Sydney Cricket and Sports Grounds Trust (SCSGT)

Sydney Football Stadium Redevelopment
Stadium Fitness Facilities

Flooding and Stormwater Management

274189-CIV-REP-0001

Issue 2 | 10 July 2020

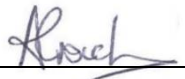
Job number 274189

Arup
Level 5
151 Clarence Street
Sydney NSW 2000
Australia
www.arup.com

ARUP

Document Verification

ARUP

Job title		Sydney Football Stadium Redevelopment Stadium Fitness Facilities		**Job number** 274189	
Document title		Flooding and Stormwater Management		**File reference**	
Document ref		274189-CIV-REP-0001			
Revision	**Date**	**Filename**	274189-CIV-REP-0001[Draft]		
Draft 1	7 Apr 2020	**Description**	First draft for project team review		
			Prepared by	Checked by	Approved by
		Name	Jordan Cashel	Andrew Crouch	Duncan Crook
		Signature			
Issue 1	30 Apr 2020	**Filename**	274189-CIV-REP-0001[1]		
		Description	First issue incorporating project team feedback		
			Prepared by	Checked by	Approved by
		Name	Jordan Cashel	Andrew Crouch	Duncan Crook
		Signature			
Issue 2	10 Jul 2020	**Filename**	274189-CIV-REP-0001[1]		
		Description	Second issue incorporating project team feedback		
			Prepared by	Checked by	Approved by
		Name	Jordan Cashel	Andrew Crouch	Andrew Crouch
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ✓

Contents

Executive Summary

The Sydney Cricket and Sports Ground Trust (SCSGT) is proposing to reinstate the former Stadium Fitness Facilities, integrated within the new Sydney Football Stadium Redevelopment (SFSR). The proposed Stadium Fitness Facilities are partially located underneath the western concourse with a low-level pavilion building, swimming pools and cabanas located behind the southern entry abutment wall at the primary site entry at Driver Avenue.

The approved stormwater and flooding management concept for the SFSR involves better managing the stormwater runoff from Moore Park Road during a significant storm event. This is achieved by grading the stadium plaza areas to allow the overland flow to drain safely around the stadium concourse and down to Driver Avenue and Kippax Lake. This management of overland flow will be complemented by the proposed local stormwater drainage network and on-site detention (OSD) to capture rainfall within the precinct and discharging it at an attenuated rate.

The Stadium Fitness Facilities location is generally shown to be flood-free in the 1% AEP flood event. Therefore, the proposal will not change flooding conditions in the surrounding areas. The proposal is consistent with the approved SFSR stormwater and flood management strategy. Local drainage from outdoor areas at the Stadium Fitness Facilities can be connected into the SFSR network with change limited to some minor realignments of the proposed network. Runoff from this area will be accounted for in site-wide on-site detention (OSD) and water quality treatment strategies for the SFSR precinct.

The proposal is consistent with the SFSR Stage 2 State Significant Development (SSD) Consent and Conditions of Consent for flooding and stormwater.

1 Introduction

On 6 December 2018, the then Minister for Planning approved a concept development application and concurrent early works package (SSD 9249) to facilitate redevelopment of the Sydney Football Stadium.

The concept approval established the maximum building envelope, design and operational parameters for a new stadium with up to 45,000 seats for patrons and allowing for 55,000 patrons in concert mode. The concurrent Stage 1 works, which were completed on 28 February 2020, facilitated the demolition of the former SFS and associated buildings.

Stage 2 of the Sydney Football Stadium (SFS) Redevelopment (SSD 9835) was approved by the Minister for Planning and Public Spaces on 6 December 2019. Stage 2 provides for:

- Construction of a new stadium with up to 45,000 seats (55,000 capacity in concert-mode), including playing pitch, grandstands, sports and stadium administration areas, food and drink kiosks, corporate facilities and all other aspects of a modern stadium;
- Operation and use of the stadium and surrounding site area for a range of sporting and entertainment events;
- Vehicular and pedestrian access and circulation arrangements, including excavation to deliver a partial basement level for storage, internal loading and servicing at the playing pitch level;
- Reinstatement of the MP1 car park following the completion of construction, including enhanced vehicle rejection facilities and direct vehicular connection to the new stadium basement level;
- Public domain improvements within the site boundary, including hard and soft landscaping, to deliver a range of publicly accessible, event and operational areas;
- Provision of new pedestrian and cycling facilities within the site;
- Signage, including building identification signage, business identification signage and a wayfinding signage strategy; and
- Extension and augmentation of physical infrastructure/utilities for the development within the site.

