

Royal Agricultural Society (NSW) Sydney Showground Main Arena Redevelopment Stormwater Drainage Report



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Royal Agricultural Society (NSW)

Sydney Showground Main Arena Redevelopment

Stormwater Drainage Report

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Date 22 October 2010

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CONTENTS

1	Introduction.....	1
2	Project Overview	2
3	Data Base	3
4	Existing Stormwater Drainage.....	4
4.1	Showground Main Arena Drainage.....	6
4.2	Concourses Draining to External Roads.....	6
4.3	Performance and Maintenance.....	7
5	Proposed Stormwater Drainage	8
5.1	Showground Main Arena Drainage.....	8
5.2	Catchment Scenario 1	10
5.3	Catchment Scenario 2	12
5.4	Staging of the Works	13
6	Conclusion	14

1 Introduction

This report details the strategy to provide stormwater drainage for the proposed alteration and additions to the Sydney Showground Main Arena within Sydney Olympic Park to allow for its enhancement as a multi-purpose stadium and arena.

The report is intended to accompany the submission documents for a Project Application under Part 3A of the Environmental Planning and Assessment Act.

The report aims to identify the following:

- The layout of the existing drainage networks and outfall locations
- The catchment areas that will be affected by the redevelopment
- Proposals for the drainage of the redeveloped Showground Main Arena
- Proposals for the detention of stormwater such that post-development flows to any drainage network outlet are no worse than existing

2 Project Overview

The Project Application relates to the redevelopment of the Sydney Showground Main Arena (Showground Main Arena) within Sydney Olympic Park to allow for its enhanced use as a multi-purpose cultural and sporting event venue.

In summary, the Major Project Application seeks approval for:

- Reconfiguration of the Showground Main Arena into an oval capable of accommodating an enhanced range of sporting and cultural events in three modes: Show mode; Concert mode; and Sporting mode.
- Increase in seats to accommodate up to 23,000 seated and 2,000 standing, to a total of 25,000 patrons (gross) within new open air and undercover grandstand areas. This includes refurbishment of existing seating and stands as well as the construction of new stands and associated roofs. Whilst there is an increase to seating capacity, there is no increase to the overall current maximum capacity of the Sydney Showground Arena.
- The proposed new stands comprise a north-west stand for Corporate Spectators and Media; a south-east stand for General Admission and Members; and a small north stand for General Admission and Members.
- New on-grade lower seating tier to the eastern half of the Showground Main Arena.
- Installation of a new video board and PA system.
- Increase in size and upgrade of facilities to the existing Level 2 concourse to include new amenities blocks and built-in food and beverage facilities.
- Two new light towers to replace the two existing eastern end light towers.
- New retractable perimeter fencing on the southern and western sides of the grounds.
- New entry structures and egress gates on various perimeter points of the ground.
- New small grassed seating 'hill' to the far east of the seating tier underneath the scoreboard.
- New pitch access vomitory to the northern side of the field.
- A 'green wall' – a vegetated screen to the outer sides of all three new stands.
- Minor internal refurbishment works to existing areas of facility.

The basis of the design of the proposed redeveloped Showground Main Arena has been to build on the success of the existing venue and enhance its function as multi-purpose, boutique oval based stadium. Whilst the proposal entails expanding the facility to create up to 25,000 (seated and standing) person capacities, there is no increase to the overall current maximum capacity of the Sydney Showground Arena taking into account the standing capacities of the facility.

The proposal entails utilising where possible, the existing infrastructure of the Showground Main Arena and will be capable of enhancing the range of sporting and cultural events including AFL matches which dictate the reconfiguration of the arena surface, as well as enhancing the Showground Main Arena event opportunities during the Royal Easter Show. Architecturally, the design has been the subject of the SOPA Design Review Panel and incorporates an important underlying theme of retaining the "agricultural soul" of the Showground Main Arena, reflecting its cultural and historical association with the Royal Agricultural Society.

