PROPOSED DEVELOPMENT
431 MASONITE ROAD
HEATHERBRAE
STORMWATER CALCULATIONS

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METHODOLOGY

This report has been prepared to detail the results of the concept design of stormwater management of the proposed development at 431 Masonite Road, Heatherbrae. A stormwater management system within the boundaries of the site has been designed to infiltrate all storm events on the site from the 1 year up to and including the 100 year average recurrence interval (ARI) storm events. Emergency overflow to Masonite Road will only occur during storm events larger than the 100 year average recurrence interval critical storm event. 100 year post development discharge rates for the site have been calculated using the rational method. Total storage volume was then calculated assuming a triangular hydrograph (Refer to Hydrology Calculations). The storage volume is proposed to be contained in three infiltration basins on site. The minimum infiltration surface area is calculated in accordance with EPA's Managing Urban Stormwater, "Treatment Techniques" (Refer to Hydraulic Calculations). The location of the infiltration basins and their configurations are shown in **Figure 01**.

The provision of rainwater tank storage to capture runoff from roof areas of the development for reuse, has been investigated as a potential option to improve the site's water cycle. This option will be further investigated during the Construction Certificate Application design phase to determine water use requirements and available storage/supply possibilities. The intent of the rainwater tanks during major storm events would be to overflow to the infiltration basins.

HYDROLOGY CALCULATIONS

Infiltration Basin No. 1

Contributing Area

Refer to **Figure 01** for the Catchment Plan.

Total Catchment Area = 10654m^2

Total Pervious area = 3748m^2

Total Impervious area = 6906m^2

Coefficients

$$
\begin{aligned}
C`_{10} &= 0.1 + (0.7-0.1) \times ({}^{10}I_1 - 25)/(70-25) \\
&= 0.1 + 0.0133({}^{10}I_1 - 25) \\
&= 0.1 + 0.0133(46.93 - 25) \\
&= 0.39
\end{aligned}
$$

$$
\begin{aligned}
C_{10} &= (0.9 \times f) + C`_{10}(1 - f) \\
&= (0.9 \times 0.65) + 0.39(1 - 0.65) \\
&= 0.722
\end{aligned}
$$

$$C_y = F_y C_{10}$$

$$C_{100} = 1.20 \times 0.722 = 0.866$$

Time of Concentration

$$t_c = \frac{6.94(Ln)^{0.6}}{I^{0.4}S^{0.3}}$$

$$^{100}t_c = \frac{6.94(70 \times 0.011)^{0.6}}{I^{0.4}0.005^{0.3}}$$
$$= \frac{29.08}{I^{0.4}}$$
$$< 6\,\text{min}$$

Adopt 6 min

Intensity

$^{100}I_{6\ mins} = 214.65$ mm/hr

Discharge

Q_{100} (developed) $= \dfrac{CIA}{3600}$

$= \dfrac{0.866 \times 214.65 \times 10654}{3600}$

$= 550.1$ l/s

Storage

Storage volume, V $= \dfrac{550.1 \times 6.0 \times 60}{1000}$

$= 198.0\ m^3$

∴ Minimum storage required = 198 m^3

Infiltration Basin No. 2

Contributing Area

Refer to **Figure 01** for the Catchment Plan.

Total Catchment Area = 44570m^2

Total Pervious area = 19374m^2

Total Impervious area = 25196m^2

Coefficients

$$
\begin{aligned}
C`_{10} &= 0.1 + (0.7-0.1) \times ({}^{10}I_1 - 25)/(70-25) \\
&= 0.1 + 0.0133({}^{10}I_1 - 25) \\
&= 0.1 + 0.0133(46.93 - 25) \\
&= 0.39
\end{aligned}
$$

$$
\begin{aligned}
C_{10} &= (0.9 \times f) + C`_{10}(1 - f) \\
&= (0.9 \times 0.57) + 0.39(1 - 0.57) \\
&= 0.681
\end{aligned}
$$

$$C_y = F_y C_{10}$$

$$C_{100} = 1.20 \times 0.681 = 0.817$$

Time of Concentration

$$t_c = \frac{6.94(Ln)^{0.6}}{I^{0.4} S^{0.3}}$$

$$\begin{aligned} {}^{100}t_c &= \frac{6.94(450 \times 0.011)^{0.6}}{I^{0.4} 0.005^{0.3}} \\ &= \frac{88.80}{\mathrm{I}^{0.4}} \\ &= 11.52\,\text{min} \end{aligned}$$

Intensity

${}^{100}\mathrm{I}_{11.52\text{ mins}} = 165.37$ mm/hr

Discharge

Q_{100} (developed) $= \dfrac{CIA}{3600}$

$= \dfrac{0.817 \times 165.37 \times 44570}{3600}$

$= 1672.7$ l/s

Storage

Storage volume, V $= \dfrac{1672.7 \times 11.52 \times 60}{1000}$

$= 1156.2\ m^3$

$\therefore$ **Minimum storage required = 1156 m^3**

Infiltration Basin No. 3

Contributing Area

Refer to **Figure 01** for the Catchment Plan.

