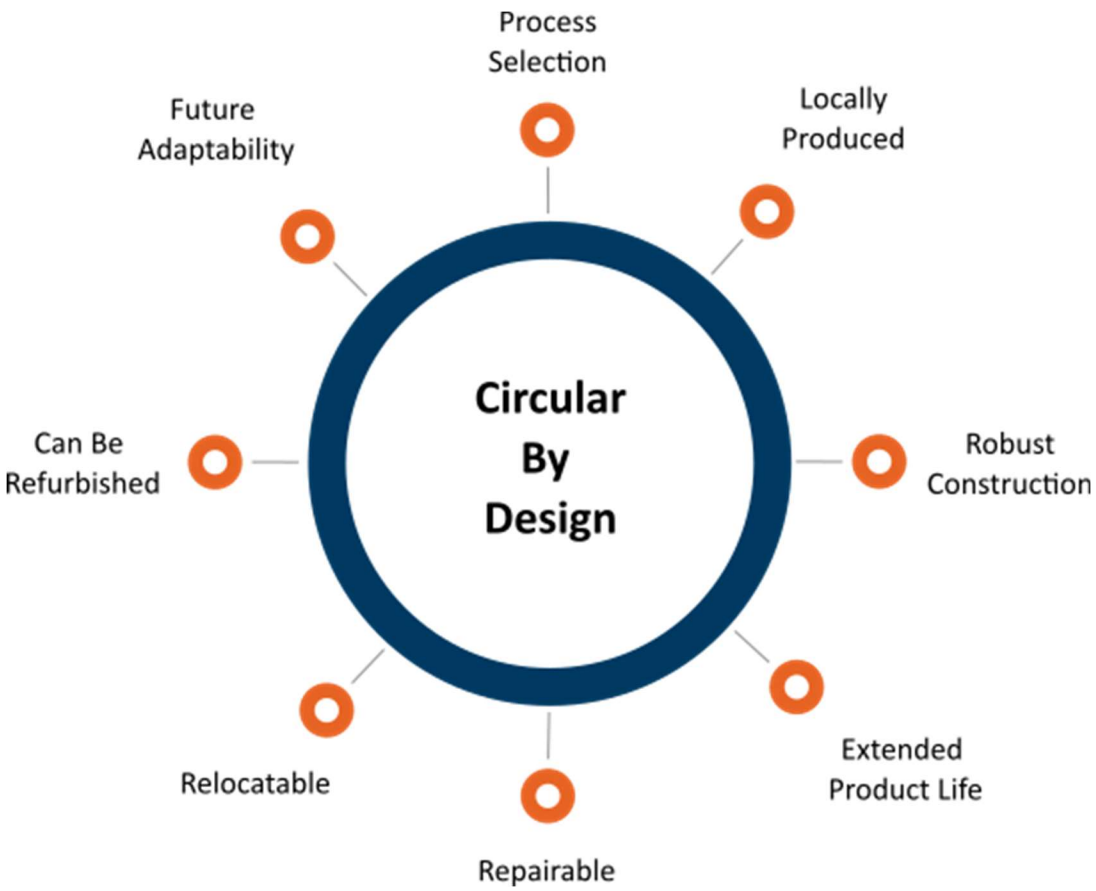
4 SPECIFICATION

The following specification provides some technical data with respect to the system offered. The Hydroflux Epco Roadtrain® package plants are built to withstand years of remote service.

- A plant that is considered set and forget, with intermittent attendance from an operator
- Remote telemetry for fault indication and process monitoring can be offered as an option
- Limited routine maintenance
- Duty / Standby pumps and blowers

4.1 Sustainable by design

The Hydroflux Epco Roadtrain® is a product range that is sustainable by design. The RoadTrain systems is designed from the basis of circular economic principals to ensure the equipment provides our clients with an economic life cycle. Robust welded 6mm mild steel epoxy coated construction for life spans in excess of 25 plus years is just one element we considered in the design process. The image below provides insight into the Hydroflux RoadTrain philosophy.



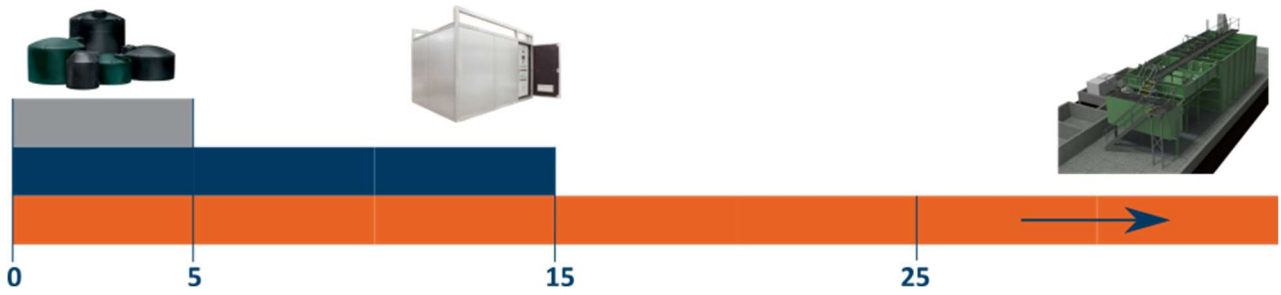
Roadtrain 40 in operation at a mine site in QLD since 1978.

4.2 Design selection

There are three methods of construction employed for sewage treatment plants in this size category.

- Poly tank farms
- Containerised Plants
- Fabricated RoadTrain

All three systems have different life expectancies shown below in years.



4.2.1 Poly Tank Farms

Hydroflux does not undertake poly tank farm projects for many sustainability reasons, one of which is the shortest life span as shown in the previous time line.

