

Hydraulic Design
Including OSD Calculations,
Overland Flow Path Details,
Existing Pit Details,
Aboveground OSD/RWT Tanks Details,
Dispersion System Details,
Elevation Details,
Roof Plan,
and
Stormwater Systems
for
Existing Single Residential Development at

Lot 1, DP 407432,
(H/No. 49) Waratah Parade,
NARRAWEENA

9 November 2023

Northern Beaches Council
Our Job Number: D4043

Nasseri Associates

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IMPORTANT NOTES:

The following hydraulic plans should be read in conjunction with:

1. Architectural plans from Masterton Homes Job No. 2015754 Issue A dated 07 March 2023 (Phone: 1300 446637).
2. Northern Beaches Council's Policy on Stormwater Requirements for Residential Developments and BASIX Requirements.

GENERAL NOTES:

1. ALL HYDRAULIC WORKS TO BE IN ACCORDANCE WITH NORTHERN BEACHES COUNCIL'S STANDARD SPECIFICATIONS AND TO THE SUPERVISING ENGINEER'S SATISFACTION.
2. THESE PLANS TO BE READ IN CONJUNCTION WITH ARCHITECTURAL PLANS FROM MASTERTON HOMES JOB No. 2015754 ISSUE A DATED 07 MARCH 2023 (PHONE: 1300 446637).
3. ALL STORMWATER PIPES TO BE 100 DIA. UPVC UNLESS NOTED OTHERWISE. PIPES UNDER DRIVEWAY TO BE SEWER GRADE.
4. DEPTH AND LOCATION OF SEWER & SERVICES TO BE CONFIRMED PRIOR TO COMMENCEMENT OF DRAINAGE WORKS.
5. THE CONTRACTOR SHALL IMPLEMENT EROSION AND SEDIMENTATION CONTROL MEASURES AS NECESSARY AND TO THE SATISFACTION OF COUNCIL PRIOR TO COMMENCEMENT OF CONSTRUCTION AND DURING CONSTRUCTION.
6. ENSURE FINISHED GROUND LEVELS ARE SLOPING AWAY FROM THE DEVELOPMENT & INTO PITS OR YARD SUMPS, AS SHOWN ON THE ATTACHED DRAINAGE PLAN.
7. HYDRAULIC PLANS ARE SUBJECT TO COUNCIL APPROVAL.

OSD CALCULATIONS SUMMARY:

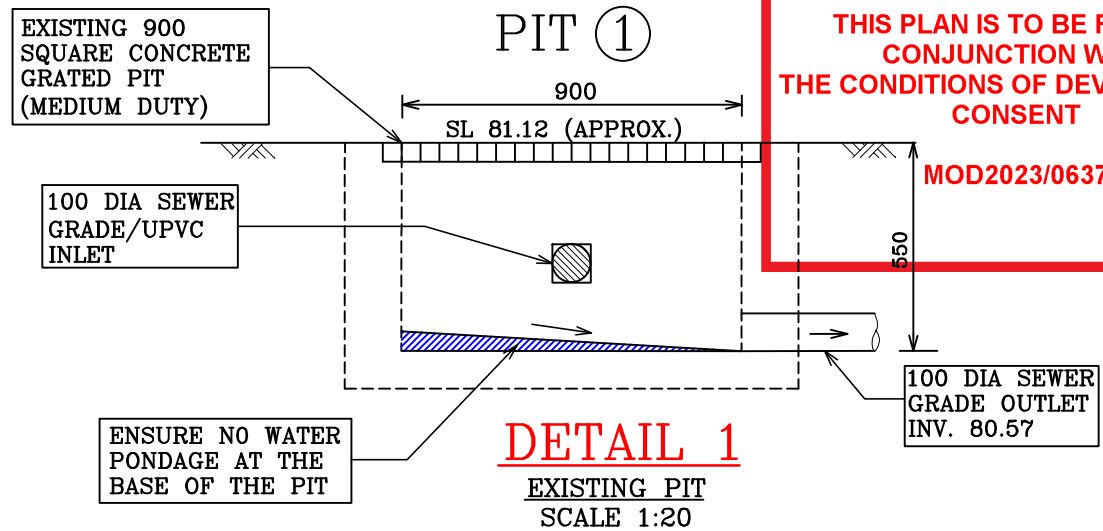
THESE CALCULATIONS SHOULD BE READ IN CONJUNCTION WITH NORTHERN BEACHES COUNCIL TECHNICAL SPECIFICATION FOR DEVELOPMENTS. CATCHMENT BASED METHOD IS USED FOR THIS DEVELOPMENT. THE SITE STORAGE REQUIREMENT(SSR) IS 200 m³/ha AND PERMISSIBLE SITE DISCHARGE (PSD) IS 400 l/s/ha.

- TOTAL SITE AREA = 556.40 m²
- SITE STORAGE REQUIREMENT (SSR) = (200 x 556.40/10,000) = 11.10 m³
- PERMISSIBLE SITE DISCHARGE (PSD) = (400 x 556.40/10,000) = 22.25 l/s

- RAINWATER TANK VOLUME = 3.0 m³
OSD VOLUME REQUIRED (11.10 m³ + 3.0 m³) = 14.10 m³
OSD VOLUME PROVIDED = 14.40 m³.....OK
PROVIDED THREE ABOVEGROUND RAINWATER TANKS WITH TOTAL EFFECTIVE CAPACITY OF 14,400 LITRES (TOP 11,270 LITRES IS FOR DETENTION SYSTEM AND BOTTOM 3,130 LITRES IS FOR RETENTION SYSTEM).

ORIFICE DIAMETER PROVIDED = 90 mm

PLEASE NOTE:
DISCUSSED THE SITE DRAINAGE ISSUES WITH COUNCIL'S DEVELOPMENT ENGINEER ON 11 OCTOBER 2023, DUE TO THE FALL OF THE LAND, NO COMPENSATION IN OSD STORAGE IS GIVEN FOR RETENTION VOLUME.



