RICHBAY VOSLOORUS

NEW CHEMICAL PLANT AT WATERLANDS, VOSLOORUS, GAUTENG:

STORMWATER MANAGEMENT PLAN

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1. INTRODCUTION

Richbay Group (Pty) Ltd is planning to construct a Chemical Plant on Portion 86 of 138-IR, Vlakplaats at Waterlands road, Vosloorus, Ekurhuleni, Gauteng. The development will house several chemical mixing and storage plants, Double Storey Office Block, a Warehouse and open parking. Access to site is through a dirt road from the R103 main road. The site is entirely within land zoned for industrial development. DMV Consultants were requested to carry out an assessment of the existing stormwater infrastructure and develop a stormwater management plan for the proposed development.

Attenuation has been provided based on the criteria of 350m^3 of attenuation for every 1ha of hardscaped area. The hardened surface amounts to 48 982,72m^2 which accounts for 60,6% of the site. The site currently has a workshop structure which will be demolished, and a proposed chemical plant built on site. DMV carried out an assessment of the existing stormwater infrastructure with a view to linking it to existing stormwater system in the vicinity of the site.

In terms of the GN704 of the National Water Act (Act 36 of 1998) water originating within the footprint of a specific activity containing harmful substances shall be intercepted and isolated from clear water systems by a dedicated containment infrastructure such as oil separators or dedicated sumps. This water must be treated to stipulated quality standards before being released to the environment. Alternatively, the water can be re-used by the industrial process from which source of pollution originated to form a closed system.

2. INFORMATION GATHERED

At present, we have the following information (supplied by Architectural Design Studio) which was used in our proposal:

1. Google Earth Imagery of the Site with all critical areas indicated.
2. A survey of the site including the earth channel.
3. A Site Inspection carried out on 12 March 2021
4. Notes and photos taken during the site visit.

3. ASSESSMENT:

DMV carried out a detailed assessment of the site conditions as follows:

- The site survey drawing indicated a low-lying area on the south-western corner of the site which is part of the natural watercourse but is not comprehensive enough and DMV had to carry out a visual inspection to verify the direction of flow and point of discharge.

4. STORMWATER MANAGEMENT PLAN

4.1 BACKGROUND

The site consists of a rectangular 8,0 ha area and will comprise of impermeable surfaces created by various structures as well as paved roadways and parking areas, with some permeable gardens in-between. The area surrounding the site is mostly vacant farmland and gently slopes towards south-west corner of the site. Regional surficial drainage generally follows the topography and flows westwards from Waterland Road to the N3 Road Embankment, which channels the stormwater to a concrete lined catchpit adjacent to the southwest corner.

The Development layout has taken cognisance of possible existence of flood lines and no flood lines exist within the proposed Development.
All storm water run-off will be collected through grid inlets and kerb inlets and channelled by stormwater pipes and discharged into an attenuation pond structure.

4.1.1 Stormwater System: Refer to Roads and Stormwater Drawing attached (Dwg 21602/02)

Stormwater from building roofs will be collected via gutters and rainwater downpipes and discharged into 900 wide concrete V-drains and spread into the surrounding garden by means of multiple spreaders in as many places as possible, to prevent concentration, from where it will follow the natural lay of the land onto the undeveloped low-lying area which forms part of the natural watercourse.

Run-off from the roads and other hardscaped areas will likewise be collected through grid inlets and kerb inlets and conveyed by a network of sub-soil stormwater pipes and channelled towards a new attenuation pond structure located in the undeveloped low-lying area of the site which forms part of the natural watercourse. Roads and parking area will be graded to attain minimum falls towards outlets.

- Flood recurrence interval: 25 Years.
- Hard surfaced paved roads at absolute minimum fall (1%) due to flat site topography.
- 900 wide concrete V-drains around buildings.
- Attenuation volume (calculated below) will be provided on the low-lying area which forms part of the natural watercourse.
- No stormwater run-off from adjacent sites or higher laying areas passes through this site.