4.2.2 Containerised Plant

Containerised systems are fit for purpose and we do provide them through our Mena Water agency where appropriate, for exploration camps and the like with medium site life spans or for clients focused on CAPEX budgets without reference to operational lifespan . The concern with containerised systems is that they are constructed for one purpose, cannot be readily upgraded and typically have a medium-term life span of 10 to 15 years.

4.2.3 Fabricated Roadtrain Plant

The RoadTrain® is the most appropriate design for sites intended to be long standing such as communities, retirement villages and resorts. The RoadTrain® design has all the sustainability attributes shown on the circularity image in section 3.1.

The RoadTrain® design life cycle is extended even further in ocean bound situations such as small island communities where grade 316 stainless steel replaces the mild steel epoxy coated standard.

The RoadTrain system is fitted with appropriate sound covers for the blowers to reduce acoustic impact. In residential or resort sites Odour scrubbing with covers on the main tanks will be included to eliminate odour.

4.3 Process selection

The treatment process is the next selection made for a site once the design selection has been identified.

The treatment process relates to the level of treatment required of the effluent to be discharged from the plant to the surrounding environment.

In the case of the Nambucca site, Hydroflux recommends the RoadTrain Ultra™ model due to the need for A class reuse quality effluent. The RoadTrain Ultra is based around MBR (Membrane Bioreactor) technology.

This design choice was made due to our understanding that the effluent will be retained on site where possible and irrigated through sub-surface means in roadside verges on adjacent public roads where necessary.

The following tables summarise the capacity and process qualities of the Roadtrain® Ultra system:

4.3.1 Incoming raw sewage parameters

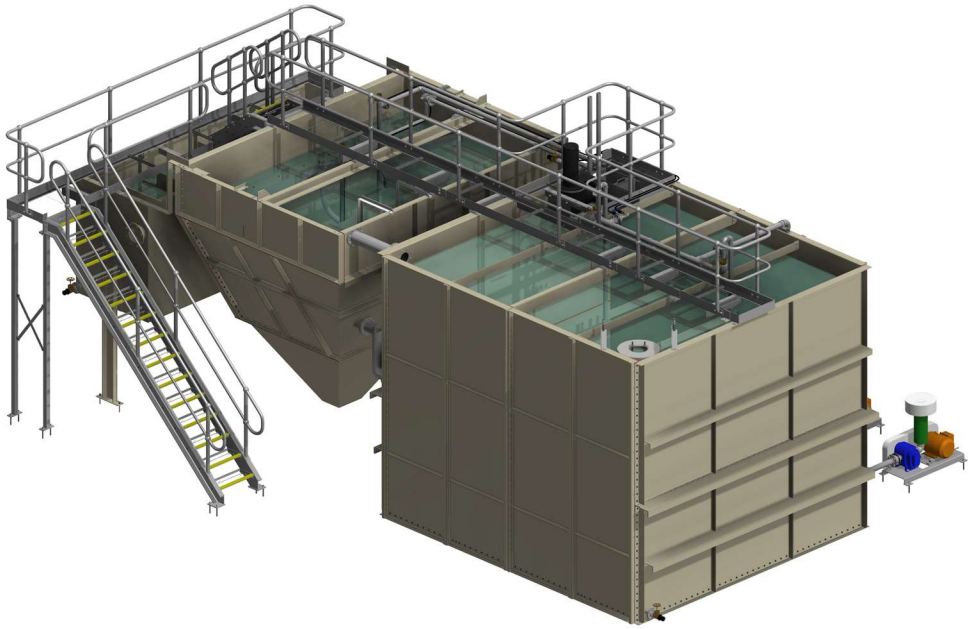
PARAMETER	SYMBOL	VALUE	UNIT
Average Dry Weather Flowrate (ADWF)	Q_{DWF}	175.0	m^3/day
Peak Dry Weather Flowrate (PDWF)	Q_{PDWF}	212.5	m^3/day
Peak Instantaneous Dry Weather Flow		18.5	m^3/hr
Chemical Oxygen Demand	COD	800.0	mg/L
Biochemical Oxygen Demand	BOD	400.0	mg/L
Total Suspended Solids	TSS	400.0	mg/L
Total Nitrogen	TN	100.0	mg/L
Total Phosphorus	TP	15.0	mg/L
Total Alkalinity*	Alk	250.0	mg/L as $CaCO_3$

4.3.2 Effluent discharge parameters

PARAMETER	SYMBOL	VALUE	UNIT
Biochemical Oxygen Demand	BOD	10.0	mg/L
Total Suspended Solids	TSS	10.0	mg/L
Total Nitrogen	TN	10.0	mg/L
Total Phosphorus	TP	1.0	mg/L
Total Alkalinity	Alk	100.0	mg/L as $CaCO_3$

The below table provides further information with respect to general technical aspects of the RoadTrain Ultra™ design.

Item	Unit	Value
Screen Type		Automatic Spiral Screen
Screen Aperture	mm	3 – perforations
Balance Tank Size	kL	50
Balance Tank HRT	hr	7.1
Aeration Tank Size	kL	110
Aeration Tank HRT	Hr	15.5
Aeration Tank SOTR	KgO2/h	30.66
Aeration Tank Water Level	m	2.5
Screenings Production	Kg/week	25 - 50
Sludge Production	Kg/d DS	44.7
Air Demand	Nm3/h	2076
MBR Type		Flat Sheet – Ultrafiltration 0.08micron
MBR Air Demand	Nm3/h	198



4.4 Process description

Sewage from the source shall be screened to remove solids and plastics using an automatic spiral screen with 3mm perforations. The screenings shall be washed to remove organics and then compacted prior to discharge into a skip. The screening skip will require disposal, typically this is via landfill. The spiral screen includes a bypass chamber for emergency discharge of flow should the screen not be available.