BASIX REQUIREMENT (11 JUNE 2021)
3,000 LITRES CAPACITY RAINWATER TANK FOR AT LEAST 223 m² OF ROOF AREA. PROVIDED 3,130 LITRES OF RETENTION WITHIN 15,300 LITRES CAPACITY ABOVEGROUND OSD/RWT SYSTEM (14,400 TOTAL EFFECTIVE CAPACITY). (REFER TO CALCULATION SHEET ATTACHED).

SITE CALCULATIONS:

TOTAL SITE AREA = 556.40 m²
TOTAL ROOF AREA IN RWT = 223.00 m²
TOTAL PROPOSED IMPERVIOUS AREA = 279.00 m² (APPROX.) (50.1%) (INCLUDING ROOF, DRIVEWAY & PATH/PAVED AREA)

IMPORTANT NOTES:

1. THIS DEVELOPMENT IS A NEW SINGLE RESIDENTIAL DWELLING ONLY. ACCORDING TO NORTHERN BEACHES COUNCIL STORMWATER GUIDELINES, OSD SYSTEM IS REQUIRED IF THE TOTAL IMPERVIOUS AREA IS GREATER THAN 40% OF THE TOTAL SITE AREA. THEREFORE, OSD SYSTEM IS REQUIRED FOR THIS DEVELOPMENT.
2. PART OF THE STORMWATER DRAINAGE SYSTEM WERE ALREADY DONE FOR THIS SITE, INCLUDING ONE ABOVEGROUND RAINWATER TANK (2,700L x 650W x 1,860H) ON SOUTHERN SIDE. THE EXISTING ABOVEGROUND TANK TO REMAIN. TWO NEW ABOVEGROUND TANKS (3,100L x 1,150 x 1,860) TO BE INSTALLED AT REAR OF THE GARAGE. ALL THREE ABOVEGROUND TANKS ARE DESIGNED FOR THE COMBINED OSD AND RWT SYSTEM.
3. RAINWATER TANKS WITH TOTAL CAPACITY OF 15,300 LITRES (14,400 LITRES EFFECTIVE CAPACITY) HAVE BEEN PLACED BEHIND THE GARAGE TO COLLECT TOTAL ROOF AREA. BOTTOM 3,130 LITRES CAPACITY OF THE TANKS IS FOR RETENTION SYSTEM (RWT) FOR RE-USE OF WATER SUCH AS TOILET FLUSHING, LAUNDARY & IRRIGATION SYSTEMS. TOP 11,270 LITRES CAPACITY OF THE TANKS IS FOR DETENTION SYSTEM (OSD) - 100 DIA SEWER GRADE OVERFLOW PIPE FROM TOP OF OSD/RWT1 TO BE CONNECTED TO 150 DIA SEWER GRADE OUTLET PIPE AT ORIFICE LEVEL AND CONNECTS SEPARATELY TO EXISTING PIT 3 AT 1% MIN FALL. (REFER TO SHEET No.2 FOR DETAILS).
4. SURFACE WATER AROUND THE DWELLING INCLUDING DRIVEWAY AND OVERFLOW/OUTLET PIPE FROM OSD/RWT1 IS TO BE DRAINED TO EXISTING PIT 3 AT REAR, PRIOR TO DISCHARGING TO NEW DISPERSION SYSTEM (REFER TO SHEET No. 2 FOR DETAILS).
5. LEVELS ARE CRITICAL. PRIOR TO ANY CHANGES CONTACT ENGINEER.
6. PRIOR TO BACKFILLING STORMWATER PIPES, CONTACT ENGINEER FOR AN INSPECTION.
7. WORK-AS EXECUTED PLANS & COMPLIANCE CERTIFICATE WILL BE ISSUED AFTER COMPLETION OF ALL HYDRAULIC WORKS.

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DATE: 09/11/2023

SYMBOLS & NOTATIONS

- STORMWATER LINES
- o DOWNPIPE
- 100 DIA YARD SUMP
- 225x100 GRATED BOX DRAIN
- INV INVERT LEVEL (PIPE / PIT)
- SL FINISHED SURFACE LEVEL
- FFL FINISHED FLOOR LEVEL
- FPL FINISHED PLATFORM LEVEL
- x- SEDIMENT CONTROL BARRIER
- PROPOSED BOUNDARY
- s- SEWER

ISSUE	AMENDMENTS	DATE
CLIENT: MR & MRS COLWELL (PRIVATE)		
LOT 1 (H/No. 49) WARATAH PARADE, NARRAWEENA		
DESIGNED SA	DRAWN SA	CHECKED JN
SCALE AS SHOWN		

HYDRAULIC DETAILS

NOTES, CALCULATIONS & PIT DETAILS

CAD REF. ENG/PRIVATE JOB No. D4043 SHEET No. 1

LOT 1
556.40 m²

EXISTING 600 SQ. GRATE CONCRETE
PIT (TO REMAIN)
SL 80.60 (APPROX.)
INV 80.10
(REFER TO SHEET No. 5 FOR DETAILS)

TWO SEPARATE
CONNECTION
REQUIRED

APPROXIMATE
LOCATION OF
SEWER MAIN

EXISTING 100 DIA
SEWER GRADE
CONNECTED TO EXISTING
PIT ③ (TO REMAIN)

PLEASE NOTE:

1. ALL THREE ABOVEGROUND RAINWATER TANKS MUST BE PLACED AT THE SAME BASE LEVEL & MUST HAVE THE SAME HEIGHT.
2. THE EXACT LOCATION OF DOWNPIPES, STORMWATER LINE, PITS AND RWT MAY ALTER DURING CONSTRUCTION, TO SUIT THE SITE CONDITION.
3. ENSURE NO DAMAGE OCCURS TO EXISTING TREE ROOTS WHILE CONSTRUCTING THE STORMWATER SYSTEM.