1.1 Stadium Fitness Facilities

The Sydney Cricket Ground and Sports Trust (SCGST) is proposing to integrate new Stadium Fitness Facilities into the SFS Redevelopment. This will reinstate the facilities that operated in conjunction with the former, demolished stadium in a new location on the site.

The Stadium Fitness Facilities are to be partially located underneath the western concourse with a low level pavilion building, swimming pools and cabanas located behind the southern entry abutment wall at the primary site entry at Driver

Avenue. It will extend to the former Indoor Cricket Centre and include part of the Sydney Cricket Ground's (SCG) practice area, part of a tennis court, and the wall extending south along Driver Avenue, south of the Driver Avenue main entry stair. A location plan is provided in Figure 1.

Figure 1 Location plan (source: Cox Architecture, July 2020)

The Stadium Fitness Facilities will include:

- A low level pavilion building located behind the southern entry abutment wall and a basement level structure, largely integrated into the under croft space beneath the approved SFS entry stairs to accommodate:
  - a gymnasium, training area and three group fitness training areas;
  - two squash courts;
  - sauna, spa, steam area;
  - wet and dry change rooms; and
  - day spa and treatment rooms.
- A café with indoor and outdoor seating for 250 – 300 people.

- A 25m long and a 50m long open-air swimming pool and surrounding areas including design, installation and commissioning of all pool deck finishes;
- Basement level to accommodate plant and equipment;
- Associated site landscaping; and
- Services and associated plant rooms.

The Stadium Fitness Facilities is proposed to be accessible to existing and future Sydney Cricket and Sports Ground Trust Members. Operating hours are proposed to be:

- 5.30am and 10pm Monday to Friday;
- 6am and 7pm on Saturdays;
- 7am and 7pm on Sundays;
- closed on Good Friday, Christmas Day, Boxing Day and New Year's Day; and
- closed for half day on Christmas Eve, New Year's Eve and Anzac Day.

Architectural and landscape plans are appended to the Planning Statement prepared by Ethos Urban, dated July 2020.

1.2 Proposed Modifications

To facilitate the Stadium Fitness Facilities, SSD 9249 and SSD 9835 are required to be modified.

The proposed modification to SSD 9249 (concept development application) is limited to a revision to the project boundary to capture the land on which the Stadium Fitness Facilities is proposed to be constructed. No other modifications are proposed.

SSD 9835 is proposed to be modified to facilitate construction, fit-out and operation of the new Stadium Fitness Facilities described in Section 1.1.

It is emphasised that the Stadium Fitness Facilities will not amend or otherwise compromise the approved design of the stadium including the location and design of site entries and circulation paths.

1.3 Purpose of this Report

This Flooding and Stormwater Management Report has been prepared to support the Stadium Fitness Facilities modification. This Report specifically considers:

- Flooding impacts as a result of the Stadium Fitness Facilities modification; and
- Stormwater considerations to adequately service the proposed Stadium Fitness Facilities proposal.

This Flooding and Stormwater Management Report is to be read in conjunction with the following reports and documents:

- Planning Statement prepared by Ethos Urban (July, 2020);
- Architectural Design Statement Addendum and plans prepared by Cox (July, 2020);
- Landscape and Public Domain Report Addendum and plans prepared by Aspect (July, 2020);
- Traffic and Transport Addendum prepared by JMT (July, 2020);
- Construction Noise and Vibration Addendum, prepared by Arup (July, 2020);
- Accessibility Review prepared by Before Compliance (July, 2020).

2 Documents Referenced

- Stormwater Management Plan Rev.E and Response to Submissions letter prepared by Aurecon (May and September, 2019);
- Stormwater and Flooding Assessment Rev.3 prepared by Arup (June, 2018);
- Environmental Impact Statement prepared by Ethos Urban (June, 2019);
- Approved SFS Plans prepared by Cox Architecture (September, 2019);
- Redevelopment of the Sydney Football Stadium Stage 2 State Significant Development Assessment SSD-9835 (November, 2019); and
- Redevelopment of the Sydney Football Stadium State Significant Development Modification Assessment SSD-9249-Mod-1 (June, 2019).

