

Sydney Science Park Bulk Earthworks

Design Report – Development Application





Prepared for Celestino Developments SSP Pty Ltd

21 January 2020



Document Information

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1 Introduction

Enspire Solutions (**Enspire**) has been engaged by Celestino Developments SSP Pty Ltd (**Celestino**) to prepare the Civil Engineering design and documentation in support of a Development Application (**DA**) submission to Penrith City Council for the proposed implementation of bulk earthworks operations over a portion of the Sydney Science Park (**SSP**) development.

This report covers the works as shown in the Enspire drawing package for the development of the site, including:

- Erosion and Sediment Control;
- Bulk Earthworks; and
- Temporary Stormwater Drainage.

2 Related Reports and Documents

This report is to be read in conjunction with the following reports and documents:

- 1. Development Application Documentation prepared by Enspire;
- 2. Documentation associated with DA 17/0784 (Dam Dewatering);
- 3. Documentation associated with approved DA 17/0100 (Site Remediation);
- 4. Geotechnical Investigation and Salinity Assessment Report, prepared by Geotechnique dated 05.02.2016 (Geotechnical Investigation Report);
- 5. Sydney Science Park Water Cycle Management Strategy Report (**WCMS Report**), revision A prepared by J.Wyndham Prince dated 26.09.2017;
- 6. Bulk Earthworks DA Stormwater Management Support Letter, prepared by J.Wyndham Prince dated 2.11.2018 (**Stormwater Support Letter**);
- 7. Penrith Development Control Plan 2014, prepared by Penrith City Council, 2014;
- 8. Design Guidelines for Engineering Works for Subdivisions and Developments, prepared by Penrith City Council, Nov 2013;
- 9. Stormwater Drainage for Building Developments, prepared by Penrith City Council, Oct 2013; and
- 10. Guidelines for Riparian Corridors on Waterfront Land, prepared by the NSW Office of Water dated July 2012.



3 The Development

3.1 The Sydney Science Park Precinct

Sydney Science Park is located within the suburb of Luddenham, in the Penrith City Council (**Council**) Local Government Area (**LGA**). SSP is approximately 287ha in size and is bound by the Warragamba Prospect Water Supply Pipeline to the north, Luddenham Road to the east, and existing rural / agricultural land to the south and west.

SSP is planned to deliver approximately 3400 dwellings, commercial, research and development space, a new town centre, education facilities, roads and infrastructure, parklands and new sports fields. The site is located approximately 8km south of Penrith City centre, 21km north-west of Liverpool and 43km west of Sydney City CBD.



The Sydney Science Park is presented in Figure 1.

Penrith City Council Development Control Plan E16 Sydney Science Park, 2014

3.2 Existing Site Conditions

The Sydney Science Park is located on Lot 2, 3 & 4 of DP 1242470 and typically falls from south to north at an average grade of 1%-2% with the eastern portion of the site falling east toward Luddenham Road. The site is currently used for agricultural purposes with farm houses, fencing and access tracks occupying very small portions of the site. Most of the site is grassed with few trees scattered throughout.

There are three existing ridge lines that define the major catchments for the site which convey stormwater runoff to a system of existing farm dams and water courses. There are two major farm dams, designated Dam 21 and Dam 28, occupying approximately 14.5ha and 9.3ha respectively, with numerous smaller farm dams dispersed throughout the site. Of the existing water courses,

Figure 1 - Sydney Science Park Masterplan Layout



one is classified as a fourth order stream, two are classified as third order streams and three are classified as second order streams. There are no contributing external catchments to the north and east of the Sydney Science Park with moderately sized external catchments (typically 5ha-10ha) contributing from the south east and west, while larger external catchments (greater than 150ha collectively) contribute from the south west into the fourth order stream.

An electrical transmission line owned and operated by Transgrid traverses the site from the south west to the north and generally follows the alignment of the fourth order stream. A 60.96m wide easement is associated with this transmission line.

An existing stand of River-Flat Eucalypt Forest is located on the western portion of the site, with remaining trees across the site in generally poor condition.

The dominant soil type on the site is clay based on site investigations.

Existing site conditions are presented in Figure 2.





3.3 **Proposed Development Location, Description and Staging**

This report supports a bulk earthworks proposal that applies to land on Lot 3 of DP 1242470 as approximately shown in **Figure 3**. Based on concept grading for the planned First Precinct of the Sydney Science Park, it is anticipated that the importation of large quantities of material will be required to achieve ultimate finished surface levels, with the value of importation a commercial risk and opportunity for the development. The objective of this proposal is to provide a mechanism to effectively manage these risks and opportunities by enabling Celestino to adjust earthworks operations to suit conditions in the earthworks market in a timely manner.