DISPERSION SYSTEM

REMOVE EXISTING GRATED BOX DRAIN AND REPLACE IT WITH 4000 LONG x 1200 WIDE (WITH 4 x 4.0m LONG 150 DIA PERFORATED PIPES) (THE EXACT LOCATION OF DISPERSION SYSTEM TO BE DETERMINED ON SITE DURING CONSTRUCTION) (REFER TO SHEET No. 5 FOR DETAILS).

EXISTING 100 DIA SEWER
GRADE CONNECTED TO
EXISTING PIT ③ (TO REMAIN)

EXISTING 100 DIA SEWER
GRADE TO TAKE ROOF WATER
TO TOP OF OSD/RWT1
(ALL DOWNPIPES TO BE
FULLY SEALED)

NEW 100 DIA SEWER GRADE
TO TAKE ROOF WATER TO
TOP OF OSD/RWT2 (ALL
DOWNPIPES TO BE FULLY
SEALED)

EXISTING 100
DIA YARD SUMP
(TO REMAIN)

NEW 100 DIA YARD
SUMP TO BE CONNECTED
TO EXISTING
STORMWATER LINE

EXISTING 900 SQ. GRATED CONCRETE
PIT (TO REMAIN)
SL 81.12
INV 80.57
(REFER TO DETAIL 1 ON SHEET No. 1)

CREATE A SWALE OR EARTH
MOUND TO DIVERT SURFACE
WATER TO EXISTING PIT ① &
TO REAR OF THE PROPERTY
(REFER TO DETAIL 2)

NEW 100 DIA SEWER GRADE TO
BE CONNECTED TO EXISTING PIT
① AT 1% MIN. FALL (THE EXACT
LOCATION TO BE DETERMINED
DURING CONSTRUCTION)

PROVIDE 100 DIA SEWER GRADE
OVERFLOW PIPE FROM TOP OF
OSD/RWT1 TO BE CONNECTED TO 150
DIA SEWER GRADE OUTLET PIPE AT
ORIFICE LEVEL AND CONNECTS
SEPARATELY TO PIT ③ AT 1% MIN FALL.
SL 80.80 (APPROX.)
INV. 80.60

NEW 100 DIA SEWER GRADE TO
TAKE ROOF WATER TO TOP OF
OSD/RWT2 (ALL DOWNPIPES TO BE
FULLY SEALED)

OSD/RWT
15,300 (2x6,100 + 1x3,100) LITRES
(14,400 LITRES TOTAL EFFECTIVE CAPACITY)
(2 NEW x (3,100L x 1,150W x 1,860H) +
1 EXISTING x (2,700L x 650W x 1,860H))
ABOVEGROUND SLIMLINE OSD/RWT TANKS
(REFER TO ELEVATION ON SHEET No. 3)

EXISTING 450 SQ. GRATED CONCRETE
PIT (TO REMAIN)
SL 81.20
INV. 80.87
(REFER TO DETAIL 5 ON SHEET No. 5)

NEW 100 DIA SEWER GRADE TO
TAKE ROOF WATER TO TOP OF
OSD/RWT3 (ALL DOWNPIPES TO
BE FULLY SEALED)

CREATE A SWALE OR EARTH
MOUND TO DIVERT SURFACE
WATER TO EXISTING PIT ②
(REFER TO DETAIL 2)

225 x 100 GRATED BOX DRAIN -
100 DIA SEWER GRADE OUTLET
TO BE CONNECTED TO EXISTING
PIT ② AT 1% MIN. FALL
SL. 81.33 (APPROX.)
INV. 81.23

NEW 100 DIA YARD
SUMP OR 250 SQUARE
GRATED PIT (TYPICAL)
STARTING POINT
SL 81.35 (APPROX.)
INV. 81.20

EXISTING 600 SQ.
GRATED CONCRETE
PIT TO BE REMOVED

www.dialbeforeyoudig.com.au



LEGEND:

- CONCRETE/ PAVED AREA
- 100 DIA UPVC OR SEWER GRADE FOR SURFACE WATER DRAINAGE
- 100 DIA SEWER GRADE FOR ROOF WATER DRAINAGE ONLY

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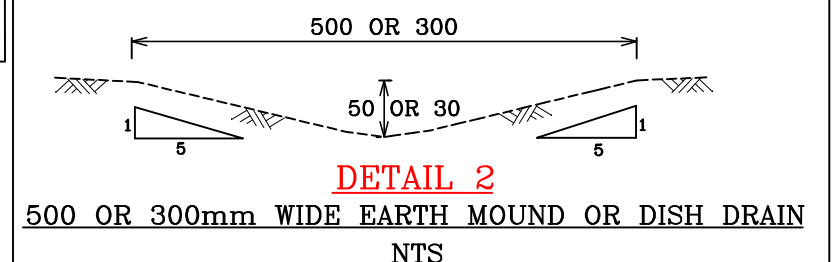
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DATE: 09/11/2023

- STORMWATER LINES
- DOWNPIPE
- 100 DIA YARD SUMP
- 225x100 GRATED BOX DRAIN
- INV INVERT LEVEL (PIPE / PIT)

- SL FINISHED SURFACE LEVEL
- FFL FINISHED FLOOR LEVEL
- FPL FINISHED PLATFORM LEVEL
- SEDIMENT CONTROL BARRIER
- PROPOSED BOUNDARY
- SEWER

WARATAH PARADE



HYDRAULIC DETAILS

DRAINAGE PLAN

ISSUE	AMENDMENTS	DATE
CLIENT: MR & MRS COLWELL (PRIVATE)		
LOT 1 (H/No. 49) WARATAH PARADE, NARRAWEENA		
DESIGNED SA	DRAWN SA	CHECKED JN
SCALE AS SHOWN		