3 Pre-SFSR Development Site Conditions

The pre-development site conditions have been detailed in the Sydney Football Stadium Redevelopment Stormwater and Flooding Assessment (Arup, June 2018) and the Sydney Football Stadium Stormwater Management Plan and Response to Submissions letter (Aurecon, May and September 2019 respectively). A short summary is included in the following sections, however for further information please refer to the individual reports.

3.1 Stadium Fitness Facilities Location

The proposed Stadium Fitness Facilities are partially located underneath the western concourse with a low-level pavilion building, swimming pools and cabanas located behind the southern entry abutment wall at the primary site entry at Driver Avenue.

The proposed footprint includes part of the Sydney Cricket Ground's (SCG) practice area, part of a tennis court located to the south-west of the stadium, and part of a wall extending south along Driver Avenue.

3.2 Pre-SFRS Development Topography

The topography of the Stadium Fitness Facilities site, prior to commencement of the SFSR project, generally graded gently from north to south, with local stormwater runoff draining towards Driver Avenue. Levels in the vicinity of the proposed SFF site ranged from RL 39.3 to RL 41.2.

Most of the area was paved. The Cricket NSW building and the northern portion of the outdoor practise area originally occupied the site.

3.3 Pre-SFSR Development Flooding Risk

In pre-development conditions, prior to commencement of the SFSR project, there was a risk of flooding adjacent to the Stadium Fitness Facilities site in extreme rainfall events. A contributing factor was flooding and overland flow on Moore Park Road overflowing into the stadium precinct. This effect has been observed during previous significant storms and is also predicted by flood models for the area.

As water spills into the northern boundary of the SFS precinct from Moore Park Road, the majority of surface water flows are directed around the main stadium. This flow path conveys surface water to a topographic low point on Driver Avenue where water is held creating substantial flooding depths. This will ultimately drain away from the site via an in-ground Sydney Water stormwater drain. Estimated peak 1% Annual Exceedance Probability (AEP) flood depths and levels at the site are shown in Figure 2 together with arrows indicating the direction of overland flow within the SFS precinct.