The overall redevelopment of the Showground Main Arena will be undertaken within three phases:

- Early works that are to be the subject of a separate Part 4 Development Application (DA). The early works package will entail demolition, excavation, deconstruction of lighting towers, site set up and services deconstruction as illustrated in the submitted demolition plan contained within a Construction Management Plan under **Appendix B**. The consent authority for the Part 4 DA is

SOPA. These works aim to occur prior to the proposed redevelopment that is sought under the Project Application.

- At this point in time, it is proposed to construct all redevelopment works associated with this Part 3A application in two stages. However, Stage 1 will be built using one of two options for the south-east stand, depending on the final allocation of the project budget. For clarity, these stages are known as Stage 1 and Stage 1A.
- Stage 1 of the Part 3A works will reflect the existing budget commitments of \$60 million and includes the majority of the above works but with the following changes:
 - The new south-east stand would consist of interim, demountable scaffold seating and will not be roofed;
 - The new north stand would consist of interim, demountable scaffold seating and will not be roofed;
 - The grassed mound to the eastern end would not be built in this stage.
- As an alternative option to Stage 1, in the event that additional funding becomes available, Stage 1a of the Part 3A works will be built. In broad terms, the work is similar to that proposed for Stage 1 with the following exceptions:
 - The new south-east stand will be constructed in its final form using a combination concrete and steel structure. The stand will not be roofed.
 - The new north stand will be constructed in its final form using a combination concrete and steel structure. The stand will not be roofed.
 - The grassed mound to the eastern end will be built in this stage.
- Stage 2 of the Part 3A works will be undertaken upon budget commitments of up to total budget of \$73 million and relates to the total project described above, including that the permanent seats to the south-east and north stands and associated roofs will be constructed.

3 Data Base

The following information has formed the data base for this stormwater drainage report.

As-Built drawings provided by the Showground Asset Management team:

- R/A/1/050 to 057 – Undercroft Plans – CPTP Architects & Planners
- R/A/1/060 to 067 – Main Concourse Plans – CPTP Architects & Planners
- R/A/1/070 to 077 – Corporate Level Plans – CPTP Architects & Planners
- R/A/1/080 to 083 – Upper Concourse Plans – CPTP Architects & Planners
- R/A/1/090 to 093 – Roof Plans – CPTP Architects & Planners
- R-HX-P20A-X-132 to 135 – Showring Inground Services RL 110.0 – HTL Reinhold Pty Ltd
- R-HX-P20A-X-136 to 139 – Showring RL 115.0 Drainage – HTL Reinhold Pty Ltd

4 Existing Stormwater Drainage

The drawings show that there are a number of existing stormwater drainage networks collecting and conveying water from the Showground Main Arena to the pit and pipe drainage networks in the surrounding roads (refer to Figure 1).

The largest drainage network captures run off from inside the Showground Main Arena and conveys it to Hawkesbury Road via a 1050mmØ pipe. A number of smaller networks capture water from the outer concourses of the Showground, discharging to nearby road drainage pits.

Drainage networks to the rear of the concourses in the South West half of the Showground Main Arena has not been considered in this report as they are not subject to any alterations by the redevelopment.

The following tables present a summary of the existing catchments draining to the arena drainage networks and external road network shown in Figure 1;

Table 1 - Summary of Existing Arena Catchment Areas

Catchment	Type	Area	Percentage of total
Field of play	Grass, permeable	14989m ²	47%
Perimeter track	Unbound, permeable	5041m ²	16%
Grandstand roof	Impermeable	4325m ²	14%
Grandstand seating	Impermeable	1014m ²	3%
Grass terrace seating	Permeable	5158m ²	16%
Concourse behind terrace	Impermeable	1436m ²	4%
Total		31963m²	100%