CAD REF. ENG/PRIVATE JOB No. D4043 SHEET No. 2

REFER TO
DETAIL 3 ON
SHEET No. 4
FOR MORE
DETAILS

NEW 100 DIA SEWER
GRADE TO TAKE ROOF
WATER TO TOP OF
OSD/RWT3
(ALL DOWNPIPES TO BE
FULLY SEALED)

EXISTING 450 SQ.
GRADED CONCRETE
PIT (TO REMAIN)
SL 81.20
INV. 80.87 (REFER
TO DETAIL 5 ON
SHEET No. 5)

NEW 100 DIA SEWER
GRADE FROM
225 x 100 BOX DRAIN
AT 1% MIN. FALL

OSD/RWT
15,300 (2x6,100 + 1x3,100)
LITRES (14,400 LITRES TOTAL
EFFECTIVE CAPACITY)
(2 NEW x (3,100L x 1,150W x
1,860H) + 1 EXISTING x
(2,700L x 650W x 1,860H))
ABOVEGROUND SLIMLINE
OSD/RWT TANKS (REFER TO
DETAIL 3 ON SHEET No. 4)

NEW 100 DIA SEWER
GRADE TO TAKE ROOF
WATER TO TOP OF
OSD/RWT3
(ALL DOWNPIPES TO BE
FULLY SEALED)

NEW 100 DIA SEWER
GRADE FROM
225 x 100 BOX DRAIN
AT 1% MIN. FALL
SL. 81.33 (APPROX.)
INV. 81.23

OSD/RWT
15,300 (2x6,100 + 1x3,100) LITRES
(14,400 LITRES TOTAL EFFECTIVE CAPACITY)
(2 NEW x (3,100L x 1,150W x 1,860H) +
1 EXISTING x (2,700L x 650W x 1,860H))
ABOVEGROUND SLIMLINE OSD/RWT TANKS
(REFER TO DETAIL 3 ON SHEET No. 4)

Boundary
NGL
②

PROVIDE 100 DIA SEWER GRADE
OVERFLOW PIPE FROM TOP OF
OSD/RWT1 TO BE CONNECTED TO
150 DIA SEWER GRADE OUTLET
PIPE AT ORIFICE LEVEL AND
CONNECTS SEPARATELY TO
EXISTING PIT ③ AT 1% MIN FALL.
SL 80.80 (APPROX.)
INV. 80.60

ELEVATION A
SCALE 1:100

EXISTING 100 DIA
SEWER GRADE
CONNECTED TO EXISTING
PIT ③ (TO REMAIN)

EXISTING 100 DIA
SEWER GRADE
CONNECTED TO
EXISTING PIT ③
(TO REMAIN)

EXISTING 100 DIA SEWER
GRADE TO TAKE ROOF
WATER TO TOP OF OSD/RWT1
(ALL DOWNPIPES TO BE
FULLY SEALED)

REFER TO DETAIL
3 ON SHEET No.
4 FOR MORE
DETAILS

EXISTING 100 DIA SEWER
GRADE TO TAKE ROOF
WATER TO TOP OF OSD/RWT1
(ALL DOWNPIPES TO BE
FULLY SEALED)

EXISTING 100 DIA
SEWER GRADE
CONNECTED TO EXISTING
PIT ③ (TO REMAIN)

100 DIA SEWER GRADE OVERFLOW PIPE
FROM TOP OF OSD/RWT1 TO BE CONNECTED
TO 150 DIA SEWER GRADE OUTLET PIPE AT
ORIFICE LEVEL AND CONNECTS SEPARATELY
TO EXISTING PIT ③ AT 1% MIN FALL.
SL 80.80 (APPROX.)
INV. 80.60

ELEVATION B
SCALE 1:100

EXISTING 100 DIA
SEWER GRADE TO TAKE
ROOF WATER TO TOP
OF OSD/RWT1
(ALL DOWNPIPES TO BE
FULLY SEALED)

EXISTING 450 SQ. GRADED
CONCRETE PIT (TO REMAIN)
SL 81.20
INV. 80.87 (REFER TO
DETAIL 5 ON SHEET No. 5)

NEW 100 DIA
YARD SUMP OR
250 SQUARE
GRADED PIT

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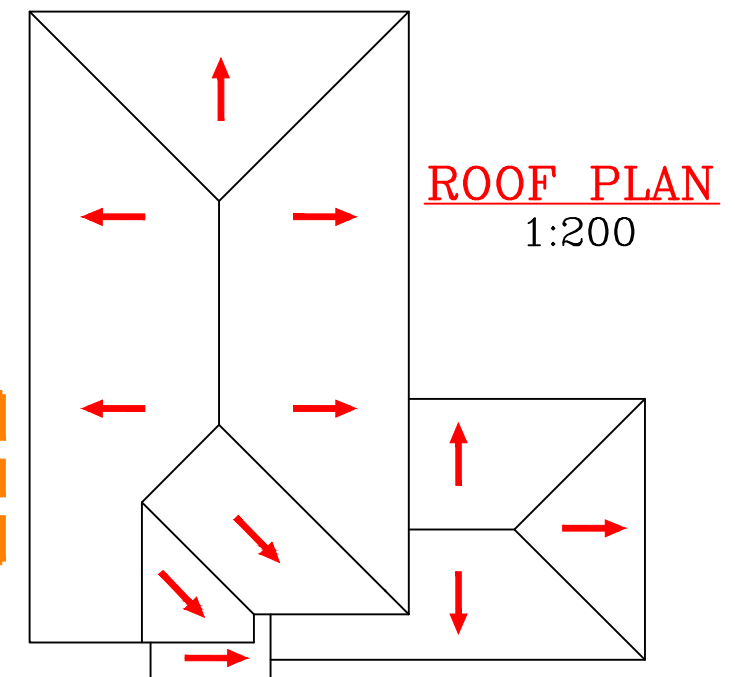
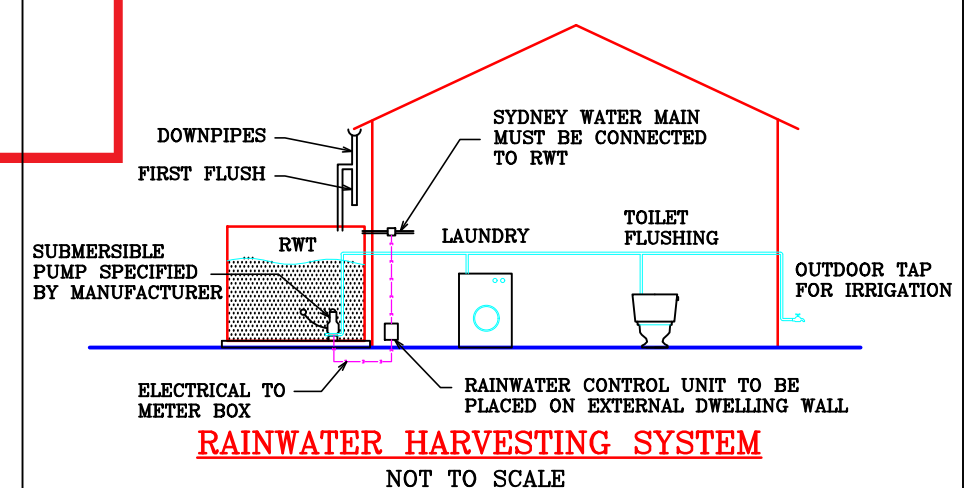
SYMBOLS & NOTATIONS