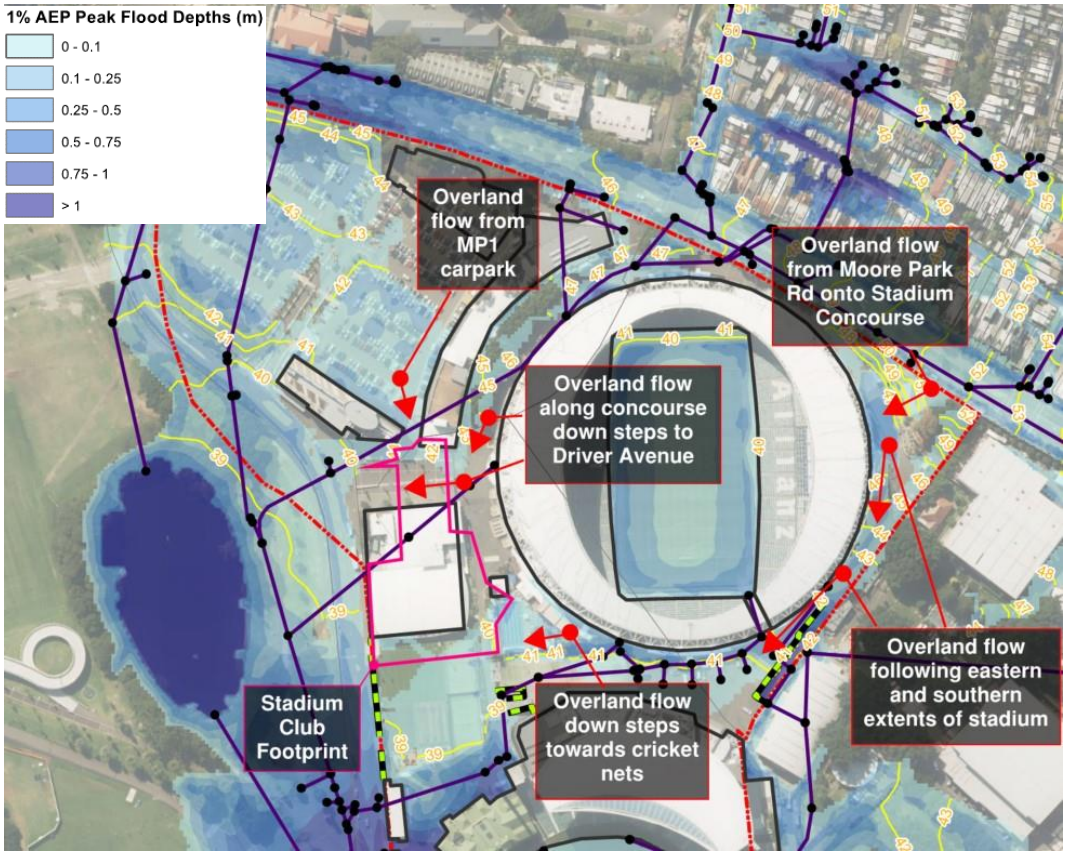


Figure 2 Pre-development 1% AEP flood levels and depths (source: Stormwater and Flooding Assessment, Arup June 2018)

3.4 Pre-development Stormwater Infrastructure

There are existing Sydney Water owned and private stormwater drains surrounding the site as illustrated by the purple lines in Figure 2. This infrastructure generally conveys water from north (Moore Park Road) to south (Driver Avenue). The existing stormwater network in the vicinity of the SFF Facilities includes pipes of varying sizes, ranging from 750mm to 1350mm, that direct flow towards the Sydney Water culverts beneath Driver Avenue. There is also an existing, privately owned on-site detention (OSD) tank that collects water from the former (and now demolished) SFS stadium and the SCG located south-east of the SFF site.

4 Proposed Development Details

As detailed in Section 1, the Stadium Fitness Facilities are proposed to be constructed underneath the proposed SFSR western concourse alongside the steps leading to Driver Avenue. The Stadium Fitness Facilities feature a variety of fitness, leisure and wellbeing facilities as described in Section 1.1, the majority of which will be constructed in the space below the concourse.

In addition, the SFF development proposal also includes outdoor swimming pools, associated deck and café. These will be located at the southern end of the SFF as indicated in Figure 3. This outdoor area will be constructed at an approximate level of RL 41.5, at a similar level to the plaza between the SFSR and the SCG, and will be raised above Driver Avenue and the outdoor cricket practise area.

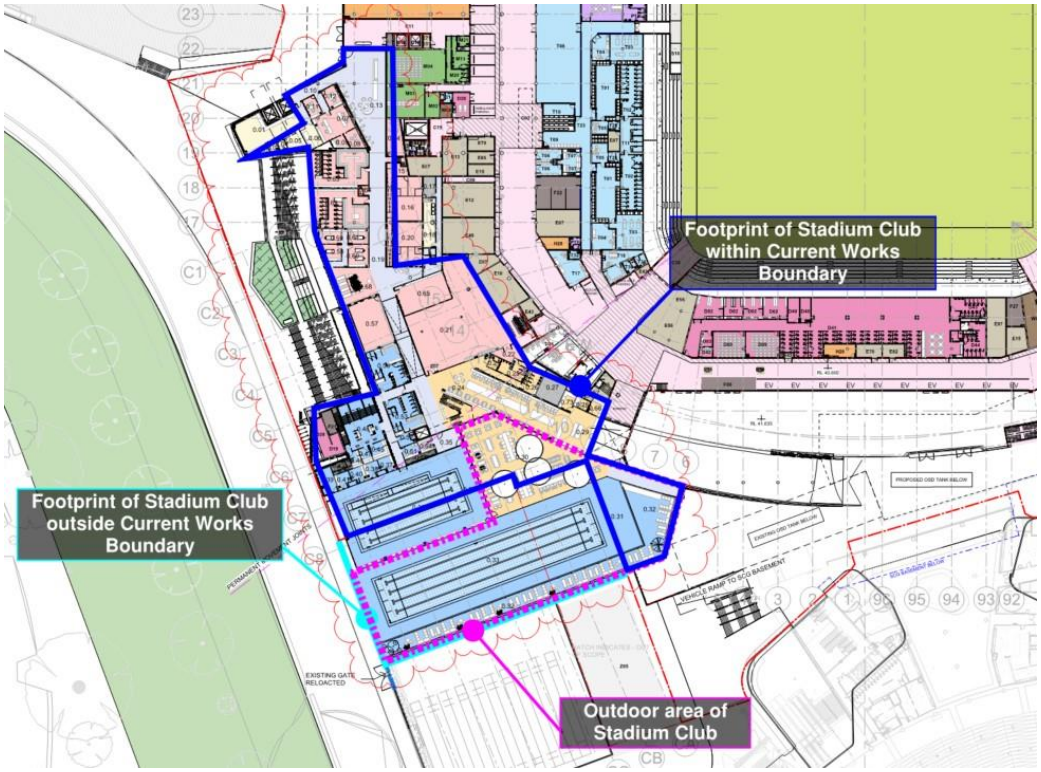


Figure 3 Stadium Fitness Facilities Plans - SFS - Ancillary Facilities (Cox Architecture, April 2020)