Total Catchment Area = 90447m^2

Total Pervious area = 3055m^2

Total Impervious area = 87392m^2

Coefficients

$$
\begin{aligned}
C`_{10} &= 0.1 + (0.7\text{-}0.1) \times ({}^{10}I_1 - 25)/(70\text{-}25) \\
&= 0.1 + 0.0133({}^{10}I_1 - 25) \\
&= 0.1 + 0.0133(46.93 - 25) \\
&= 0.39
\end{aligned}
$$

$$
\begin{aligned}
C_{10} &= (0.9 \times f) + C`_{10}(1 - f) \\
&= (0.9 \times 0.97) + 0.39(1 - 0.97) \\
&= 0.885
\end{aligned}
$$

$$C_y = F_y C_{10}$$

$$C_{100} = 1.20 \times 0.885 = 1.0$$

Time of Concentration

$$t_c = \frac{6.94(Ln)^{0.6}}{I^{0.4}S^{0.3}}$$

$$^{100}t_c = \frac{6.94(500 \times 0.011)^{0.6}}{I^{0.4}0.005^{0.3}}$$
$$= \frac{94.60}{\mathrm{I}^{0.4}}$$
$$= 12.45\,\mathrm{min}$$

Intensity

$^{100}\mathrm{I}_{12.45\ \mathrm{mins}} = 159.84$ mm/hr

Discharge

Q_{100} (developed) $= \dfrac{CIA}{3600}$

$= \dfrac{1.0 \times 159.84 \times 90447}{3600}$

$= 4015.9$ l/s

Storage

Storage volume, V $= \dfrac{4015.9 \times 12.45 \times 60}{1000}$

$= 2999.9\ \mathrm{m}^3$

∴ Minimum storage required = 3000 m^3

HYDRAULIC CALCULATIONS

Infiltration Basin No. 1

Volume for Infiltration = 198m^3 (Refer Page 3)

Surface Area Required for Infiltration

$$A = \frac{Vd}{Kt(h+d)}$$ (EPA's Managing Urban Stormwater – Treatment Techniques pg63)

Where A = surface area of filter (m^2)
V = volume to be infiltrated (m^3)
K = hydraulic conductivity (m/h)
t = drainage time (h)
h = average head above filter [half the storage depth] (m)
d = depth of filter (m)

For this design the following values were used:
V = 198m^3
K = 0.50m/hr ["Concept Stormwater Manangement Plan", Barker Ryan Stewart, August 2009]
t = 16 hours [EPA, page 64]
h = 0.6m
d = 1.0m

$$A = \frac{Vd}{Kt(h+d)}$$

$$= \frac{198 \times 1.0}{0.5 \times 16(0.6 + 1.0)}$$

$$= 15.5m^2$$

∴ Adopt a minimum infiltration base area of 16m^2 for Infiltration Basin No. 1.

Infiltration Basin No. 2

Volume for Infiltration = $1156m^3$ (Refer Page 5)

Surface Area Required for Infiltration

$$A = \frac{Vd}{Kt(h+d)}$$ (EPA's Managing Urban Stormwater – Treatment Techniques pg63)

Where A = surface area of filter (m^2)

V = volume to be infiltrated (m^3)

K = hydraulic conductivity (m/h)

t = drainage time (h)

h = average head above filter [half the storage depth] (m)

d = depth of filter (m)

For this design the following values were used:

V = $1131m^3$

K = 0.50m/hr ["Concept Stormwater Manangement Plan", Barker Ryan Stewart, August 2009]

t = 16 hours [EPA, page 64]

h = 1.05m

d = 1.0m

$$A = \frac{Vd}{Kt(h+d)}$$

$$= \frac{1156 \times 1.0}{0.5 \times 16(1.05 + 1.0)}$$

$$= 70.5m^2$$

∴ Adopt a minimum infiltration base area of $71m^2$ for Infiltration Basin No. 2.