Rainfall intensity (mm/hr) for constant 5min duration

Paving 1:10yr	**External Gutters** 1:25yr	**Roof Slabs** 1:50yr
195mm	220mm	240mm

$Q = \frac{CiA}{3,6}$ (Rational Method)

Mannings Formulae: $V = R^{3/2} s^{½} \frac{1}{n}$ (Manning chart for pipes flowing full)

4.2 PRE-DEVELOPMENT:

Return Period = **1:25** Rainfall intensity (i) = 220mm/hr
Total Hardscaped Area = 9 415m^2 Runoff Coefficient (c) = 1,0
Total Site Area = 80 795m^2
Remainder of Site (undeveloped) = 71 380m^2 Runoff Coefficient (c) = 0,4

$Q_1 = \frac{CiA}{3,6} = \frac{1,0\ x\ 220\ x\ 0,009415}{3,6}$
$= 0,5754\ m^3/s$

$Q_2 = \frac{CiA}{3,6} = \frac{0,4\ x\ 220\ x\ 0,07138}{3,6}$
$= 1,7448\ m^3/s$

$Q_T = Q_1 + Q_2 = 0,5754 + 1,7448$
$= 2,320\ m^3/s$

Return Period = **1:10** Rainfall intensity (i) = 195mm/hr
Total Hardscaped Area = 9 415m^2 Runoff Coefficient (c) = 1,0
Total Site Area = 80 795m^2
Remainder of Site (undeveloped) = 71 380m^2 Runoff Coefficient (c) = 0,4

$Q_1 = \frac{CiA}{3,6} = \frac{1,0\ x\ 195\ x\ 0,009415}{3,6}$
$= 0,51\ m^3/s$

$Q_2 = \frac{CiA}{3,6} = \frac{0,4\ x\ 195\ x\ 0,07138}{3,6}$
$= 1,5466\ m^3/s$

$Q_T = Q_1 + Q_2 = 0,51 + 1,5466$
$= 2,0566\ m^3/s$
$= 2\ 057\ell/s$

4.3 POST-DEVELOPMENT:

Return Period = 1:25 Rainfall intensity (i) = 220mm/hr
Total Hardscaped Area = 48 982,73m^2 Runoff Coefficient (c) = 1,0
Total Site Area = 80 795m^2
Remainder of Site = 31 812,27m^2 Runoff Coefficient (c) = 0,45
(garden & landscaping

$Q_1 = \frac{CiA}{3,6} = \frac{1,0\ x\ 220\ x\ 0,04898273}{3,6}$
$= 2,9934\ m^3/s$

$Q_2 = \frac{CiA}{3,6} = \frac{0,45\ x\ 220\ x\ 0,03181227}{3,6}$
$= 0,87484\ m^3/s$

$Q_T = Q_1 + Q_2 = 2,9934 + 0,87484$
$= 3,868\ m^3/s$

Post development peak run-off is greater than 1:25 Pre-development therefore attenuation has to be provided at a rate of 350m^3 for every 1ha of hardscaped area.

5. ATTENUATION:

Total Post-development Hardscaped Area	=	48 982,73m^3 (4,9ha)
Attenuation Volume Required	=	350 x 4,9
	=	1 715m^3

The Attenuation Pond will be created by constructing a 1.5m high berm on the lower southwestern corner of the site with 3 x 525 diameter outlet pipes. The outlet of the pipes will be 1,560m^3/s (1560ℓ/s) which is less than 1:10 flow for pre-development.

6. STORMWATER PIPE SIZING:

AREA A – Storage Area and Truck Parking (including building roofs)

Area = 29 695,22m^2 = 0,02969522 Km^2

Q = $\frac{CiA}{3,6} = \frac{1.0\ x\ 220\ x\ 29695.22\ x\ 10^{-6}}{3,6}$

= 1.81m^3/s

= 1814,7ℓ/s

AREA B – Acid Manufacturing (including building roof)

Area = 5037,50m^2 = 0,0050375 Km^2

Q = $\frac{CiA}{3,6} = \frac{1.0\ x\ 220\ x\ 5037,5\ x\ 10^{-6}}{3,6}$

= 0,30785m^3/s

= 307,85ℓ/s

AREA C – Admin Building, Parking and Road (including building roof)