--- STORMWATER LINES
○ DOWNPIPE
100 DIA YARD SUMP
225x100 GRATED BOX DRAIN
INV INVERT LEVEL (PIPE / PIT)
SL FINISHED SURFACE LEVEL
FFL FINISHED FLOOR LEVEL
FPL FINISHED PLATFORM LEVEL
---X--- SEDIMENT CONTROL BARRIER
--- PROPOSED BOUNDARY
---S--- SEWER

THIS PLAN IS TO BE READ IN
CONJUNCTION WITH
THE CONDITIONS OF DEVELOPMENT
CONSENT

MOD2023/0637

PLEASE NOTE: ALL THREE RAINWATER TANKS MUST BE AT
THE SAME BASE LEVEL & MUST HAVE THE SAME HEIGHT



IMPORTANT NOTES:

1. RAINWATER TANKS ARE FROM TANKWORKS AUSTRALIA OR SIMILAR. PH: 1300 736 562
2. A FIRST FLUSH DEVICE IN ACCORDANCE WITH THE MANUFACTURERS REQUIREMENTS SHALL BE FITTED TO THE SYSTEM TO DIVERT THE FIRST 0.5mm OF RUN-OFF FROM THE AREA DRAINING AWAY FROM THE STORAGE TANK. (eg.0.5 l/m2)
3. ALL THREE ABOVEGROUND RAINWATER TANKS MUST BE PLACED AT THE SAME BASE LEVEL & HAVE THE SAME HEIGHT.
4. PLACE 50 DIA INTERCONNECTING PIPES AT THE BASE OF ALL THREE TANKS.

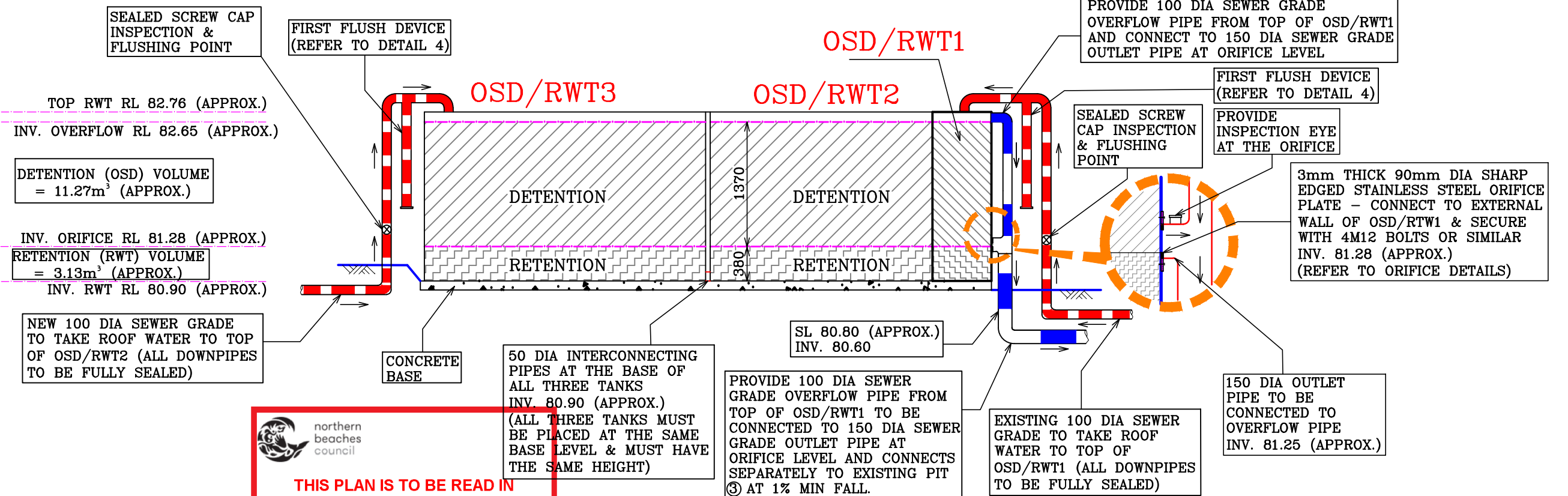
HYDRAULIC DETAILS

ELEVATION PLAN

ISSUE	AMENDMENTS	DATE
CLIENT: MR & MRS COLWELL (PRIVATE)		
LOT 1 (H/No. 49) WARATAH PARADE, NARRAWEENA		
DESIGNED SA	DRAWN SA	CHECKED JN
SCALE AS SHOWN		

CAD REF. ENG/PRIVATE JOB No. D4043 SHEET No. 3

SLIMLINE RWT: (TWO 3100L x 1150W x 1860H + ONE 2700L x 650W x 1860H)



THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE CONDITIONS OF DEVELOPMENT CONSENT

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DETAIL 3

OSD/RWT DETAILS

N.T.S.