Screened effluent will then discharge into an equalisation tank. This tank will buffer peak loads from the retirement village which is a critical step for the downstream aerobic process. The equalisation tank shall be fully mixed to keep the contents aerobic. From here, duty/standby feed pumps shall transfer the sewage to the membrane bioreactor (MBR).

The MBR consists of three zones, Anoxic, Aerobic and MBR Zone. In the anoxic zone nitrates generated from the downstream aerobic/MBR zone are converted to nitrogen gas as part of the nitrogen removal process. The flow then moves into the aerobic zone where a biomass consumes the organics under aerobic conditions. Process air is supplied from a blower package and operates under dissolved oxygen control. The MBR zone separates the biomass from the treated water using ultra-filtration membranes.

In the aerobic zone and MBR zone, ammonia is converted to nitrate. Part of the biomass is recirculated to the anoxic zone to complete the nitrogen removal process. A coagulant is used to remove phosphorous and this is dosed to the aerobic or MBR Zones.

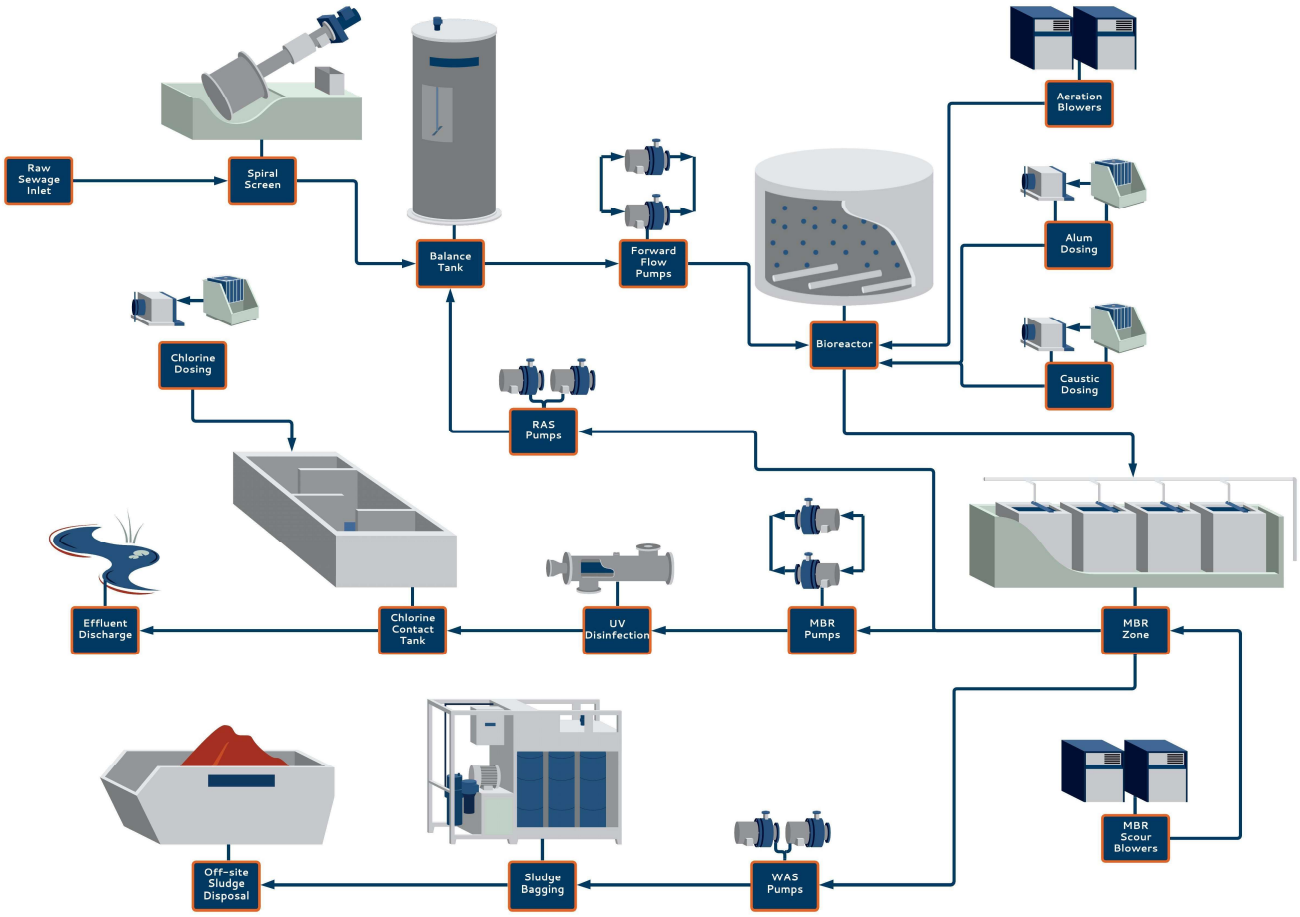
Part of the biomass is wasted to a sludge bagging system to remove the excess biomass offsite as a solid. Drained water from the sludge bagging system is collected and pumps back to the head of the process.

Air is required to scour the membranes and this is supplied via a dedicated set of blowers. The phase separation in the MBR is driven by dry mounted MBR Permeate pumps. Periodic cleaning of the MBR is required using a chemicals. The make up and dosing for this is provided as part of the design.

The pumped permeate from the MBR zone is sterilised using UV Disinfection and then chlorinated using liquid chlorine.

