David Wills and Associates
Consulting Engineers

INFRASTRUCTURE SERVICING REPORT

Infinite Green Energy, Northam

Stage 1: Initial Site Layout

Client's Reference Number: MEG-E01-SER-RPT-DWA-0001-RevH

21295
REVISION H
JULY 2023

DOCUMENT CONTROL DATA

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		Author	BC
		Checked	BD
		Approved	DW
		Synopsis	

Reference: 21295
Client: Infinite Green Energy

Revision Table

Ver	Description	Date	Authorised
A	Draft	25/01/23	BD
B	Initial Submission	02/02/23	BD
C	DA Submission	26/06/23	DW
D	DA Submission	04/07/23	DW
E	DA Submission	04/07/23	DW
F	DA Submission	07/07/23	DW
G	DA Submission	11/07/23	DW
H	DA Submission	14/07/23	DW

Distribution Table

Date	Version	Distribution
25/01/23	A	Infinite Green Energy
02/02/23	B	Infinite Green Energy
26/06/23	C	Infinite Green Energy
04/07/23	D	Infinite Green Energy
04/07/23	E	Infinite Green Energy
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CONTENTS

1 INTRODUCTION

David Wills and Associates (DWA) have been commissioned by Infinite Green Energy (IGE) to produce the Services Plan for the proposed Hydrogen Plant located on York Road, Northam.

The property is shown below with a red border and is approximately 28.3 Ha in size. It is proposed to have an area of approximately 33'000m^2 developed to allow for facility operations, including a hardstand area, offices and plant area.

The site is to be used to produce hydrogen gas and is expected to produce approximately 4 tonnes of hydrogen per day.

To produce the hydrogen, the nearby solar farm was been acquired by Infinite Green Energy and drinking water from the town of Northam will be used to produce the hydrogen gas. This solar farm is proposed to be expanded to meet the plant's future power requirements. The expansion is proposed to take place in the Stage 2 development of the site at a later date.

Figure 1: Site Overview (Nearmaps, 2022)

2 LAND SERVICING OBJECTIVES

Included in this land servicing report is information relating to:

- Water availability and demand;
- Vehicular access to the site
    - Internal Road Design
    - Main Roads WA network access;
    - Impacts to the Rail Crossing;
- Reverse Osmosis Discharge Water;
- Sewerage Management
- Stormwater Management and Drainage;
- Site Energy Requirements

3 LIASION

For the purpose of establishing a connection to statutory authority infrastructure services and impacts to their network, liaison has been undertaken with:

- Infinite Green Energy;
- Shire of Northam Representatives;
- Aimee Campbell of Arc Infrastructure;
- Caitlin Richards of Arc Infrastructure;
- Cherie Wallace of Mainroads, and
- Christian Koesnadi from the Water Corporation.

3.1 Water Availability and Demand

Water is intended to be supplied to the site by the Northam potable water supply, which is under the care and responsibility of the Water Corporation. The Water Corporation has undertaken an initial assessment of the water mains nearby the property. Based on the Water Corporation assessment, there is capacity to draw 1L/s (or 86.4kL/day) from the water main that runs along York Road.

The site connection will be non-standard due to the distance from the pipe in the road reserve to the lot boundary exceeding 30m. It is proposed to install a backflow device and a water meter in the road reserve and install private water pipe to service the site.

This private pipework is required to cross the railway corridor. Approval is currently being sought by external consultants from Arc Infrastructure to allow boring of a sleeve under the existing railway line to permit water access to the site.

David Wills and Associates recommends a minimum sleeve size of 150mm to allow up to a 100mm diameter MDPE pipe to be installed. This sleeve has been sized to allow for future upgrades of the pipe if required.

3.2 Vehicular Access

3.2.1 Internal Road Design

The internal roads are to be designed for the CBR (California Bearing Ratio) values obtained in the geotechnical report by Brown Geotechnical. Laboratory testing shows a CBR value of 1.0 – 1.5 for the clays on-site and a value of 10 for the silty sands.

Initially, it is proposed for 4 trucks per day into and out of the site, with the potential for expansion if the plant is expanded in a future stage.

3.2.2 Main Roads WA Road Network Access

A Traffic Impact Assessment of the proposed development has been undertaken by Transcore. Based on the assessment the traffic generated by the development would not normally warrant an upgrade of the existing access to the site. This report is attached in Appendix D.

To ensure as little impact as possible on the users of the existing Northam-York Road, the Developer proposes that the existing access to the site is to be upgraded and a deceleration lane is constructed within the existing road reserve. David Wills and Associates are undertaking a detailed design of the proposed deceleration lane to the site which will be 3.5m wide and designed to Main Roads requirements and specifications.

The rail crossing will be upgraded and increased in width to 9.5m to allow for two semi-trailers to pass. Solar-powered boom gates are to be installed and the deceleration lane is sized to allow two 19.0m long prime movers and semi-trailers to come to a complete stop and queuing to allow for the activity of the rail corridor.

Detailed design will be progressed once the exact requirements from all involved Authorities are gained.

3.2.3 Impact to the Rail Crossing

Infinite Green Energy (IGE) have undertaken discussions to be a permitted user of the level crossing over the existing railway line.

In addition to the boring required for the proposed water pipework as described above, a level crossing complying with AS 1742.7 is required. This includes the installation of boom gates, flashing lights, and any additional signalling pits required with any associated underground conduits. This design is currently being undertaken by Concept Rail Services.

The design is to be to the satisfaction of Arc Infrastructure and approval from Arc Infrastructure is required before the commencement of any construction works.

3.3 Reverse Osmosis Discharge Water

To produce the Hydrogen from the plant, potable drinking water is required to undergo reverse osmosis to further purify the water. The disposal water's chemical composition has been estimated by Nitto Hydronautics and is attached in Appendix B.

The project is estimated to consume approximately 70 cubic meters of water per day and produce approximately 20 cubic meters of disposal water.

The key water parameter that exceeds potable water standards is the Total Dissolvable Solids (TDS). The water is proposed to be used in combination with stormwater as irrigation for screening vegetation around the plant and to overflow into nutrient-stripping basins, planted with sedges, rushes and reeds, with plant species to be agreed with the Shire of Northam. The basins will have an emergency overflow into the Mortlock River for major storm events. Due to this emergency overflow, chlorine content is also a critical water parameter.

Further details of the nutrient stripping basin are provided in the Drainage Management Report in Appendix C.

The total dissolved solids level has been compared to drinking water standards, agriculture standards and the existing levels in the Mortlock River. Drinking water limits TDS shall be below 600 mg/l, while agricultural levels can be up to 4,000 mg/l for cattle and sheep.

Levels in the Mortlock River fluctuate with flow, with a summary listed in the table below.

Table 1: Total Dissolved Solids in the Mortlock River

Median (mg/l)	Mean (mg/l)	Max (mg/l)
12,612.85	12,256.62	26,661.32

The expected TDS of the reverse osmosis discharge water is approximately 1,346 mg/l prior to polishing through irrigation or from the nutrient stripping basins. Therefore, the discharge of 'reject' water into the Mortlock River during major storm events will have a benign effect as the water quality discharging from the site is significantly better quality than the river water quality.

The site clays have a Phosphorous Retention Index of between 11 and 30, which will help improve the quality of water as it passes through the basins.

3.4 Sewerage Management

Once the plant becomes operational, it is anticipated to employ two permanent staff members at the site, along with a maximum of five truck drivers responsible for daily collection of hydrogen. As operations progress, the number of truck drivers may increase to a maximum of 25 per day. The site is planned to operate continuously, 24 hours a day, seven days a week. Eventually, the goal is for the site to operate remotely, removing the 2 full permanent staff members.

No Water Corporation sewer connection is available so the effluent is to be treated by an ATU (aerobic treatment unit), under a system approved by the Department of Health. At a minimum, the system is to be sized for 2 people at the standard rate of 70L/person/8 hours, with additional allowances made for visiting truck drivers to shower.

The overall tank size is proposed sized for 10 equivalent populations and is approximately 5 times greater than the required size during initial operations and ensures adequate capacity for the maximum expected truck movement.

The treatment unit will be selected from the list of appropriately sized, Western Australian Department of Health-approved products. The sizing of the leech drain is generally to be in accordance with AS 1547 "On-site domestic wastewater management" and Department of Health Western Australia guidelines, with the specific product dependent on availability. The total length of the leech drains is estimated at 30m.

The leech drain system is to be installed with the base of the system a minimum of 0.6m above the 1 in 100-year flood level of the Mortlock River which is set by DWER at 153.5mAHD. The leech drain base will be founded on free-draining sands. The clay material on site has a Phosphorus Retention Index (PRI) of between 11 and 30 as determined by the Geotechnical Report attached in Appendix A.

The ATU system will pump effluent to the leech drain, with the pump to be sized during the detailed design stage. The leech drains will be set over 200m from the top of the bank of the river, which is in exceedance of the minimum setback distance of 100m from known waterways. On-site stormwater drainage basins/channels discharging to the waterway is to be maintained as required by the Western Australian 2019, Government Sewerage Policy.

3.5 Stormwater Management and Drainage

A detailed drainage management plan has been prepared. Reference is drawn to DWA Report *21295 – Infinite Green Energy – Drainage Management Plan* attached in Appendix C. The design objectives of the stormwater management plan are to:

- Manage rainfall events to minimise runoff as high in the catchment as possible. The one-year, one-hour (1 in 1) ARI event should be retained on-site;
- Infiltration should be encouraged in permeable areas through mechanisms such as soakwells, landscaping and flush kerbing;
- Manage catchment runoff up to 1 in 100-year ARI event for peak flows, to pre-development levels;
- Maximise water use efficiency, reduce potable water demand, and maximise the re-use of water harvested,
- Stormwater egress from the site post-development must not exceed pre-development flows;

- All stormwater runoff from the plant area is to be polished in planted stormwater basins before flowing into the river;
- No development in the flood fringe area; and
- A minimum of 0.5m freeboard above the 1 in 100-year ARI river flood levels for flood-sensitive buildings.

Heavily Planted stormwater basins are proposed along the southern bank of the river. These basins will be sized for the one-year, one-hour storm event plus the reverse osmosis disposal water produced by the hydrogen plan over one hour period. An overflow towards the Mortlock River is provided for storms beyond this size.

This design allows for all minor storms and reverse osmosis wastewater to undergo filtration and polishing before entering the groundwater and/or Mortlock River.

3.6 Site Energy Requirements

Detailed Power and Communication design is currently being undertaken by external consultants at the request of IGE. During the detailed design, any possible clashes between services will be re-assessed.

Power is to be sourced from the existing solar panel farm located to the north of the proposed Hydrogen Plant. An approximately 1.7km long overhead power line is to be installed to feed the proposed facility.

All equipment on site shall be powered by electricity from the solar panel farm to the north. It is envisaged that the solar panel farm will be expanded in future development of the site.

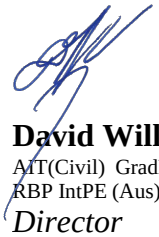
4 CONCLUSION

From the above, the required infrastructure for development is existing or able to be upgraded to service the requirements of the development. Further detailed design is to continue once the specific site requirements are received and approvals are able to progress.

Prepared by:

Blake Collins
BEng (Hons) (Civil) GradIEAust
Engineer

Authorised by:



David Wills
AIT(Civil) GradDipB FIEAust CPEng EngExec NER APEC RPEQ RBP IntPE (Aus)
Director

Encl.

Appendix A: Geotechnical Report
Appendix B: Theoretical Reverse Osmosis Disposal Water
Appendix C: Drainage Management Plan
Appendix D: Traffic Impact Assessment
Appendix E: DWA Drawings Set
Appendix F: Notice of Intent to Pump

S:\Projects\21295 - Infinite Green Energy Site at York Road, Northam\Correspondence

APPENDIX A: GEOTECHNICAL REPORT

Brown Geotechnical

Consulting Engineers – Land Development Geotechnical/Acid Sulphate Soil/Groundwater Monitoring

Our reference: 22050 18 October 2022
Your reference:

Infinite Green Energy
Level 19 / 99 St George Terrace
Perth WA 6000

Attn: Michael Hutt

Geotechnical Investigation – Northam, Infinite Green Energy Hydrogen Plant.

Introduction

Brown Geotechnical was commissioned by Infinite Green Energy to undertake an investigation to gain geotechnical properties to allow for the construction of a new hydrogen plant in Northam. This report presents the results of the investigation conducted at the site. Fieldwork commenced on 30 September 2022.

Brief

The brief discussed with the client, and detailed in our cost proposal dated 18th August 2022, required the report to address:

- Subsurface conditions.
- Soil strength.
- Site classification in accordance with AS2870-2011.
- Bearing capacity for footings.
- CBR values for pavement design.
- Excavatability of the soils.

Scope of Work

The following scope of work was undertaken:

- A mechanical auger and a 3 tonne excavator were used to excavate test holes for soil descriptions and sampling.
- Soil descriptions were carried out by a geotechnical engineer.
- Groundwater levels were recorded in each test hole.
- Samples were taken for geotechnical laboratory testing for soil classification.
- Topsoil and subsoil samples were taken for Phosphorous Retention Index (PRI).
- Bulk samples taken for MMDD/CBR testing.
- A sample was also taken from an adjacent soil stockpile to determine geotechnical properties for potential use as fill in the development.

Test Results

Table 1 – Geotechnical Test Results

Test Hole No.	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	CBR (%)	PRI (%)
TH1	0.0 – 0.1	-	-	-	-	-	-	8
TH2	0.3 - 0.5	-	-	-	-	-	-	30.3
TH4	0.3 - 0.8	57	43	0	39	17	1.5	-
TH6	0.5 –1.0	61	39	0	42	17	-	-
TH7	0.0 - 0.1	-	-	-	-	-	-	24.7
TH7	0.7 –1.0	52	48	0	35	17	-	11
TH8	0.3 - 0.5	-	-	-	-	-	1	-
TH8	0.5 - 1.0	69	31	0	52	20	-	-
TH9	0.2 - 0.5	33	67	0	NP	NP	-	-
Stockpile	-	22	78	0	NP	NP	-	-

*NP: Non-plastic

Subsurface Conditions

A thin layer of silty sand topsoil is present across the site to approximately 0.1m. PRI values ranged from 8 to 25.

A 0.5m layer of dense, silty sand was encountered in TH1 and TH9. The material is non plastic.

Stiff, fine grained, sandy clay then extends to at least 1.5m depth. The material has a high plastic fines content, exhibiting intermediate to high plasticity and moderate expansive properties. PRI values ranged from 7 to 30. Permeability of the stiff clayey soil would be $<1x10^{-8}$m/sec.

This graded into extremely weathered bedrock, recovered as a clayey sand with gravel below approx. 1.6m. Refusal of the 3 tonne excavator occurred at approx. 1.6m in most test holes.

Stockpile

The stockpile sample consists of a silty sand, with minimal cohesive properties. This is a similar material to that encountered to 0.5m in TH9. The soil could be used as fill in the development, however fines are relatively high so correct moisture conditioning during compaction will be important. The soil will likely have a low to moderate permeability when compacted due to the elevated fines content. Further testing on the stockpile will be required to confirm these observations and to confirm the uniformity of the soil type within the stockpile.

Groundwater Levels

No groundwater was encountered.

Existing Site Classification

The site is underlain by clayey subgrade close to or at the surface. It has been determined that the appropriate site classification for footing design is Class 'M' in accordance with AS2870-2011 (refer Table 2). The land is therefore suitable for development.

Table 2. Definition of Site Classifications (Australian Standard AS2870-2011)

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement for moisture changes (y_s<20mm).
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes (y_s 20-40mm).
H1	Highly reactive clay site, which can experience moderate to high ground movement from moisture changes (y_s 40-60mm)
H2	Highly reactive clay site, which can experience high ground movement from moisture changes (y_s 60-75mm)
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes (y_s>75mm)

y_s: Characteristic Surface Movement

Bearing Capacity

The site is underlain by a stiff sandy clay to at least 1.5m. A bearing capacity of 200kpa is appropriate for footing design.

CBR

Following removal of the topsoil, the base of the road and pavement areas will be founded on a stiff sandy clay subgrade or silty sand. Laboratory testing show CBRs of 1 and 1.5 for the clay. A CBR of 10 will be appropriate for the silty sand. Further testing will be required if the stockpile material is to be use below the pavement areas.

Excavatability

The use of a mechanical auger or excavator will be best suited for the footing excavations. Excavations may encounter very stiff or weakly weathered bedrock at depth and may require a rock breaker.

