



# WILSHAW

**EMERALD RESOURCES WA PTY LTD**

**DINGO RANGE GOLD PROJECT**

**WASTEWATER TREATMENT PLANT**

**OVERVIEW**

**AND**

**DESIGN CAPACITY**

**JOB No. 8469**

**JULY 2024**

Rev	Prepared	Reviewed	Approved	Date	Description
A				30.07.2024	Issued for Client Review

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## 1 INTRODUCTION

At the request of Emerald Resources NL, the following report summarises the proposed Wastewater Treatment Plant (WWTP) and its design capacity, which is to be installed at the North Laverton Gold Project mine site. As per discussions with the Client, the scope of the project is limited to the design of the separation tank, primary and secondary ponds, evaporation basin and irrigation system. Design of the sewage transfer stations and piping to the separation tank has been undertaken by the Client.

## 2 WASTEWATER TREATMENT PLANT OVERVIEW

The WWTP design has been based on a 276-room village operating at 100% occupancy at the request of the Client. With common design practice to assume an occupancy rate of 80% at any given time, enables the village to expand to 345-rooms without a redesign of the proposed WWTP.

The WWTP will consist of a separation tank which discharges into the primary stabilisation pond. A weir in the primary stabilisation pond allows effluent to overflow into the secondary stabilisation pond. Effluent is then periodically discharged into an evaporation/irrigation field by means of a pump and system of irrigation sprays.

Drawing 363-L-001 included in Appendix A shows the approximate arrangement and location of the WWTP in relation to the village.

Drawing Nos. 363-L-002 & 363-L-003 shows the layout and details of the WWTP.

## 3 DESIGN CAPACITY OF SEWAGE SYSTEM

### 3.1 Stabilisation Ponds

The WWTP only treats sewage from the North Laverton Village. There are no additional municipal wastes treated.

The proposed stabilisation ponds will be lined with 1.6mm HDPE.

The bank widths of the proposed stabilisation ponds is 3m which exceeds the minimum required width of 2.4m dictated by the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*.

The downstream (i.e. internal) and upstream (i.e. external) slopes of the proposed stabilisation pond sides are 1 in 3 which complies with the *Health Regulations*.

The banks of the primary stabilisation ponds are 2.3m higher than the base of the pond, with overflow channels into the secondary ponds at 1.8m high. The banks of the secondary stabilisation pond is 2.0m higher than the base of the pond, with the overflow channel into the evaporation/irrigation field at 1.5m high. This is in line with the recommended freeboard of 400mm given in the Department of Water's *Water Quality Protection Note 39*.

With the proposed stabilisation pond design as per Drawing No. 363-L-002, and with the primary and secondary ponds filled to depths of 1.8m and 1.5m respectively, the following will be available:

Primary Pond Area:	1,953 m <sup>2</sup>
Primary Pond Vol.:	3,691 m <sup>3</sup>
Secondary Pond Area:	1,793 m <sup>2</sup>
Secondary Pond Vol.:	2,754 m <sup>3</sup>

### 3.2 Evaporation / Irrigation Field

With the proposed evaporation/irrigation field design as per Drawing No. 363-L-001, the following will be available:

Evaporation Field Area:	30,000 m <sup>2</sup>
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## 4 CALCULATED INFLOWS

### 4.1 Stabilisation Ponds

Assuming 276 personnel on site and 200 litres per person per day, the combined outflows from the village will be  $276 \times 200 = 55,200$  litres per day, which equates to 1,679 kL per month.

This monthly flow-rate was then combined with the mean monthly rainfall data and the monthly pan evaporation rates for Leinster (approximately 120km south-west of the North Laverton Mine), as shown below:

Monthly Influent Volume						1679	kL
Primary & Secondary Stabilisation Pond Area						3746	m <sup>2</sup>
Month	Historical Gross Evaporation (mm)	Historical Gross Evaporation (kL)	Historical Mean Rainfall (mm)	Historical Mean Rainfall (kL)	Net Evaporation (Evap'n - R'fall) (kL)	Calculated Excess Requiring Discharge (kL)	
Jan	450	1685.7	39.4	147.6	1538.1	140.9	
Feb	350	1311.1	39.9	149.5	1161.6	517.4	
Mar	300	1123.8	35.8	134.1	989.7	689.3	
Apr	200	749.2	23.7	88.8	660.4	1018.6	
May	150	561.9	13.8	51.7	510.2	1168.8	
Jun	80	299.7	14.1	52.8	246.9	1432.1	
Jul	100	374.6	15.0	56.2	318.4	1360.6	
Aug	125	468.3	8.5	31.8	436.4	1242.6	
Sep	200	749.2	4.1	15.4	733.8	945.2	
Oct	300	1123.8	11.3	42.3	1081.5	597.5	
Nov	400	1498.4	16.2	60.7	1437.7	241.3	
Dec	400	1498.4	22.4	83.9	1414.5	264.5	
Annual Total	3055.0	11444.0	244.2	914.8	10529.3	9618.7	
Monthly Avg	254.6	953.7	20.4	76.2	877.4	801.6	
Daily Avg	8.4	31.4	0.7	2.5	28.8	26.4	

Table 1 - Primary & Secondary Stabilisation Ponds

With a primary pond volume of 3,691m<sup>3</sup>, the detention time will be 3,691 ÷ 55.2 = 66.9 days.

With a secondary pond volume of 2,754 m<sup>3</sup>, the detention time will be a further 2,754 ÷ 55.2 = 49.9 days.

A flowmeter will be installed to measure the effluent outflows from the stabilisation ponds and readings will be taken monthly.

## 4.2 Evaporation / Irrigation Field

Using a similar methodology to that of the stabilisation ponds, and using the monthly Calculated Excess Requiring Discharge volumes from Table 1, the capacity of the evaporation / irrigation field is shown below:

Evaporation Basin Area						30000	m <sup>2</sup>
Month	Historical Gross Evaporation (mm)	Historical Gross Evaporation (kL)	Historical Mean Rainfall (mm)	Historical Mean Rainfall (kL)	Net Evaporation (Evap'n - R'fall) (kL)	Treated Water Discharge from Ponds (kL)	Treated Water - Net Evaporation (kL)
Jan	450	13500	39.4	1197	12303.0	140.9	-12162.1
Feb	350	10500	39.9	1074	9426.0	517.4	-8908.6
Mar	300	9000	35.8	711	8289.0	689.3	-7599.7
Apr	200	6000	23.7	414	5586.0	1018.6	-4567.4
May	150	4500	13.8	423	4077.0	1168.8	-2908.2
Jun	80	2400	14.1	450	1950.0	1432.1	-517.9
Jul	100	3000	15.0	255	2745.0	1360.6	-1384.4
Aug	125	3750	8.5	123	3627.0	1242.6	-2384.4
Sep	200	6000	4.1	339	5661.0	945.2	-4715.8
Oct	300	9000	11.3	486	8514.0	597.5	-7916.5
Nov	400	12000	16.2	672	11328.0	241.3	-11086.7
Dec	400	12000	22.4	7326	4674.0	264.5	-4409.5
Annual Total	3055.0	91650.0	244.2	13470.0	78180.0	9618.8	-68561.2
Monthly Avg	254.6	7637.5	20.4	1122.5	6515.0	801.6	-5713.4
Daily Avg	8.4	251.1	0.7	36.9	214.2	26.4	-187.8

Table 2 – Evaporation/Irrigation Field

As the Net Evaporation for the 12 month period greatly exceeds the Treated Water Discharge from Ponds for the same period, the evaporation / irrigation field has sufficient capacity for the hydraulic loading.

The soil characteristic of the evaporation / irrigation field will be sandy clay loam, and it will be located more than 500m from sensitive water resources. Consequently, *WQPN22* specifies limits for the application rates of Nitrogen and Phosphorus to 480 kg/ha/year and 120 kg/ha/year, respectively.

Based on data for similar facilities at other mine-sites, the expected concentrations of Nitrogen and Phosphorus are 15 mg/L and 3 mg/L, respectively. Using these figures, combined with the projected annual total Treated Water Discharge from Ponds volume from Table 2, and the evaporation / irrigation field area of 3 hectares, the projected discharge concentrations of Nitrogen and Phosphorus are:

Nitrogen concentration =  $9,618,800 \times 0.000015 / 3 = 48.1$  kg/ha/yr

Phosphorus concentration =  $9,618,800 \times 0.000003 / 3 = 9.6$  kg/ha/yr

The projected discharge nutrients to the evaporation / irrigation field are significantly less than those specified in *WQPN22*. Consequently, the evaporation / irrigation field is adequate.

## 5 FINDINGS & RECOMMENDATIONS

### 5.1 Stabilisation Ponds

Based on the sewage flow from the village, as well as the mean rainfall and evaporation rates, the stabilisation ponds are of sufficient capacity.

The WWTP (i.e. the stabilisation ponds and evaporation/irrigation field) will be surrounded by a 2.2m high wire mesh fence, with a locked access gate, in compliance with the *Health Regulations*.