The entire process is automatically controlled using a Control System. A PLC is used together with a HMI (Human Machine Interface) to enable operation of the treatment. Remote monitoring is provided via HyConnect.

Below is a flow diagram summarising the above description.



4.5 Assumptions

Please note the following:

- The raw sewage will be of a normal domestic nature with no non-biodegradable substances, industrial wastes or substances poisonous to the plant biomass are to be present in the flow. The domestic sewage shall be within the range set out in the table above
- The inflow into the plant varies throughout the day. A balance tank has been fitted to manage fluctuations in flow which can be experienced in sites such as retirement villages.
- The plant will commence operation on at least 30 to 40% of the ultimate load it is designed and purchased to serve
- Minimal chemical dosing and handling for simplicity of operation and reduced WHS risk
- Influent is expected to be managed upstream of the STP to resemble as closely as possible standard domestic waste. Waste from the kitchen will pass through a grease trap before discharging into the PSTP. Waste from the laundry or any other facility will have a water temperature < 38^{o}C
- Surface preparation and painting shall be to Hydroflux Epco standards
- The control system shall be built to Australian standards and to Hydroflux Epco's standard design

4.6 Effluent Quality Data

The following table summarises the expected effluent quality of the Roadtrain® system:

ITEM	VALUE
BOD5	<10 mg/L median
Total Suspended Solids	<10 mg/L median
E.Coli	<100 CFU/100mL median

In QLD and Victoria this level of effluent quality is classified as class A for reuse purposes in applications such as landscape irrigation. The proposed system exceeds treatment levels for environmental discharge into a nearby natural water course. Environmental discharge is class B (lower quality 20/30/100).

In NSW the classification of effluent is around risk and "fit for purpose" determination not classes. In our opinion, the treatment process offered is fit for purpose for the intended reuse on the site.

The effluent quality is treated in accordance with Australian guidelines for water recycling. Validation of the system being "fit for purpose" will require third party consultation by the local authority's nominated consultant prior to a formal and final estimation being provided.

5 SAMPLE INSTALLATIONS

Roadtrain® packages sewage treatment plants are operating in over 140 sites around the world. The key feature of Roadtrain® is that it has been designed for remote locations, such as mine sites, resorts and rural communities.

This section provides some examples.

5.1 Port Hinchinbrook Resort

- 500 EP capacity Roadtrain® Units
- Sewage from a resort with discharge to the great barrier reef
- High water quality required
- Prefabricated systems to reduce site installation time and costs

5.2 Oilsearch, Southern Highlands, PNG

- Multiple Roadtrain® systems
- Sewage from various camps across the Highlands over twenty years of mining operations and camps from 1988 to present day
- Flat pack panel construction for easy installation and augmentation
- Plant on the right installed 1992, plant on left installed 2015 for increased capacity at Moro camp

5.3 Gobe Construction Camp, Southern Highlands, PNG

- 200 EP Roadtrain® system
- Sewage from a construction camp in 1997 and later the airport facility from 2000 to present day
- High discharge requirements, the site is in an environmentally sensitive area
- Robust solution to manage the variations experienced in resort wastewater

5.4 OK Tedi, Western Province, PNG

- Multiple Roadtrain® units from 4000EP to 400EP in Tabubil and Kiunga
- Sewage from township and port facility
- Prefabricated systems for delivery by river

5.5 Wujal Wujal Community, QLD, Australia

- 350 EP Roadtrain® system
- Sewage from a remote community
- Environmental discharge with high quality effluent required
- Prefabrication to simplify the site installation process

5.6 Masig Island, Torres Straits, QLD, Australia

- 650 EP Roadtrain® system
- Sewage from the island of Masig, located in the Torres Straits
- High discharge requirements, the site is in an environmentally sensitive area
- Robust solution to manage the variations experienced

6 SCOPE OF SUPPLY

This section provides details on the items supplied by Hydroflux and the additional items or work required by the client to complete the project.

6.1 Hydroflux Scope

6.1.1 Equipment

We have costed the project comprising the following elements:

- Welded package plant, painted 6mm thick steel, configuration in four tank components:
  - Balance tank
  - Bioreactor tank
  - MBR tank
  - Detention type chlorine tank

With regard to the plant we offer the following elements:

- Locally fabricated, tanks in 6mm mild steel, epoxy coated
- 1 x central walkway set complete with:
  - Galvanised grating and handrails
  - Access stairs in two locations, typically at the end of tanks
- 1 x Aeration set using:
  - Hydroflux Epco cast iron coarse bubble diffusers for MBR scouring
  - Aerostrip fine bubble membrane diffusers for Bioreactor aeration
- 1 x set of flat sheet membranes
- 1 x set galvanised mild steel mounting brackets and Gr316SS bolting
- 1 x Control switchboard for local mounting to provide automatic and manual control of pumps and airlifts
- Blowers with sound covers
  - 2 x Aeration tank blowers
  - 2 x scour blowers
  - In Duty/ Standby configuration
- Instrumentation:
  - Influent flow meter
- Bunded chemical dosing x 3 sets:
  - Chlorine
  - Alum
  - Caustic
- Inlet screen complete with:
  - 1 x Inlet screen of German construction in stainless steel
  - 1 x set of screenings chutes in stainless steel
  - 1 x set of chute brackets
- Odour Control
  - 1 x set of aluminium covers over the appropriate STP tanks
  - 1 set of odour extraction pipework
  - 1 x Odour scrubbing unit

6.1.2 Engineering and Documentation

- Engineering Assistance
  - Proposed site layout:
    - For use by civil contractor as a guide
    - Complete with static live tank loads
  - General Assembly Drawing
  - Control philosophy, in O&M manual
  - P+ID
  - Operation + Maintenance manual (1 x electronic)

6.1.3 Installation and Commissioning

- Site instruction crew
  - Will report to your own site foreman
  - All tools and equipment for client's crew to install the package

6.1.4 Delivery and Commissioning

- Delivery
  - FOT Site
- Commissioning and training visit (14 days)

6.1.5 Warranty

Twenty-four (12) months from commissioning or maximum for eighteen (18) months upon delivery to site, which ever comes first.