Regards

Ken Brown

Senior Geotechnical Engineer
BROWN GEOTECHNICAL

Attachments: Site and Test Location Plans
Test Hole Logs and Photos
Laboratory Test Certificates
Conditions Relating to this Report

Brown Geotechnical
Suite 9, 47 Monash Avenue
Como WA6152
Email: admin@browngeotechnical.com.au

Date	Description	Drawn	Checked	Approved
14.10.22	Site Location Plan	BB	KB	

SITE LOCATION PLAN

HYDROGEN PLANT
NORTHAM

CLIENT

Infinite Green Energy

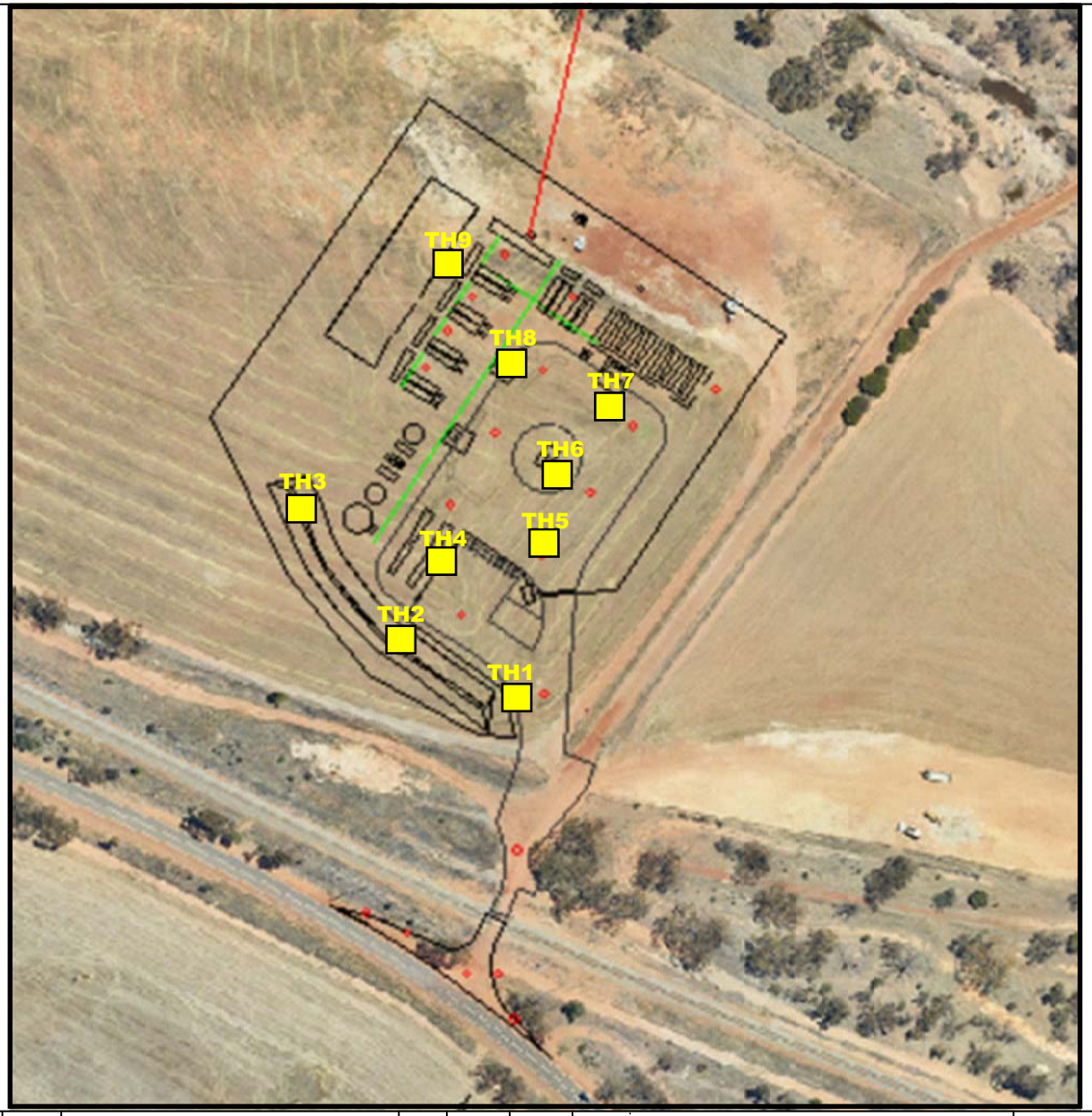
Drawing No.22050 Fig 1

Scale: NTS

Sheet Size: A4

Job No: 22050.01

FIGURE 1



Brown Geotechnical
Suite 9, 47 Monash Avenue
Como WA6152
Email: admin@browngeotechnical.com.au

Date	Description	Drawn	Checked	Approved
14.10.22	Test Location Plan	BB	KB	

TEST LOCATION PLAN

HYDROGEN PLANT
NORTHAM

CLIENT

Infinite Green Energy

Drawing No.22050 Fig 2

Scale: NTS

Sheet Size: A4

Job No: 22050.01

FIGURE 2

BOREHOLE NUMBER TH1

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR _____ **SLOPE** 90° **BEARING** ---

EQUIPMENT Mechanical Auger **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.3m dia **LOGGED BY** KB **CHECKED BY** KB

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, grey, silty sand with organics	PRI=8	
					SM	SILTY SAND: Dense, fine to medium grained, red brown, trace gravel and clay, dry		
			0.5					
	Not Encountered				SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, red brown, w<wp		
			1.0					
			1.5			becoming extremely weathered bedrock (recovered as clayey sand with gravel)		
			2.0			Borehole TH1 terminated at 2m		
			2.5					

TH1

BOREHOLE NUMBER TH2

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Mechanical Auger **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.3m dia **LOGGED BY** KB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, grey, silty sand with organics		
	Not Encountered		0.5		SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, red brown, w<wp	PRI=30.3	
			1.0					
			1.5			becoming extremely weathered bedrock (recovered as clayey sand with gravel)		
			2.0			Borehole TH2 terminated at 2m		
			2.5					

TH2

BOREHOLE NUMBER TH3

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR _____ **SLOPE** 90° **BEARING** ---

EQUIPMENT 3 tonne Excavator **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.5m x 1.0m **LOGGED BY** KB **CHECKED BY** KB

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encountered		0.5			TOPSOIL: Loose, grey, silty sand with organics		
					SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, red brown, w<wp		
			1.0					
			1.5					
			2.0			Refusal Borehole TH3 terminated at 1.7m		
			2.5					

TH3

BOREHOLE NUMBER TH4

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT 3 tonne Excavator **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.5m x 1.0m **LOGGED BY** KB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, grey, silty sand with organics		
	Not Encountered		0.5		SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, red brown, w<wp	MC=10% DD=1.90Mg/m^3 LL=39 PL=17 Fines=57% Sand=43 CBR=1.5	
			1.0					
			1.5			becoming extremely weathered bedrock (recovered as clayey sand with gravel)		
						Refusal Borehole TH4 terminated at 1.6m		
			2.0					
			2.5					

TH4

BOREHOLE NUMBER TH5

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR _____ **SLOPE** 90° **BEARING** ---

EQUIPMENT 3 tonne Excavator **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.5m x 1.0m **LOGGED BY** KB **CHECKED BY** KB

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encountered		0.5			TOPSOIL: Loose, grey, silty sand with organics		
					SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, red brown, w<wp		
			1.0			becoming extremely weathered bedrock (recovered as clayey sand with gravel)		
			1.5			Refusal Borehole TH5 terminated at 1.5m		
			2.0					
			2.5					

TH5

BOREHOLE NUMBER TH6

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR _____ **SLOPE** 90° **BEARING** ---

EQUIPMENT 3 tonne Excavator **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.5m x 1.0m **LOGGED BY** KB **CHECKED BY** KB

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0.0			TOPSOIL: Loose, grey, silty sand with organics		
	Not Encountered				SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, red brown, w<wp	LL=42 PL=17 Fines=61% Sand=39	
			1.5			Refusal Borehole TH6 terminated at 1.5m		
			2.0					
			2.5					

TH6

BOREHOLE NUMBER TH7

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR _____ **SLOPE** 90° **BEARING** ---

EQUIPMENT 3 tonne Excavator **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.5m x 1.0m **LOGGED BY** KB **CHECKED BY** KB

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0.0			TOPSOIL: Loose, grey, silty sand with organics	PRI=24.7	
	Not Encountered				SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, brown, w<wp		
			0.5					
			1.0				LL=1 PL=1 Fines=1% PRI=11	
			1.5					
						Refusal Borehole TH7 terminated at 1.6m		
			2.0					
			2.5					

TH7

BOREHOLE NUMBER TH8

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR _____ **SLOPE** 90° **BEARING** ---

EQUIPMENT 3 tonne Excavator **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.5m x 1.0m **LOGGED BY** KB **CHECKED BY** KB

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0			TOPSOIL: Loose, grey, silty sand with organics		
	Not Encountered				SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, brown, w<wp		
			0.5				CBR=1	
			1.0				LL=1 PL=1 Fines=1% Sand=	
			1.5					
						Refusal Borehole TH8 terminated at 1.6m		
			2.0					
			2.5					

BOREHOLE / TEST PIT NORTHAM.GPJ GINT STD AUSTRALIA.GDT 18/10/22

TH8

BOREHOLE NUMBER TH9

BG Brown Geotechnical

CLIENT IGE **PROJECT NAME** Hydrogen Plant

PROJECT NUMBER 21050 **PROJECT LOCATION** Northam

DATE STARTED 30/9/22 **COMPLETED** 30/9/22 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR _____ **SLOPE** 90° **BEARING** ---

EQUIPMENT 3 tonne Excavator **HOLE LOCATION** -32.030440 115.948349

HOLE SIZE 0.5m x 1.0m **LOGGED BY** KB **CHECKED BY** KB

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, grey, silty sand with organics		
					SM	SILTY SAND: Dense, fine to medium grained, red brown, trace gravel and clay, dry	LL=NP PL=NP Fines=33% Sand=67	
	Not Encountered		0.5		SC	SANDY CLAY: Stiff, intermediate plasticity, fine grained, red brown, w<wp		
			1.0					
			1.5			becoming extremely weathered bedrock (recovered as clayey sand with gravel)		
						Borehole TH9 terminated at 1.8m		
			2.0					
			2.5					

TH9

CONDITIONS RELATING TO THIS REPORT

1. This report has been prepared for the sole use of the client. It has been issued in accordance with the agreed terms and scope detailed in the proposal for the investigation. No responsibility or liability to any third party is accepted for any damages arising out of the use of this report.

2. This report has been prepared by suitably qualified and experienced personnel for the purposes stated herein. Every care is taken with the report as it relates to interpretation of sub-surface conditions, discussion of findings and recommendations given. No responsibility for the consequences of extrapolation by others is accepted by the company.

3. Findings and conclusions produced in the report are based on the investigation of the sub-surface through isolated locations. Conditions between investigated sites are based on extrapolation, interpretation and professional estimates. Unexpected variations in ground conditions often occur which cannot always be anticipated. The conclusions and recommendations in the report were considered accurate at the time of issue and based on certain assumptions at the time. Conditions and assumptions change with time and may affect the accuracy of the report.

4. Certain content within this report is based on information provided by the client and/or other parties and the accuracy of this information cannot be guaranteed.

5. These conditions must be read as part of the report and must be reproduced with all future copies.

6. The recommendations of this report should be considered a starting point. Recommendations should be continuously reviewed during the earthworks stage as sub-surface information and results from monitoring become available. It is strongly recommended that the Brown Geotechnical be retained to provide consultancy and/or inspections during the earthwork stages.

APPENDIX B: THEORETICAL HYDROGEN DISPOSAL WATER

Nitto HYDRANAUTICS
Innovation for Customers

Basic Design

Project name	Northam Hydrogen project
Client Name	Infinite Green
Calculated by	Ludo
HP pump flow	2.38 m3/h
Feed pressure	4.7 bar
Feed temperature	25.0 °C
Feed Water pH	8.00
Chemical dose, mg/l	None
Pumping specific energy	0.23 kWh/m3
Pass NDP	4.0 bar
Average flux	18.7 lmh

Permeate flow/train	40.00 m3/d
Raw water flow/train	57.10 m3/d
Permeate recovery	70.00 %
Membrane age	0.0 years
Flux decline,per year	5.0 %
Fouling factor	1.00
SP increase, per year	7.0 %
Feed type	Brackish Well Non-Fouling
Pretreatment	Conventional

Pass-Stage	Perm. Flow	Flow / Vessel Feed	Flow / Vessel Conc	Flux	DP	Flux Max	Beta	Stagewise Pressure Perm.	Stagewise Pressure Boost	Stagewise Pressure Exhaust	Stagewise Pressure Conc	Perm. TDS	Membrane Type	Membrane Quantity	PV# x Elem #
	m3/h	m3/h	m3/h	lmh	bar	lmh		bar	bar	bar	bar	mg/l			
1-1	1.2	1.2	0.6	19.7	0.3	20.7	1.20	0.0	0.0	0	4.4	3.4	ESPA2-LD-4040	8	2 x 4M
1-2	0.5	1.2	0.7	16.6	0.3	17.8	1.15	0.0	0.0	0	4.1	8.1	ESPA2-LD-4040	4	1 x 4M

Ion (mg/l)	Raw Water	Feed Water	Permeate Water	Concentrate 1	Concentrate 2
Hardness, as CaCO3	106.68	106.68	0.033	210.2	355.9
Ca	23.00	23.00	0.007	45.3	76.7
Mg	12.00	12.00	0.004	23.6	40.0
Na	110.00	110.00	1.797	215.5	362.9
K	4.20	4.20	0.078	8.2	13.8
Cu+2	0.003	0.003	0	0.006	0.01
CO3	0.00	0.00	0.000	0.0	0.0
HCO3	0.50	0.50	0.011	1.0	1.6
SO4	30.00	30.00	0.092	59.0	99.9
Cl	226.50	226.50	2.766	444.4	749.4
NO3	0.46	0.46	0.041	0.9	1.4
OH	0.02	0.02	0.000	0.0	0.1
CO2	0.01	0.01	0.01	0.01	0.01
NH3	0.00	0.00	0.00	0.00	0.00
TDS	**406.67**	**406.67**	**4.80**	**797.99**	**1345.92**
pH	**8.00**	**8.00**	**6.38**	**8.27**	**8.48**

Saturations	Raw Water	Feed Water	Permeate Water	Concentrate	Limits
CaSO4 / Ksp * 100, %	0	0	0	2	400
SrSO4 / Ksp * 100, %	0	0	0	0	1200
BaSO4 / Ksp * 100, %	0	0	0	0	10000
SiO2 Saturation, %	0	0	0	0	140
CaF2 / Ksp * 100, %	0	0	0	0	50000
Ca3(PO4)2	0.0	0.0	0.0	0.0	2.4
CCPP, mg/l	0.00	0.00	-0.16	0.22	850
Langelier index	-2.58	-2.58	-9.17	-1.12	2.8
Ionic strength	0.01	0.01	0.00	0.03	
Osmotic pressure, bar	0.3	0.3	0.0	1.0	
TDS / Osmotic pressure, mg/l.bar	1402.4	1402.4	1290.6	1403.4	

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Pretreatment	Conventional

Pass-Stage	Perm. Flow	Flow / Vessel Feed	Conc	Flux	DP	Flux Max	Beta	Stagewise Pressure Perm.	Boost	Exhaust	Conc	Perm. TDS	Membrane Type	Membrane Quantity	PV# x Elem #
	m3/h	m3/h	m3/h	lmh	bar	lmh		bar	bar	bar	bar	mg/l			
1-1	1.2	1.2	0.6	19.7	0.3	20.7	1.20	0.0	0.0	0	4.4	3.4	ESPA2-LD-4040	8	2 x 4M
1-2	0.5	1.2	0.7	16.6	0.3	17.8	1.15	0.0	0.0	0	4.1	8.1	ESPA2-LD-4040	4	1 x 4M

Pass-Stage	membrane no.	Feed Pressure	Pressure Drop	Conc Osmotic pressure	NDP	Permeate Water Flow	Flux	Recovery	Beta	Permeate (Stagewise cumulative) TDS	Econd (@ 25.0 °C)	Ca	Na	Cl
		bar	bar	bar	bar	m3/h	lmh	(%)		mg/l	µS/cm	mg/l	mg/l	mg/l
1-1	1	4.7	0.10	0.3	4.3	0.2	20.7	12.9	1.13	2.7	3.2	0.004	1.016	1.562
1-1	2	4.6	0.08	0.4	4.2	0.1	20.0	14.4	1.15	2.9	3.4	0.004	1.076	1.655
1-1	3	4.5	0.06	0.5	4.1	0.1	19.4	16.2	1.17	3.0	3.6	0.005	1.138	1.749
1-1	4	4.5	0.05	0.6	3.9	0.1	18.7	18.7	1.20	3.4	4.0	0.005	1.270	1.953
1-2	1	4.4	0.10	0.6	3.8	0.1	17.8	11.0	1.11	5.8	6.9	0.009	2.187	3.367
1-2	2	4.3	0.08	0.7	3.6	0.1	17.1	11.8	1.12	6.5	7.6	0.010	2.419	3.724
1-2	3	4.2	0.07	0.8	3.4	0.1	16.3	12.7	1.13	7.2	8.5	0.011	2.698	4.155
1-2	4	4.2	0.06	1.0	3.2	0.1	15.4	13.8	1.15	8.1	9.5	0.012	3.042	4.687

Basic Design

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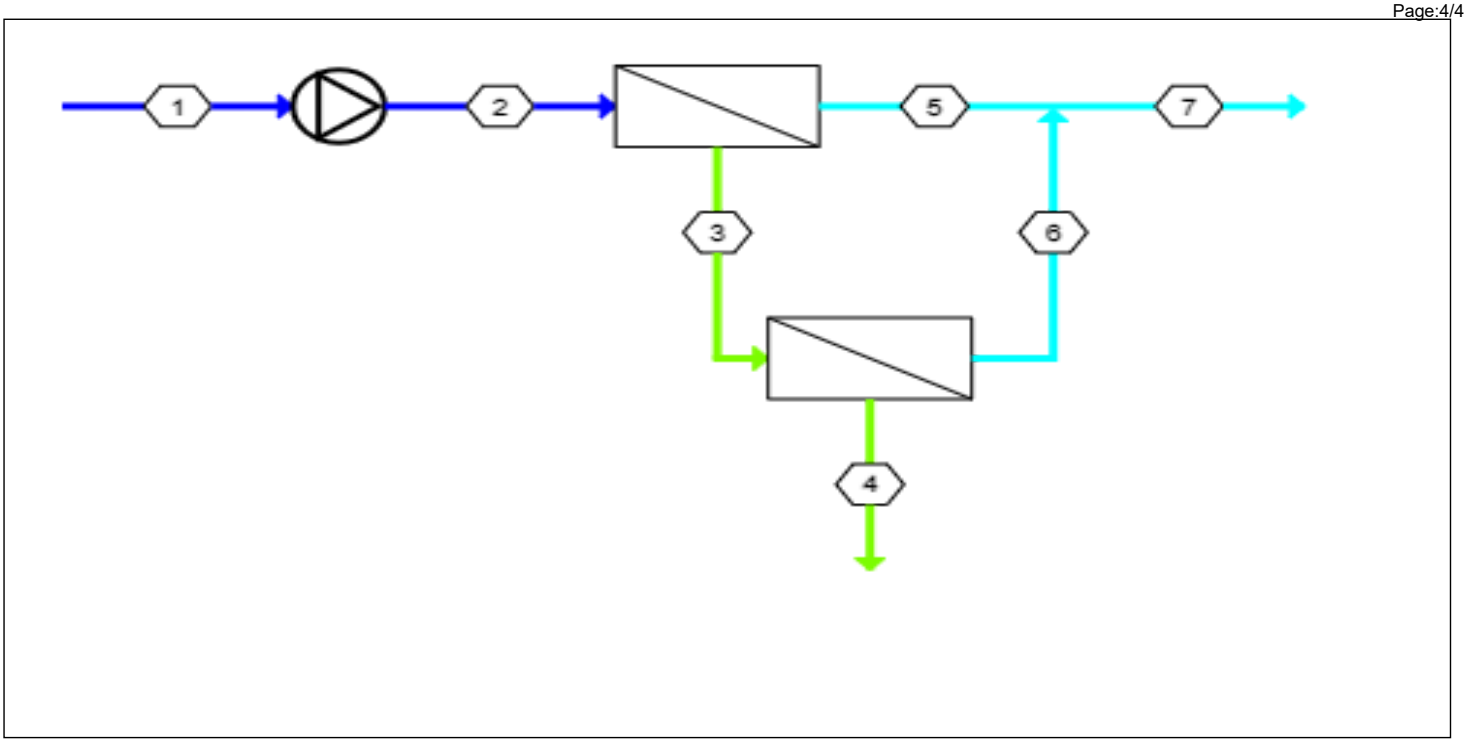
Permeate recovery	70.00 %
Membrane age	0.0 years
Flux decline,per year	5.0 %
Fouling factor	1.00
SP increase, per year	7.0 %
Feed type	Brackish Well Non-Fouling
Pretreatment	Conventional

The following parameters exceed recommended design limits

Pass 1-1: Concentrate flow per vessel (0.604127 m3/h) is lower than limit (0.681302 m3/h) for (ESPA2-LD-4040) membrane.