Table 2 - Summary of Existing Catchments to External Roads

Catchment	Destination	Area
A	New England Avenue, Pit SW108	654m ²
B	New England Avenue, Pit SW107	511m ²
C	New England Avenue, Pit SW106	511m ²
D	New England Avenue, Pit SW105	1127m ²
E	Landscaped area at corner of New England Avenue and Hawkesbury Street	2168m ²
F	Hawkesbury Street, Pit SW116	627m ²
G	Hawkesbury Street, Pit SW113	1123m ²
H	Hawkesbury Street, Pit SW186	1550m ²
I	Overland flow to Grand Parade	1095m ²
Total		9366m²

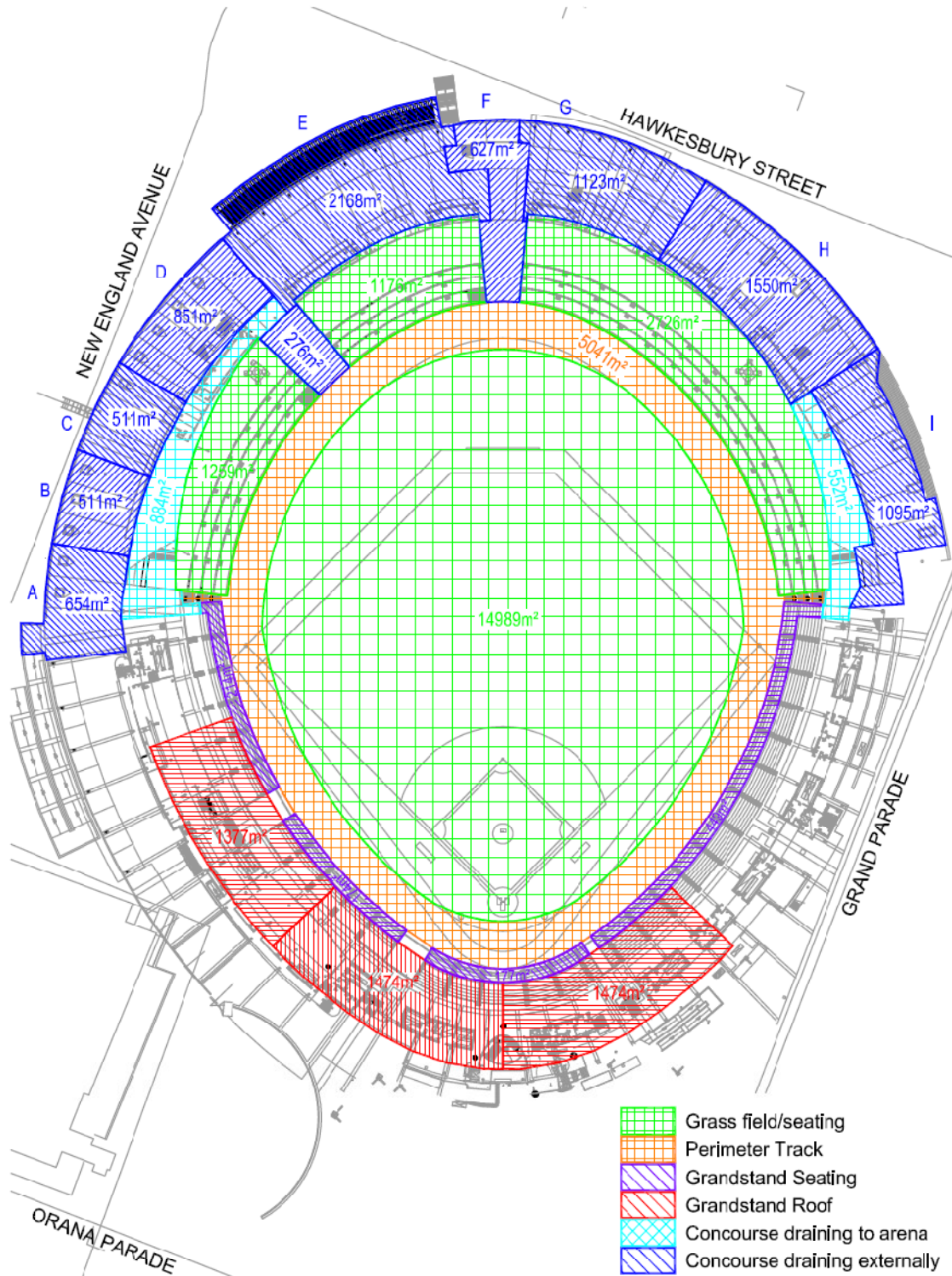


Figure 1 - Existing Catchment Areas¹

¹ Unshaded areas drain to drainage networks unaffected by the works.

4.1 Showground Main Arena Drainage

4.1.1 Field of Play and Perimeter Track

The field of play area is drained by a network of 150mmØ sub-soil drainage pipes connecting to a perimeter drain located at the edge of the grass. The perimeter drain flows from the goal locations at each end to the half way line.

Run off from the 10.0m wide perimeter track is captured by inlet pits spaced along the perimeter drain. The pits are of concrete construction with a metal plate lid with synthetic grass cover flush with the field of play. Water enters the pit through a 50mm (approx.) high opening on the track side.

At the half way line the perimeter drain connects to a 525mmØ pipe crossing the field of play in a North West direction where it joins a 750mmØ pipe connecting to a rainwater harvesting tank. The stored water is used for irrigation of the field.

From the rainwater tank water flows to a 1050mmØ pipe exiting the Showground Arena behind the North Eastern goal, out to an existing pit (SW116) in Hawkesbury Street.

The existing catchment of the Showground Arena is 79% permeable (i.e. grass or unbound track). The remaining 21% is impermeable (i.e. canopy roof or concrete decking/surfacing).

4.1.2 Grandstand Roof and Seating Area

Rainwater on the existing grandstand canopy is collected in a gutter system and conveyed in downpipes built into the canopy support columns. At the base of the columns the roof water is directed either to the perimeter drain in the Showground Main Arena or to road pits in Grand Parade and New England Avenue.

4.1.3 Grass Terrace Seating

Run off from the grass terrace seating area is captured at the back of the track perimeter retaining wall in a concrete dish drain. Pipes from the dish drain convey the run off to the perimeter drain.

4.1.4 Concourses