6.1.6 Specifications

- Please refer to the attached Application of SS which identifies the limits for H2S and Salinity (among others) as apply for the SS construction
- These limits apply for the medium and the operating environment
- Any performance data provided is an estimation and not an express performance guarantee
- The equipment offered is of a proprietary standard design proven in this application around the world and in Australia
- The equipment offered is built to Hydroflux Epco Standard Mechanical and Paint Specification

6.2 Client Scope

6.2.1 General

- All civil works
- On site "field" electrical installation
- Pipework to and from the RoadTrain™ installation
- Wash water supply pipework
- Subnatent pump stations or other additional scopes outside of the site
- Plant fencing and security
- Plant site lighting
- Filling of the plant with clean water for commissioning
- Power for testing and commissioning

7 MAINTENANCE

The following tables summarises the major maintenance activities on a weekly, monthly and annual basis. Further information is provided on major overhauls and replacement of wear parts.

Major works would be required at the end of the third year in operation. This would include replacement of various wear items in the bottom section of the screen.

7.1 Routine Maintenance

Routine maintenance is restricted to the following:

Daily

- Inlet - Inspect and clean if required
- Check / Add Chlorine tablets as required
- Record flow meter totalizations
- Check both blowers
- Visual inspection of treatment skid
- Visual inspection of membranes

Monthly

- Check blower belt tensions (isolate first)
- Check for build up around control float nozzle and ensure flow is unimpeded
- Check scum airlift is effective in removing scum from the surface of the clarifier tank

Quarterly

- Hose off or brush down effluent weirs as required to remove any growth
- Lubricate blower nipples with NLGI Grade 2 EP grease. (Two nipples on each blower)
- Drain and clean Chlorine contact tank.

Six Monthly

- Inspect condition of blower belts

Annually

- Exchange blower oil
- Replace Blower air filters
- Inspect membranes by draining membrane tank

7.2 Spare/Wear Parts

ITEM	ACTIVITY	LIFE
Blower	Pulley belts	1 to 2 years
Blower	Filter elements	12 months
MBR memrbanes	Replacement	7 to 10 years
Fine bubble diffusers	Replacement	15 years

7.3 Service and Maintenance

Hydroflux staff are expert at service and maintenance of all EPCO equipment. Customised service agreements, such as annual inspections, can be tailored to suit client needs.

7.4 Whole of Life

- Tank life is designed to exceed 25 years
- Pump, blower & membrane life in accordance with OEM manufacturer guidelines

8 COMMERCIAL

Hydroflux Pty Ltd is a specialist engineering firm that provides wastewater process equipment for the municipal, industrial, mining and commercial markets.

There are over 1000 Hydroflux Epco installations already across Australasia and Middle East, within sewage treatment plants, industrial wastewater plants and packaged sewage systems.

This quotation is based on the design, manufacture, supply, mechanical installation and commissioning of components and engineering as described herein. Hydroflux has the capacity to undertake complete design and construct packages should this be preferred. Hydroflux has comprehensive insurance policies including Public liability ($20M) and professional indemnity ($10M).

8.1 Proposal Validity

The budget pricing offered has been calculated using an exchange rate of AUD = EURO 0.614. Thirty per cent of the final value may be subject to foreign exchange adjustment on the date of the order. We have been experiencing sharp unscheduled increases in some pricing for items such as raw steel and imported goods as a result of Covid related global production shortages in some products and commodities.

Hydroflux Terms of Sale applies to this quotation – click here to view these terms

8.2 Pricing Schedule

8.2.1 Included Items

ITEM	DETAIL	PRICE ($)
1	1 x EPCO Roadtrain Ultra™	$1,653,505
2	1 x Installation, Commissioning/Training Services	$218,920
TOTAL		**$1,872,425**

8.2.2 Optional Items

ITEM	DETAIL	PRICE ($) EXCL GST
1	Site Attendance (add for Travel & Accommodation expenses)	$1,200.00
2	None	$0,000.00

8.3 Payment Terms

The following payment terms apply to this quotation:

- 30% on submission of general arrangement drawings
- 30% on receipt of major materials
- 40% on delivery to site
- 30 days terms only apply where credit has been approved by Hydroflux

8.4 Delivery Period

- Ex-Works delivery shall be twenty (24) weeks from Approval to Manufacture
  (Please allow an additional 3 weeks is this period occurs over Christmas / New Year and 4 weeks if this period occurs over August)
- Unspecified Covid delays have not been accounted for

8.5 Contract Conditions

The following conditions apply to this proposal:

- Hydroflux Terms of Sale applies to this proposal, unless otherwise agreed
- No allowance has been made for security and/or retentions for the warranty period. This can be factored into the proposal if required
- No allowance has been made for liquidated damages. This can be factored into the proposal if required
- Consequential or undefined losses or similar are not accepted

8.6 GST

GST is excluded from this quotation and any prices provided in communications. GST will be added to the value at the appropriate rate.