The WWTP will be maintained to ensure there is no vegetation on the banks of the ponds.

The proposed stabilisation ponds will be lined with 1.6mm HDPE, which exceeds the permeability requirement in *WQPN39* and has an approximate UV lifetime of 20 years.

### 5.2 Evaporation / Irrigation Field

Based on the treated water discharge from the stabilisation ponds, as well as the mean rainfall and evaporation rates, the evaporation / irrigation field is of sufficient capacity.

The discharge nutrients also fall within the limits specified in *WQPN22*.

Emerald Resources will implement a monitoring regime for the WWTP as follows:

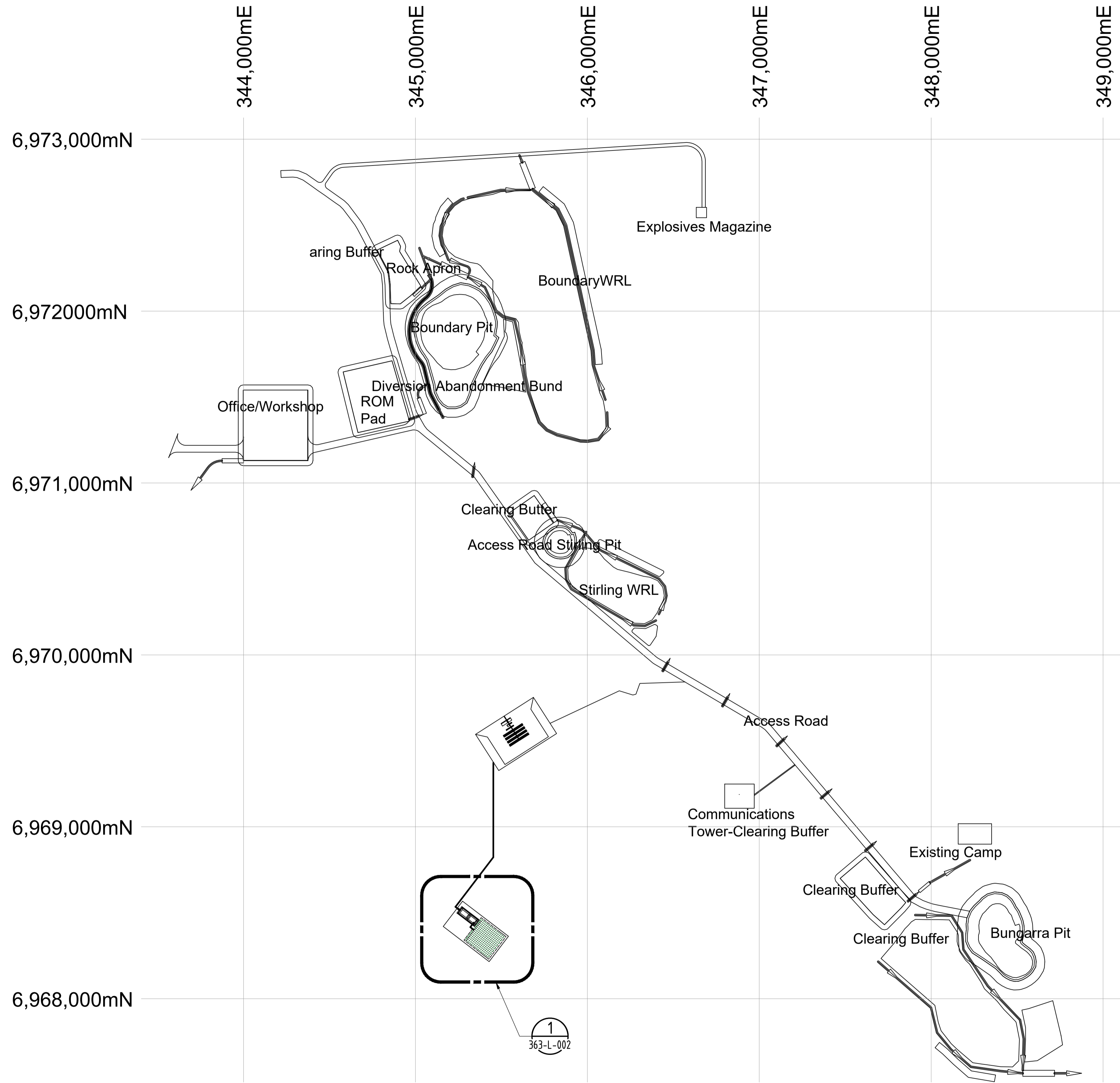
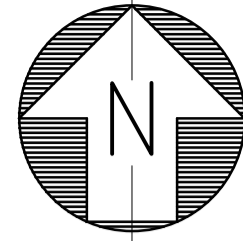
- Quarterly samples taken from the sampling point at the stabilisation ponds to ensure that the Phosphorus and Nitrogen concentrations comply with *WQPN22*
- Accurate monthly measuring of flows at the discharge of the village sewage transfer station and at the discharge of the stabilisation ponds
- Egress points for fauna
- Weekly inspections of the stabilisation pond banks and HDPE liner as well as the sprinklers to ensure operation as per design
- The solids separation tank will be regularly inspected and pumped out by a licenced sewage contractor when it reaches  $\frac{3}{4}$  full

# Appendix A

## Drawings

<b>Drawing Number</b>	<b>Revision</b>	<b>Title</b>
363-L-001	A	Dingo Range – Site Plan Layout
363-L-002	A	Dingo Range – Wastewater Treatment Plant – Layout
363-L-003	A	Dingo Range – Wastewater Treatment Plant – Details
363-L-004	A	Dingo Range – Irrigation Area Sprinkler Detail





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363-L-004  
363-L-003  
363-L-002

SPRINKLER DETAILS  
DETAILS  
LAYOUT

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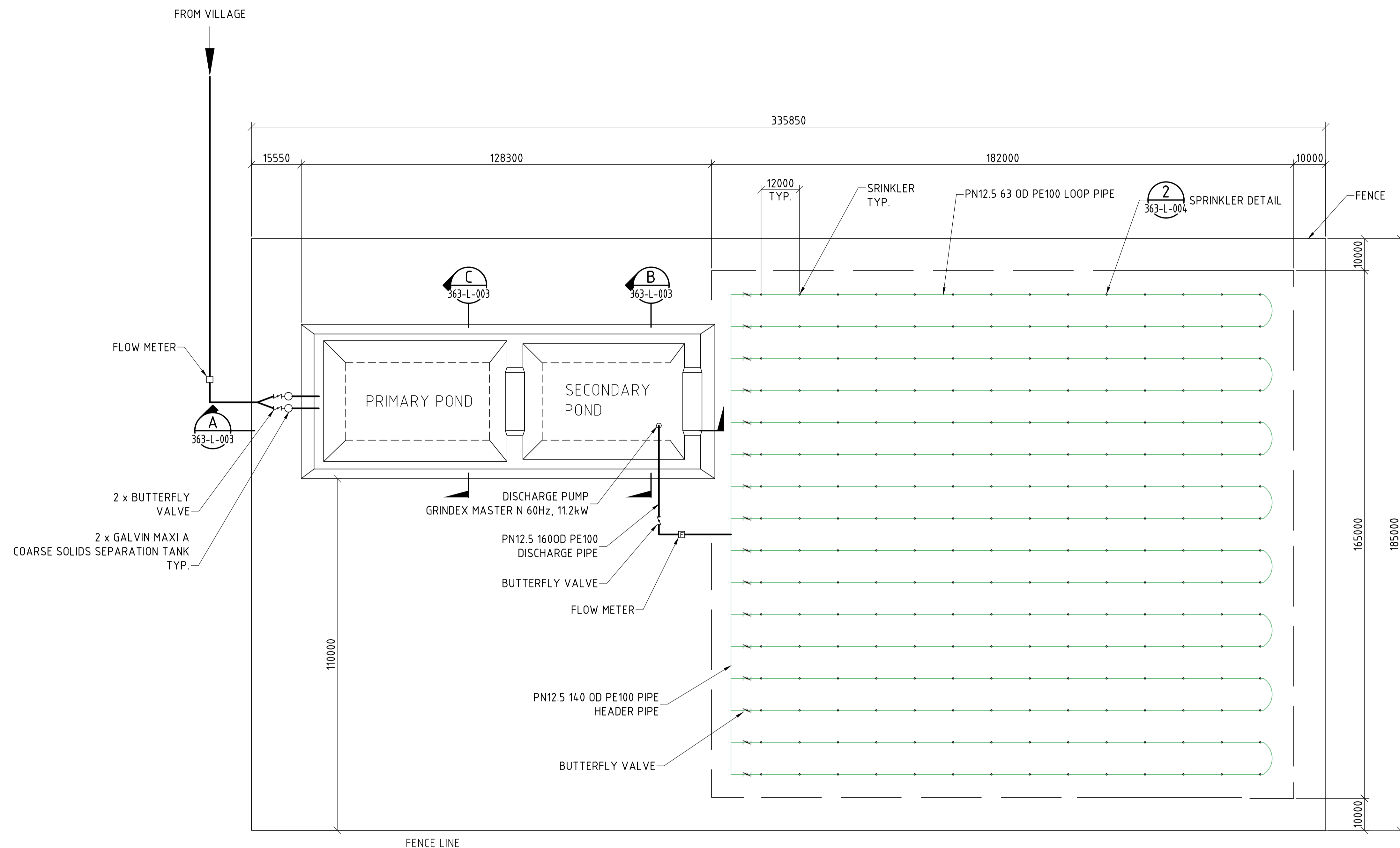
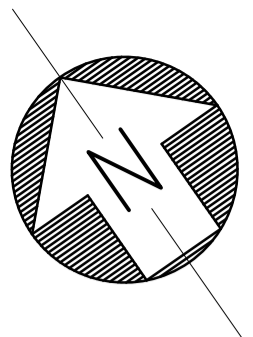
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DESIGN APPROVED		
DESIGNED		JULY 2024
DRAWING CHECKED	GP	JULY 2024
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TITLE  
**DINGO RANGE GOLD PROJECT  
VILLAGE WASTE WATER TREATMENT PLANT  
SITE PLAN LAYOUT**