Area = 2404,67m^2 = 0,00240467 Km^2

Q = $\frac{CiA}{3,6} = \frac{1.0\ x\ 220\ x\ 1940,67\ x\ 10^{-6}}{3,6}$

= 0,1186m^3/s

= 118,6ℓ/s

Design flood frequency Major systems	1:25 years
Design flood frequency Minor systems	1:5 years

For a 900mm Ø Pipe @ 1:100 gradient

Flow (Q) = 2,1 m^3/s

(Q) = 2100 ℓ/s

For a 525mm Ø Pipe @ 1:100 gradient

Flow (Q) = 0,52 m^3/s

(Q) = 520 ℓ/s

For a 375mm Ø Pipe @ 1:100 gradient
Flow (Q) = 0,22 m^3/s
(Q) = 220ℓ/s

Therefore 375Ø, 525Ø and 900 Ø pipes have excess hydraulic capacity.

7. STORMWATER MANAGEMENT

7.1 Methodology:

The Stormwater Management Plan (SMP) for the Chemical Plant Development includes both the construction phase as well as operational phase. The objectives of the SMP are;

- Protection of Water Sources from pollution.
- Mitigating damage of land due to erosion.
- Preserving the Natural Environment.
- Maintain water quality.
- The stormwater drainage network system is separate from the sewer effluent system.
- The stormwater drainage system is designed to convey drainage and run-off in a controlled manner by stormwater pipes and that stormwater of a suitable quality will be discharged on site through spreaders/outlets.
- The site will be graded to ensure free flow of runoff and to prevent ponding of water in areas where grading of natural ground is necessary, which will be achieved by following the natural ground slope.
- Drainage will be controlled to ensure that runoff from the site will not culminate in off-site pollution or cause water damage to properties adjacent to the site. This is done by natural free surface drainage that will slow down flow, allowing runoff to follow the natural watercourse.

7.2 Construction Phase

In order to prevent damage due to flooding and erosion as well as stormwater of questionable quality from entering the permeable soils of the natural stormwater system it is imperative that the detailed requirement as prescribed in the Environmental Management Plan (EMP) prepared by Messrs WSP Consultants and forming part of the EIA submission e.g., the use of Berms to avoid flooding, bunded areas to contain spillage from construction vehicles, bunded mixing areas for building materials, temporary berms to redirect stormwater from upstream site to prevent flooding and damage.

Strict adherence to the EMP is required in order to limit the risk of damage and flooding of the site.

Further Management Practices:

- Removal/Damage to natural vegetation shall be kept to a minimum.
- Construction footprint minimized to areas where work is undertaken.
- Divert run-off from higher lying surrounding area where necessary.
- Continuously monitor potential sources of oil and fuel (hydrocarbons) contamination such as construction vehicles and equipment by;
  - Use bunded, roofed areas for fuel and oil storage.
  - Use drip trays and plastic sheets under construction vehicles when not in use (designated parking area).
  - Remove any contaminated soil/material to a hazardous waste site.

7.3 Operational Phase

Management Practices during the Operational Phase:

Monitor erosion at stormwater spreaders/outlets as well as natural flow paths regularly (especially after heavy rains). If necessary, implement appropriate measures such as backfilling and planting of vegetation where required. Although the risk is low, monitor any possible contamination and take appropriate corrective action if and when required. This can be further minimized by keeping clean and sweeping the paved area periodically and disposing of any wastage such as plastic bags and papers etc. Ensure that the stormwater system remains fully functional by regular monitoring at fixed intervals. Effect any remedial measures before the rain season.

Contaminated Stormwater Run-off

The effluent from the chemical mixing and decanting plant is collected into dedicated sumps and is neutralised by a separate system and is taken off site. These areas are bunded and any accidental spillage is channelled to dedicated sumps.

8. CONCLUSION

The above outlined proposed Stormwater Management Plan is designed to adequately convey stormwater ruff-off away from the structure and to discharge this water into the existing Stormwater System without adversely affecting upstream, adjacent, and downstream developments.

ANNEXURE A: STORMWATER MANAGEMENT PLAN