9 ATTACHMENTS

The following have been attached to this proposal:

ITEM	REFERENCE	DESCRIPTION
1	Installation List	RoadTrain Installation list
2	Ok Tedi	Long life case study
3	Port Hinchinbrook	Mid – sized RoadTrain example
4	Lady Elliot Island	Mid-sized RoadTrain example
5	RoadTrain	General brochure
6	SK7432	Congarrinni North Pty Ltd, Macksville Sewerage reticulation layout

Appendix D: Ecologist Report - Methodologies for waste water (gray water) removal at Coronation Drive, North Congarinni, via Macksville, NSW

Dr Trevor J. Hawkeswood
[DipArch, DipSc(CMS), BSc (Hons)(NE), BAppSc (EnvSC)(CSU), BS & MS (AIM), MHsB & MHsM (IMHS), PhD (AIM, BPI, IMHS]
AQF 8 Arborist, AQF 8 Ecologist
Member of the International Society of Arboriculture CSID: 290763
Fellow of the Royal Entomological Society of London (FRES)

Director, *Advanced Arborist Reporting*
PO Box 842
Richmond NSW 2753
Mobile: 0423 498 942
Email: drtjhawkeswood@gmail.com
website: www.advancedarboristreporting.com

Consultant for Tree Reports, Vegetation Management Plans, Flora and Fauna Reports, Land and Environment Court Cases, Reviews of Environmental Reports

[TO WHOM IT MAY CONCERN]

Methodologies for waste water (gray water) removal at Coronation Drive, North Congarinni, via Macksville, NSW

Introduction

The applicant has received a request for additional information from Council in the following regard:

An option to provide an on-site sewerage treatment plant has been provided by the applicant and it is understood that the proposal is to discharge treated water to the environment in the order of 170,000 litres per day. The receiving environment is a mapped SEPP Coastal Wetland. The environmental impacts associated with the proposed disposal of treated (potentially chlorinated) water have not been considered. Information addressing potential environmental impacts upon the receiving Coastal Wetland are required.

My recommendations are below:

A. No effluent water (gray water) shall be directly sprayed or piped into the neighbouring wetlands. Any water into the wetlands from the site will be from direct runoff from rain and natural seepage through the soil.

B. The use of gray water for toilets, laundries and watering of personal gardens should be encouraged even though this will add to the cost of extra piping. In the long term this will save money, resources and protect the environment because recycling some of the gray water will reduce the strain on the environment to handle gray water.

C. A series of absorption trenches should also be implemented. These absorption trenches will be dug and filled with rocks, sand and sandy soil. They should each be at least 100 m long and have at least 30 cm diameter piping. It is proposed that up to 500 m of absorption trenches can be installed in the landscape open buffer areas. The gray water can be pumped into them with usual functioning of the absorption trenches. The tops of the trenches can be grassed or made into gardens containing small shrubs or ferns etc. (no trees are to be planted over the trenches) which will

also be irrigated by gray water. The soil will purify the gray water on the surface as well as that waste water pumped into the trenches. I suggest at least 30,000-50,000 litres of gray water could be processed per day through the absorption trenches.

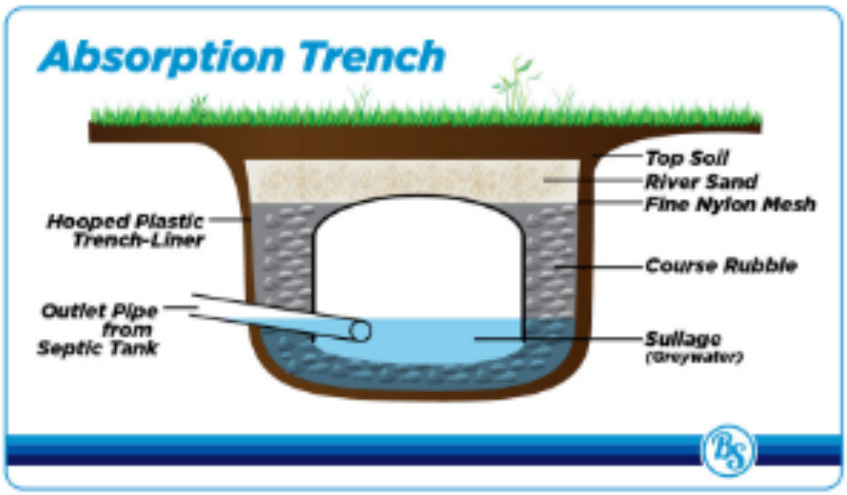


Fig. 1. Typical design of a simple absorption trench . (From : https://www.expresswastewater.com.au/septic-systems/information/how-does-an-absorption-trench-work).

Fig. 2. An unfinished absorption trench. (From: Design and installation of water waste systems, Sydney Catchment Authority).

D. Gray water can be used to continually irrigate the buffer areas (outside the dwelling areas) which can be planted with ferns, tall grasses and palms (e.g. *Dypsas lutescens,* Arecaceae, Fig. 3) amd *Cordyline petiolaris* (Arecaceae)(FIg, 4) and and other plants that take up water excessively and also all transpire it at a high rate. These plants transpire 99% per day of the water uptaken through the roots. The high transpiration rate plants will be a major key to reducing the gray water from the site each day. Some 30 or more high transpiration trees can also be planted which can finally uptake 10,000 litres per day (about 300 litres per tree). when they are mature. About 1000 - 1500 palms will also need to be planted in the buffer areas or around the dwellings. Each palm plant (about 12.5-2.0 m tall) can absorb up to 25 litres or more per day each such that up to 25000 - 37500 litres per day can be absorbed and transpired away from the site merely by the 1000-1500 palm trees themselves. If more palms can be planted then this will assist the issue of gray water removal even further. The lawned areas can also be watered in the buffer areas. The grasses within the buffer areas could take up 10,000 litres per day or more with slow drip feed.