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DETAIL 1  
363-L-001

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363-L-003	DETAILS
363-L-001	SITE PLAN LAYOUT
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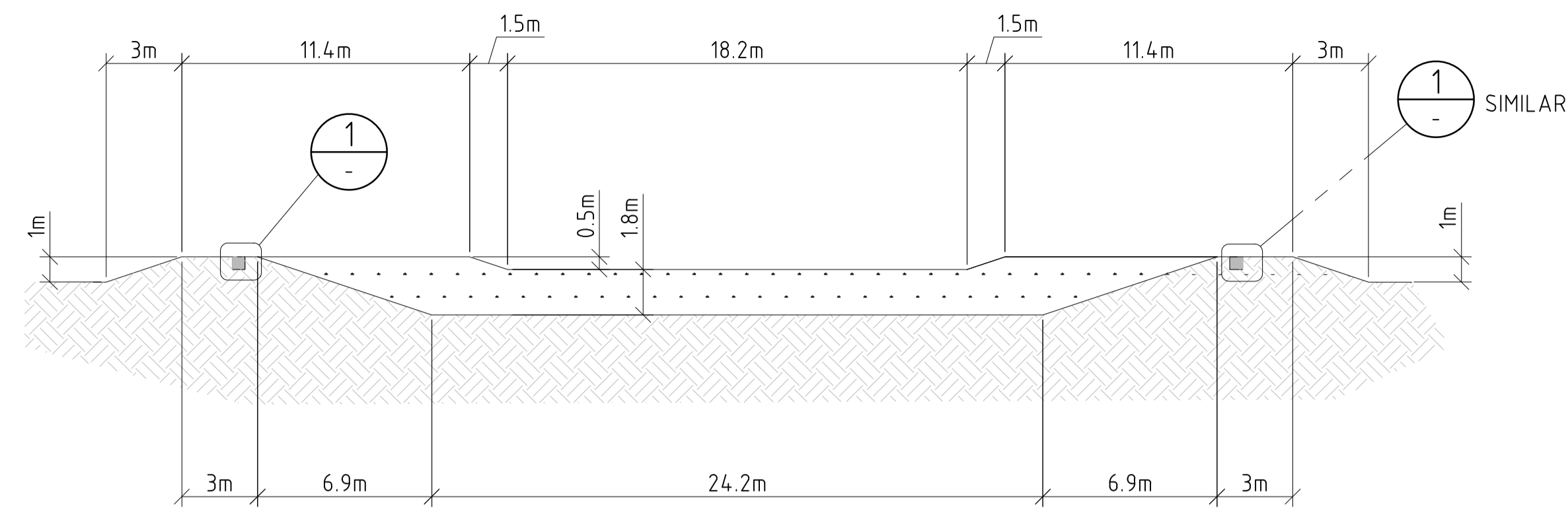
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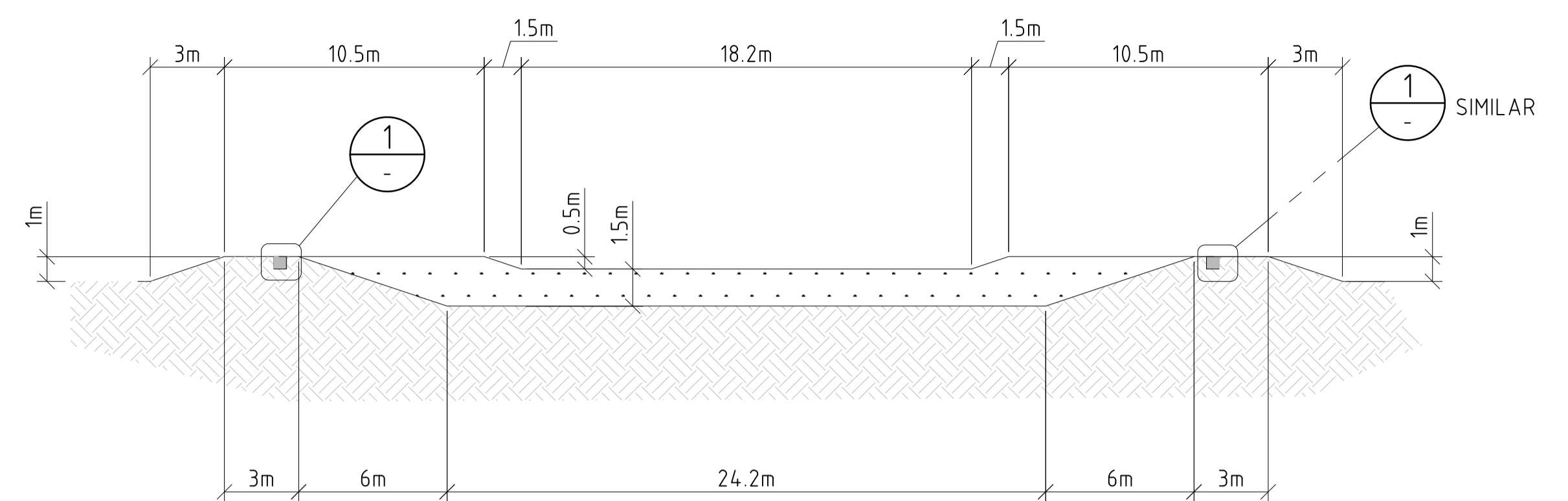
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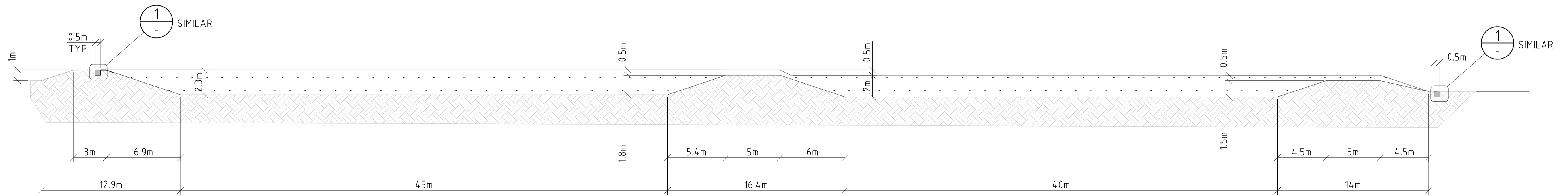




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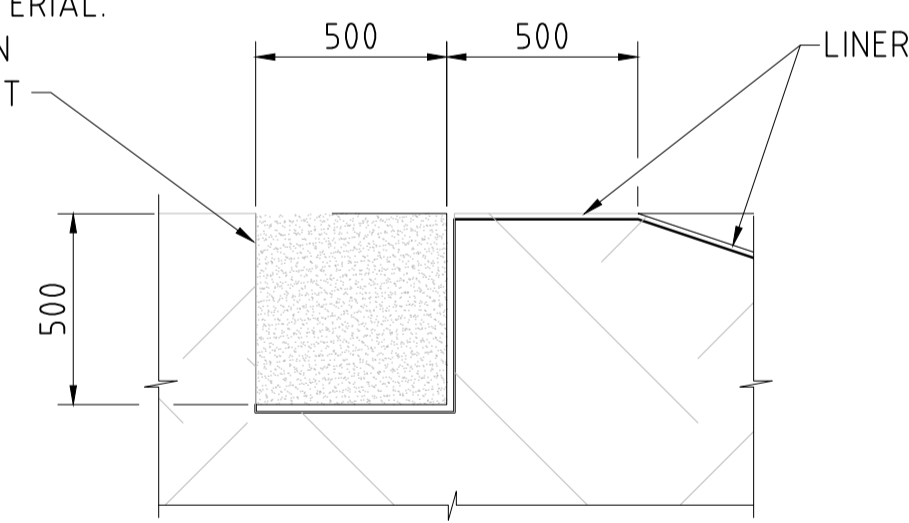