Basic Design



Stream No.	Flow (m3/h)	Pressure (bar)	TDS (mg/l)	pH	Econd (µS/cm) (@ 25.0 °C)
1	2.38	0	407	8.00	913
2	2.38	4.69	407	8.00	913
3	1.21	4.41	798	8.27	1746
4	0.713381	4.10	1346	8.48	2765
5	1.17	0	3.39	6.23	7.50
6	0.494874	0	8.12	6.60	17.7
7	1.67	0	4.80	6.38	10.5

APPENDIX C: DRAINAGE MANAGEMENT PLAN

David Wills and Associates
Consulting Engineers

STORMWATER MANAGEMENT PLAN

Infinite Green Energy, Northam

Stage 1: Initial Site Layout

Client's Reference Number: MEG-E01-DES-PLN-DWA-0001-RevH

21295
REVISION H
JULY 2023

DOCUMENT CONTROL DATA

DWA David Wills and Associates Consulting Engineers	David Wills and Associates Unit 1/9 Shields Crescent Booragoon WA 6158 PO BOX 3084 Myaree WA 6158 Tel: (08) 9424 0900 www.dwaconsulting.com.au	**Title**	Stormwater Management Plan
		Author	BC
		Checked	BD
		Approved	DW
		Synopsis	

Reference: 21295
Client: Infinite Green Energy

Revision Table

Ver	Description	Date	Authorised
A	Draft	25/01/23	BD
B	Initial Submission	02/02/23	BD
C	DA Submission	26/06/23	DW
D	DA Submission	04/07/23	DW
E	DA Submission	04/07/23	DW
F	DA Submission	07/07/23	DW
G	DA Submission	11/07/23	DW
H	DA Submission	14/07/23	DW

Distribution Table

Date	Version	Distribution
25/01/23	A	Infinite Green Energy
02/02/23	B	Infinite Green Energy
26/06/23	C	Infinite Green Energy
04/07/23	D	Infinite Green Energy
04/07/23	E	Infinite Green Energy
07/07/23	F	Infinite Green Energy
11/07/23	G	Infinite Green Energy
14/07/23	H	Infinite Green Energy

EXECUTIVE SUMMARY

David Wills and Associates (DWA) have been commissioned by Infinite Green Energy (IGE) to provide the drainage management plan for Lot 6 Northam-York Rd Muluckine. The property is proposed to be developed with a hydrogen production facility. This drainage management plan will assess the impact of the reverse osmosis discharge water and the effects from the change in land use and provide a drainage strategy to mitigate any adverse effects.

Stormwater Management

Stormwater runoff from the plant area will be managed by a series of stormwater basins, drainage channels and pipes. These basins, pipes and channels are required to be sized for the 1 in 1 year, 1-hour storm event.

Soil permeability in the area is extremely low, water from the basins is required to flow into the nearby Mortlock River to the north of the site with a controlled outflow from the basins.

Storms greater than the 1 in 1 year, 1-hour event will overtop the basin in a controlled manner and flow into the Mortlock River, matching the predevelopment conditions.

Water Quality Management

Analysis has been undertaken to model the levels in the reverse osmosis discharge water and Mortlock River and to compare the total dissolved solids. During periods of no rainfall, the reverse osmosis disposal water will be polished in the basins and during infiltration. During storm conditions, while this polishing becomes less effective, the rainwater dilutes the disposal water. The reverse osmosis disposal water is of higher water quality than the water typically in the Mortlock River.

Managing Construction

During the construction, no debris or residue from the construction site shall be allowed to wash into the river. Adequate care must also be taken by contractors to appropriately manage dust levels to avoid negatively affecting the nearby Mortlock River, local flora and fauna.

Monitoring

If required as part of the approval process from the relevant government authority, periodic monitoring of the water quality of the reverse osmosis discharge will be undertaken to ensure acceptable water quality.

CONTENTS

1 INTRODUCTION

David Wills and Associates have been commissioned by Infinite Green Energy, to produce a Drainage Management Plan for the proposed development at 161 (Lot 6) Northam-York Road Muluckine.

2 PROPOSED SITE DEVELOPMENT

The Northam project site is shown in Figure 1 below and is approximately 28.3 Ha in size. It is proposed to have an area of approximately 33,000m^2 developed to allow for facility operations, including hardstand vehicle access, and office and plant areas.

Figure 1: Site Overview (Courtesy of Nearmaps, 2023)

It is proposed to develop the site with a Hydrogen Plant to allow for production of hydrogen gas that will be distributed across Western Australia. The facility will include construction of office and ablution blocks, potable and fire water tanks with associated infrastructure as well as facility specific on surface equipment. A detailed site plan of the proposed facility is provided below.

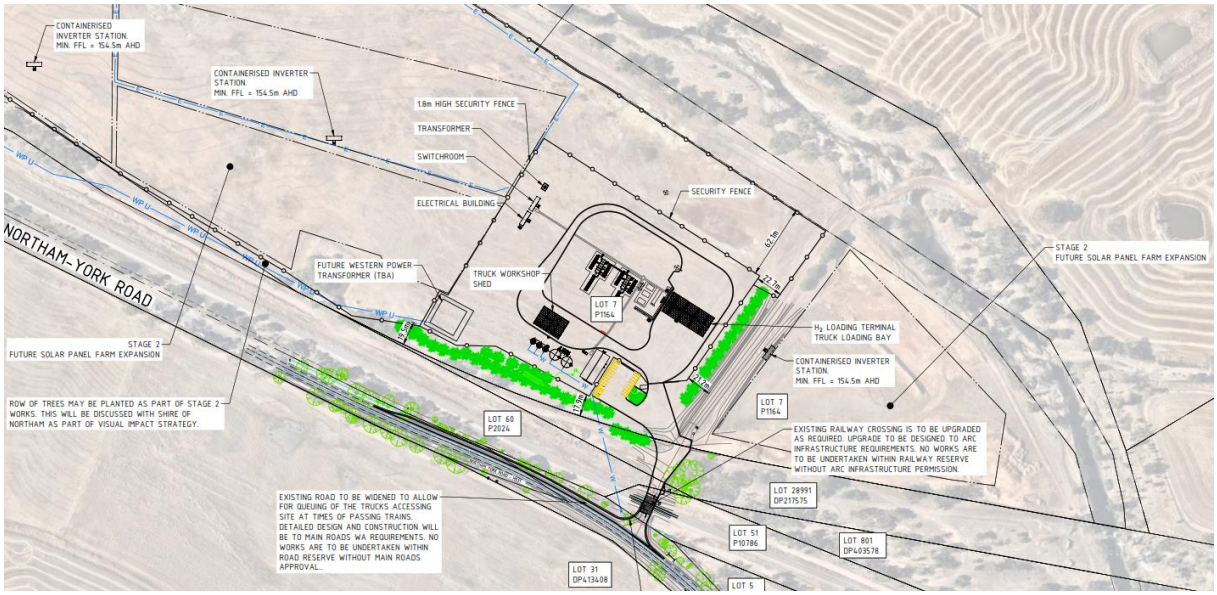


Figure 2: DWA Proposed Site Plan

3 DESIGN OBJECTIVES

Consistent with the Stormwater Management Manual for Western Australia and Draft State Planning Policy 2.9 – Planning for Water (2021), the following policy objectives and principles, form the basis for stormwater management at the proposed development site:

- Protect and improve the environmental, social, cultural and economic values of the State's water resources;
- Protect public health and the long-term supply of good quality affordable drinking water;
- Manage the risk of riverine flooding to people, property and infrastructure;
- Ensure the secure and sustainable supply, use and re-use of water resources;
- Ensure future development is resilient to the water-related impacts of climate change; and
- Minimise future costs and protect public health by ensuring that appropriate wastewater infrastructure is provided.

4 SITE CHARACTERISTICS

Location and Climate

The site is located within Shire of Northam to the east of Northam township. The site is positioned between the existing state road connecting Northam with York and the Mortlock River reserve.

The climate is Mediterranean with hot, dry summers and cool, wet winters. The mean maximum temperature is approximately 25.4°C and the mean minimum temperature is approximately 11°C.

Mean annual rainfall is approximately 427.2mm with the majority of the rainfall occurring during the months between May and August.

The below Figure 2 sourced from Bureau of Meteorology presents rainfall intensity for the site location.

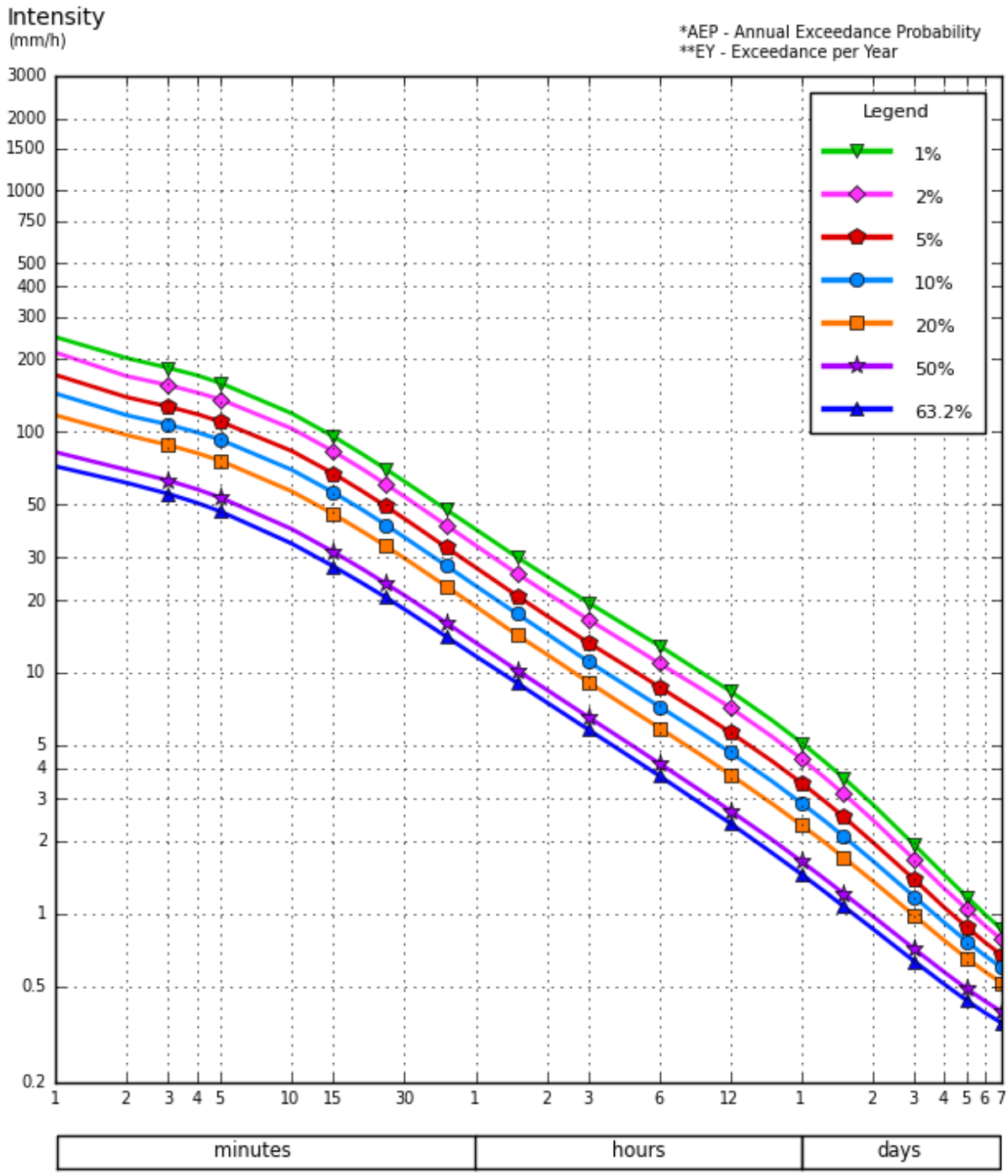


Figure 3: IFD chart for Northam (Courtesy of Bureau of Meteorology, 2023)

Site Topography

The existing site topography has been obtained from a site survey and data provided by the Water Corporation from ESINET. The existing site generally falls to the northwest, with the majority of stormwater flowing into the Mortlock River. The site also has sections of low-lying areas that currently pool in storm conditions. An extract of the ESINET contours is provided below.

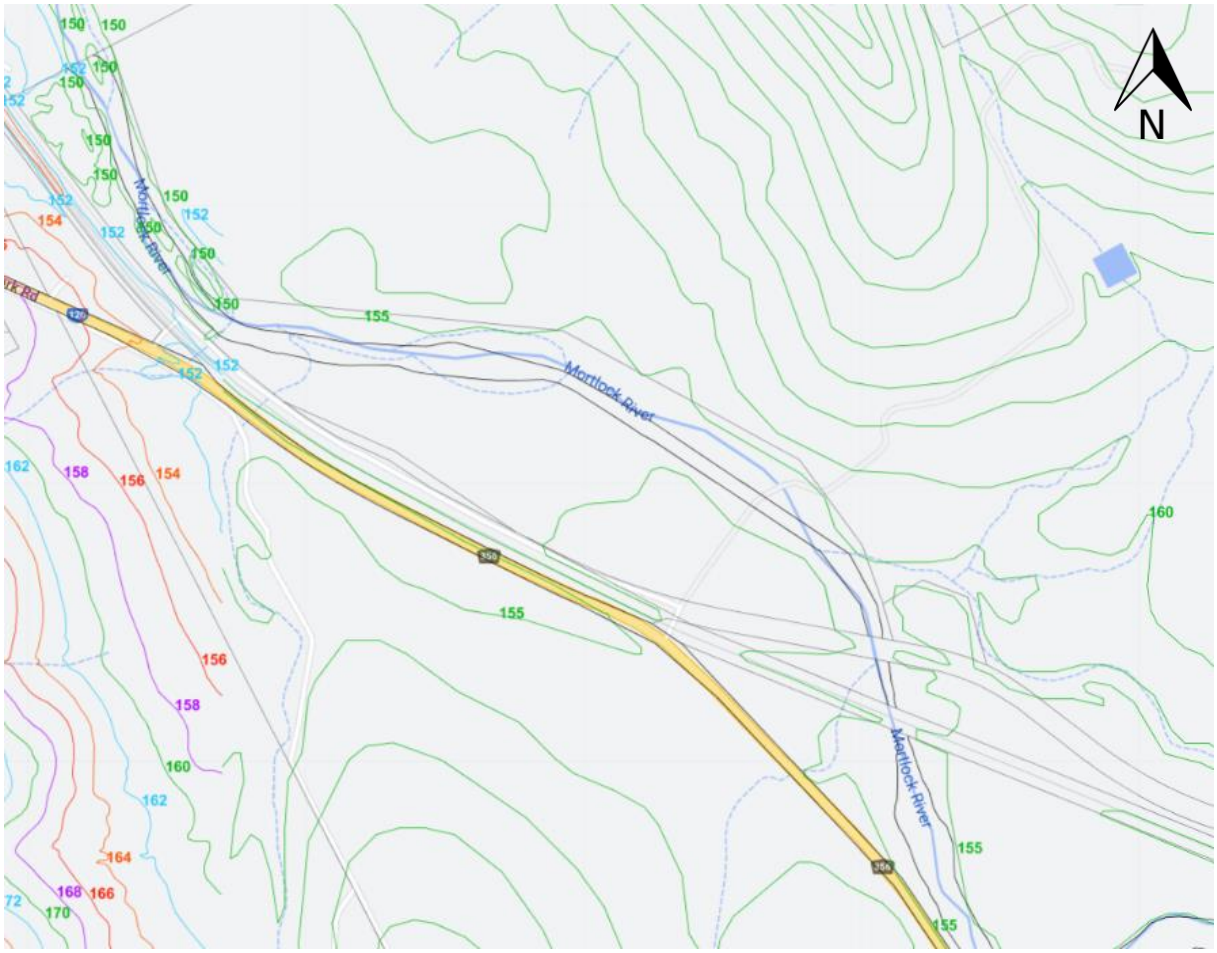


Figure 4: Site Contours (ESINET, 2023)

Geotechnical

A detailed geotechnical report was undertaken by Brown Geotechnical on September 30, 2022. A full copy of the geotechnical report is attached in Appendix A of the Services Plan. A summary of the report is provided below:

- A thin 0.1m layer of silty sand is present across the entire site, PRI (Phosphorus Retention Index) values ranged from 8 to 25. A 0.5m layer of dense silty sands was encountered at Test Holes 1 and 9;

- Stiff, fine-grained, sandy clay then extends to at least 1.5m depth. The material has a high plastic fines content, exhibiting intermediate to high plasticity and moderate expansive properties. PRI values ranged from 7 to 30. Permeability of the stiff clayey soil would be $<1x10^{-8}$ m/sec or very poor. Because of this, stormwater is required to discharge off-site rather than purely infiltrate;

- This graded into extremely weathered bedrock, recovered as clayey sand with gravel below approx. 1.6m. Refusal of the 3-tonne excavator occurred at approx. 1.6m in most test holes;

- No Groundwater levels were encountered during testing, and

- Acid Sulphate Soils were not encountered during geotechnical testing and are a low probability of occurrence based on soil mapping from Geoscience Australia. An extract is provided below in Figure 4.

- The site is underlain by a clayey subgrade close to or at the surface. It has been determined that the appropriate site classification for footing design is Class 'M' (Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes (y_s 20-40mm)) in accordance with AS2870-2011. The land is therefore suitable for development.