Fig. 3. *Dypsis lutescens*. (From: https://plants.ces.ncsu.edu/plants/dypsis-lutescens/).

E. One or more large absorption ponds, or dams can be created on the site which will grow plants such as *Typha orientalis* (Typhaceae)(2-3 m tall) (Fig. 5) and willow trees (*Salix* spp., Salicaceae)(up to 15 m tall) which also transpire water excessively and even in winter during windy conditions. Such plants as *Typha* can transpire more than 20 litres each day each plant during summer and willow trees can transpire 300 litres per day. A single pond could contain several thousand *Typha* plants such that 20,000 litres

per day or more could be transpired by the 1000-2000 *Typha* water plants. These ponds would also attract wildlife such as birds, frogs and turtles. The absorption ponds can also evaporate water from the site especially during summer through sunlight action (heating of the water surface). The dams/ponds would have to be large enough to support a few thousand *Typha* plants and other water plants. I suggest 1-3 megalitre size for each dam/pond (a standard Olympic-size swimming pool contains approximately 2.5 megalitres).

Fig, 4. Cordyline petiolaris (Arecaceae) (from : https://www.olelantanaseeds.com.au/product/cordyline-petiolaris-native-palm-lily-seed-x20/).

Fig. 5. *Typha orientalis* (Typhaceae) (From: https://www.freepik.com/premium-photo/green-reeds-background_7931885.htm).

All of these methodologies (C-E above) are environmentally friendly and will assist safe removal of gray water from the site both through the soil and through the atmosphere. The continual recycling of water through the toilet/laundry system should reduce the amount of water required to be processed by the natural means, i.,e. sunlight, soil, soil bacteria and plants.

So concluding, the buffer areas and areas around the dwellings will not be be able to take all of the gray water per day. The absorption trenches and absorption ponds (dams) will be pivotal in removing the remaining gray water each day. The ponds and the additional planting of native palms and other plants on site either around dwellings, in the buffer areas, ad in the ponds will enhance the local environment in a number of ways apart from dealing successfully with the problem of waste water removal.

I am Yours faithfully,

Dr Trevor J. Hawkeswood

[DipArch, DipSc(CMS), BSc (Hons)(NE), BAppSc (EnvSC)(CSU), BS & MS (AIM), MHsB & MHsM (IMHS), PhD (AIM, IMHS]
AQF 8 Arborist, AQF 8 Ecologist
(4 October 2021)

Appendix E: Wet Weather Flow / Emergency Storage Water balance

Development of Seniors Living and Aged Care Facilities, 24 Coronation Road, Congarinni North, NSW
Site Sewer Management Strategy
APPENDIX D - Wet Weather Flow / Emergency Storage Water balance

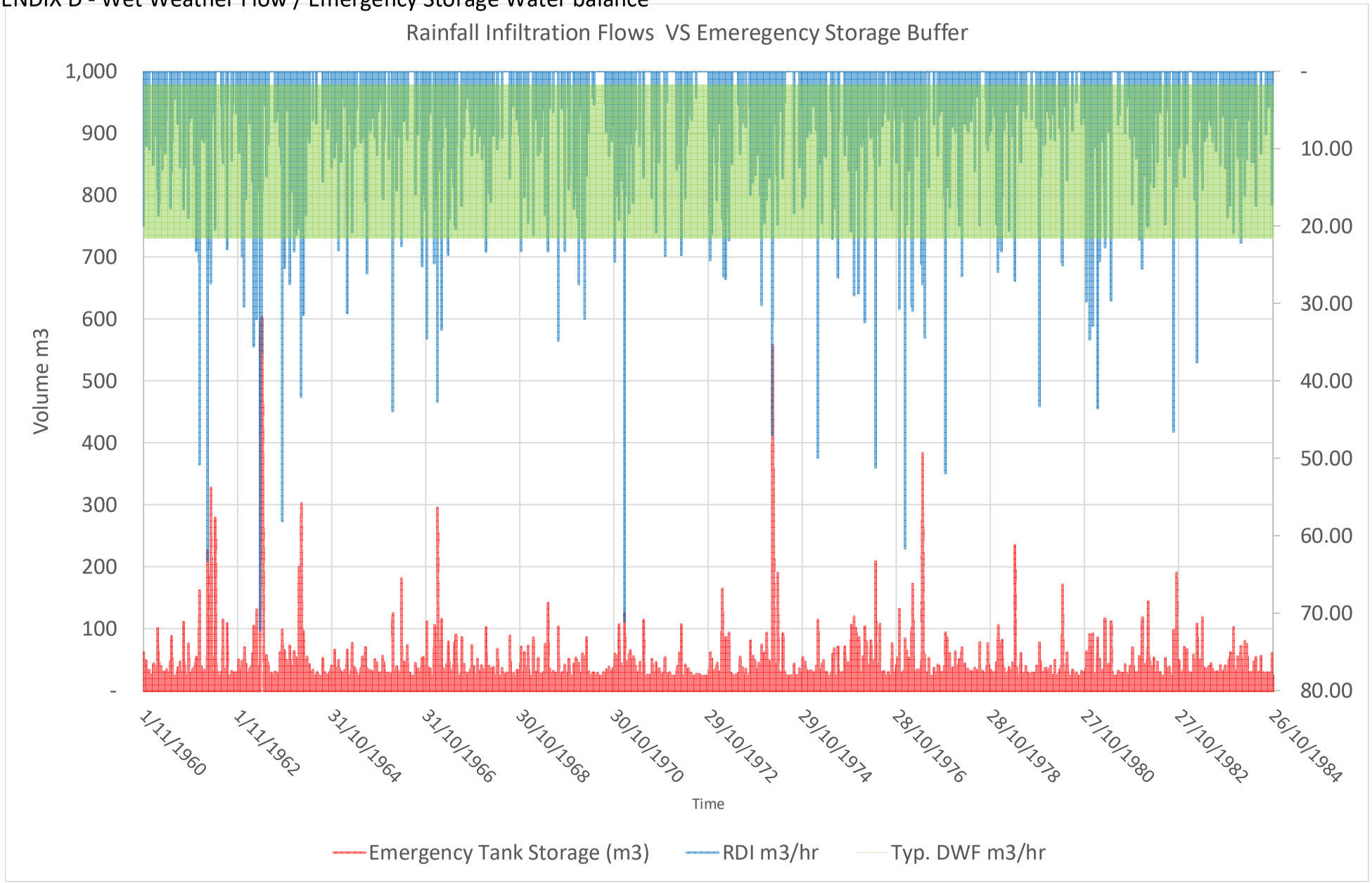
Total ET	353.70
Total EP	955.00
Site Area (ha)	18.00
d (peak factor)	3.58
Density (EP/Ha)	53.06
A(eff)	10.71
ADWF (L/s)	1.99
PDWF (L/s)	7.11
GWI (L/s)	0.15