PLEASE NOTE:

ALL THREE ABOVEGROUND RAINWATER TANKS MUST BE AT THE SAME BASE LEVEL & MUST HAVE THE SAME HEIGHT

CALCULATIONS (OSD/RWT):

TANKS VOLUME = 15,300 LITRES

EFFECTIVE VOLUME = $(1.750/1.860) \times 15,300 = 14,400$ LITRES (APPROX.)

RETENTION VOLUME = $(0.380 \times 14,400) / 1.750 = 3,130$ LITRES (APPROX.)

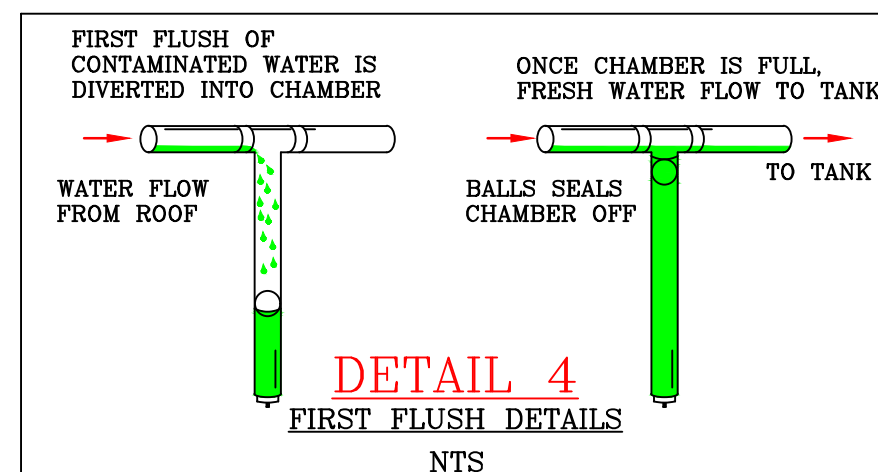
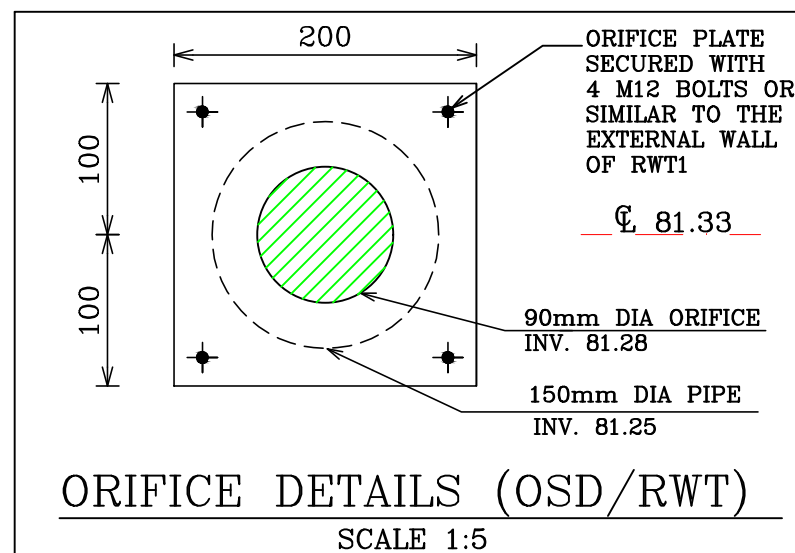
DETENTION VOLUME = $(1.370 \times 14,400) / 1.750 = 11,270$ LITRES (APPROX.)

>11,100 REQUIRED

*ORIFICE = 90 mm

IMPORTANT NOTES:

1. RAINWATER TANKS ARE FROM TANKWORKS AUSTRALIA OR SIMILAR. PH: 1300 736 562
2. A FIRST FLUSH DEVICE IN ACCORDANCE WITH THE MANUFACTURERS REQUIREMENTS SHALL BE FITTED TO THE SYSTEM TO DIVERT THE FIRST 0.5mm OF RUN-OFF FROM THE AREA DRAINING AWAY FROM THE STORAGE TANK. (eg. 0.5 l/m²)
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SYMBOLS & NOTATIONS