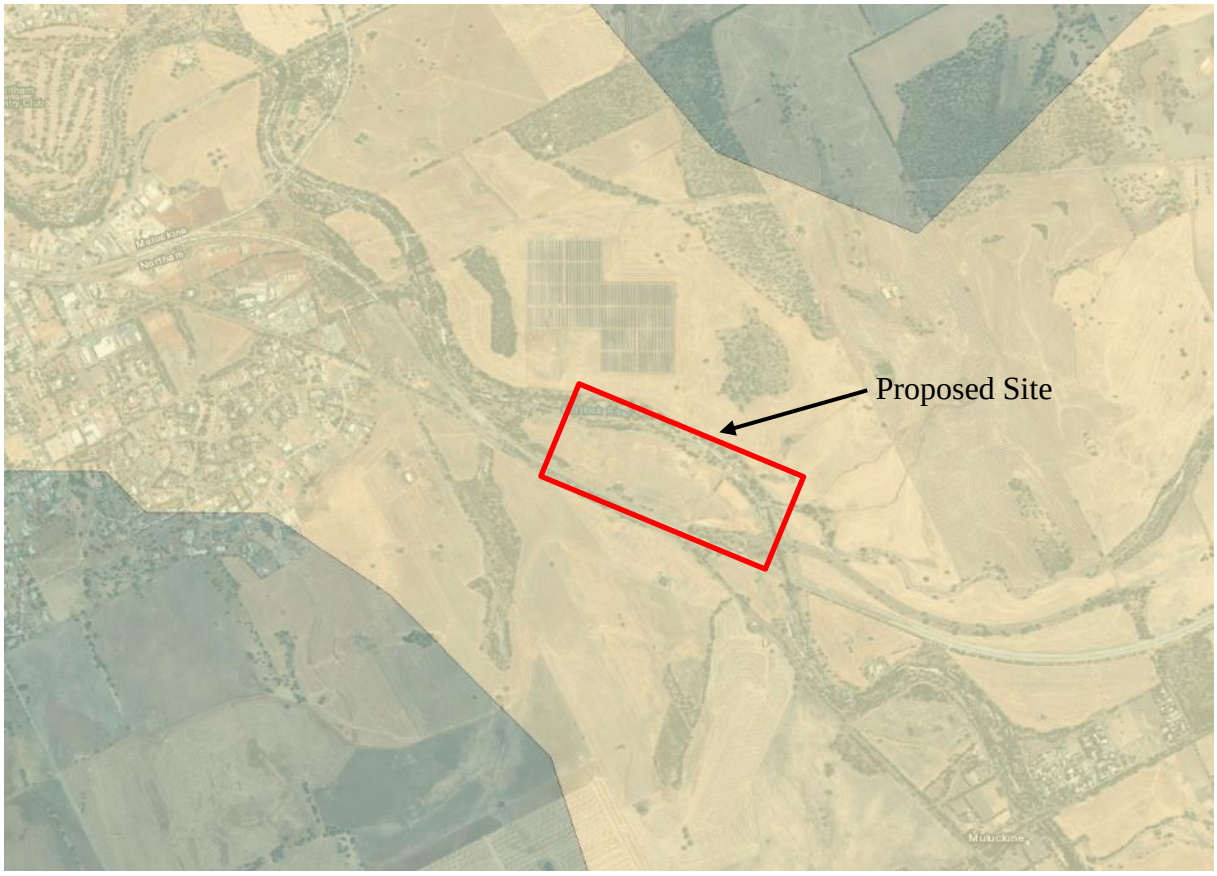


Figure 5: Acid Sulphate Soils (Courtesy of Geoscience Australia, 2023)

Legend:
Yellow - Low Probability of Occurrence
Blue - Extremely Low Probability of Occurrence

Surface Water

The existing site generally grades towards the northwest, with a large amount of the runoff flowing towards the Mortlock River that flows along the northern boundary of the site. A section of the stormwater currently flows to the southern boundary of the site where it collects in a small dam and natural depression basins.

From data provided by the upstream DWER stream gauging station (O'Driscoll's Farms - Station Number 615020) the 1 in 100 year flood level of the Mortlock River is 153.5m RL. This 1 in 100 year event conveys a flow of $172m^3/s$ from the Department of Water flood modelling. A 0.5m minimum freeboard is required for the finished floor level of all flood sensitive buildings.

Historic Land Use

The current land use is farmland, with large numbers of sheep previously being located at the property. The land has also been used as a quarry from historical aerial images. The adjacent northern lot has been fitted with a large solar panel farm.

The change in land use will improve the quality of stormwater runoff by reducing the biological load from the livestock.

Other Relevant Information

The tributaries of the Avon River are of Aboriginal cultural significance. The Mortlock River is included in this. Data from the Department of Land Administration and the Aboriginal Affairs Department shows that there are no registered sites or communities of Aboriginal significance along Mortlock River North.

Anecdotal evidence suggests that there were once Aboriginal clans living in the area surrounding this River, with territories bordering the waterway. Past occupation of the land by Aboriginal people suggests that the land may have important spiritual and cultural meaning to the current generations of these tribes.

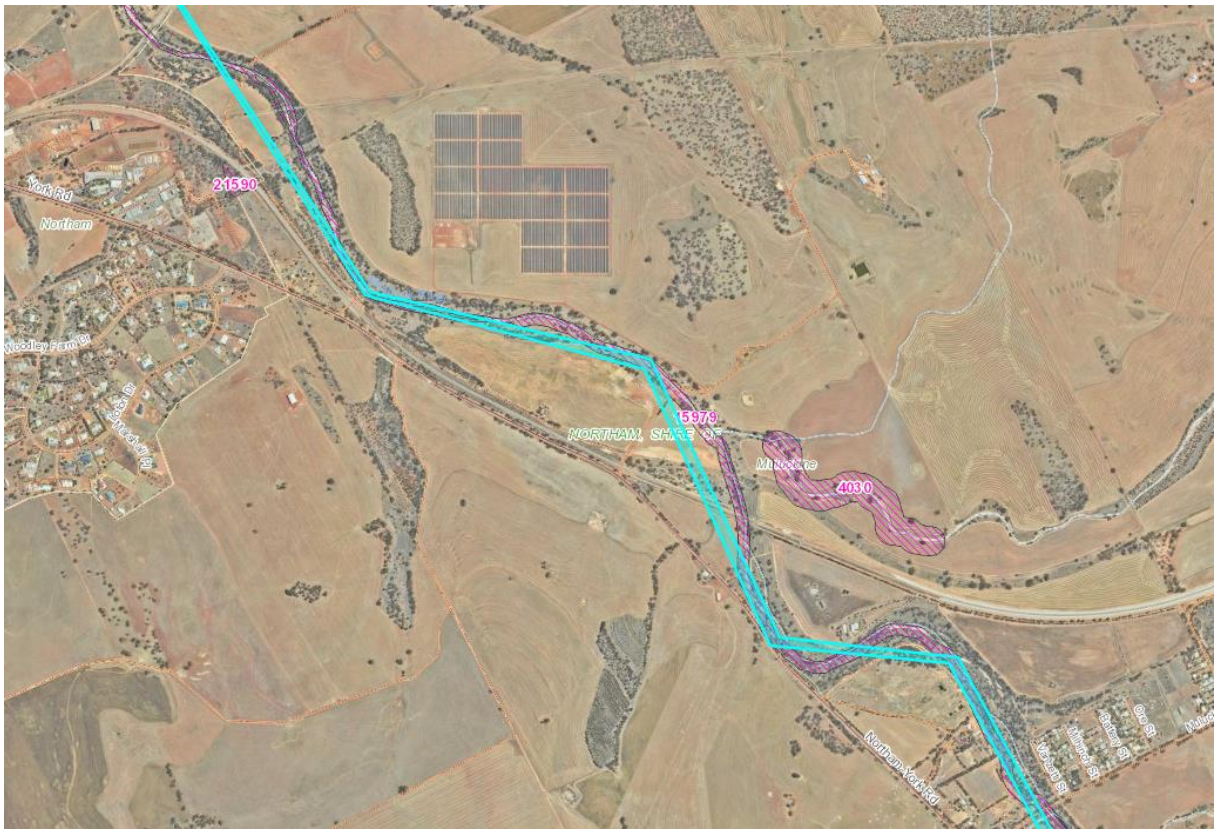


Figure 6: Area of Aboriginal Heritage Significance (Courtesy of the Western Australian Department of Planning, Lands and Heritage, 2023)

5 STORMWATER MANAGEMENT OBJECTIVES

The objectives of the stormwater management plan as listed in "Section 3. Design Objectives" taken from Stormwater Management Manual for Western Australia and Draft State Planning Policy 2.9 – Planning for Water (2021) can then be achieved by the following:

Water Quantity Management

- Manage rainfall events to minimise runoff as high in the catchment as possible. The one-year, one-hour (1 in 1) ARI event should be detained on-site;

- Infiltration should be encouraged in permeable areas through mechanisms such as soakwells, landscaping and flush kerbing;

- Manage catchment runoff up to 1 in 100-year ARI event for peak flows, to pre-development levels;

- Maximise water use efficiency, reduce potable water demand, and maximise the re-use of water harvested; and

- Stormwater egress from the site post-development must not exceed pre-development flows.

Water Quality Management

- All stormwater runoff from the plant area is to be polished in planted stormwater basins before flowing into the river. The basins will be heavily vegetated to remove nutrients from the runoff and to ensure the quality of the stormwater discharge into the river body.

Protect and manage water bodies

- No development within the flood fringe area;

- 0.5m freeboard above the 1 in 100-year ARI river flood levels to all flood sensitive buildings.

6 PROPOSED STORMWATER MANAGEMENT REGIMENT

Design Approach

The design approach is to:

1. Collect and treat stormwater runoff generated by the site development for a 1 in 1 year, 1-hour storm event;
2. Also collect and treat the volume of disposal water produced during reverse osmosis over a 1 hour period. The resulting total volume is the critical design parameter for the proposed nutrient stripping basins, pipes and channels.

Water Quantity Management

Preliminary stormwater calculations have been undertaken to provide indicative basin sizing. These calculations are required to be confirmed at the detailed design stage once all relevant approvals are gained.

Table 1: Catchment Summary

Catchment	Catchment Area (m^2)	C_{10}	1 year, 1-hour volume (m^3)
Total Site Affected	180’101	0.6	1’011.45
Developed Plant Area	33’000	0.9	277.99

The location of the basins may require slight adjustment depending on the exact level of the river bank.

The proposed basins plan area, average depth and assumed volume are listed in the table below.

Table 2: Proposed Basin Summary

Basin	Plan Area (m^2)	Ave Depth Assumed (m)	Assumed Volume (m^3)
East	5'620	0.2	1'124
Central	2'870	0.2	574
West	1'790	0.2	358

The total estimated supplied volume of the basins is approximately 2'050 m^3 or approximately 200% greater than the design storm's resulting volume. These numbers will be re-assessed in the detailed design stage but there is a high degree of flexibility to meet the designed stormwater design volume.

Preliminary channel sizes and pipe sizes between basins have also been detailed in the DWA drawing set. The sizes and detailed scour protection design will be re-assessed in the detailed design stage.

Water Quality Management

During periods of no rainfall, reverse osmosis disposal is to be used to water the basins and landscaping areas. During storm conditions, while this polishing becomes less effective, the rainwater dilutes the disposal water. The reverse osmosis disposal water is of higher water quality than the water typically in the Mortlock River. More details regarding the reverse osmosis disposal can be found in DWA Report 21295—Infinite Green Energy – Infrastructure Servicing Report.

The basins will cascade downstream to the west, through a series of specifically designed drainage channels and pipes. These channels will be planted with nutrient-stripping plants and protected with rock pitching where required. This combination of planting and rock pitching will aid to reduce the velocity of collected stormwater runoff prior to final discharge into the Mortlock River.

For storm events beyond the 1 in 1 year, 1-hour storm event, the basins will overtop at the eastern most basin in a controlled manner, with the excess stormwater falling towards the nearby Mortlock River.

Protect and Manage Water Bodies

In order to protect the accessible buildings from flooding of the river, the Finished Floor Levels (FFL's) of all accessible buildings will be set at a minimum of 154.0m AHD. This is 0.5m above the predicted Mortlock River 1 in 100-year flood level of 153.5m AHD.

Fire Protection

A detailed fire hydrant system with pumps and tanks shall be installed and shall use potable water only.

A deluge system shall be installed over the truck refuelling area. The truck refuelling area shall be bunded and contain two 1050mm diameter stormwater pits to collect runoff from the deluge system and any spillage generated inside the refuelling area.

An irrigation slide gate valve shall be installed at the outlet of the first nutrient stripping basin. This can be shut during a fire event and will allow any fire water runoff to be collected and treated if required. This limits the hydrocarbons generated from the fire, flowing into the nearby Mortlock River.

Grading

The proposed plant area will be graded towards the proposed nutrient striping basins located near the northern boundary of the site. All stormwater landing on the proposed roof areas shall be directed onto the pavement and then flow north towards the proposed basins.

The western basin is proposed to be the lowest laying to mimic current site conditions and to allow for controlled discharge of stormwater runoff from major storm events A detailed grading plan will be undertaken as part of the detailed design for the site. The site grading has been indicated with arrows on DWA 21295-C-06 Stormwater discharge plan included as part of Appendix E of the Services Plan.

The overall site has been separated into the plant area with development occurring (3.3 ha) and the total affected area (18.0 Ha).

7 CONSTRUCTION SITE MANAGEMENT

During the construction, no debris or residue from the construction site shall be allowed to wash into the river. Adequate care must also be taken by contractors to appropriately manage dust levels to avoid negatively affecting the nearby Mortlock River, and local flora and fauna.

8 POST-DEVELOPMENT MONITORING

If required as part of the approval process from the relevant government authorities including the Department of Primary Industries and Regional Development, periodic monitoring of the water quality of the reverse osmosis discharge will be undertaken. All required testing will be undertaken in accordance with the requirements.

9 IMPLEMENTATION AND MAINTENANCE

Implementation

Stormwater basins are required to be constructed during the site grading process to ensure that they are established prior to the construction of the plant.

Planting of the basins is required to be undertaken at the end of the winter months to ensure the vegetation can be established before the warmer summer months while reducing the risk of being washed out.

Maintenance

Maintenance of the swales and basins shall be managed by Infinite Green Energy.

Short term maintenance shall include:

- Plants are suitably established at a density of approximately 6-10 plants per square meter (depending on species)
- Plants are to be regularly irrigated during the establishment period (18-24 months).
- Plants that fail to thrive during this period shall be replaced as required.

Long Term maintenance shall include:

- Assess plants for disease, pest infection, stunted growth or senescent plants.
- Treat or replace as necessary. Reduced plant density reduces pollutant removal and infiltration performance.
- Maintain original plant density.
- Inspect for and manually remove weed species. Application of herbicide should be limited to a wand or restrictive spot sprayer.

Long term maintenance tasks shall be undertaken at a 3-month frequency period or as desired for aesthetics.

10 CONCLUSION

From the above, the listed objectives of the drainage management plan can be achieved on the site. This will ensure that: sufficient storage is provided for the 1 in 1 year, 1 hour storm event, the property is sufficiently protected from flood damage, and runoff water quality is of an acceptable level.

The area is therefore suitable to be developed provided the proposed infrastructure is constructed.

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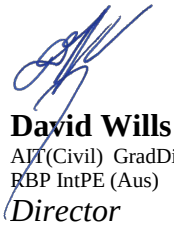

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APPENDIX D: TRAFFIC IMPACT ASSESSMENT

Engineering a better future for over 20 years!

Proposed Hydrogen Plant at Northam Solar Farm

Transport Impact Statement

PREPARED FOR:
Infinite Green Energy

June 2023

Document history and status

Author	Revision	Approved by	Date approved	Revision type
R White	r01	B Bordbar	12/07/2022	Draft
R White	r01a	B Bordbar	4/08/2022	Final draft
R White	r01b	B Bordbar	8/08/2022	Final
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1 Introduction

This Transport Impact Statement has been prepared by Transcore on behalf of Infinite Green Energy (IGE) with regard to the proposed hydrogen production plant at the existing Northam solar farm.

The subject site is located approximately one kilometre east of the Northam townsite, on the northeast side of the Northam – York Road and the East Perth – Kalgoorlie railway line, as shown in **Figure 1**.

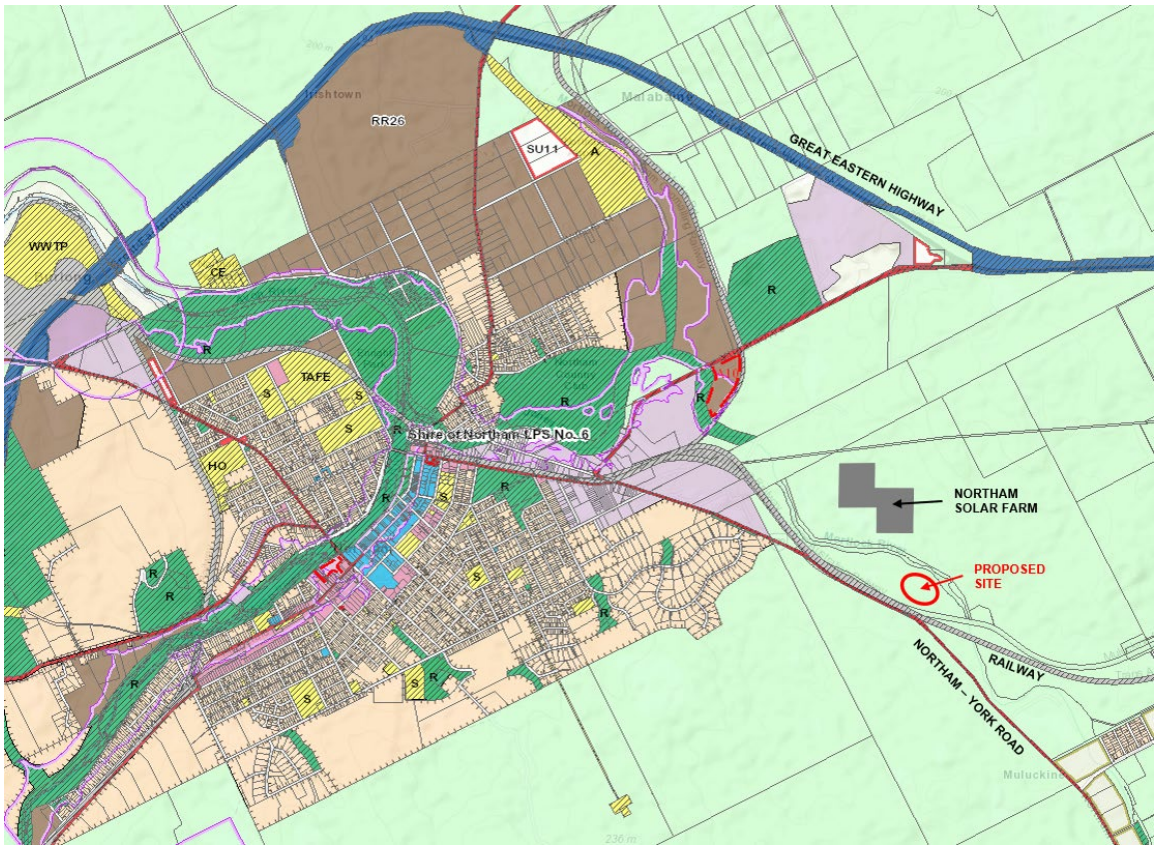


Figure 1: Location of the subject site

This revision of the Transport Impact Statement takes into consideration an increase in the traffic movements to and from the subject site to allow for potential future intensification of activity at the subject site.

The WAPC *Transport Impact Assessment Guidelines* (2016) state: *"A Transport Impact Statement (TIS) is required for those developments that would be likely to generate moderate volumes of traffic*[1] *and therefore would have a moderate overall impact on the surrounding land uses and transport networks"*. Section 6.1 of this report provides

[1] *Between 10 and 100 vehicular trips per hour*

details of the estimated trip generation for the proposed development. Accordingly, as the total peak hour vehicular trips are estimated to be less than 100 trips, a *Transport Impact Statement* is deemed appropriate for this development.

2 Proposed Development

Infinite Green Energy have acquired (long term lease) the Northam Solar Farm for the purpose of upgrading the facility to produce and distribute hydrogen gas to clients.

The proposed hydrogen production plant is located on the northeast side of the Northam – York Road and the East Perth – Kalgoorlie railway line and south of the Mortlock River, as shown in **Figure 1** and **Figure 2**. The layout of the proposed hydrogen plant is shown in **Appendix A**.