As illustrated in Figure 3, the majority of the Stadium Fitness Facilities will be located within the currently approved project boundary. The SFF footprint extends only a short distance south and incorporates a portion of the outdoor cricket practise area and tennis court. Given most of the SFF is located within the SFSR project boundary and stadium building, the area has already been subject to stormwater and flood risk assessment.

5 Flood Risk Management

This section provides details of the adopted flood management strategy for the SFSR. In addition, the potential flood impacts have been considered together with the mitigation measures for the proposed Stadium Fitness Facilities development.

5.1 SFSR Flood Mitigation Strategy

The flood mitigation strategy adopted for the SFSR project fundamentally involves better managing the stormwater runoff from Moore Park Road during a significant storm as described in Section 3.3. This can be achieved by grading the stadium plaza areas to allow the overland flow to drain safely westerly around the stadium concourse and down to Driver Avenue and Kippax Lake. This location is generally open, hard paved and remote from buildings and so can safely accommodate short term flooding as it does in the pre-SFSR and SFF development conditions.

To support this strategy, the Stormwater Management Plan (Aurecon, May 2019) proposes the introduction of new levels and grading to external areas together with retaining walls and flow barriers to direct overland flow originating from Moore Park Road. This management of overland flow will be complemented by the proposed local stormwater drainage network and on-site detention (OSD) to capture rainfall within the precinct and discharging it at an attenuated rate.

From the flood study work completed to date, the following principal overland flow paths adjacent to the proposed Stadium Fitness Facilities site have been identified:

i) Overland flow from the MP1 carpark directed towards the Rugby League Building and alongside the lower side of the proposed SFSR west concourse wall and stairs facing onto Driver Avenue;

ii) Overland flow around the proposed SFSR western concourse (originating to the north of the Stadium Fitness Facilities) and directed down the concourse steps towards Driver Avenue;

iii) Overland flow around the proposed SFSR western concourse (originating in the vicinity of the Stadium Fitness Facilities) flowing in a south-easterly direction towards the plaza between the SCG and SFSR; and

iv) Overland flow from the plaza between the SFSR and SCG directed in a westerly direction down the steps towards the practice area south of the SFF site.

These flow paths are indicated in Figure 4.