A small area of concourse behind the grass terrace seating area is drained to the perimeter drain. Runoff is collected by a series of grated trench drains and conveyed below the grass terrace seating in pipes.

4.2 Concourses Draining to External Roads

The majority of existing concourse is drained to the pit and pipe system in the adjacent roads. Runoff is collected in dish drains, grated trench drains and inlet gullies then routed through the structural slab into the below ground pipe system. These catchments are 100% impermeable, being made up of concrete slab pavements.

4.3 Performance and Maintenance

Hyder met with representatives of the Showground Maintenance Team to discuss the performance and maintenance of the existing drainage system.

Generally, the drainage system performs as required. There is a localised area of ponding at the edge of grass in the southern area of the arena. The subsoil drainage system for the field performs to expected standards. Currently there are no specific problems with the removal of surface water.

However, regular maintenance has been required to deal with sedimentation of the rainwater tank. Runoff from the track area washes sediment into the inlet pits and eventually to the rain water tank. The sediment is deposited in a mound at the entrance to the tank. Originally, the irrigation pumps were located close to this inlet and became clogged with sediment resulting in their failure. To deal with this issue, pumps have been moved to the far side of the rainwater tank. Whilst this solves the problem of sedimentation of the pumps it requires personnel with confined space training to perform maintenance on the pumps.

5 Proposed Stormwater Drainage

The proposed alterations to the Showground Main Arena will change the catchment areas and the characteristics of each catchment. The alterations that have an effect on the drainage are summarised as;

- Removal of the terraced grass seating area in the north-east half of the Showground
- Construction of new grandstand seating over a new concrete slab.
- Construction of a canopy over the new seating area covering a portion of the concourse catchments draining to the external roads
- Increasing the size of the playing field and providing a narrower (8.0m) track around the perimeter. The 5.0m safety zone around the field of play will be split between the grass and the track. Where the safety zone is over the track, synthetic grass will be laid as a continuation of the grass.