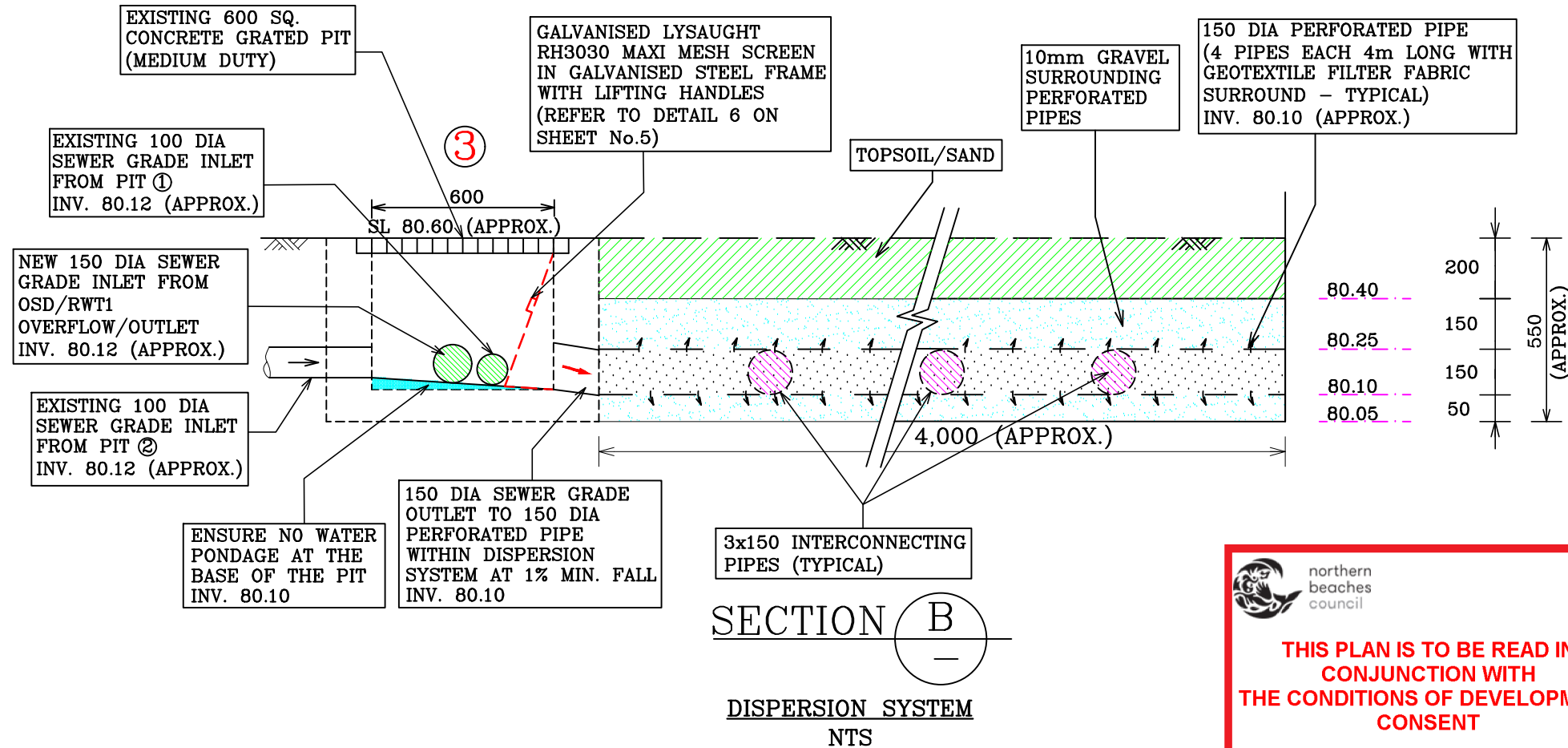
--- STORMWATER LINES	SL FINISHED SURFACE LEVEL
o DOWNPIPE	FFL FINISHED FLOOR LEVEL
100 DIA YARD SUMP	FPL FINISHED PLATFORM LEVEL
225x100 GRATED BOX DRAIN	---X--- SEDIMENT CONTROL BARRIER
INV INVERT LEVEL (PIPE / PIT)	--- PROPOSED BOUNDARY
	---S--- SEWER

ISSUE	AMENDMENTS	DATE
CLIENT: MR & MRS COLWELL (PRIVATE)		
LOT 1 (H/No. 49) WARATAH PARADE, NARRAWEENA		
DESIGNED SA	DRAWN SA	CHECKED JN
SCALE AS SHOWN		

HYDRAULIC DETAILS

OSD/RWT TANKS DETAILS

CAD REF. ENG/PRIVATE JOB No. D4043 SHEET No. 4



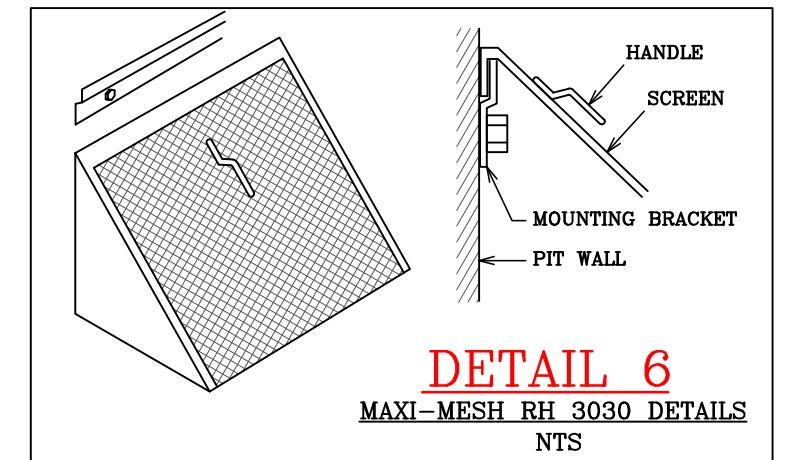
VOLUME PROVIDED (DISPERSION SYSTEM)

PIPE = $4.0\text{m} \times 4 \times \pi \times 0.15^2 \times \frac{1}{4} = 0.28\text{m}^3$

GRAVEL = $[4.0\text{m} \times 1.2\text{m} \times 0.35 - \text{PIPE}] \times 0.2 = 0.28\text{m}^3$