SECTION B  
1:200 363-L-002



SECTION A  
1:200 363-L-002

BACKFILL WITH DAMP  
NON-COHESIVE BEDDING MATERIAL.  
HAND TAMP TO 90% M.D.D. IN  
2 - 150 LIFTS AND 1 - 200 LIFT



DETAIL 1 BUND LINER  
1:20 TYP. SECTION

**STABILISATION PONDS**

①	PRIMARY POND VOLUME	= 3691 m <sup>3</sup>
	PRIMARY POND SURFACE AREA	= 1953 m <sup>2</sup>
②	SECONDARY POND VOLUME	= 2754 m <sup>3</sup>
	SECONDARY POND SURFACE AREA	= 1793 m <sup>2</sup>

**EVAPORATION / IRRIGATION BASINS**

①	EVAPORATION BASIN AREA	= 30000m <sup>2</sup>
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**GENERAL NOTES:**

- BUND WALLS AND FLOOR BUND WALLS SHOULD BE CONSTRUCTED USING SUITABLE LOCAL CLAY MATERIAL IMPORTED, SPREAD AND COMPACTED IN LAYERS. COMPACTION SHALL BE DEEMED ADEQUATE FOR 500 mm THICK LAYERS WHEN PROOF ROLLED WITH A MINIMUM OF FIVE (5) PASSES OF A SINGLE DRUM PEDESTRIAN SIZE VIBRATING ROLLER WITH TOTAL MASS NOT LESS THAN 350 kg. AFTER THE BUND WALLS HAVE BEEN CONSTRUCTED TO THE MINIMUM REQUIRED HEIGHT THE SIDES SHALL BE CAREFULLY SHAPED TO PRODUCE A UNIFORMLY GRADED, FLAT SURFACE TO THE DIMENSIONS AND SHAPES SHOWN ON THE DRAWINGS. EXCAVATE AROUND THE PERIMETER OF THE BUND WALL TO PROVIDE A SUITABLE KEY FOR THE IMPERVIOUS MEMBRANE. ANY DAMAGE OR PENETRATION OF THE LINER MUST BE MADE GOOD BY LINER INSTALLATION CONTRACTOR.
- BUND PREPARATION AND LINER INSTALLATION TO BE AS PER SUPPLIER/INSTALLERS INSTRUCTION. LINER PERMEABILITY TO BE LESS THAN 10<sup>-9</sup> LINER TO BE UV STABILISED/RESISTANT LIFE EXPECTANCY OF LINER TO BE 15 YEARS OR GREATER. FOLD THE FREE EDGES OF THE BUND LINER DOWN INTO THE ANCHOR TRENCH AND BACK FILL AS SHOWN.

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100mm  
90  
80  
70  
60  
50  
40  
30  
20  
10  
0