Time step (min)	60.00
GWI Volume / time step (m3)	0.55
Maximum Treatment capacity (l/s)	2.46
Max Treatment capacity / time step (m3)	8.85
Normal Treatment capacity (l/s)	1.99
Normal Treatment capacity / time step	7.16
Rainfall threshold to produce runoff infiltration (mm/hr)	3.000
Sewer Volume/ day (m3/day)	171.90

RDI (percentage -	1.00%
Storage Proposed	603.75
Equivalent storage time (day)	3.51
Max flow in emergency storage (m3)	601.550
Sewer overflow (hr)	-

Coffs Harbour NSW, BOM 59047 rainfall records

Ts (hourly)	Date / time	Rainfall I mm/hr	Factored Runoff Infiltration (m3/S)	RDI Volume (m3) /ts	GWI Volume (m3) /ts	ADWF (m3) /ts	Volume in (m3) / ts	Vol on E storage 0 (m3)	Treatment Volume (m3) / ts	Vol on E storage 1 (m3)	Overflow counter (hrs)
1	1/11/1960 0:00	0	-	-	-	1.72	1.724	1.724	1.724	-	0
2	1/11/1960 1:00	0	-	-	-	1.72	1.724	1.724	1.724	-	0
3	1/11/1960 2:00	0	-	-	-	1.72	1.724	1.724	1.724	-	0
4	1/11/1960 3:00	0	-	-	-	1.72	1.724	1.724	1.724	-	0
5	1/11/1960 4:00	0	-	-	-	1.72	1.724	1.724	1.724	-	0
6	1/11/1960 5:00	0	-	-	-	1.72	1.724	1.724	1.724	-	0
7	1/11/1960 6:00	0	-	-	-	10.35	10.345	10.345	8.854	1.491	0
8	1/11/1960 7:00	0	-	-	-	21.55	21.552	23.043	8.854	14.189	0
9	1/11/1960 8:00	0	-	-	-	13.79	13.793	27.983	8.854	19.128	0
10	1/11/1960 9:00	0	-	-	-	5.17	5.173	24.301	8.854	15.447	0
11	1/11/1960 10:00	0	-	-	-	3.45	3.448	18.895	8.854	10.041	0
12	1/11/1960 11:00	0	-	-	-	6.03	6.035	16.076	8.854	7.221	0
13	1/11/1960 12:00	0	-	-	-	8.62	8.621	15.842	8.854	6.988	0
14	1/11/1960 13:00	0	-	-	-	20.69	20.690	27.678	8.854	18.824	0
15	1/11/1960 14:00	0	-	-	-	13.79	13.793	32.618	8.854	23.764	0
16	1/11/1960 15:00	0	-	-	-	5.17	5.173	28.936	8.854	20.082	0
17	1/11/1960 16:00	0	-	-	-	1.72	1.724	21.806	8.854	12.952	0
18	1/11/1960 17:00	0	-	-	-	1.72	1.724	14.676	8.854	5.822	0
19	1/11/1960 18:00	0	-	-	-	13.79	13.793	19.615	8.854	10.761	0
20	1/11/1960 19:00	0	-	-	-	20.69	20.690	31.451	8.854	22.597	0
21	1/11/1960 20:00	0	-	-	-	8.62	8.621	31.218	8.854	22.364	0
22	1/11/1960 21:00	0	-	-	-	3.45	3.448	25.812	8.854	16.958	0
23	1/11/1960 22:00	0	-	-	-	1.72	1.724	18.682	8.854	9.828	0
24	1/11/1960 23:00	0.15	-	-	0.55	1.72	2.273	12.102	8.854	3.247	0
25	2/11/1960 0:00	0.7	-	-	0.55	1.72	2.273	5.521	5.521	-	0


Rainfall Infiltration Flows VS Emeregency Storage Buffer
Volume m3
1,000
900
800
700
600
500
400
300
200
100
-
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
1/11/1960
1/11/1962
31/10/1964
31/10/1966
30/10/1968
30/10/1970
29/10/1972
29/10/1974
28/10/1976
28/10/1978
27/10/1980
27/10/1982
26/10/1984
Time
Emergency Tank Storage (m3)
RDI m3/hr
Typ. DWF m3/hr