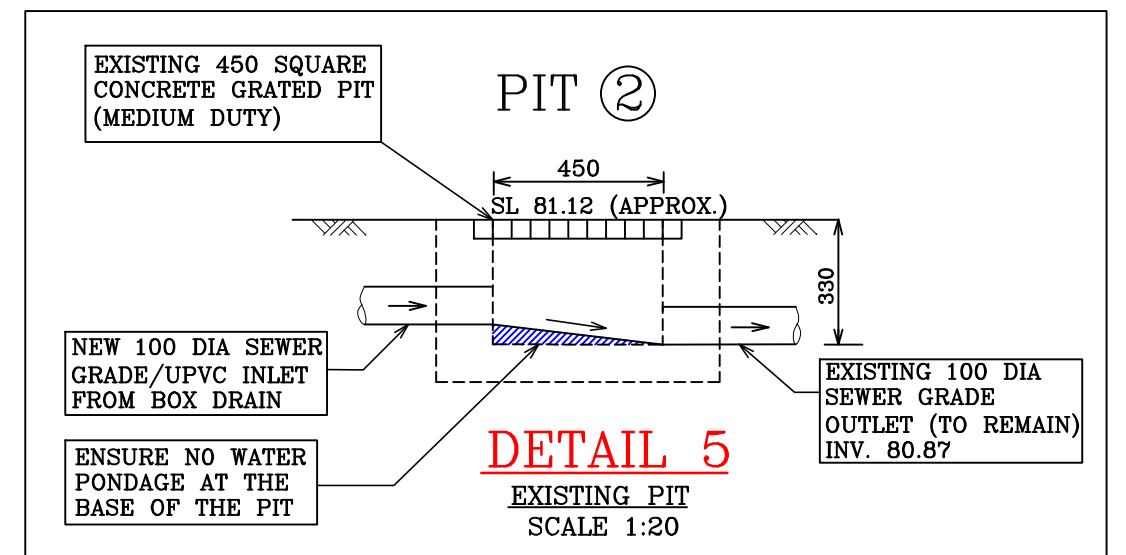
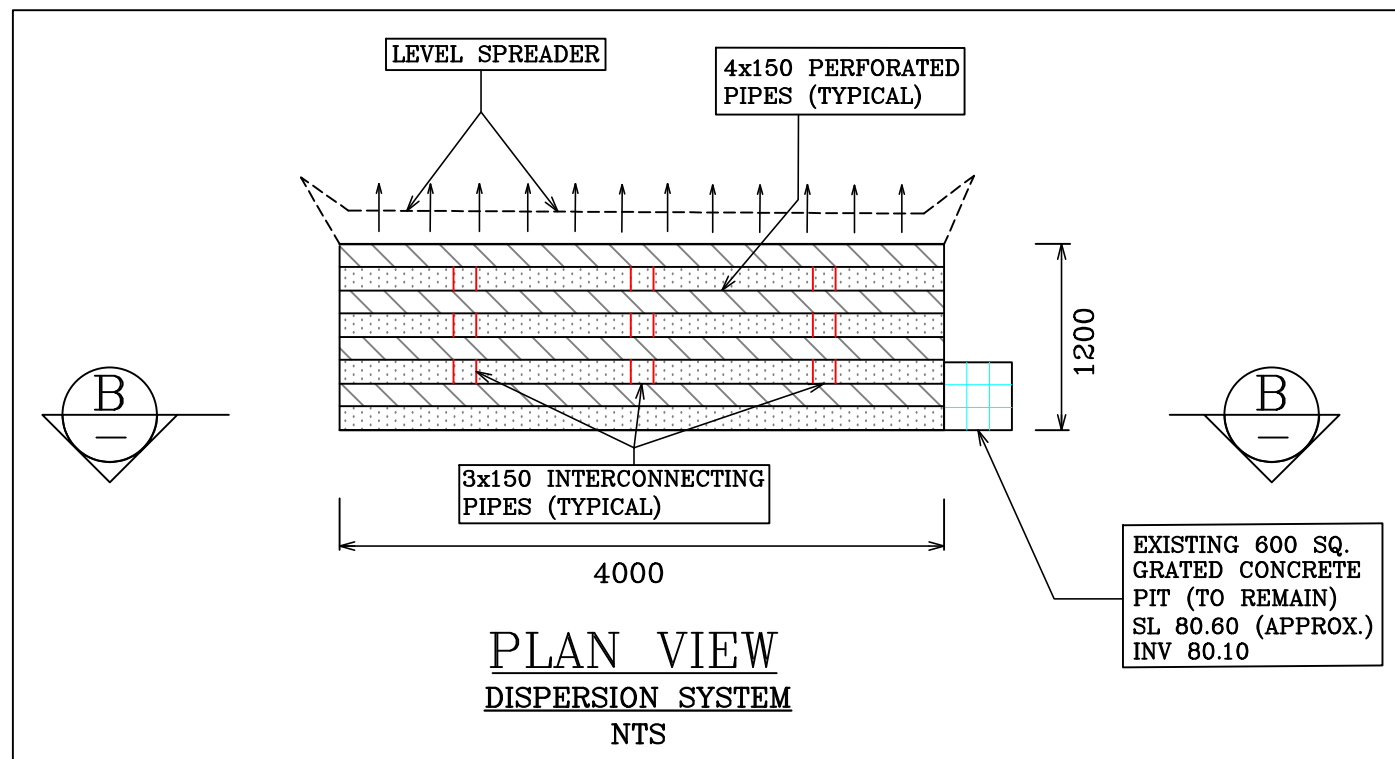
PIT = $0.6 \times 0.6 \times 0.5 = 0.18 \text{ m}^3$

TOTAL VOLUME = $0.28 + 0.28 + 0.18 = 0.74\text{m}^3$



THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE CONDITIONS OF DEVELOPMENT CONSENT

MOD2023/0637



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--- STORMWATER LINES

o DOWNPIPE

100 DIA YARD SUMP

225x100 GRATED BOX DRAIN

INV INVERT LEVEL (PIPE / PIT)

SL FINISHED SURFACE LEVEL

FFL FINISHED FLOOR LEVEL

FPL FINISHED PLATFORM LEVEL

--- SEDIMENT CONTROL BARRIER

--- PROPOSED BOUNDARY

--- S SEWER

ISSUE	AMENDMENTS	DATE
CLIENT: MR & MRS COLWELL (PRIVATE)		
LOT 1 (H/No. 49) WARATAH PARADE, NARRAWEENA		
DESIGNED SA	DRAWN SA	CHECKED JN
SCALE AS SHOWN		

HYDRAULIC DETAILS

DISPERSION SYSTEM & MISCELLANEOUS DETAILS

CAD REF. ENG/PRIVATE JOB No. D4043 SHEET No. 5