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363-L-002  
363-L-001

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REFERENCE DRAWING SPRINKLER DETAILS LAYOUT SITE PLAN LAYOUT

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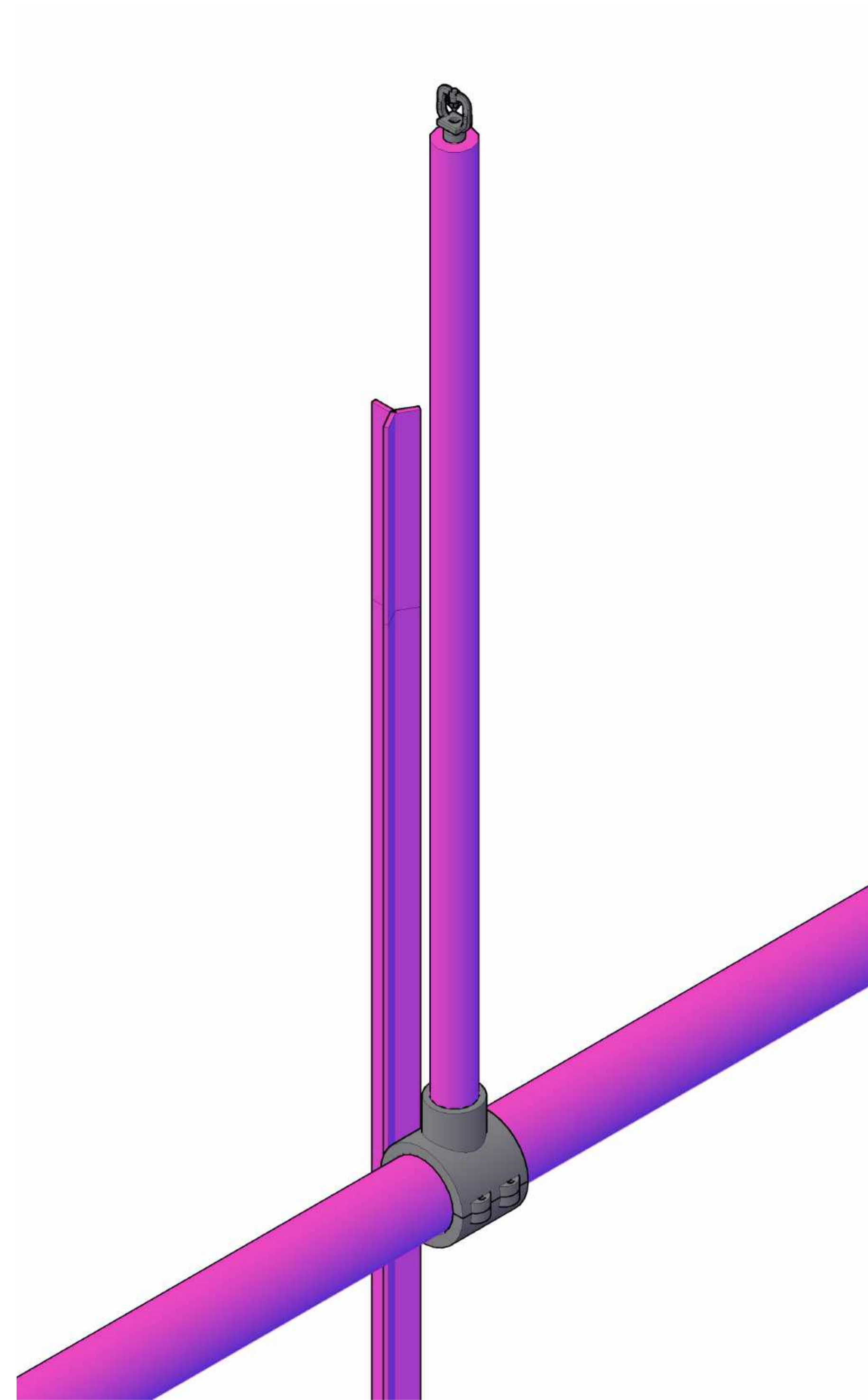
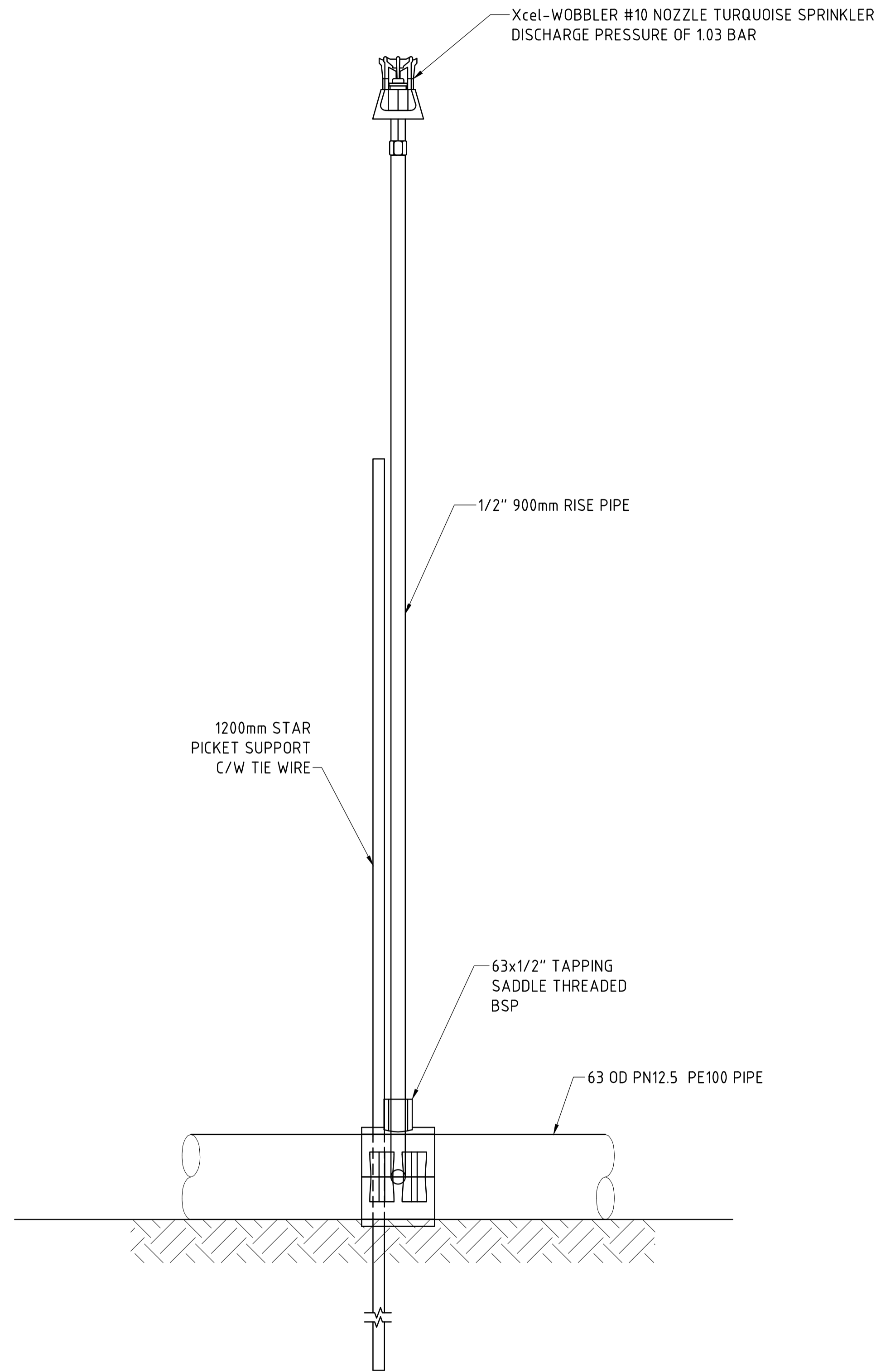
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DRAWING No. 363-L-003  
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DETAIL 2  
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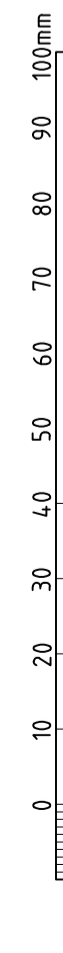
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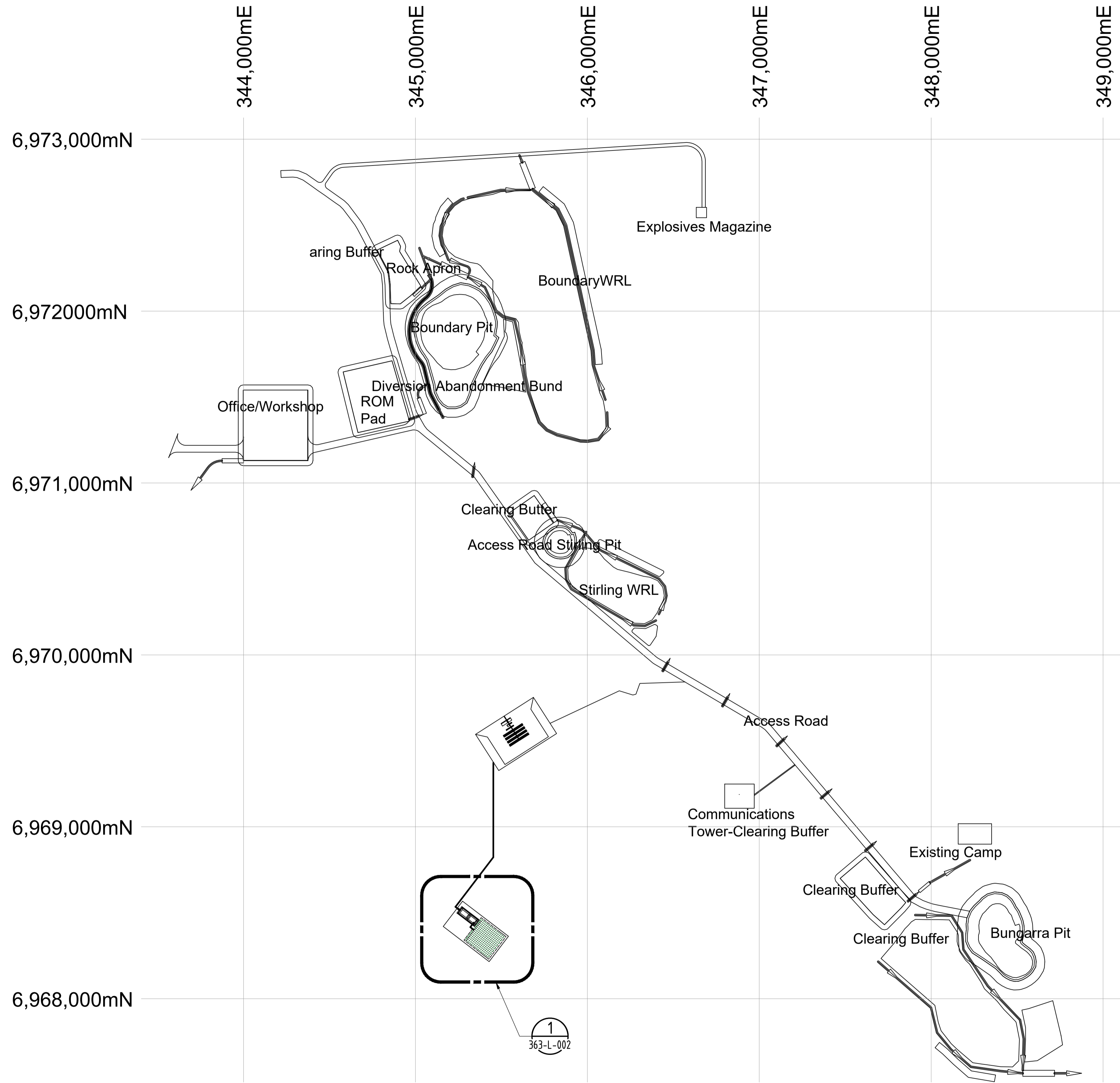
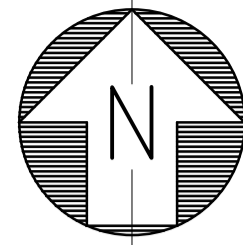
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363-L-003	DETAILS
363-L-002	LAYOUT
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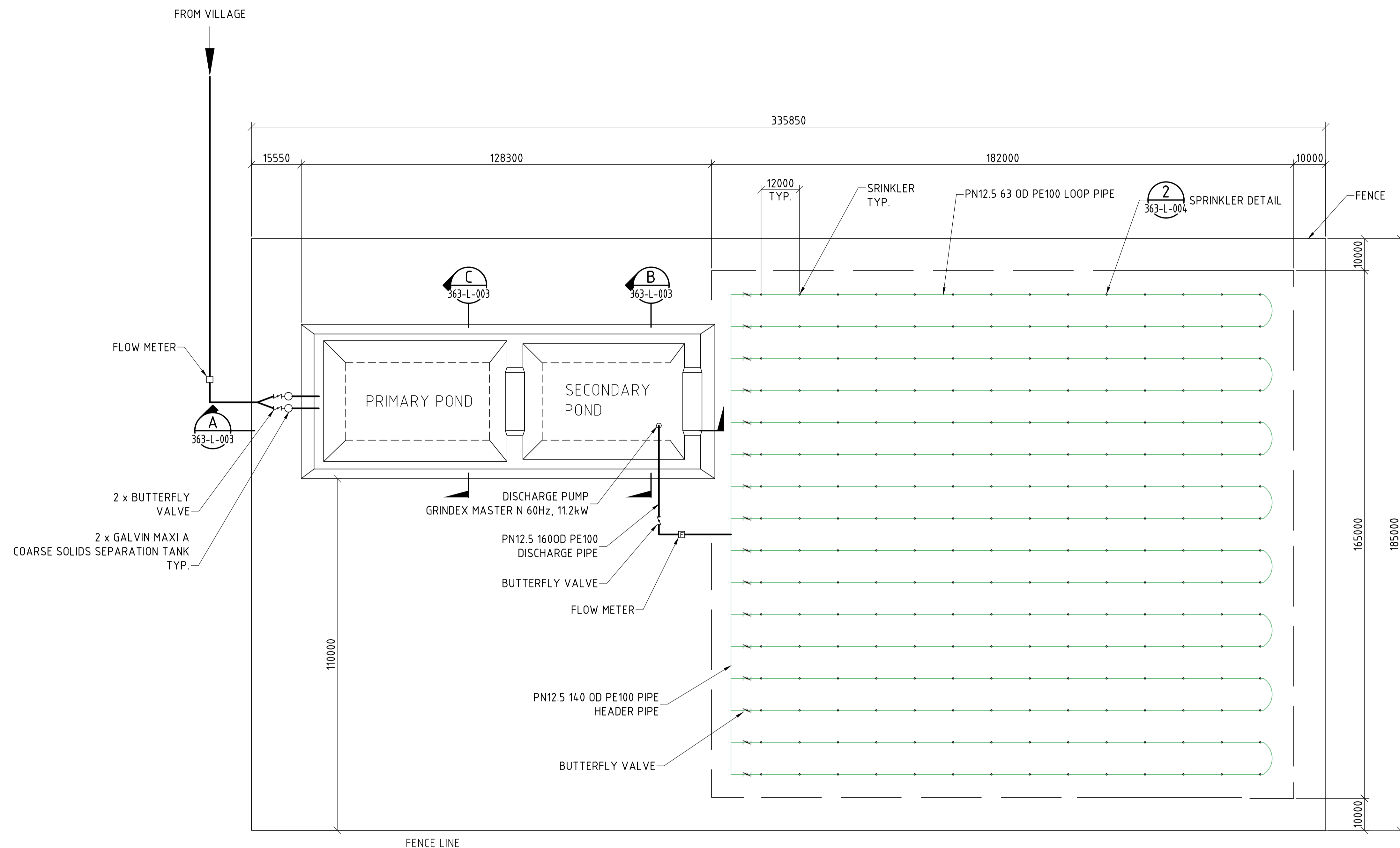
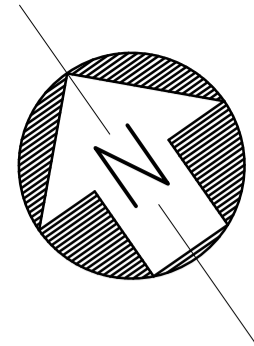
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JOB No.	8469	A1
FILE NAME	363L001.dwg	
DRAWING No.	363-L-001	REV No. A
- DO NOT SCALE - - IF IN DOUBT ASK -		