Infiltration Basin No. 3

Volume for Infiltration = 3000m^3 (Refer Page 7)

Surface Area Required for Infiltration

$$A = \frac{Vd}{Kt(h+d)}$$ (EPA's Managing Urban Stormwater – Treatment Techniques pg63)

Where A = surface area of filter (m^2)

V = volume to be infiltrated (m^3)

K = hydraulic conductivity (m/h)

t = drainage time (h)

h = average head above filter [half the storage depth] (m)

d = depth of filter (m)

For this design the following values were used:

V = 3000m^3

K = 0.50m/hr ["Concept Stormwater Manangement Plan", Barker Ryan Stewart, August 2009]

t = 16 hours [EPA, page 64]

h = 1.4m

d = 1.0m

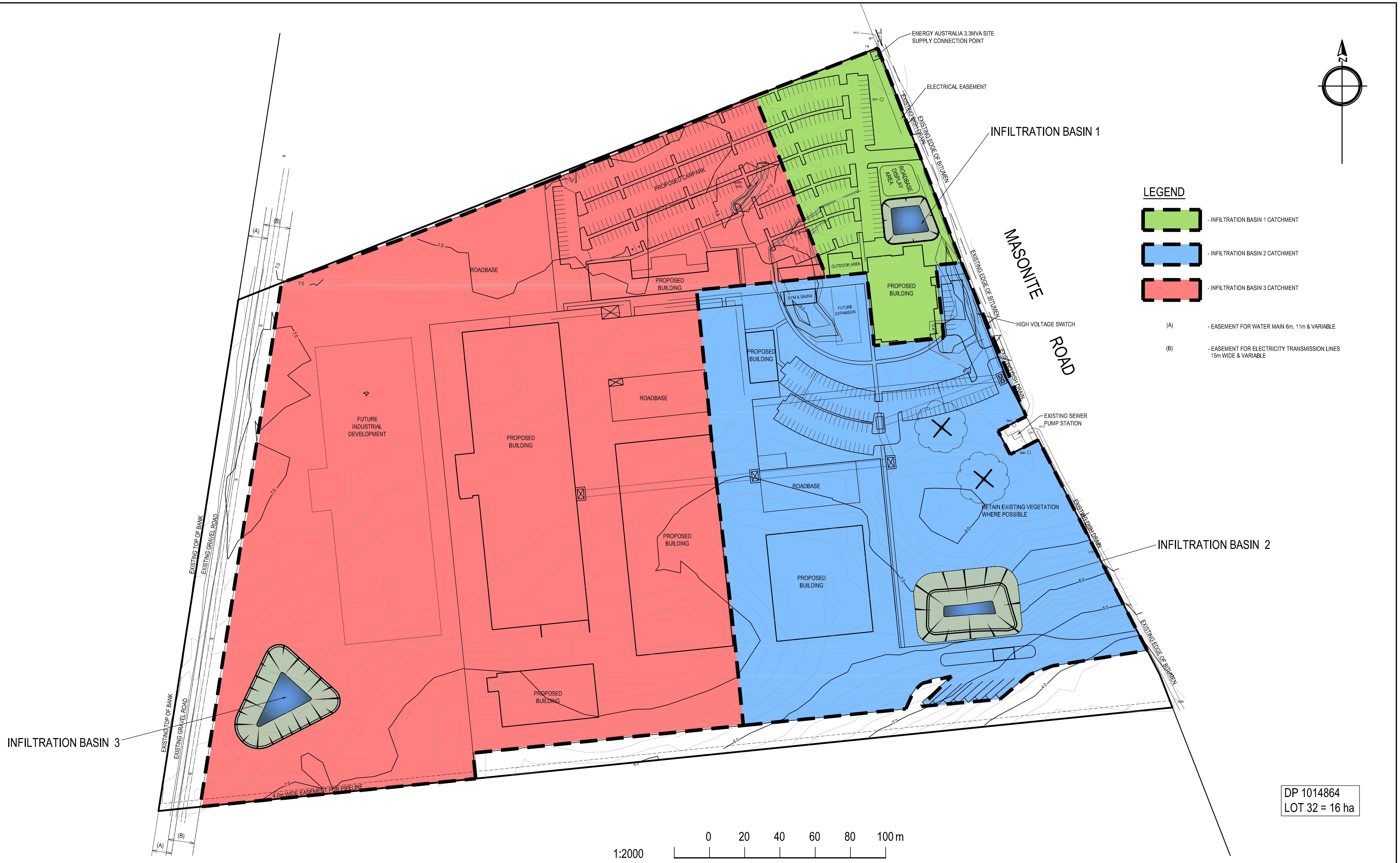
$$A = \frac{Vd}{Kt(h+d)}$$

$$= \frac{3000 \times 1.0}{0.5 \times 16(1.4 + 1.0)}$$

$$= 156.3m^2$$

∴ Adopt a minimum infiltration base area of 157m^2 for Infiltration Basin No. 3.

FIGURES



DP 1014864
LOT 32 = 16 ha

Client: SANDVIK MINING AND CONSTRUCTION AUSTRALIA PTY LTD

Project: PROPOSED INDUSTRIAL DEVELOPMENT

Location: LOT 32 MASONITE ROAD, HEATHERBRAE

PROJECT NUMBER: 10096C dF01r4
DATE: 18.06.10

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CATCHMENT PLAN

FIGURE 01