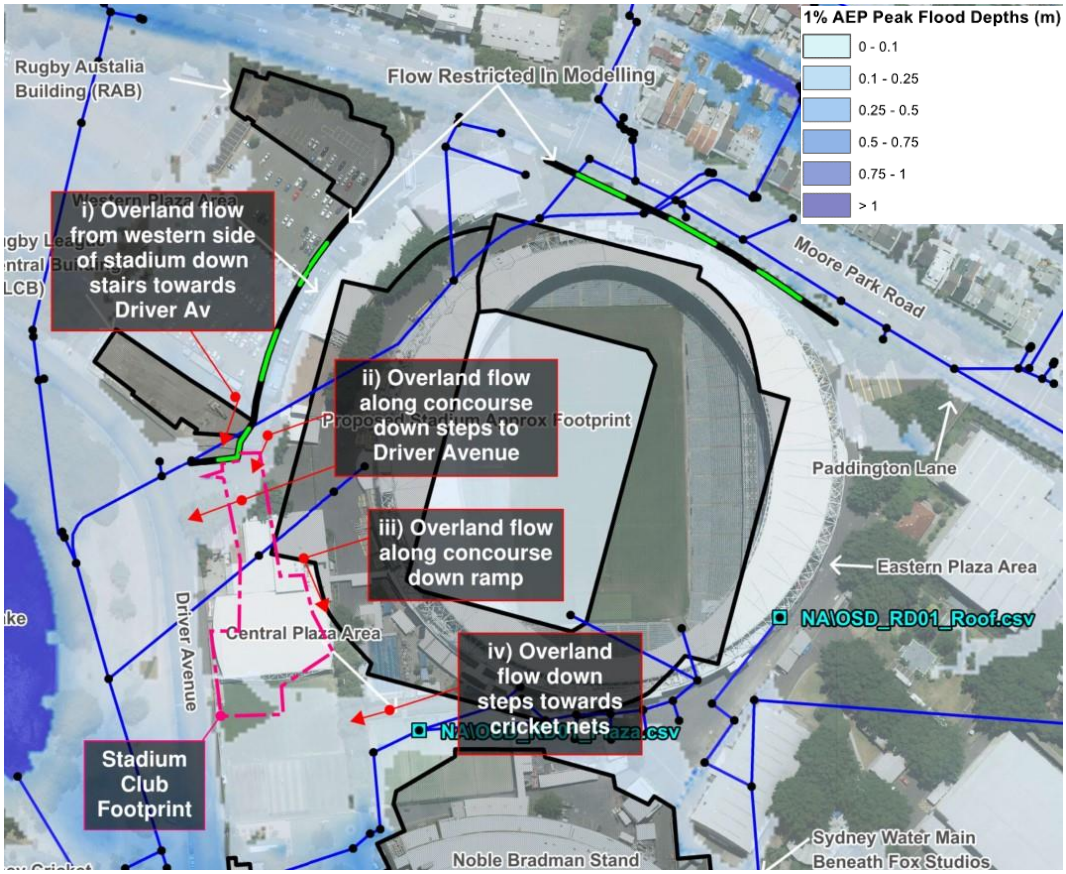


Figure 4 Overland flow paths in vicinity of Stadium Fitness Facilities (source: SFS Redevelopment SWMP, Aurecon May 2019)

5.2 Stadium Fitness Facilities Flood Mitigation

The SFSR flood modelling results show the SFF footprint to be generally flood-free in the 1% AEP flood event as indicated in Figure 4. Shallow overland flow up to 0.1m deep (item ii, Figure 4), at the north of the SFF footprint will occur at the concourse level above the roof level of the SFF. This overland flow is part of the intended flood management strategy for the approved SFSR proposals. The original design intent is unaffected by the addition of the Stadium Fitness Facilities and the concourse design also remains unchanged.

Similarly, shallow flooding approximately 0.1m deep (item iv, Figure 4), moving with low velocities will occur at the southern extent of the development footprint in the 1% AEP event. The design of the SFF and associated external areas results in a small extension of the SFSR building footprint to the south. The proposed development in this area is minor in nature and will not affect existing overland flow paths or active flood storage. Therefore, the Stadium Fitness Facilities will not materially change flooding behaviour or flood levels in areas surrounding the proposed development.

In terms of flooding risk to the development, Figure 4 (items i and iii) illustrates that there are overland flow paths in adjacency to the SFF on Driver Avenue and on the concourse down ramp. These overland flow paths have already been

contemplated as part of the SFSR development and the associated planning approvals.

The risks associated with nearby overland flows present are generally flood damage to the building and associated assets/infrastructure within. As part of ongoing design, it will be important to reassess and confirm that the SFF finished floor levels are established at a suitable elevation above the expected peak flood levels together with a suitable freeboard allowance. This will offer passive protection and mitigate the risk of internal flood damage as well as provide adherence to the City of Sydney Interim Floodplain Management Policy.

In addition, the flood evacuation strategy for the Stadium Fitness Facilities will be integrated with the evacuation strategy from the SFSR and broader precinct and will include the options to either rest in place or evacuate via the emergency exit gates along Paddington Lane.

5.3 SFSR Flooding Planning Conditions

The relevant stormwater and flood risk related planning conditions associated with the SFSR SSD approval (ref: SSD-9835) will be considered as part of the Stadium Fitness Facilities detailed design, together with the strategies and commentary offered in this report. These relevant conditions are:

- SFSR Condition of Consent B47 requires an appropriate Operational Stormwater Management System to be prepared, submitted and approved by the Certifying Authority prior to commencement of construction. The subclauses of this condition address a variety of stormwater management matters. It is considered the Stadium Fitness Facilities development proposals are generally compatible with the proposed SFSR stormwater management strategy prepared by John Holland and Aurecon as reviewed by Arup at the time of publication. Nevertheless, formal approval will be required.
- SFSR Condition of Consent D30 requires an appropriate Emergency Flood Evacuation Management Plan be prepared, submitted and approved by the Certifying Authority prior to occupation. The John Holland and Aurecon proposals for flood evacuation as reviewed by Arup at the time of publication are broadly consistent with the NSW Floodplain Development Manual (2005) and will be finalised through design development. As noted in Section 5.2, the flood evacuation proposals for the Stadium Fitness Facilities will need to be integrated into the broader SFSR Flood Evacuation Management Plan prior to finalisation and approval.