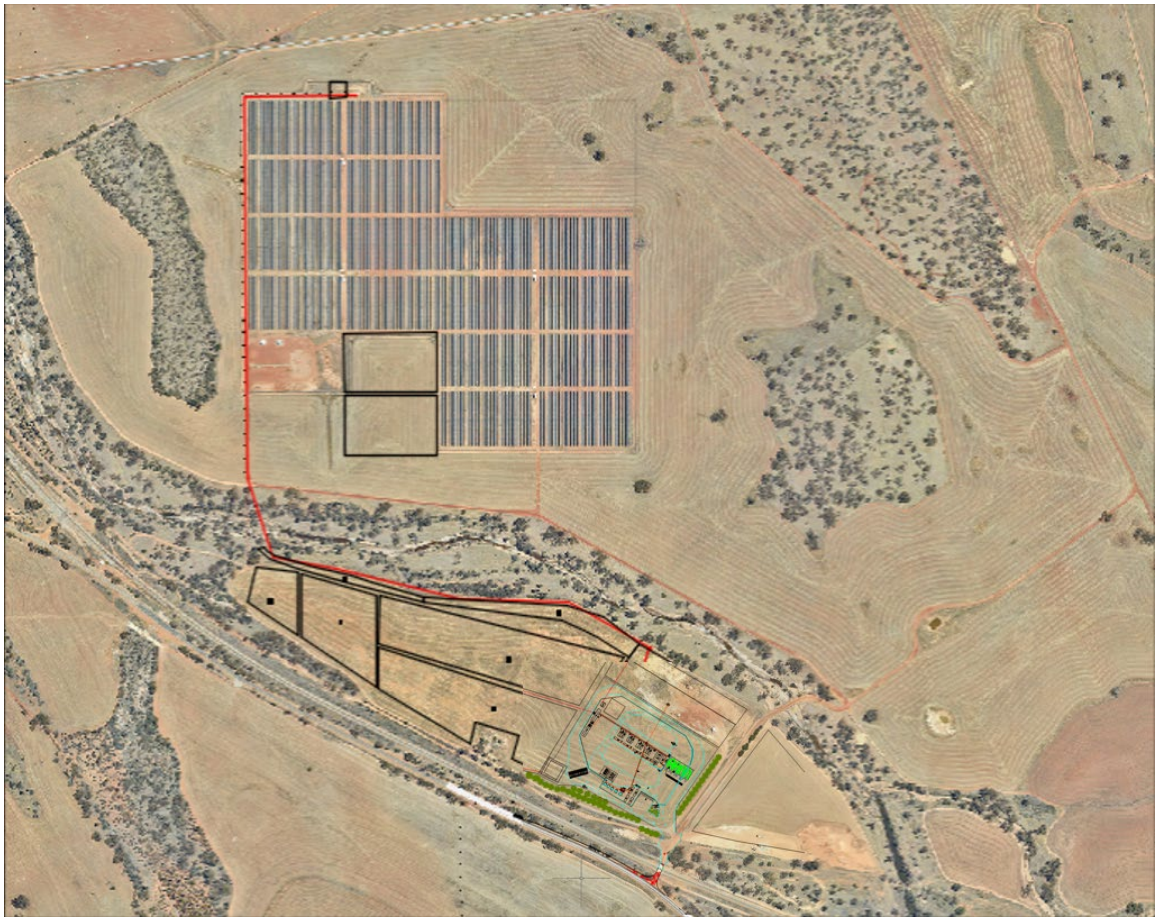


Figure 2: Northam Solar Farm and Proposed Hydrogen Plant

Access to the subject site is proposed to utilise the existing private level crossing of the railway line that currently provides access to the Northam Solar Farm from the Northam – York Road.

As this is a private level crossing it is currently subject to a Level Crossing Access Agreement (and Safety Interface Agreement) between DK West Investments Pty Ltd (the landowner) and Arc Infrastructure (the rail operator). Currently the only persons permitted to use that Level Crossing are personnel of DK West Investments Pty Ltd and their Permitted Users (as named in the agreement itself). Arc have advised that formal amendment to the agreement between Arc and DK West Investments will be

required to enable any such access. This would also require a review of the Safety Interface Agreement currently in place between the parties. Transcore understands that these matters are currently in the process of being addressed.

IGE has advised that they anticipate a construction period of up to 18 months for construction of the hydrogen plant, with production of hydrogen gas scheduled for the fourth quarter of 2023 subject to arrival of equipment with long lead times.

When the hydrogen plant is operational it is anticipated that hydrogen gas cylinders will be transported to and from the site in standard 20-foot or 40-foot shipping containers, using appropriate trucks up to 20m in length. Current advice from IGE indicates this is anticipated to involve 7 to 8 truckloads per day but allowance is made in this report for potential future intensification of activity in the operation of this site.

Due to the nature of the hydrogen cargo, appropriate safety measures are an important feature of this project. Accordingly, IGE are prepared to fund the installation of boom barriers and flashing lights at the railway level crossing. IGE also propose construction of a left turn lane on the Northam – York Road on approach to the level crossing to provide safe storage space clear of the through traffic lane for any inbound vehicle that needs to wait for a train to clear the level crossing.

3 Vehicle Access and Parking

3.1 Access

Access to the subject site is proposed to utilise the existing private level crossing of the railway line that currently provides access to the Northam Solar Farm from the Northam – York Road, as illustrated in **Figure 3**.

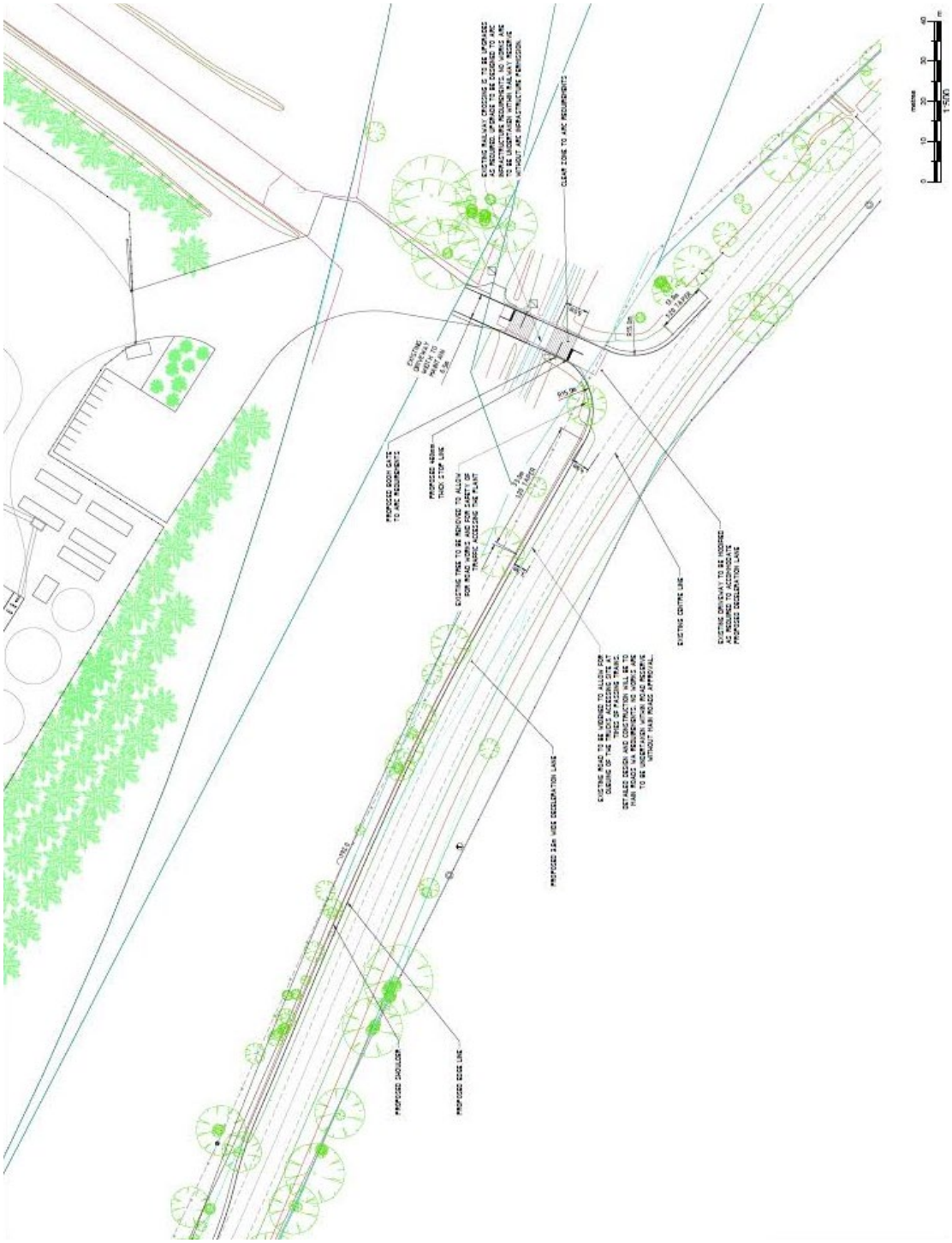


Figure 3: Proposed Access

As noted in section 2 of this report, Arc have advised that formal amendment to the existing agreement between Arc and DK West Investments will be required to enable this access.

IGE propose to fund the installation of boom gates and flashing lights at the railway level crossing. The design and installation of this upgraded level crossing would be undertaken by Arc Infrastructure.

IGE also propose construction of a left turn lane on the Northam – York Road on approach to the level crossing to provide safe storage space clear of the through traffic lane for any inbound vehicle that needs to wait for a train to clear the level crossing. **Figure 4** shows Northam – York Road immediately north of the level crossing where that left turn lane would be constructed.

Figure 4: Northam – York Road looking northwest from existing level crossing

Figure 5: Existing level crossing from Northam - York Road

The only physical constraint on vehicle access to and from the subject site via this level crossing relates to the queuing space available between the Northam – York Road and the railway line to accommodate a vehicle waiting to turn right out onto that road. The distance from the closest rail to the edge of the traffic lane is approximately 28m and 5m clearance distance is required (3m from the nearest rail and 2m from the edge of the through road[2]) leaving 23m available to accommodate a vehicle waiting to turn right onto the Northam – York Road. Accordingly, Main Roads WA has advised that the longest vehicle that should be permitted to use this access would be 20m in length.

3.2 Internal Site Traffic Movements

The main vehicle movements within the site for the hydrogen production operation will be the trucks transporting hydrogen from the site. Trucks will enter via the security gate at the southeast corner of the site, immediately to the east of the security hut. These trucks will travel in a clockwise direction within the loading area as shown and exit via the same security gate.

A parking area for ten vehicles is shown on the site plan at **Appendix A**, located outside of the security fence immediately to the west of the security hut.

3.3 Parking

The proposed development provides for all parking requirements on-site, as discussed above.

During construction the anticipated demand is in the order of 15 to 20 vehicles per day.

During the subsequent operational phase parking demand of the hydrogen plant is anticipated to be in the order of 5 light vehicles and typically one or two trucks (or heavy vehicle combinations up to 20m in length).

Additional parking would be available within a separate, fenced, ring road outside of the main security fence all the way around the hydrogen plant, which would cater for any future increase in parking demand associated with future intensification of operations.

[2] Source: Railway Crossing Control in Western Australia Policy and Guidelines (Main Roads WA, April 2017), section 13.1.

4 Provision for Service Vehicles

As discussed in section 3.1, the largest vehicles that will be permitted to access the site via the existing level crossing from the Northam – York Road will be 20m in length.

Subject to relevant height, width and weight limits, the largest vehicles allowed on virtually all roads in Western Australia without a special permit or order are semi-trailers up to 19m in length or heavy rigid vehicles up to 12.5m in length.

A 20m long vehicle would require a permit or order from Main Roads WA as a Restricted Access Vehicle (RAV). Specification of this size vehicle is consistent with RAV Network 1, which allows various vehicle and trailer combinations up to 20m in length, as illustrated in **Figure 6**. Almost all roads in Western Australia are included in RAV Network 1, including the Northam – York Road.

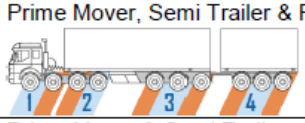
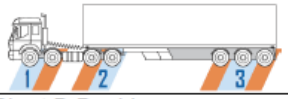
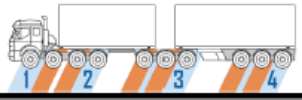
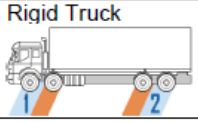
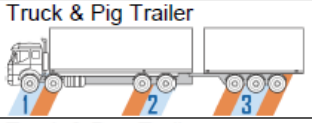
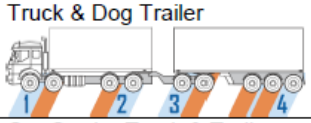
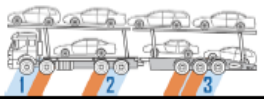
Category 1 RAVs				
Category	**Vehicle Description**	**Length**	**Max. Mass**	**Approved Network**
1A	Prime Mover, Semi Trailer & Pig Trailer 	≤20 m	50 t	Tandem Drive Network 1
1B	Prime Mover & Semi Trailer 	≤19.0 m	48.5 t	Tandem Drive Network 1
1C	Short B-Double 	≤20 m	50 t	Tandem Drive Network 1
Category 1 RAVs				
Category	**Vehicle Description**	**Length**	**Max. Mass**	**Approved Network**
1A	Rigid Truck 	≤12.5 m	28.5 t	Tandem Drive Network 1
1B	Truck & Pig Trailer 	≤20 m	46.5 t	Tandem Drive Network 1
1C	Truck & Dog Trailer 	≤20 m	50 t	Tandem Drive Network 1
1D	Car Carrier Truck & Trailer 	≤20 m	46.5 t	Tandem Drive Network 1

Figure 6: Category 1 RAVs up to 20m in length

5 Hours of Operation

The timing of construction operations will comply with any restrictions imposed by the Town of Northam as conditions of approval of this proposed development, if required.

The previous vehicle and traffic management plan for the construction of the Northam Solar Farm in 2017-2018 indicated most traffic movements would be from 7am to 5pm, which gives an indication of likely construction timing.

The proposed hydrogen plant will be powered by electricity from the solar farm and will therefore operate mainly during daylight hours. However, transport of hydrogen gas cylinders to and from the site would potentially occur at any time of the day to suit the needs of clients and transport operators.

It is anticipated that IGE will seek unrestricted use of the existing level crossing (in terms of time of day and days of the week) for access to and from the site.

6 Daily Traffic Volumes and Vehicle Types

6.1 Trip Generation

The trip generation associated with the proposed project can be separated into two discrete stages: construction stage and operational stage.

6.1.1 Construction Stage Traffic

Current advice from IGE indicates construction traffic of 15 to 20 vehicles per day (i.e. 30-40 vpd two-way total), with a construction period of up to 18 months.

Detailed information that has been provided for the previous construction of the solar farm on this property in 2017 – 2018 indicated up to 30% of construction traffic would be heavy vehicles during the busiest months of the construction period for that project.

Based on that heavy vehicle proportion and traffic patterns for that previous construction project it is estimated that the busiest months of the construction period for the proposed hydrogen plant would involve 20 vehicles per day (round trips) (14 light vehicles and 6 heavy vehicles). Construction staff were anticipated to be onsite between 7am and 5pm, so most of those light vehicles would arrive around 7am and depart around 5pm, whereas the heavy vehicle movements would be spread throughout that period and would seldom involve more than one inbound and one outbound heavy vehicle per hour. Accordingly, the anticipated typical construction traffic flows are shown in **Table 1**.

Table 1: Trip generation of the proposed development – construction stage

Period	Direction	Workforce traffic		HV traffic		Total Traffic	
		Split	Total	Split	Total	Split	Total
Morning Peak	Inbound	14	**14**	1	**2**	15	**16**
	Outbound	0		1		1	
Typical Hour	Inbound	0	**0**	1	**2**	1	**2**
	Outbound	0		1		1	
Afternoon Peak	Inbound	0	**14**	1	**2**	1	**16**
	Outbound	14		1		15	

6.1.2 Operational Stage Traffic

When the hydrogen plant is operational it is anticipated that hydrogen gas cylinders will be transported to and from the site in standard 20-foot or 40-foot shipping containers, using appropriate trucks up to 20m in length. Current advice from IGE indicates this is anticipated to involve 7 to 8 truck loads per day (i.e. 14 to 16 vpd two-way total truck movements). On-site staff numbers would be low and are anticipated to involve approximately 5 light vehicles per day (i.e. 10 vpd two-way total). This indicates initial operational traffic flows of up to 26 vpd two-way total.

Accordingly, the anticipated typical operational traffic flows are shown in **Table 2**.

Table 2: Trip generation of the hydrogen plant – operational stage

Period	Direction	Staff traffic		HV traffic		Total Traffic	
		Split	Total	Split	Total	Split	Total
Morning Peak	Inbound	5	**5**	1	**2**	6	**7**
	Outbound	0		1		1	
Typical Hour	Inbound	0	**0**	1	**2**	1	**2**
	Outbound	0		1		1	
Afternoon Peak	Inbound	0	**5**	1	**2**	1	**7**
	Outbound	5		1		6	

However, to ensure a robust assessment and to allow for potential additional growth of operational traffic flows in future, the applicant has requested that future maximum daily traffic generation be increased to 128 vpd with up to 80% of this total traffic being heavy vehicles (i.e. 26 light vehicles and 102 heavy vehicle movements).

For this maximum traffic scenario analysis, the additional light vehicle movements are assumed to be additional staff movements during the AM and PM peak periods. It is assumed that the additional heavy vehicle movements would be spread throughout the day, with only about 10% occurring during the AM peak hour and 10% during the PM peak hour.

The corresponding maximum total traffic generation (128vpd) during the operational phase is shown in **Table 3**.

Table 3: Maximum total trip generation – operational stage

Period	Direction	Staff traffic		HV traffic		Total Traffic	
		Split	Total	Split	Total	Split	Total
Morning Peak	Inbound	13	**13**	5	**10**	18	**23**
	Outbound	0		5		5	
Typical Hour	Inbound	0	**0**	5	**10**	5	**10**
	Outbound	0		5		5	
Afternoon Peak	Inbound	0	**13**	5	**10**	5	**23**
	Outbound	13		5		18	

6.2 Impact on Surrounding Roads

The WAPC *Transport Impact Assessment Guidelines (2016)* provides guidance on the assessment of traffic impacts:

"As a general guide, an increase in traffic of less than 10 percent of capacity would not normally be likely to have a material impact on any particular section of road but increases over 10 percent may. All sections of road with an increase greater than 10 percent of capacity should therefore be included in the analysis. For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10 percent of capacity. Therefore, any section of road where the development traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis."

As discussed in sections **6.1.1** and **6.1.2** of this report the maximum anticipated traffic impact from the proposed development will occur during the construction stage of the project and would only result in up to an additional 23 vehicle trips per hour (vph) on the access road and the Northam – York Road.

This is significantly less than the quoted WAPC threshold of 100vph (per lane) and therefore does not warrant further detailed analysis. Accordingly, the impact on the surrounding road network will not be significant.