DETAIL 1  
363-L-001

**PRELIMINARY ISSUE  
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363-L-004	SPRINKLER DETAILS
363-L-003	DETAILS
363-L-001	SITE PLAN LAYOUT
DRAWING No.	REFERENCE DRAWING

A	TG	30.07.2024	ISSUED FOR CLIENT REVIEW	CHKD	APPD
No.	BY	DATE	REVISION	CHKD	APPD

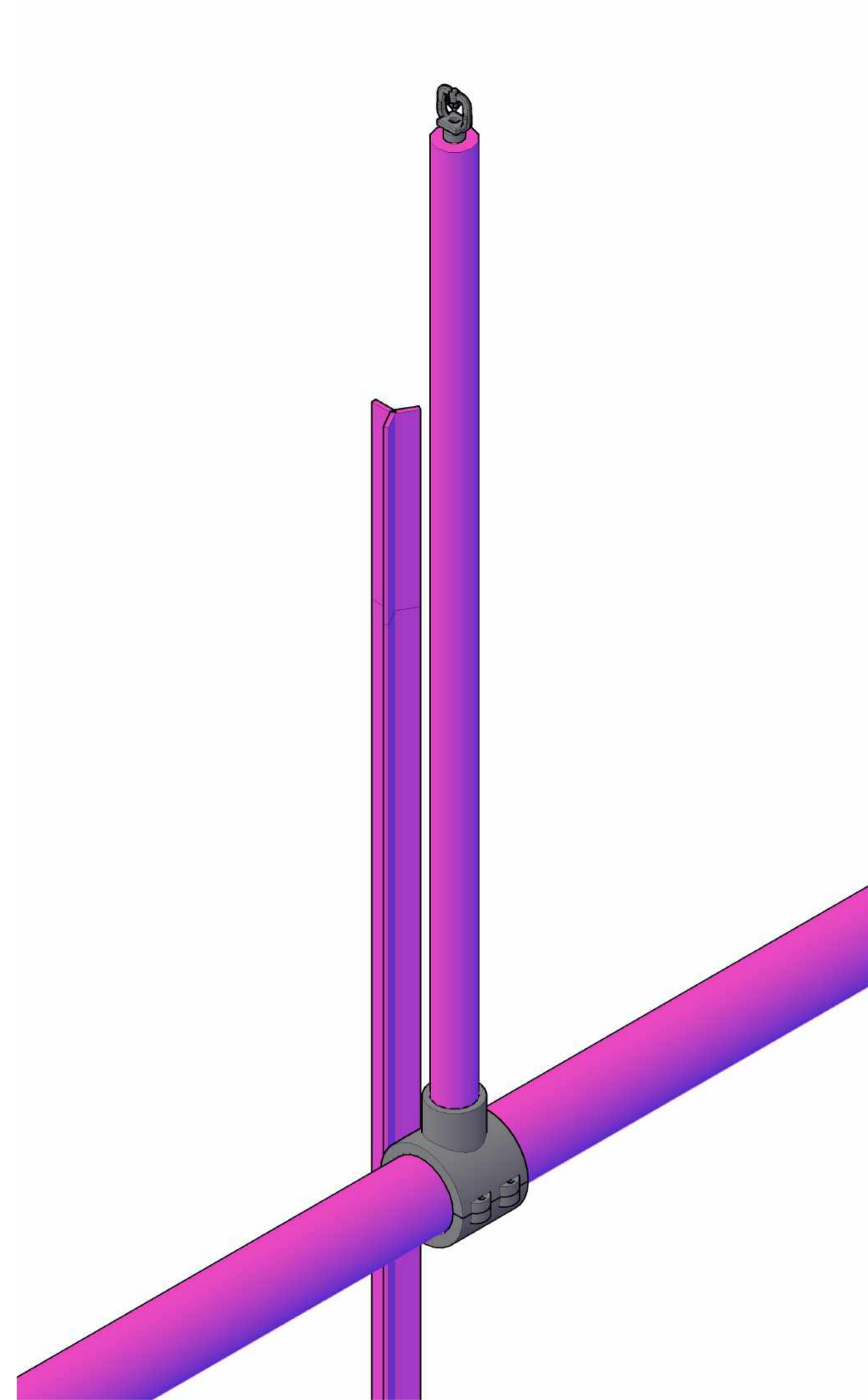
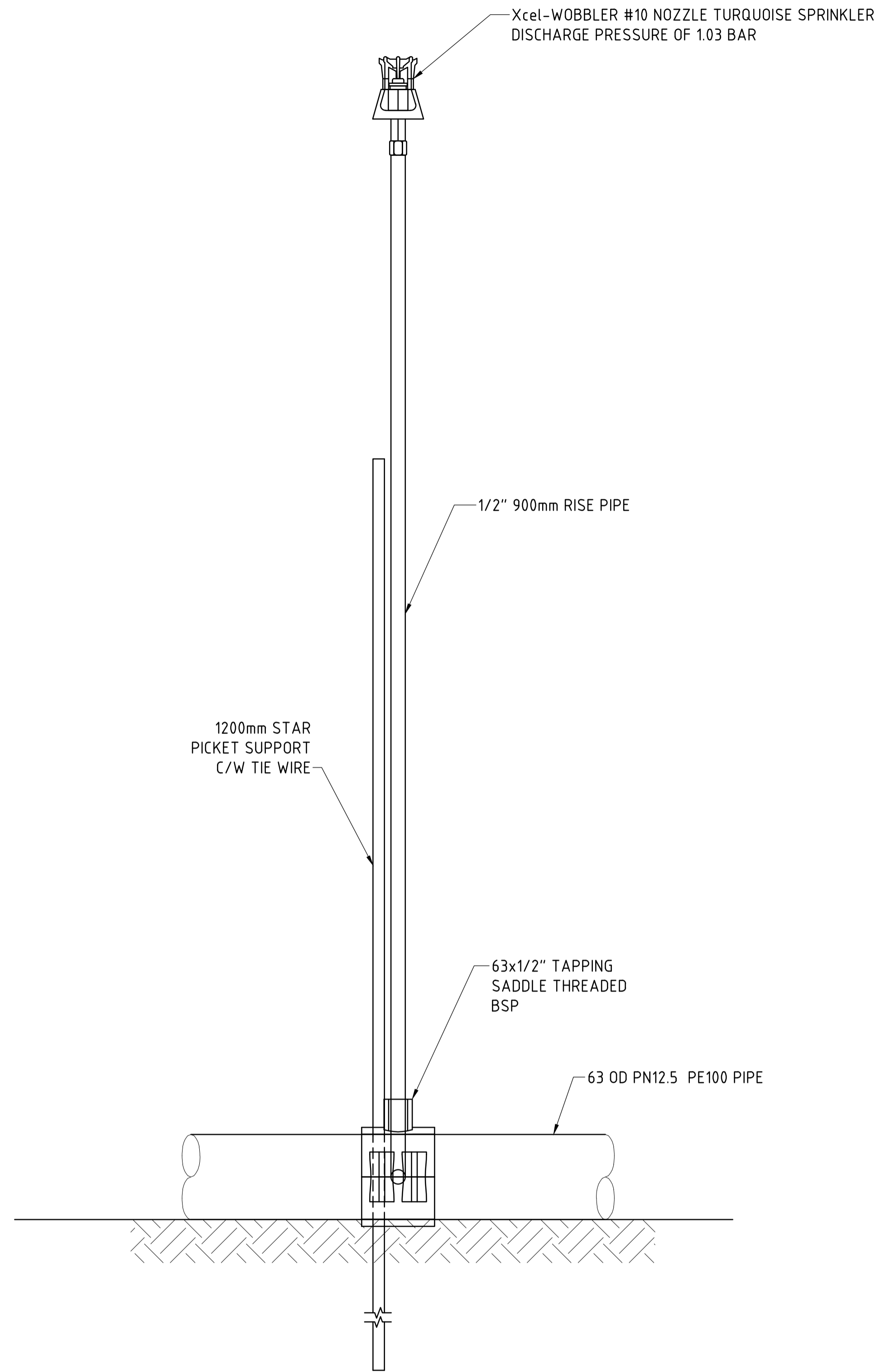
PROJECT APPROVED	BY	DATE
DESIGN APPROVED		
DESIGNED	GP	JULY 2024
DRAWING CHECKED	GP	JULY 2024
DRAWN	TG	JULY 2024