The proposed redevelopment will not only change the catchment areas for each network but also the response of each catchment. A portion of the existing permeable catchment is converted to impermeable by the removal of the grassed terrace seating and construction of the new canopy. This will increase the rate of runoff which will need to be managed with on-site detention such that the redevelopment does not have an adverse impact on neighbouring areas.

5.1 Showground Main Arena Drainage

5.1.1 Field of Play and Perimeter Track

The proposed field of play area will be enlarged to 17,782m² (an increase of approximately 2,800m²). Whilst the perimeter track becomes longer, its proposed narrowing to 8.0m will reduce its area by 970m² to 4,071m².

The larger field of play area results in the existing perimeter drain and inlet pits being located either inside the AFL field of play or very close to the side line.

It is proposed that the existing pits and perimeter drain are taken up and a new pit and pipe system is constructed at the new edge of grass location. The existing subsoil drainage pipes will be given a condition survey to ascertain if they are suitable for reuse. If they are, they will be extended and connected to the new perimeter drain. If they are found to be unsuitable due to blockage or damage, they will be replaced.

The inlet pits will be designed in consultation with the Royal Agricultural Society and AFL to achieve a design such that the pit: -

- should have sufficient inlet capacity to drain the track and field,
- should be suitably covered, with synthetic grass, such that it does not pose a risk to the end user (sports players, animals at the Royal Easter Show etc.),
- can capture and store the sediment from the track, minimising the quantity that accumulates in the rain water tank.

5.1.2 Existing Grandstand Roof and Seating Area

Existing connections from the grandstand roof and seating area will be connected to the re-aligned perimeter drain.

5.1.3 Additional Grandstand Roof and Seating Area

The construction of the new grandstand seating area and canopy to the new seating area will capture rainfall that previously fell on the concourse areas draining to the external roads. Two scenarios have been considered at this stage;

- 1 Runoff from the new canopy is directed into the Showground Main Arena drainage system. The increase in catchment area, and hence rate of discharge, will be offset by the provision of on-site detention within the Showground Arena
- 2 Downpipes from the new canopy are directed such that some catchment is routed to the external road drainage networks and some to the perimeter drain. The split will need to be carefully designed to ensure that the areas discharging to the external road pits does not exceed the existing rate.

5.1.4 Rainwater Harvesting/Irrigation Tank

The existing rainwater harvesting tank will be retained and reused in the same function as it is currently. The 750mmØ pipe connecting the subsoil drainage system to the rainwater tank and on to the 1050mmØ outlet pipe will be maintained and reused as far as practically possible.

The proposed redevelopment will result in the tank being located approximately 8.0m inside the field of play. The configuration of the tank will be adjusted in consultation with the Royal Agricultural Society to ensure that a suitable means of maintenance access can be provided including;

- Lowering and burying of the existing access cover to below the playing surface
- locating the irrigation pumps in a shallow chamber at the edge of grass providing ease of access and eliminating the requirement to excavate the playing surface to gain access
- minimising, as far as practically possible, the accumulation of sediment in the tank by capturing and storing sediment in the inlet pits (refer to 5.1.1 above)

5.1.5 Concourses Draining to External Roads

As discussed in the previous paragraph, the new canopy will affect the catchment areas drainage to the pits and pipes in the external roads. The remaining dish drains, grated drains and inlet pits will be retained and reused in the future.

5.2 Catchment Scenario 1

The first scenario considers that the whole of the new canopy is directed to the field of play perimeter drain. This will reduce the area of concourse contributing to the external road catchments which will provide a benefit to the drainage in New England Avenue, Hawkesbury Street and Grand Parade (refer to Figure 2). The catchment areas contributing to the Showground Main Arena are presented in Table 3.