7 Traffic Management on the Frontage Streets

The proposed hydrogen production plant is located on the northeast side of the Northam – York Road and the East Perth – Kalgoorlie railway line, east of Northam townsite, as shown in **Figure 1.**

7.1 Existing Road Network

Northam – York Road, in the vicinity of the subject site, is a two-lane rural road with 7m sealed width and unsealed shoulders on each side. The speed limit on this section is 110km/h.

Figure 7: Northam – York Road looking southeast (level crossing to the left)

Northam – York Road is a *State Road* controlled by Main Roads WA and is classified as a *Primary Distributor* road in the Main Roads WA functional road hierarchy.

The access road from Northam – York Road to the subject site is an unsealed, private road.

This access road has a sealed width of approximately 6m at the railway crossing and is sealed for a distance of approximately 16m southwest of the railway crossing and 10m on the northeast side, as shown in **Figure 8**.

Figure 8: Northam – York Road and existing level crossing

7.2 Existing Traffic Volumes

Traffic count data obtained from the Main Roads WA website documents a 2022/23 traffic count on Northam – York Road south of Carter Rd (Northam – Pithara Rd), which is about 8km further southeast from the subject site. That count recorded average weekday traffic (AWT) flows of 1,389 vehicles per day (vpd) with 20.1% being heavy vehicles. The peak hour of traffic flows occurred between 7:45 – 8:45am and 3:45 – 4:45pm with 123 vehicles per hour (vph) in both peaks but relatively consistent traffic volumes ranging between 88 vph and 123vph occur throughout the 7am to 6pm period at that location.

Transcore undertook a manual traffic count from 4:00 – 5:00pm on 16 June 2022 at the access road intersection on Northam – York Road to the subject site, which recorded a total of 145 vph (90 southbound and 55 northbound) on Northam – York Road at the subject site location, although only 6.2% were heavy vehicles. This indicates slightly higher total traffic flows on this section of Northam – York Road closer to the Northam townsite but fewer heavy vehicles.

There were no traffic movements across the level crossing during the 4-5pm survey period on 16 June 2022, which corresponds to the anticipated existing situation of minimal traffic flows on this existing private access road.

7.3 Future Traffic Volumes

In section 6.1 of this report, it is indicated that the majority of site traffic is anticipated to arrive around 7am and depart around 5pm during the construction period. Timing of arrival and departure peaks during the operational period are not yet known but may coincide with existing road network peak periods (7:45 – 8:45am and 3:45 – 4:45pm). Accordingly, to ensure robust assessment, we will utilise the existing AM and PM peak traffic flows on the Northam – York Road as the base traffic flows for traffic calculations.

The 2022/23 count on Northam – York Road south of Carter Rd (Northam – Pithara Rd) has the following traffic flows during the AM and PM peak hours:

- 7:45 – 8:45am: 84 northbound / 39 southbound
- 3:45 – 4:45pm: 44 northbound / 79 southbound

The manual traffic count at the site access intersection on 16 June 2022 recorded 55 northbound / 90 southbound (145 vph total) during the 4-5pm peak period. This is approximately 18% higher than the corresponding count at the other site (123 vph total), so the 7:45 – 8:45am count at the other site will be factored up by 18% to provide AM peak hour base traffic flows in the vicinity of the subject site. The resulting base traffic flows on Northam – York Road at this location are therefore as follows:

- AM peak hour: 99 northbound / 46 southbound
- PM peak hour: 55 northbound / 90 southbound

The highest traffic generation by the subject site will occur during the operational period. For this analysis the maximum future peak hour traffic generation during the operational period (as set out in Table 5) is anticipated to be as follows:

- AM peak hour: 18 in / 5 out
- PM peak hour: 5 in / 18 out

All of the hydrogen plant traffic is anticipated to travel to and from the northwest on Northam – York Road. The majority of the potential additional future traffic generated by the site is also anticipated to travel to and from the northwest but allowance is made for approximately 10% to travel to and from the southeast on Northam – York Road.

The resultant future operational phase maximum peak hour traffic flows at the Northam – York Rd / site access road intersection are shown in **Figure 9**. The traffic flows shown on Northam – York Road assume that site traffic peak would coincide with road network peak, as a worst-case scenario to ensure robust assessment.

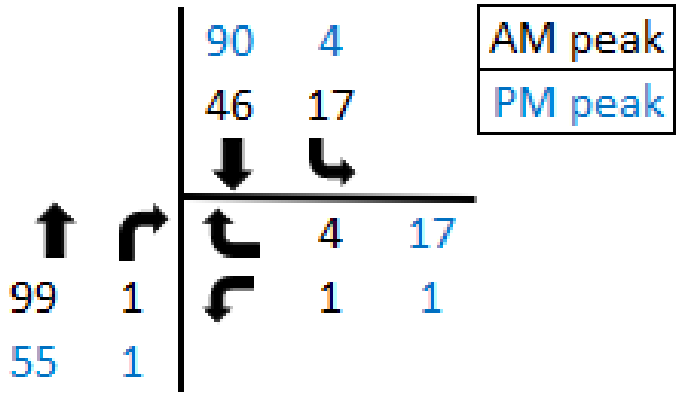


Figure 9: Future maximum operational phase peak hour traffic flows

7.4 Intersection Treatment

In a normal traffic situation, the warrants for turn lane treatments (eg. construction of left turn lanes or right turn lanes on the major road) are as set out in Figure 2.26 of Austroads *Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings*. The relevant graph for design speed greater than 100km/h on the major road is Figure 2.26a, as shown below.

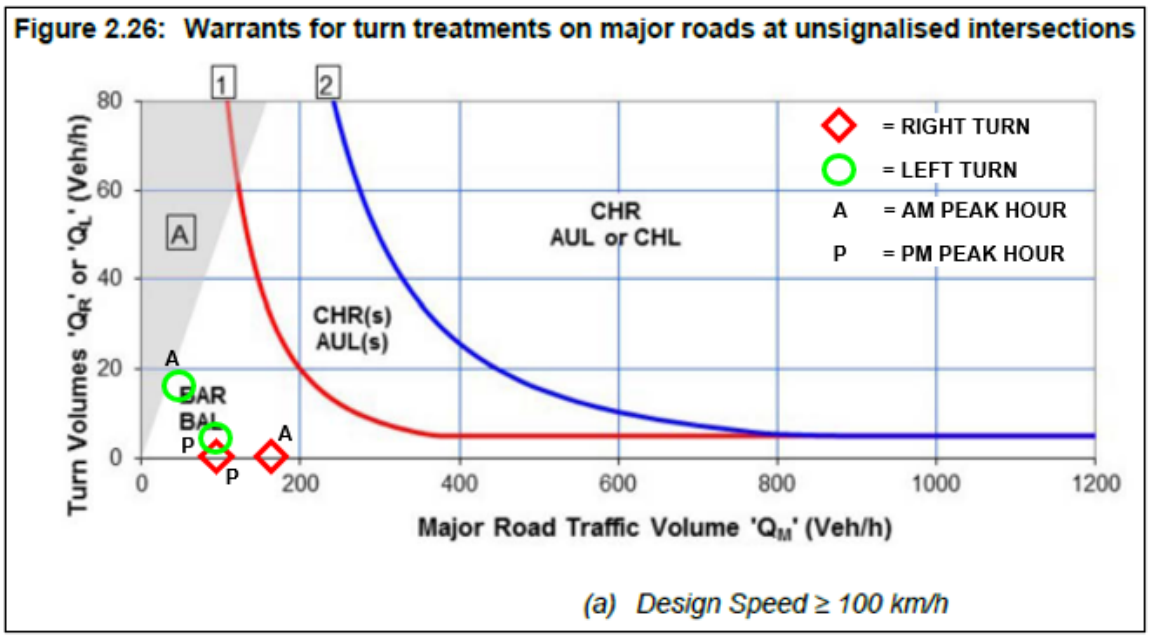


Figure 10: Warrants for turn lanes on the major road

The future maximum operational phase peak hour traffic flows shown in **Figure 9** are plotted on that graph in **Figure 10**. This demonstrates that the modelled peak traffic flows do not warrant provision of turn lanes under that Austroads guideline.

As virtually all of the site-generated traffic is anticipated to turn left into the access road from Northam – York Road (inbound) and right out from the access road onto

Northam – York Road, there is no need for a right turn lane on Northam – York Road and the only upgrade that may be required is a left turn lane on Northam – York Road.

However, the applicant still proposes to construct an auxiliary left turn lane treatment (AUL) on the Northam – York Road on approach to the level crossing to provide safe storage space clear of the through traffic lane for any inbound vehicle that needs to wait for a train to clear the level crossing. After discussion with Main Roads WA this left turn deceleration lane has been designed as 250m total length which will provide full deceleration distance and storage for vehicles clear of the through traffic lanes on the Northam – York Road.

As noted in section 3.1, the distance from the closest rail to the edge of the traffic lane is approximately 28m and 5m clearance distance is required, leaving 23m available to accommodate a vehicle waiting to turn right onto the Northam – York Road. No vehicles longer than 20m in length will be permitted to use this access, as advised by Main Roads WA.

If it is ever necessary for any vehicles longer than 20m to use this railway crossing (eg. if a crane has to be transported to and from the site during the construction phase), this would require prior approval by Main Roads WA and the rail operator and appropriate traffic management (including a traffic management plan approved by Main Roads WA) to ensure that vehicle would have priority for the right turn out onto Northam – York Road and would not obstruct the railway crossing.

8 Public Transport Access

Due to the type and location of the proposed development the availability of public transport services is not relevant.

9 Pedestrian and Bicycle Access

Due to the type and location of the proposed development the availability of pedestrian and bicycle access on the surrounding road network is not relevant.

The site plan at Appendix A has security controlled access at the southeast corner of the site controlled by the security hut. The plan also shows two personnel escape gates near the northeast and northwest corners of the site in case of an emergency.

10 Site Specific Issues

One site specific issue has been identified in relation to this project, which is the proposed access via the existing level crossing of the East Perth – Kalgoorlie railway line.

Based on preliminary advice from Main Roads WA (level crossing safety and policy section) we understand that Arc undertook an ALCAM (Australian Level Crossing Assessment Model) assessment of this level crossing in 2018 in relation to the construction of the Northam Solar Farm. It is understood that the main issue identified related to vehicle storage distance between the railway line and Northam – York Road, as discussed in section 3.1.

Due to the nature of the product being transported, appropriate safety measures are an important feature of this project. Accordingly, IGE are prepared to fund the installation of boom barriers and flashing lights at the railway level crossing. As noted in section 3.1, the distance from the closest rail to the edge of the traffic lane is approximately 28m and 5m clearance distance is required, leaving 23m available to accommodate a vehicle waiting to turn right onto the Northam – York Road. Accordingly, Main Roads WA has advised that the longest vehicle that should be permitted to use this access would be 20m in length. IGE have acknowledged this restriction on maximum vehicle length.

Main Roads WA (level crossing safety and policy section) have recently undertaken updated ALCAM assessment of this level crossing for the construction and operational phases of this project, based on the traffic generation documented in the February 2023 version of this report and again for this current version of the report.

ALCAM assessment has now considered 7 separate scenarios:

- "Current LXM assessment" = during construction of the Solar Farm (existing level crossing with existing stop sign control), 25vpd and 50% heavy vehicles: ALCAM risk score = 0.00268
- "Proposal 1" = Hydrogen Plant & Solar Farm fully operational (existing stop signs replaced with active flashing light controls), 36vpd and 45% heavy vehicles: ALCAM risk score = 0.00182
- "Proposal 2" = Hydrogen Plant & Solar Farm fully operational (existing level crossing with existing stop sign control), 36vpd and 45% heavy vehicles: ALCAM risk score = 0.00248
- "Proposal 3" = Hydrogen Plant construction & Solar Farm operational (existing level crossing with existing stop sign control), 50vpd and 30% heavy vehicles: ALCAM risk score = 0.0024
- "Proposal 4" = existing situation = Solar Farm operational (existing level crossing with existing stop sign control), 10vpd and 5% heavy vehicles: ALCAM risk score = 0.00127

- "Proposal A" = Hydrogen Plant & Truck Parking Facility & Solar Farm fully operational (existing stop signs replaced with active flashing light controls), 128vpd and 80% heavy vehicles: ALCAM risk score = 0.00321
- "Proposal B" = Hydrogen Plant & Truck Parking Facility & Solar Farm fully operational (existing stop signs replaced with boom gate controls), 128vpd and 80% heavy vehicles: ALCAM risk score = 0.0019

These results indicate that an ALCAM risk score of 0.00268 occurred during the previous construction period for the Solar Farm. The existing level crossing (stop sign control) was deemed satisfactory for that construction period.

During construction of the Hydrogen Plant the existing level crossing (stop sign control) ALCAM risk score will increase again (0.0024) but will still be less than during the Solar Farm construction period.

In the maximum future traffic scenario (128vpd) the level crossing (with existing stop signs replaced with active flashing light controls) ALCAM risk score would be 0.00321, which would be slightly higher than during the Solar Farm construction period. This risk score would be reduced significantly (0.0019) if the existing stop signs are replaced with boom barriers in addition to flashing lights.

Based on preliminary advice from Main Roads WA (level crossing safety and policy section) it is noted that it is not the ALCAM assessment that determines the need for a level crossing to be upgraded from Stop sign control to flashing lights and boom barrier control. In Western Australia the *Railway Crossing Control in Western Australia Policy and Guidelines* (Main Roads WA) "are to be applied to all railway crossings on public roads throughout Western Australia, and can be used as a reference for managing and assessing railway crossing control at railway crossings on non-public roads".

The warrants for determining the type of railway crossing control that is required use formulae that calculate a weighted conflict score, which is the product of average daily traffic and average number of train movements per week, weighted by factors relating to vehicle and train speeds, proportion of heavy vehicles in that daily traffic, and road gradient. Boom barriers are considered warranted when the weighted conflict score is greater than 700,000 (or flashing lights only at 14,000) but with the relatively low traffic volumes associated with the proposed development (i.e. 30-40 vpd during construction and up to 128 vpd during operational phase), upgrading to boom barrier control may not be warranted by road and rail traffic volumes alone.

Nonetheless, due to the volatile nature of the product being transported and the economic and environmental importance of the success of this project, it is considered that high priority must be given to safety considerations.

Accordingly, we are advised that IGE are fully supportive of installation of boom barriers and are prepared to fund the installation of boom barriers and flashing lights at this level crossing to address any potential concern about this proposed access.

In addition, Main Roads WA (level crossing safety and policy section) has advised that the existing sealed road panel at the level crossing should be extended southwards to

connect to the Northam – York Road and should also extend 50m north of the crossing.

To accommodate simultaneous two-way truck traffic across the level crossing, it is also recommended that the sealed width of the crossing should also be increased to 7 metres to accommodate two 3.5m traffic lanes.

Main Roads WA have also recommended the installation of 'Keep Clear' hatch markings and associated signage to limit any potential for queuing over the crossing.

11 Safety Issues

The only traffic-related safety issues that have been raised in relation to this project relate to the proposed access route to and from the Northam – York Road via the existing level crossing across the railway line.

IGE proposes the following measures to address any perceived safety concerns:

- IGE are prepared to fund the installation of boom barriers and flashing lights at this level crossing (refer section 10);
- No vehicles longer than 20m in length will be permitted to use this access, as advised by Main Roads WA, due to storage distance between the railway line and Northam – York Road for vehicles turning right out from the access road (refer sections 3.1 and 7.4); and
- IGE propose construction of a left turn lane on the Northam – York Road on approach to the level crossing to provide safe storage space clear of the through traffic lane for any inbound vehicle that needs to wait for a train to clear the level crossing (refer sections 3.1 and 7.4).

12 Conclusions

This Transport Impact Statement has been prepared by Transcore on behalf of Infinite Green Energy (IGE) with regard to the proposed hydrogen production plant at the existing Northam solar farm. This report also takes into consideration potential future increase in the traffic movements to allow for potential future intensification of activity at the subject site.

The subject site is located approximately one kilometre east of the Northam townsite, on the northeast side of the Northam – York Road and the East Perth – Kalgoorlie railway line.

Access to the subject site is proposed to utilise the existing private level crossing of the railway line that currently provides access to the Northam Solar Farm from the Northam – York Road.

As this is a private level crossing it is currently subject to a Level Crossing Access Agreement (and Safety Interface Agreement) between DK West Investments Pty Ltd (the landowner) and Arc Infrastructure (the rail operator). Amendment to that agreement will be required to enable access for this proposed development.

No vehicles longer than 20m in length will be permitted to use this access, as advised by Main Roads WA, due to storage distance between the railway line and Northam – York Road for vehicles turning right out from the access road.

Traffic generation associated with the proposed development will be relatively low at only 30 to 40 vpd during the construction phase. Operational phase traffic generation may range from 26 vpd up to a potential future maximum of 128 vpd during the operational phase.

As safety is a very important consideration for this project, appropriate upgrading of the existing railway crossing and access road intersection on the Northam – York Road is proposed.

IGE propose construction of a left turn lane on the Northam – York Road on approach to the level crossing to provide safe storage space clear of the through traffic lane for any inbound vehicle that needs to wait for a train to clear the level crossing.

IGE are also fully supportive of and prepared to fund the installation of boom barriers and flashing lights at this level crossing to address any perceived safety concerns.