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CLIENT	EMERALD RESOURCES WA PTY LTD
TITLE	DINGO RANGE GOLD PROJECT VILLAGE WASTE WATER TREATMENT PLANT LAYOUT

SCALE	1:750
JOB No.	8469
DRAWING No.	363-L-002
REV No.	A
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0 10 20 30 40 50 60 70 80 90 100mm



DETAIL 2  
1:3 363-L-002

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363-L-003	DETAILS				
363-L-002	LAYOUT				
363-L-001	SITE PLAN LAYOUT				
DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION

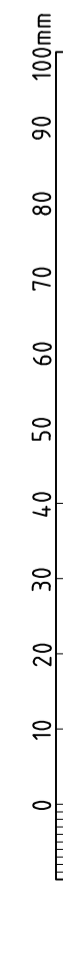
A	TG	30.07.2024	ISSUED FOR CLIENT REVIEW	CHKD	APPD
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PROJECT APPROVED	BY	DATE
DESIGN APPROVED		
DESIGNED		JULY 2024
DRAWING CHECKED	GP	JULY 2024
DRAWN	TG	JULY 2024

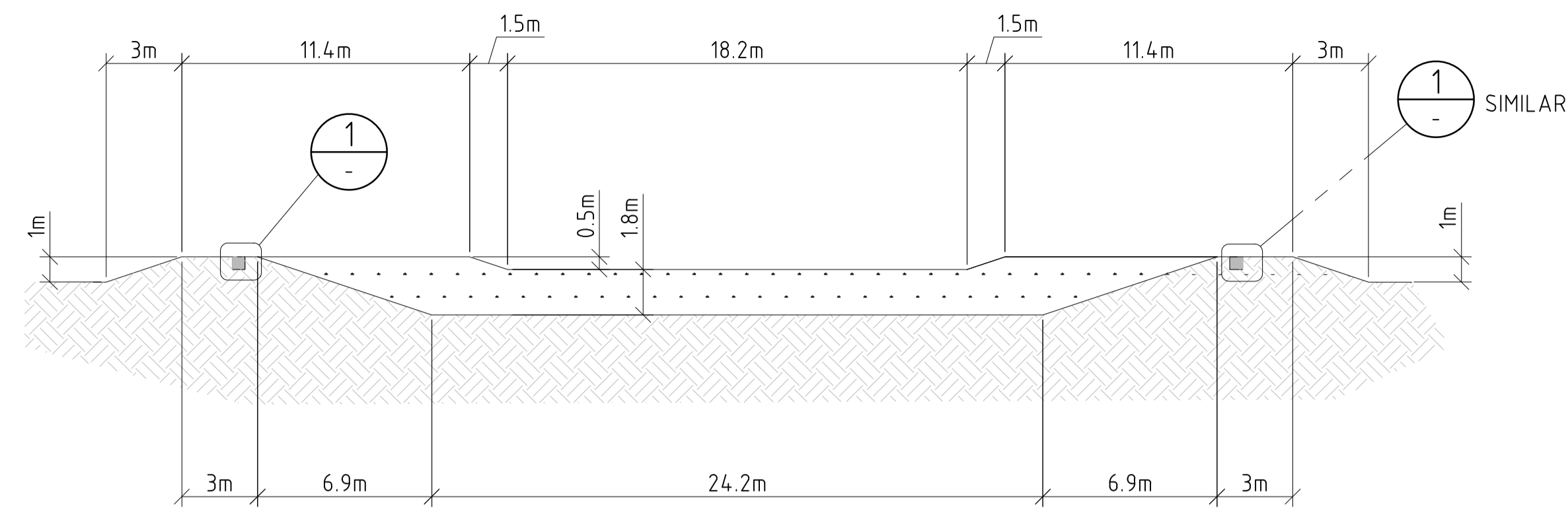
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CLIENT	EMERALD RESOURCES WA PTY LTD
TITLE	DINGO RANGE GOLD PROJECT VILLAGE WASTE WATER TREATMENT PLANT SPRINKLER DETAIL

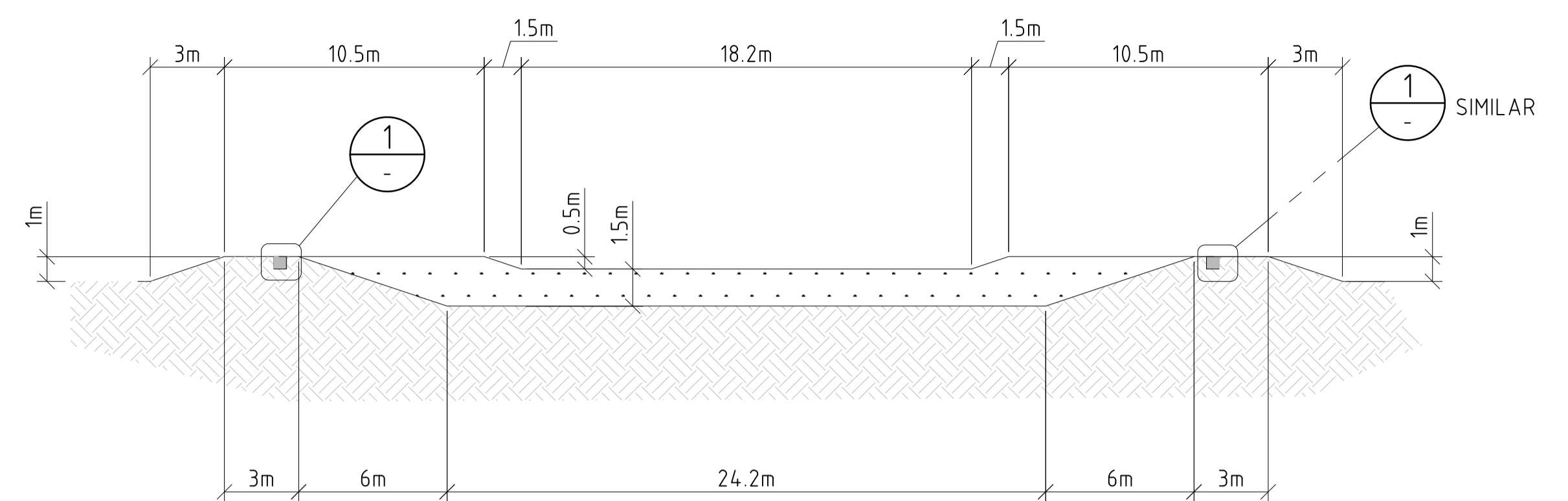
SCALE	1:750
JOB No.	8469
DRAWING No.	363-L-004
REV No.	A
- DO NOT SCALE - - IF IN DOUBT ASK -	