6 Stormwater Infrastructure

This section provides details of the proposed SFSR stormwater drainage strategy. The proposed strategy for drainage of outdoor areas at the Stadium Fitness Facilities and how this will integrate into the existing and planned stormwater network is also discussed.

6.1 SFSR Stormwater Infrastructure Strategy

The approved SFSR drainage strategy proposes the provision of stormwater drainage pits and pipes around the extents of the new stadium which will service the proposed building roof and external areas. A proportion of this drainage infrastructure will be connected to the on-site detention (OSD) tanks, which will ultimately discharge to the existing Sydney Water systems through Driver Avenue and Fox Studios.

A trunk drain is proposed to convey collected stormwater from the western side of the stadium in a southerly direction to the OSD tanks, as shown in Figure 5.

Another component of the Stormwater Management Plan (Aurecon, May 2019) is a proposal to increase the capacity of the existing OSD system with two separate OSD tanks. The location of these proposed tanks is indicated in Figure 5.

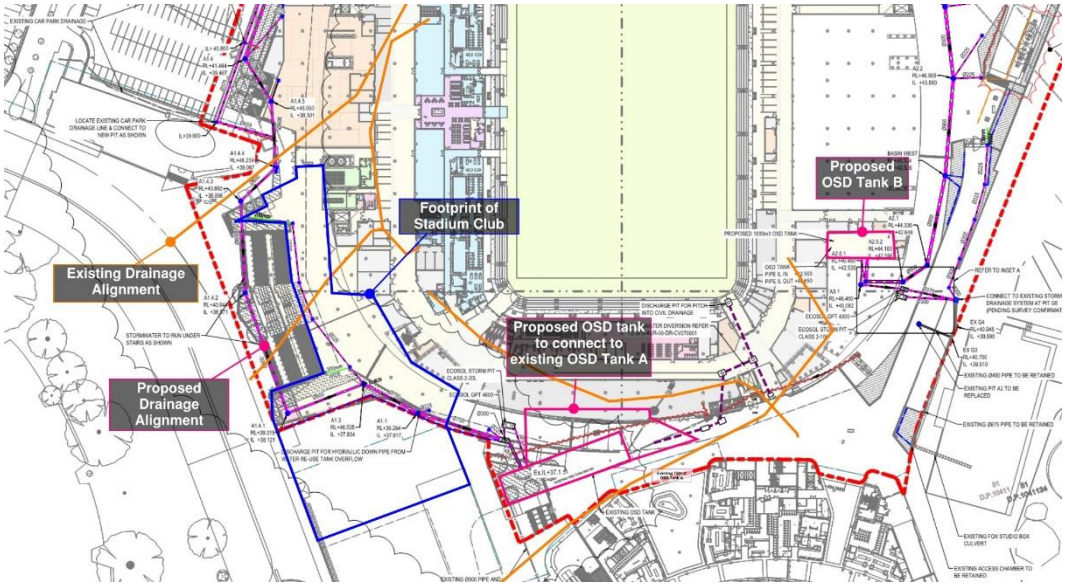


Figure 5 SFSR stormwater drainage plan (Aurecon, April 2020)

6.2 Stadium Fitness Facilities Stormwater Implications

The SFF design proposal aligns well with the current SFSR design in the context of the proposed stormwater infrastructure. A large part of the SFF will be located beneath the SFSR western concourse replacing the shell space that has been approved under SSD 9835. The remaining proportion of the Stadium Fitness

Facilities are situated to the south-west of the SFSR development replacing a proportion of the existing cricket practise area and an external access path.

The overall drainage strategy for the site will not be significantly impacted by the SFF development or the associated extension of the works area. The proposed stormwater discharge points, OSD strategy and discharge rates will also remain broadly unaffected by these changes.