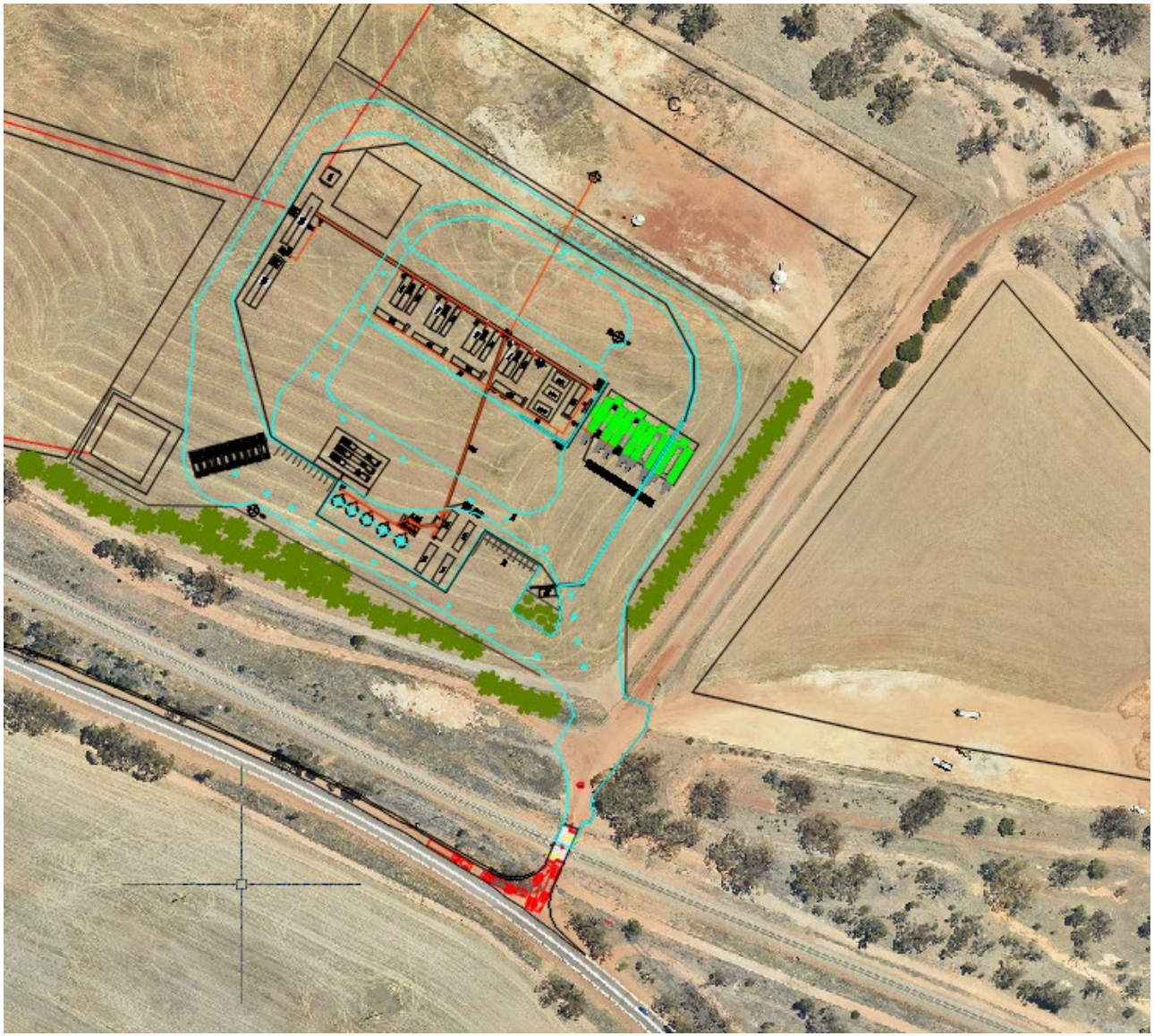
The existing sealed road section across the railway crossing would also be increased in length to connect to the Northam – York Road and extend at least 50m north of the railway crossing, and widened to 7m sealed width to accommodate simultaneous two-way truck traffic.

It is therefore concluded that traffic-related issues should not form an impediment to the approval of the proposed development.

Appendix A

PROPOSED SITE PLAN

Engineering a better future for over 20 years!



APPENDIX E: DWA DRAWINGS SET

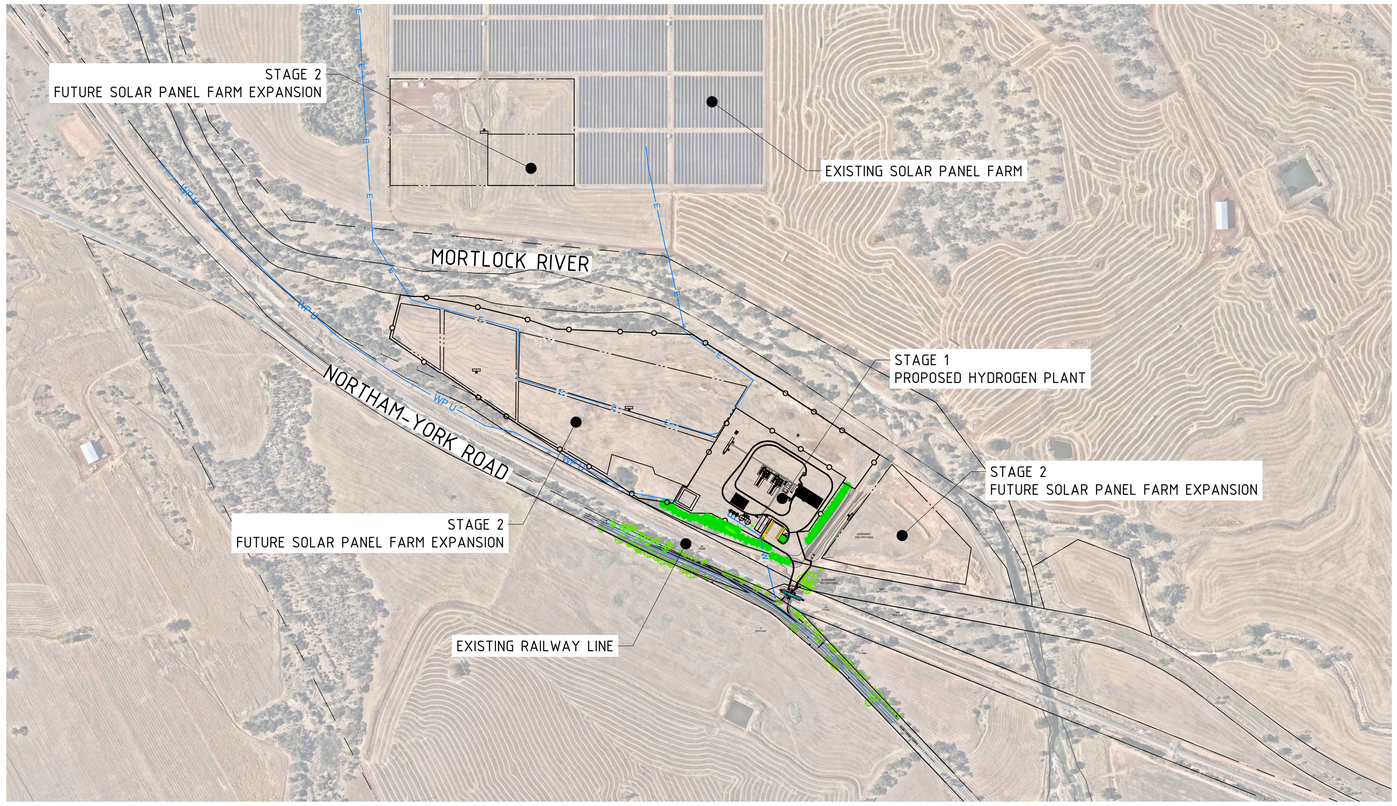
David Wills and Associates
Consulting Engineers

HYDROGEN PLANT

NORTHAM - YORK ROAD, NORTHAM

ON BEHALF OF:

INFINITE GREEN ENERGY



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DRAWING No.	DRAWING TITLE
21295-C-00	COVER SHEET & LOCALITY PLAN
21295-C-01	SITE PLAN
21295-C-02	DETAILED SITE PLAN
21295-C-03	WATER CONNECTION
21295-C-04	SEWER DISPOSAL PLAN
21295-C-05	STORMWATER DISCHARGE PLAN
21295-C-06	PLANT ACCESS
21295-C-07	SITE GRADING PLAN
21295-C-08	SITE FLOOD AREA

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D	26/06/2023	ISSUED FOR APPROVAL	KB	BC	DW
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DRAWING REFERENCES

DRAWING NUMBER	DRAWING TITLE / DESCRIPTION

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TITLE	NAME	DATE
DRAFTER	BD	27/01/2023
DESIGNER	BD	27/01/2023
ENG. CHECK	---	--/--/----

NORTH

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HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

COVER SHEET AND LOCALITY PLAN

AUTHORISED BY:
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REF# MEG-A02-DES-DRW-GE-0001-H | SCALE N.A. @A1

DRAWING No. 21295-C-00 | REV H

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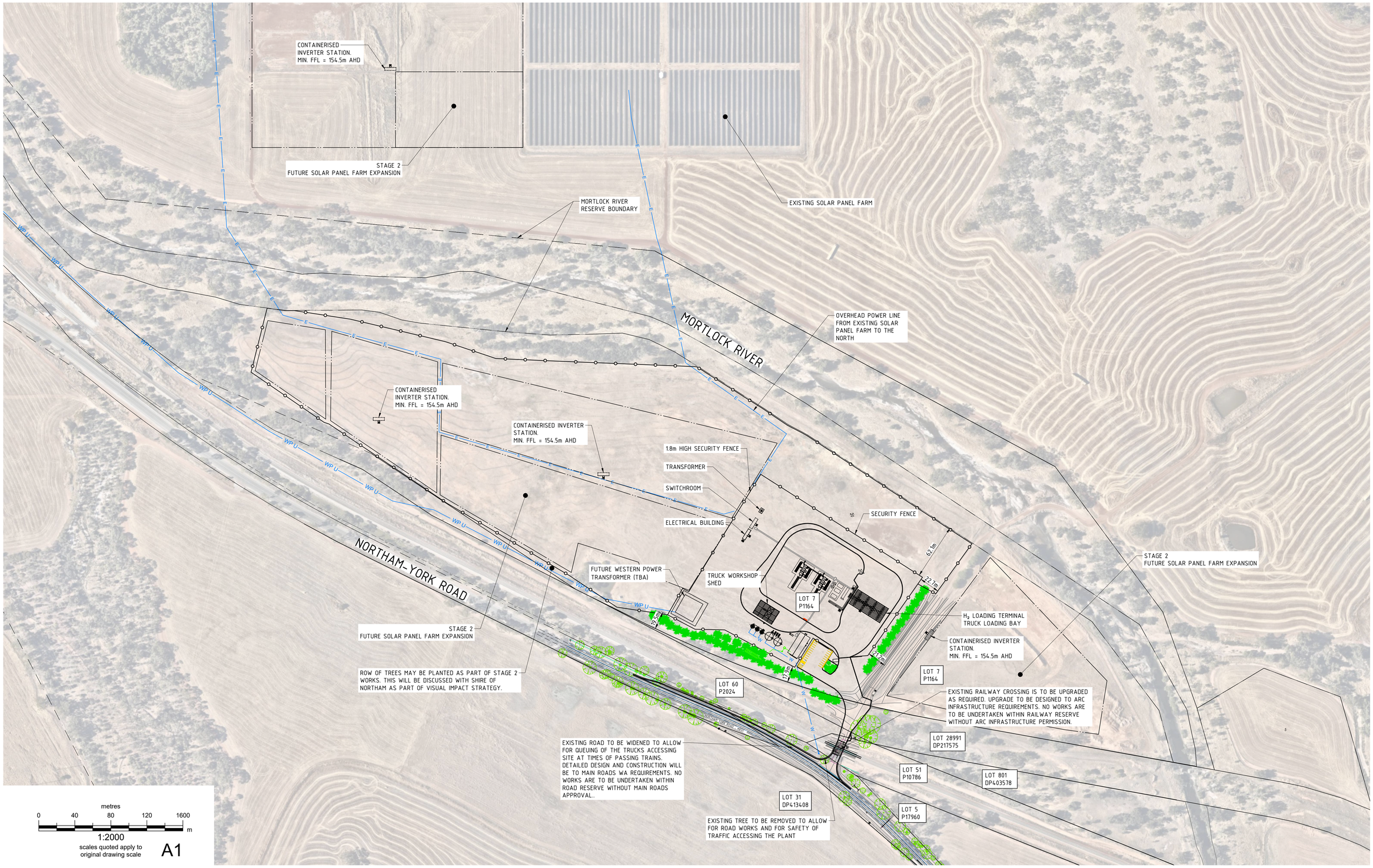

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PROJECT INFORMATION

HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

SITE PLAN

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REF# MEG-A02-DES-DRW-IGE-0002-H | SCALE AS SHOWN @A1

DRAWING No. 21295-C-01 | REV H

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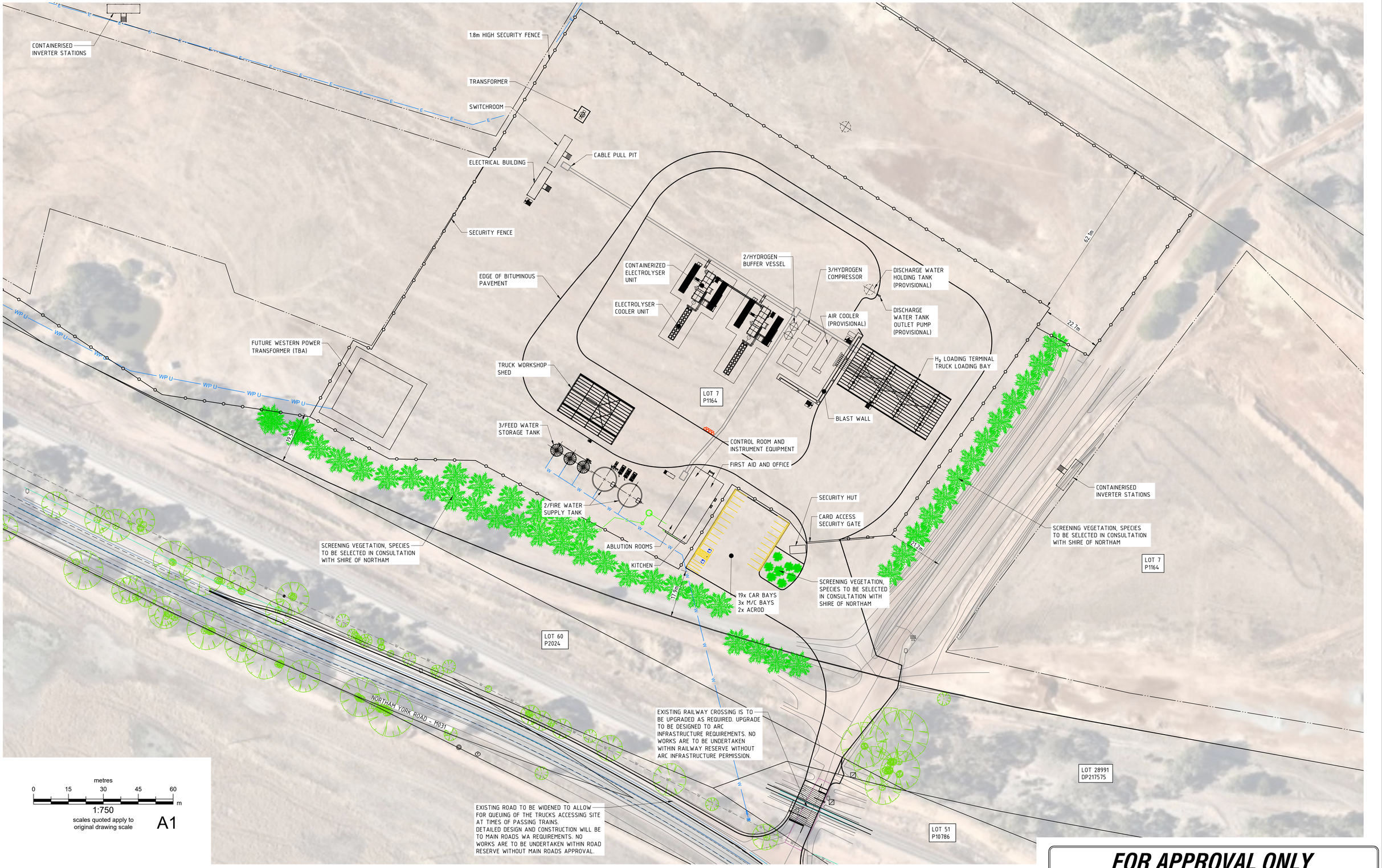

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PROJECT INFORMATION

HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

DETAILED SITE PLAN

AUTHORISED BY: 10/07/2023
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REF# MEG-A02-DES-DRW-GE-0003-H | SCALE AS SHOWN @A1

DRAWING No. 21295-C-02 | REV H | SHEET SIZE A1

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NORTHAM-YORK ROAD, NORTHAM

WATER SUPPLY

AUTHORISED BY:
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REF# MEG-A02-DES-DRW-IGE-0004-G | SCALE AS SHOWN @A1

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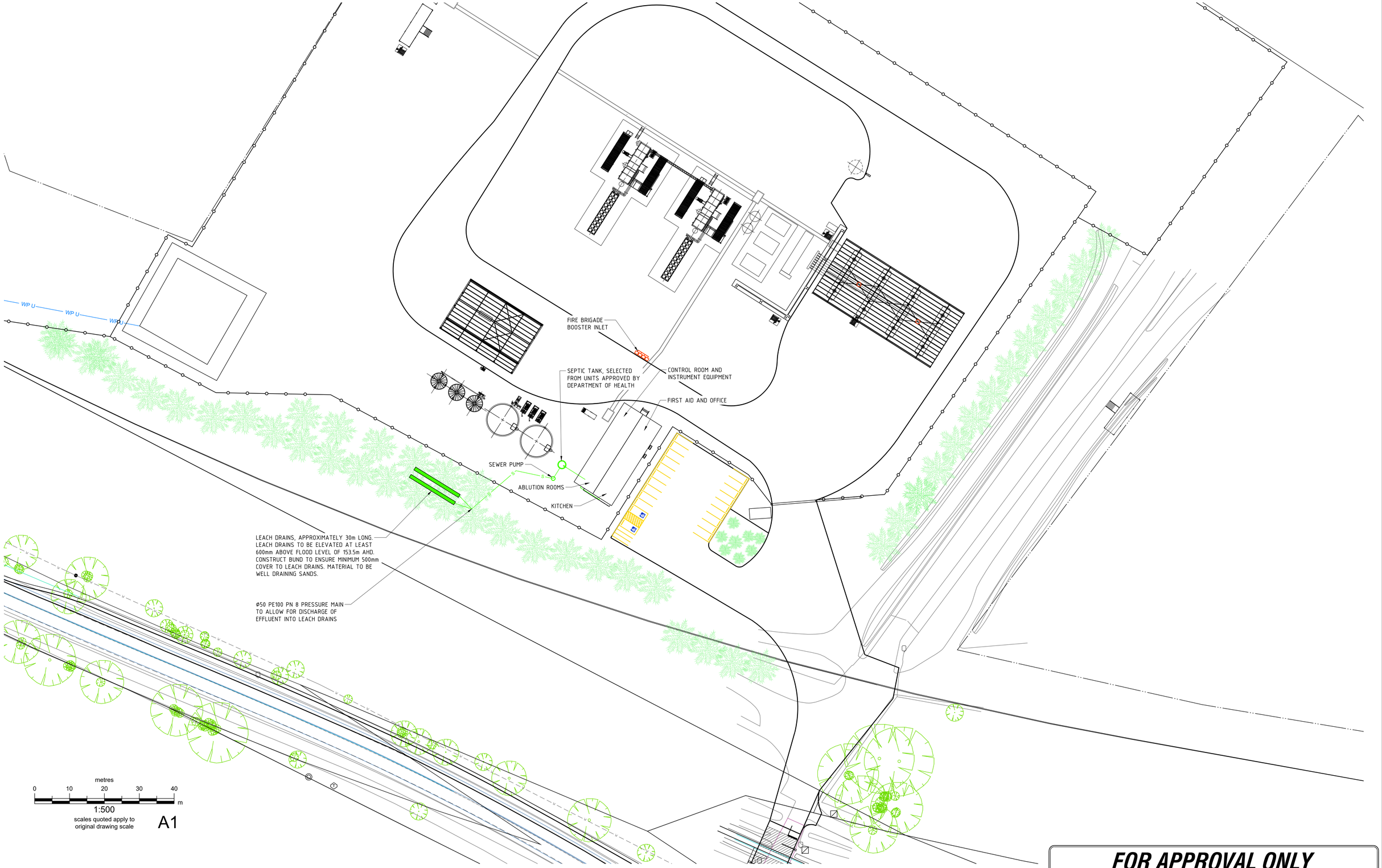