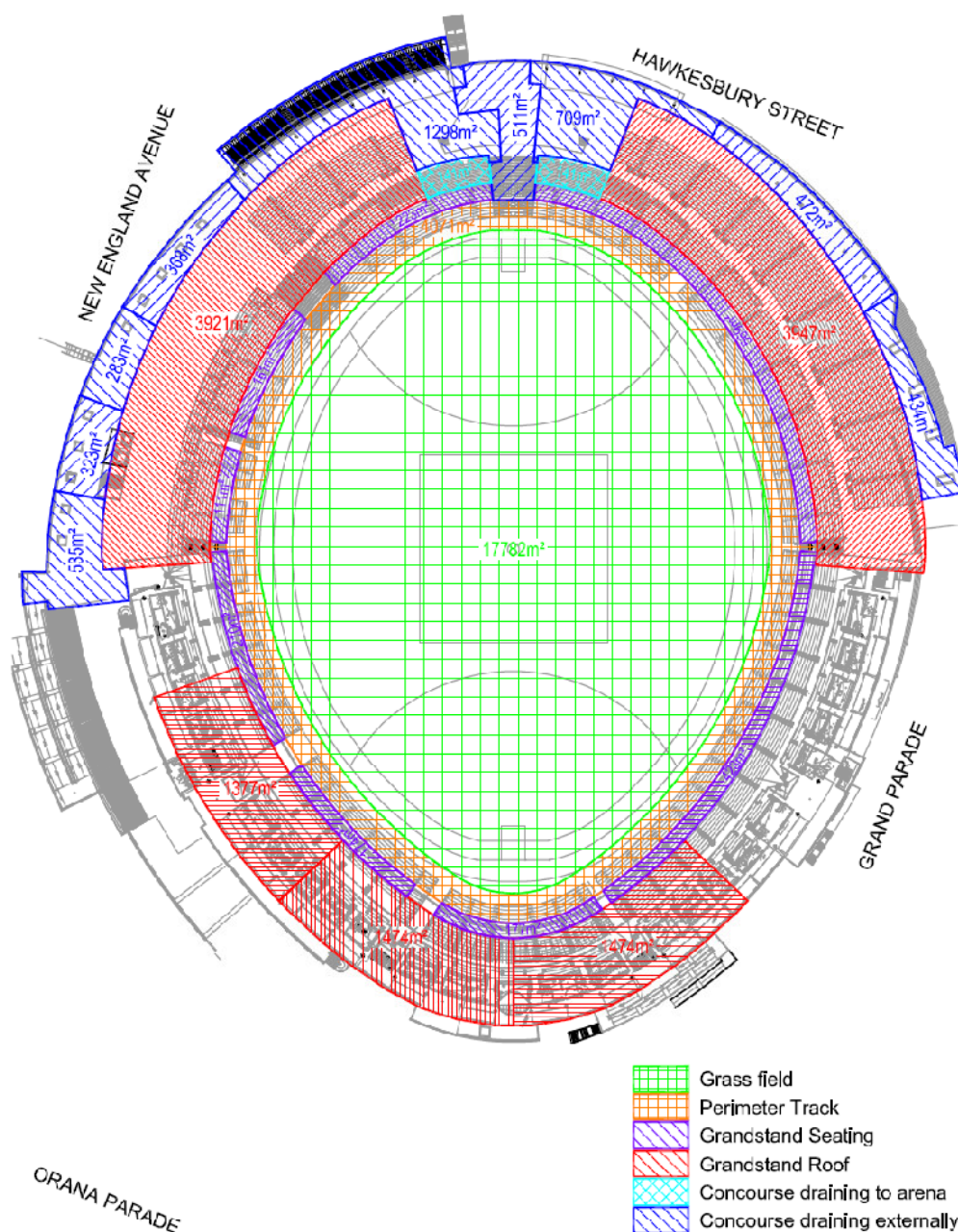


Figure 2 - Scenario 1 Catchment Plan²

² Unshaded areas drain to drainage networks unaffected by the works.