Future detailed design of the Stadium Fitness Facilities will need to give careful consideration to the configuration of the stormwater infrastructure to integrate the SFF into the SFSR design. Elements to be considered are likely to include the local stormwater drainage, local runoff collection and treatment, and connection to the OSD system. Some early consideration has been given to these elements as described in the following sections.

6.2.1 Local Stormwater Drainage

The proposed SFF will be located in an area where the SFSR design currently proposes a trunk stormwater drain. This pipe discharges water flowing from areas to the north of the SFF into the OSD tank located to the southeast of the SFF. This drain is an important link and will need to be maintained. As such, a small adjustment to the pipe alignment may be required within the development site boundary to accommodate the SFF footprint. The proposed realignment of this trunk drain at the time of publication has been assessed and appears to be compatible with the SFF proposal, however further consideration will be required during the detailed design phase. The proposed alignment being considered by the design team is shown in Figure 5.

Likewise, local modifications to proposed stormwater drainage on the western concourse, above the SFF, may be required. This infrastructure collects rainfall and runoff from this area and conveys stormwater into the trunk drain described above.

These minor changes to accommodate the Stadium Fitness Facilities can be incorporated as part of the usual detailed design process. The details of local drainage are typically finalised during detailed design; therefore, any design modifications would not constitute significant changes to the SFSR drainage strategy.

6.2.2 Local Runoff Collection and Treatment

In addition to the western concourse drainage, external areas including the outdoor café and pool deck area will also require local stormwater drainage. A network of surface drainage grates, pits and pipes is proposed.

The majority of the SFF site fits within the approved SFSR footprint, therefore, the SFSR stormwater quality treatment strategy inherently accounts for runoff from most of the Stadium Fitness Facilities. The small increase in area associated with the SFF extended footprint is not expected to have a material impact on the performance of the proposed stormwater treatment system.

Wherever possible this drainage network will connect to the newly proposed trunk drain that discharges to the OSD tank. Where this outcome cannot be achieved, connections should be made to existing drainage infrastructure situated to the south of the pool deck, downstream of the OSD tank.

6.2.3 Connection to On Site Detention (OSD)

Where possible, stormwater discharge from the Stadium Fitness Facilities should be designed to drain to the existing OSD tank to maintain the original strategy for proposed off-site discharge rates and downstream flood mitigation. The surface area of rainwater and runoff capture is slightly increased by virtue of the boundary alterations. Likewise, the perviousness of the existing cricket nets is likely to be adjusted by virtue of the SFF development proposal.

For these reasons the current SFSR design proposals are likely to require minor adjustments to the OSD volumes and peak off-site discharge rates. This reassessment will be driven by any implemented bypass flows, i.e. any stormwater discharge to downstream infrastructure that do not flow through the OSD tank prior to connection to the downstream infrastructure.

This reassessment and associated design modifications are necessary to ensure that the OSD tank and flow controls are adequately designed. In turn this will maintain compliance with the Sydney Water requirements for OSD and permissible site discharge (PSD) as well as the City of Sydney Council requirement to not worsen downstream flooding conditions.

Any necessary adjustments to the OSD capacity will be determined in the detailed design phase. Given the small increase in site area, any changes would be minor, and no issues are foreseen incorporating these changes in the detailed design.

As part of the detailed design, consideration shall be given regarding surcharge risk to the SFF infrastructure. Should the OSD tank become full during a significant rainfall event, the design of any stormwater pits and lids located within the SFF shall be designed with sealed lids to minimise the risk of surcharge and resultant flooding within the building.

6.3 SFSR Stormwater Planning Conditions

This report has demonstrated that Stadium Fitness Facilities proposal is consistent with the SFSR stormwater condition B47 approved under SSD 9835. Notably, the stormwater management proposal is consistent with the SFSR conceptual designs that were submitted with the EIS. As the stormwater drainage system will be integrated with the SFSR system, it is also consistent with the water sensitive urban design strategy for the SFSR.

7 Conclusion

This report has assessed the stormwater and flooding impacts of the proposed Stadium Fitness Facilities on the surrounding area in the context of the approved SFSR project. Based on this assessment it can be concluded that the proposed Stadium Fitness Facilities development is consistent with the existing SSD 9835 consent in regard to stormwater and flood management. There are no additional concerns relating to these components of the design and as such, no aspect that should preclude the Stadium Fitness Facilities from acquiring planning approval.