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PROJECT INFORMATION

HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

SEWER DISPOSAL PLAN

AUTHORISED BY:
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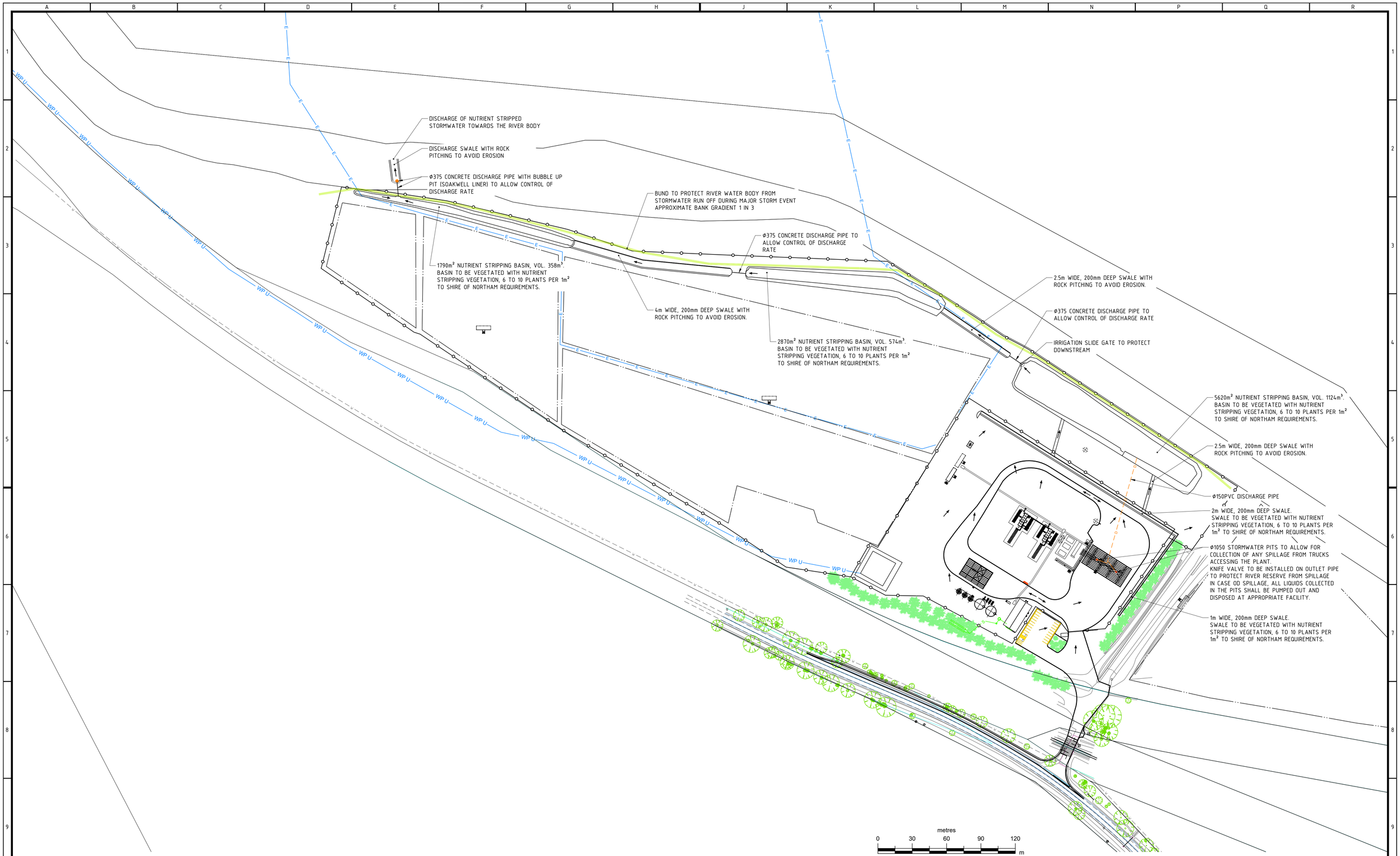

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PROJECT INFORMATION

HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

STORMWATER DISCHARGE PLAN

AUTHORISED BY: D. Wills 14/07/2023
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REF# MEG-A02-DES-DRW-GE-0006-H | SCALE AS SHOWN @A1

DRAWING No. 21295-C-05 | REV H

SHEET SIZE: A1

PROPOSED HYDROGEN PLANT

PROPOSED SHOULDER

PROPOSED EDGE LINE

192.0

PROPOSED 3.5m WIDE DECELERATION LANE

30.0m 1:20 TAPER

PROPOSED BOOM GATE TO ARC REQUIREMENTS

PROPOSED 450mm THICK STOP LINE

EXISTING DRIVEWAY WIDTH TO MAINTAIN 9.5m

EXISTING RAILWAY CROSSING IS TO BE UPGRADED AS REQUIRED. UPGRADE TO BE DESIGNED TO ARC INFRASTRUCTURE REQUIREMENTS. NO WORKS ARE TO BE UNDERTAKEN WITHIN RAILWAY RESERVE WITHOUT ARC INFRASTRUCTURE PERMISSION.

4.1m TYP.

2.6m TYP.

R15.0m

20.6m

24.1m

R20.0m

13.0m 1:20 TAPER

EXISTING ROAD TO BE WIDENED TO ALLOW FOR QUEUING OF THE TRUCKS ACCESSING SITE AT TIMES OF PASSING TRAINS. DETAILED DESIGN AND CONSTRUCTION WILL BE TO MAIN ROADS WA REQUIREMENTS. NO WORKS ARE TO BE UNDERTAKEN WITHIN ROAD RESERVE WITHOUT MAIN ROADS APPROVAL.

EXISTING CENTRE LINE

EXISTING TREE TO BE REMOVED TO ALLOW FOR ROAD WORKS AND FOR SAFETY OF TRAFFIC ACCESSING THE PLANT

EXISTING DRIVEWAY TO BE MODIFIED AS REQUIRED TO ACCOMMODATE PROPOSED ACCESS LANE

NOTE:

GEOMETRY OF THE ACCESS LANE TO BE CONFIRMED DURING DETAIL DESIGN.

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1:500
scales quoted apply to original drawing scale

A1

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PROJECT INFORMATION

HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

PLANT ACCESS

AUTHORISED BY:
D. Wills 10/07/2023
David Wills
AIT(Civil) GradDipB FIEAust CPEng EngExec NER

REF# MEG-A02-DES-DRW-IGE-0007-I SCALE AS SHOWN @A1

DRAWING No. 21295-C-06 REV I

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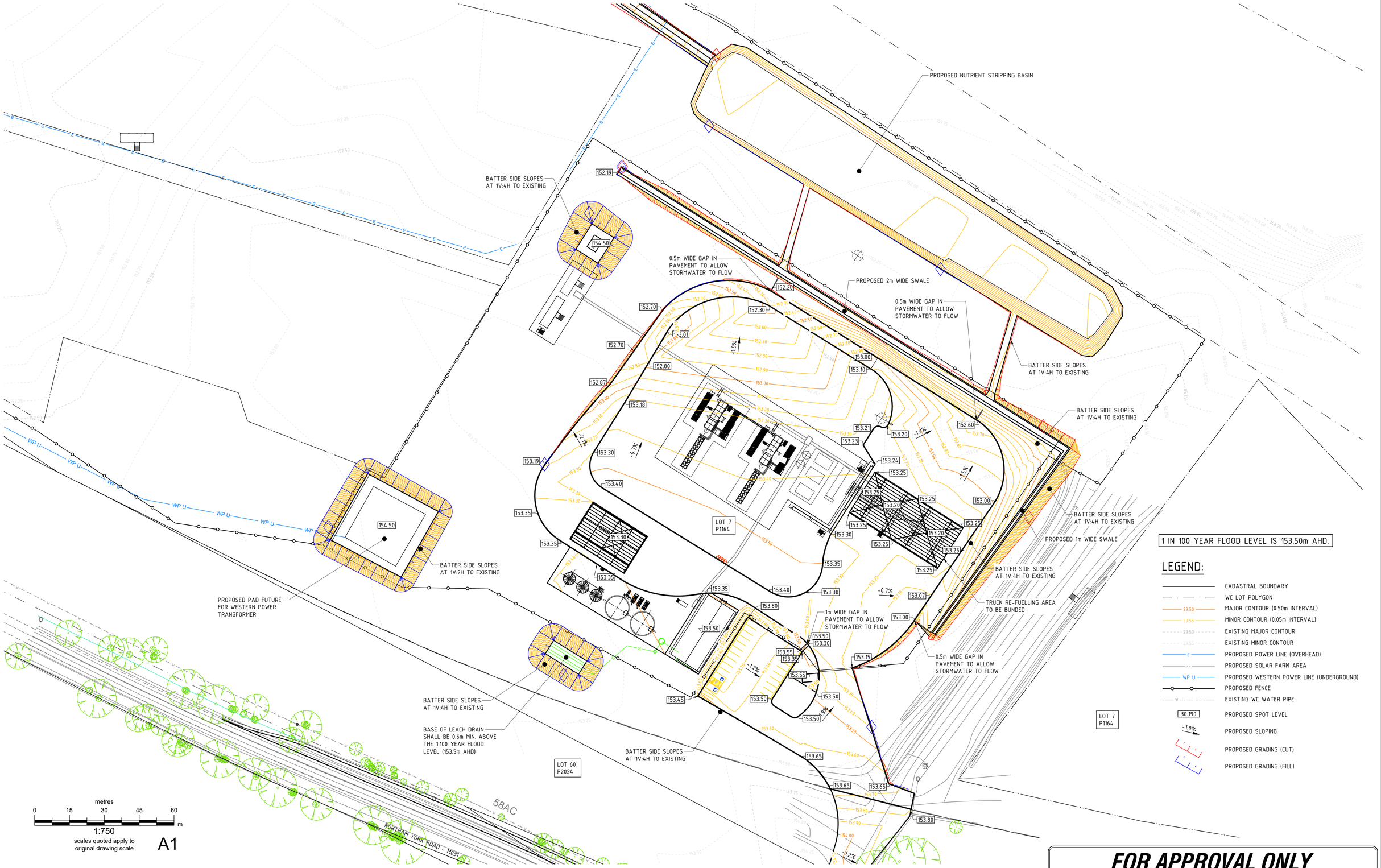

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PROJECT INFORMATION

HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

SITE GRADING PLAN

AUTHORISED BY: D. Wills 14/07/2023
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REF# MEG-A02-DES-DRW-IGE-0008-F | SCALE AS SHOWN @A1

DRAWING No. 21295-C-07 | REV F

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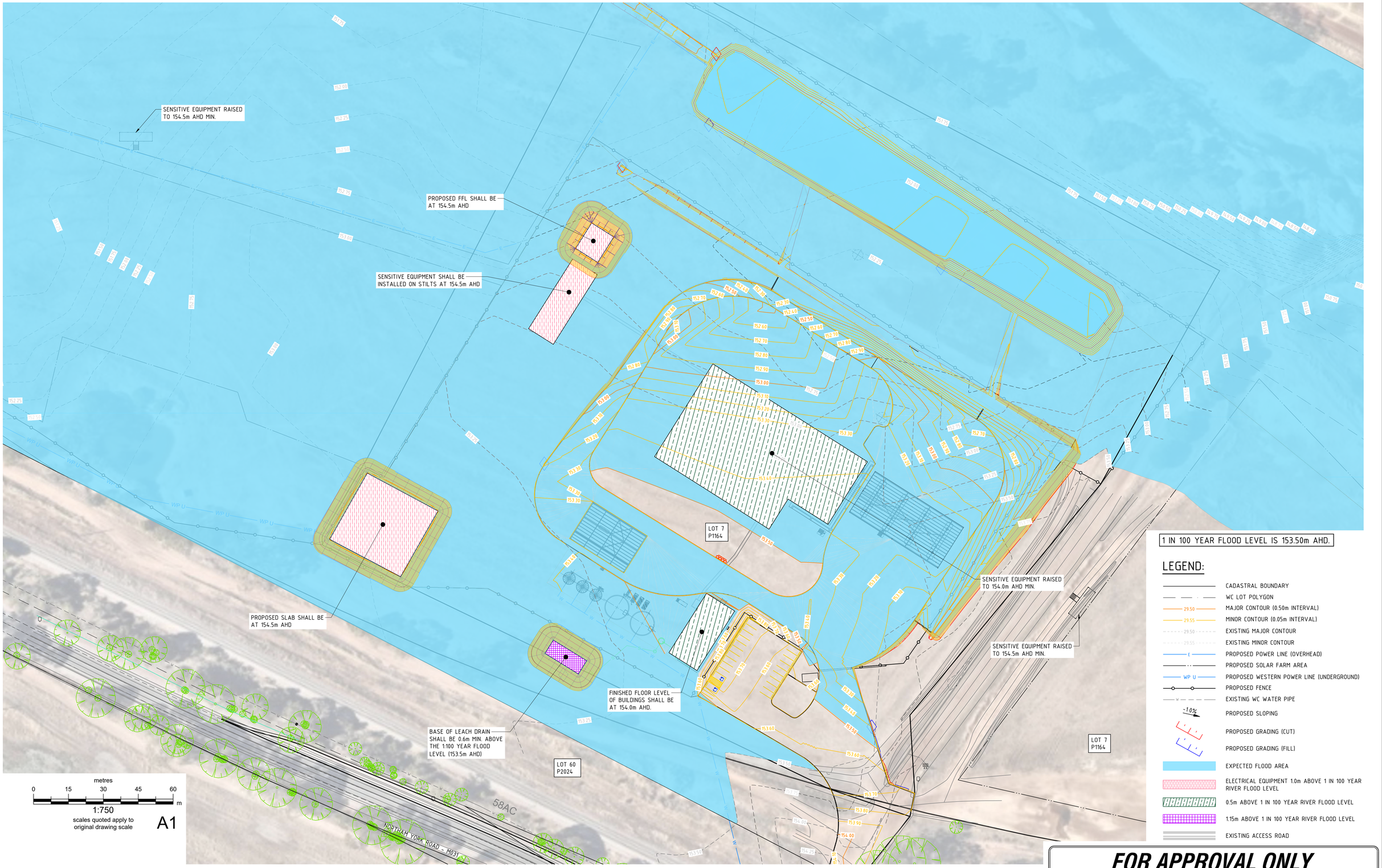

1 IN 100 YEAR FLOOD LEVEL IS 153.50m AHD.

LEGEND:

- CADASTRAL BOUNDARY
- WC LOT POLYGON
- MAJOR CONTOUR (0.50m INTERVAL)
- MINOR CONTOUR (0.05m INTERVAL)
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED POWER LINE (OVERHEAD)
- PROPOSED SOLAR FARM AREA
- PROPOSED WESTERN POWER LINE (UNDERGROUND)
- PROPOSED FENCE
- EXISTING WC WATER PIPE
- PROPOSED SLOPING
- PROPOSED GRADING (CUT)
- PROPOSED GRADING (FILL)
- EXPECTED FLOOD AREA
- ELECTRICAL EQUIPMENT 1.0m ABOVE 1 IN 100 YEAR RIVER FLOOD LEVEL
- 0.5m ABOVE 1 IN 100 YEAR RIVER FLOOD LEVEL
- 1.15m ABOVE 1 IN 100 YEAR RIVER FLOOD LEVEL
- EXISTING ACCESS ROAD

FOR APPROVAL ONLY

ISSUE/REVISIONS

REV	DATE	ISSUE / REVISION DESCRIPTION	DRN	CHK	APP
A	26/06/2023	ISSUED FOR APPROVAL	KB	BC	DW
B	04/07/2023	ISSUED FOR APPROVAL	KB	BC	DW
C	04/07/2023	ISSUED FOR APPROVAL	KB	BC	DW
D	07/07/2023	ISSUED FOR APPROVAL	KB	BC	DW
E	10/07/2023	ISSUED FOR APPROVAL	KB	BC	DW
F	14/07/2023	ISSUED FOR APPROVAL	KB	BC	DW

DRAWING REFERENCES

DRAWING NUMBER	DRAWING TITLE / DESCRIPTION

DRAWING INFORMATION

TITLE	NAME	DATE
DRAFTER	KB	26/06/2023
DESIGNER	BC	26/06/2023
ENG. CHECK	DW	26/06/2023

NORTH

DISCLAIMER:

CLIENT INFORMATION

infinite green

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PROJECT INFORMATION

HYDROGEN PLANT
NORTHAM-YORK ROAD, NORTHAM

SITE FLOOD AREA

AUTHORISED BY:
D. Wills
14/07/2023
David Wills
AIT(Civil) GradDipB FIEAust CPEng EngExec NER

REF# MEG-A02-DES-DRW-IGE-0009-F
SCALE AS SHOWN @A1
DRAWING No. 21295-C-08
REV F
SHEET SIZE: A1

APPENDIX F: NOTICE OF INTENT TO PUMP

Department of
Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Mr S Gauld
Level 13
99 St Georges Tce.
PERTH WA 6000

Email: sjgauld@igeh2.com

Our Ref: 23-19160
Enquiries: B. Wheaton
Telephone: 9368 3282
Date: 1 May 2023

Dear Mr Gauld

NOTICE OF INTENT TO PUMP (DESALINATION): LOT 7 ON PLAN 1164 -SHIRE OF NORTHAM

I refer to your Notice of Intent to Pump (NOIP) number 03/23 registered at my office on 8 February 2023 (copy attached). I have received comment from the Department of Water and Environmental Regulation (DWER) and an onsite assessment report from my field officer Mr John Simons.

I am aware from your NOIP that you propose to desalinate water from a Water Corporation mains system and use the reject water for irrigation purposes.

In his report Mr Simons noted that groundwater at the discharge site was stable but fluctuated seasonally in response to rainfall and evaporation.

Further, Mr Simons' analysis of water quality data supplied by Nitto Hydraulics determined that the reject water had a low sodium adsorption ratio (low hazard) and a medium salinity hazard (245mS/m) rating for irrigation purposes. Therefore, the salt content of the reject water has a slight to moderate restriction for irrigation purposes.

To address this limitation, I recommend using moderately salt tolerant tree species and irrigation management practices with an adequate leaching fraction to manage salt concentrations in the root zone. The sodium adsorption ratio and salinity of the irrigation water indicate that no reduction in infiltration rates should occur.

Following this assessment of your proposal, I wish to advise that I have no objection to the proposed works being implemented in accordance with my recommendations.

Please note that this no objection to the proposed works does not prevent future action under the Soil and Land Conservation Act (1945) should land degradation occur because of these works.

Should you require further information you can contact me at this office on telephone 9368 3282.

Yours sincerely

B. Wheaton

Buddy Wheaton
DEPUTY COMMISSIONER OF
SOIL AND LAND CONSERVATION

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