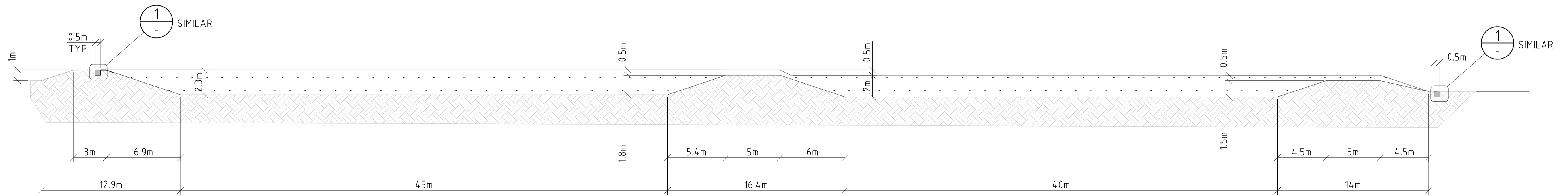




SECTION C  
1:200 363-L-002

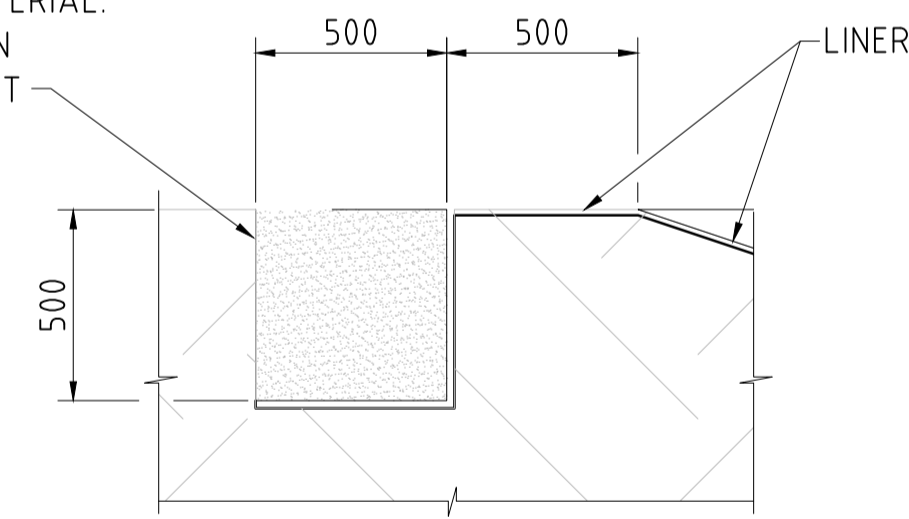


SECTION B  
1:200 363-L-002



SECTION A  
1:200 363-L-002

BACKFILL WITH DAMP  
NON-COHESIVE BEDDING MATERIAL.  
HAND TAMP TO 90% M.D.D. IN  
2 - 150 LIFTS AND 1 - 200 LIFT



DETAIL 1 BUND LINER  
1:20 TYP. SECTION

**STABILISATION PONDS**

①	PRIMARY POND VOLUME	= 3691 m <sup>3</sup>
	PRIMARY POND SURFACE AREA	= 1953 m <sup>2</sup>
②	SECONDARY POND VOLUME	= 2754 m <sup>3</sup>
	SECONDARY POND SURFACE AREA	= 1793 m <sup>2</sup>

**EVAPORATION / IRRIGATION BASINS**

①	EVAPORATION BASIN AREA	= 30000m <sup>2</sup>
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**GENERAL NOTES:**

- BUND WALLS AND FLOOR BUND WALLS SHOULD BE CONSTRUCTED USING SUITABLE LOCAL CLAY MATERIAL IMPORTED, SPREAD AND COMPACTED IN LAYERS. COMPACTION SHALL BE DEEMED ADEQUATE FOR 500 mm THICK LAYERS WHEN PROOF ROLLED WITH A MINIMUM OF FIVE (5) PASSES OF A SINGLE DRUM PEDESTRIAN SIZE VIBRATING ROLLER WITH TOTAL MASS NOT LESS THAN 350 kg. AFTER THE BUND WALLS HAVE BEEN CONSTRUCTED TO THE MINIMUM REQUIRED HEIGHT THE SIDES SHALL BE CAREFULLY SHAPED TO PRODUCE A UNIFORMLY GRADED, FLAT SURFACE TO THE DIMENSIONS AND SHAPES SHOWN ON THE DRAWINGS. EXCAVATE AROUND THE PERIMETER OF THE BUND WALL TO PROVIDE A SUITABLE KEY FOR THE IMPERVIOUS MEMBRANE. ANY DAMAGE OR PENETRATION OF THE LINER MUST BE MADE GOOD BY LINER INSTALLATION CONTRACTOR.
- BUND PREPARATION AND LINER INSTALLATION TO BE AS PER SUPPLIER/INSTALLERS INSTRUCTION. LINER PERMEABILITY TO BE LESS THAN 10<sup>-9</sup> LINER TO BE UV STABILISED/RESISTANT LIFE EXPECTANCY OF LINER TO BE 15 YEARS OR GREATER. FOLD THE FREE EDGES OF THE BUND LINER DOWN INTO THE ANCHOR TRENCH AND BACK FILL AS SHOWN.

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DIMENSIONS IN MILLIMETRES

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363-L-004	SPRINKLER DETAILS																			
363-L-002	LAYOUT																			
363-L-001	SITE PLAN LAYOUT																			
DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION	CHKD	APPD													

A	TG	30.07.2024	ISSUED FOR CLIENT REVIEW																	
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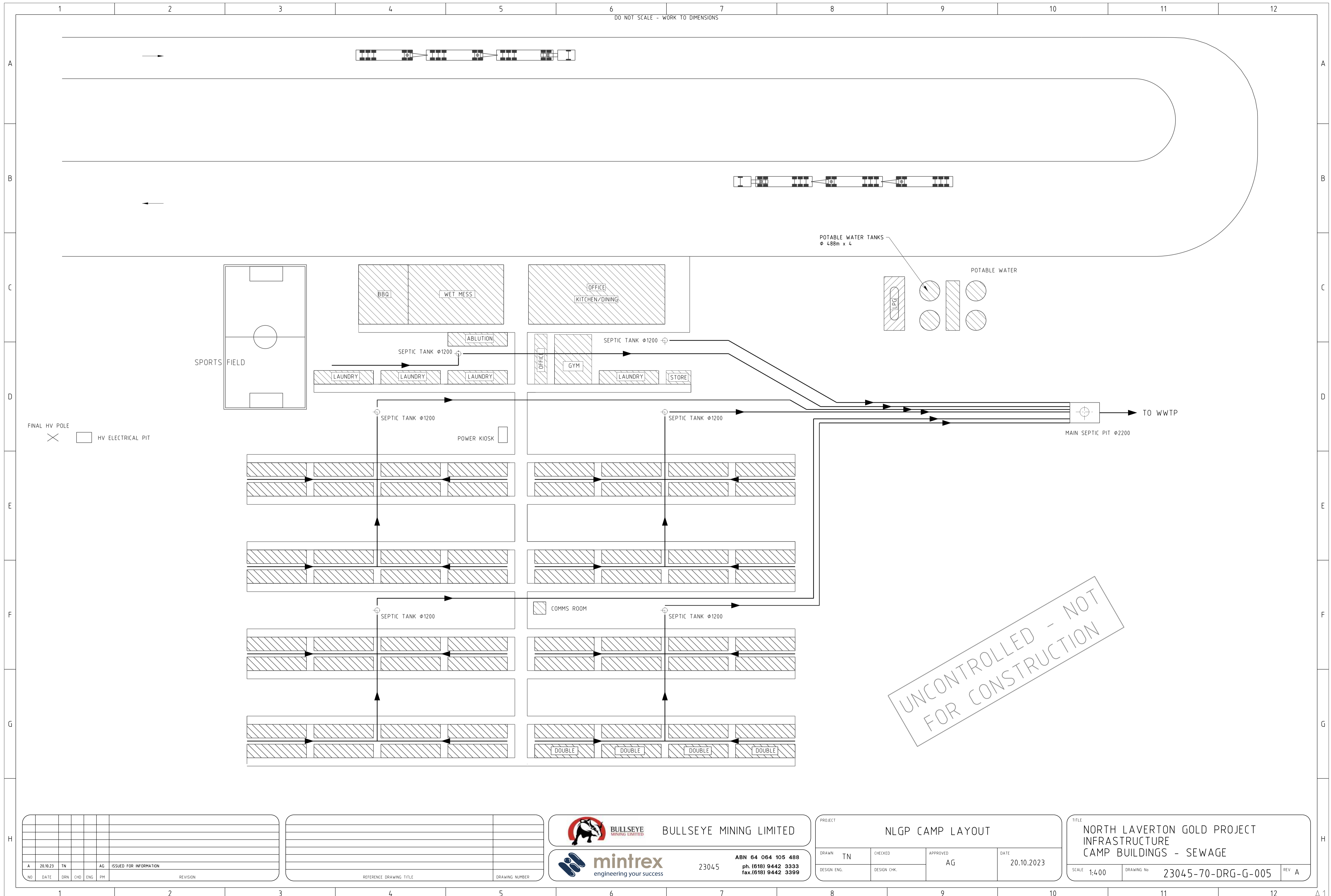
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CLIENT	EMERALD RESOURCES WA PTY LTD
TITLE	DINGO RANGE GOLD PROJECT VILLAGE WASTE WATER TREATMENT PLANT DETAILS

SCALE	1:200	UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE IN MILLIMETRES.
JOB No.	8469	FILE NAME
DRAWING No.	363-L-003	REV No.
		A
	- DO NOT SCALE - - IF IN DOUBT ASK -	





DO NOT SCALE - WORK TO DIMENSIONS

POTABLE WATER TANKS  
φ 4.88m x 4

POTABLE WATER

SPORTS FIELD

FINAL HV POLE

HV ELECTRICAL PIT

POWER KIOSK

TO WWTP

MAIN SEPTIC PIT φ2200

UNCONTROLLED - NOT FOR CONSTRUCTION

NO	DATE	DRN	CHK	ENG	PM	REVISION
A	20.10.23	TN		AG		ISSUED FOR INFORMATION

REFERENCE DRAWING TITLE	DRAWING NUMBER

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 **mintrex**  
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23045  
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fax. (618) 9442 3399

PROJECT			
NLGP CAMP LAYOUT			
DRAWN	TN	CHECKED	APPROVED
DESIGN ENG.	DESIGN CHK.	AG	DATE
			20.10.2023

TITLE			
NORTH LAVERTON GOLD PROJECT INFRASTRUCTURE CAMP BUILDINGS - SEWAGE			
SCALE	1:400	DRAWING No	23045-70-DRG-G-005
			REV A