Table 3 - Summary of Scenario 1 Catchment Areas

Item	Type	Area	Percentage of total
Field of play	Grass, permeable	17782m ²	49%
Perimeter track	Unbound, permeable	4071m ²	11%
Grandstand roof	Impermeable	4325m ²	12%
Grandstand seating	Impermeable	989m ²	3%
New grandstand roof	Impermeable	7868m ²	22%
New grandstand seating	Impermeable	1064m ²	3%
Concourse	Impermeable	282m ²	<1%
Total		36381m²	100%

Comparing this summary with the current situation it can be seen that the total catchment area increases by 4,418m² (14%) which increases flows discharging to Hawkesbury Road.

It should also be noted that the permeable area of the catchment is reduced by 3,335m² and the impermeable area increased by 7,753m². Both of these changes will increase the rate of runoff above the current situation and will need to be compensated for in the form of on-site detention.

A preliminary Drains model was created to compare the current situation with the increase in area. In order to compensate for this scenario and on-site detention tank in the order of **600m³** will be required.

5.3 Catchment Scenario 2

Scenario 2 considers an option to direct some of the canopy run off to the existing pits in New England Avenue and Hawkesbury Street and the remainder to the field of play perimeter drain. The area of catchment directed to the existing pits in New England Avenue and Hawkesbury Street will be no greater than existing, thus not increasing flows in these networks. The catchment areas contributing to the Showground Main Arena are presented in Table 4.

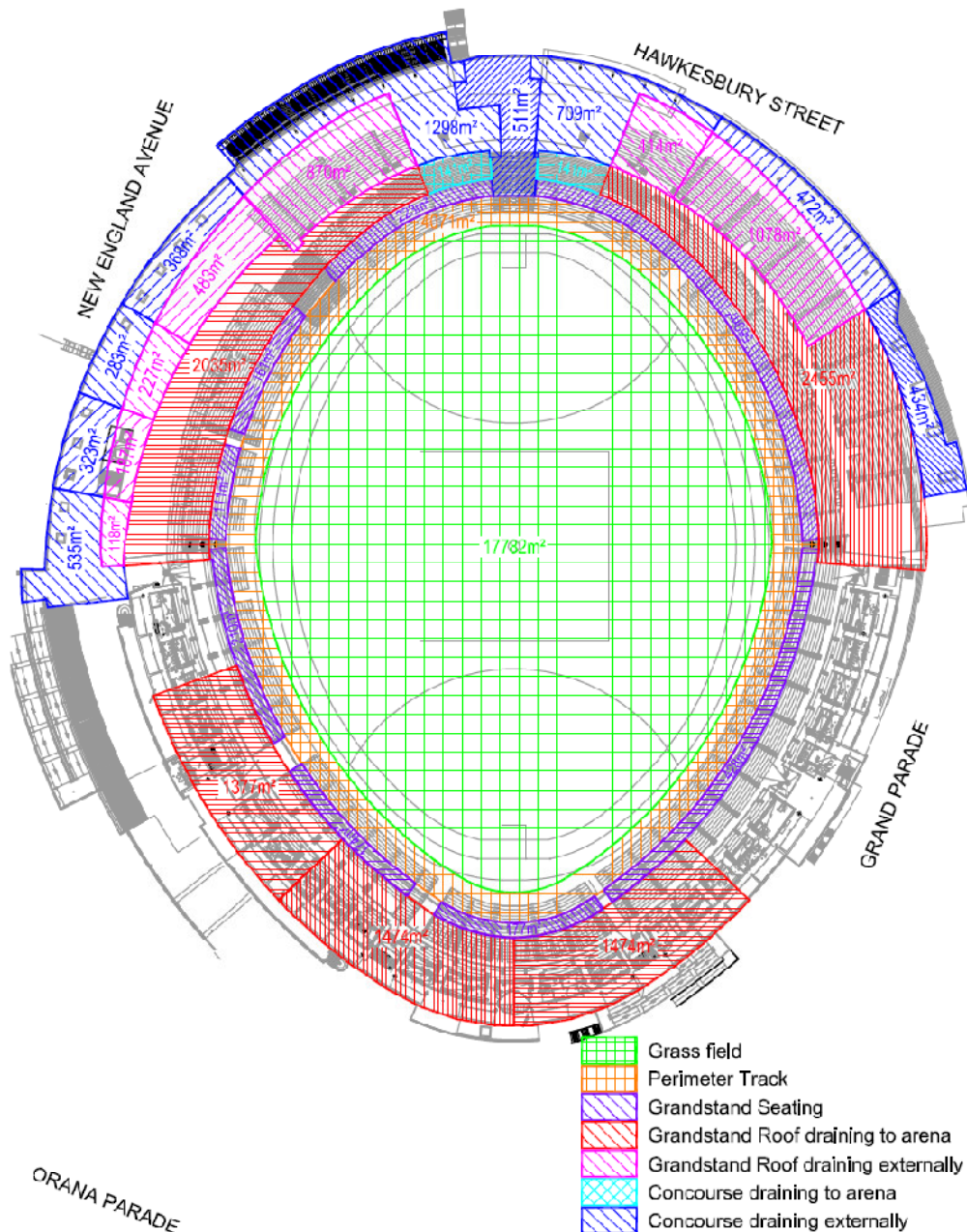


Figure 3 – Scenario 2 Catchment Plan³

³ Unshaded areas drain to drainage networks unaffected by the works.

Table 4 - Summary of Scenario 2 Catchment Areas

Item	Type	Area	Percentage of total
Field of play	Grass, permeable	17782m ²	54%
Perimeter track	Unbound, permeable	4071m ²	13%
Grandstand roof	Impermeable	4325m ²	13%
Grandstand seating	Impermeable	989m ²	3%
New grandstand roof	Impermeable	4386m ²	13%
New grandstand seating	Impermeable	1064m ²	3%
Concourse	Impermeable	282m ²	1%
Total		32899m²	100%

Comparing this summary with the current situation it can be seen that the total catchment area increases by 936m² (3%) which increases flows discharging to Hawkesbury Road.

It should also be noted that the permeable area of the catchment is reduced by 3,335m² and the impermeable area increased by 4,271m². Both of these changes will increase the rate of runoff above the current situation and will need to be compensated for in the form of on-site detention.

A preliminary Drains model was created to compare the current situation with the increase in area. In order to compensate for this scenario and on-site detention tank in the order of **300m³** will be required.

5.4 Staging of the Works

As described in Section 2, the project will be constructed in stages. The proposed stormwater drainage will be designed to accommodate the drainage of the new stand without the roof (Stage 1 and 1a) and allow for the future connection of downpipes from the roofs constructed in Stage 2.

The stormwater detention will be analysed for Stage 1, Stage 1a and Stage 2 and the volume of storage designed such that run off does not exceed the pre-development outflows in any stage.

6 Conclusion

This report has reviewed the existing drainage networks of the Showground Main Arena that will be affected by the proposed redevelopment. The findings of this report are;

- 1 The existing subsoil drainage pipes below the field of play will be retained and reused where practically possible.
- 2 The existing perimeter drain and pits around the field of play will be taken up and new pits and pipes will be constructed below the proposed edge of grass.
- 3 The existing rainwater harvesting system will be retained and reused for the irrigation of the playing surface.
- 4 The irrigation pumps should be located remote to the tank for ease of future maintenance.
- 5 Subject to detailed modelling, detention storage is required to maintain post development stormwater outflows equivalent to existing outflows for Stage , Stage 1a and Stage 2 scenarios.