Figure 3 – Development Location and Staging

1. Design contours shown are indicative only and are to be refined as part of detailed design.

The bulk earthworks proposal seeks to:

- 1. Conduct bulk earthworks operations for a portion of the Sydney Science Park to an earthworks surface based on an anticipated ultimate design surface;
- 2. Conduct cut to fill operations within the site;
- 3. Provide opportunity to win fill from an onsite borrow pit;
- 4. Provide opportunity to import up to 370,000m³ of material to the site; and
- 5. Provide opportunity to stage earthworks as part of detailed design to suit market conditions.

It is anticipated that the ultimate design surface is likely to change as part of detailed design and this earthworks proposal seeks flexibility in bulk earthworks levels to accommodate such variances. Variances are unlikely to significantly alter work extent, catchments or the adopted grading principles of the site and are intended to capture the slight modifications that occur as part of design development. It is acknowledged that modifications that alter the intent of the design may be subject to Council reassessment of the proposal.



3.4 Development Applications

Table 1 provides a list of existing civil infrastructure development applications associated with the Sydney Science Park, including this development proposal and brief descriptions of their development intent. It is noted that the chronological order of application numbers or submission date does not necessarily indicate the intended order of development.

PCC DA Number	Status / Lodgement Date	Description
DA 16/0176	DA Approved Phase 1 Constructed	Temporary road and earthworks
DA 17/0784	DA Approved	Dam dewatering and site clearing
DA 17/0100	DA Approved	Site remediation
DA 18/0241	DA Approved	Potable water lead in
DA 18/1162	This Application	Bulk earthworks and borrow pit

 Table 1 – Sydney Science Park Development Application Summary



4 Bulk Earthworks

The proposed bulk earthworks design surface is based on planned future design levels for the Sydney Science Park development with modifications for topsoil placement. As noted in **Section 3.3** it is anticipated that ultimate design levels will vary in future as a function of design development with the bulk earthworks design surface to be adjusted to suit as part of the Construction Certificate phase. Details of the design assumptions adopted in generating the ultimate, earthworks and existing surface profiles are provided in the following sections.

4.1 **Design Assumptions**

The design of the ultimate future design surface incorporates the following assumptions:

- Minimum road grade of 0.7%;
- Road and superiot levels match existing along all existing property boundaries;
- Road alignments and profiles as generally proposed in the First Precinct Plan;
- 1 in 3 maximum interface batters; and
- General grading of roads and superlots to match existing topography for preservation of pre-development to post-development flow regimes.

The design of the bulk earthworks surface subject of this proposal incorporates the following assumptions based on the ultimate future design surface:

- Limiting the works extent to avoid existing second order or greater water courses and their associated riparian corridors;
- Limiting the works extent to avoid existing Dam 21 and Dam 28;
- Incorporating a borrow pit wholly contained within Lot 3 DP 1242470;
- Adopting temporary maximum 1 in 3 interface batters at existing property boundaries;
- Adopting generally 1 in 10 interface slopes north and west of the proposed First Precinct limit of works;
- No allowances for pavement boxing. Road design and alignments do not form part of this application; and
- 100mm topsoil placement depth for superlots and embankments.

The existing surface for earthworks calculations incorporates the following assumptions:

• The Phase 1 temporary estate entry road as part of DA 16/0176 has been constructed.

Site sections are provided in the Enspire drawing package providing profiles of each of the above surfaces.





4.2 Earthworks Volumes

Table 2 provides a summary of approximate earthworks volumes per stage with the following adjustments:

- Allowance for a nominal 10% bulking factor on excavated material;
- Allowance for 1000mm of silt removal from the base of existing farm dams;
- Allowance for 50mm of stripped topsoil to be blended in accordance with the Geotechnical Investigation Report; and
- Allowance for 150mm of topsoil stripping from the existing surface in accordance with the Geotechnical Investigation Report.

Stage	Fill (m³)	Cut ¹ (m ³)	Balance ² (m ³)	Comment
First Precinct	440,000	92,300	+ 338,100	Earthworks may be staged to suit market conditions.
Borrow Pit	0	293,000	- 293,000	The borrow pit is an opportunity to win fill onsite where material external to the Sydney Science Park can not be reasonably secured.
Total	440,000	385,300	+ 45,100	Up to 370,000m ³ importation proposed where fill can be secured external to the Sydney Science Park.

Table 2 – Earthworks Volume Summary

1. Cut values include bulking factor.

2. Balance allows for topsoil blending.

Stage	Strip (m³)	Place (m³)	Blend (m³)	Balance (m ³)	Comment
Precinct 1	28,900	15,800	9,600	3,500	
Borrow Pit	21,600	14,400	0	7,200	
Total	50,500	30,200	9,600	10,700	Excess to be disposed of offsite

Table 3 – Topsoil Volume Summary

Earthworks volumes are preliminary only for planning purposes and it is intended to generate further earthworks calculations as part of staged detailed designs. This application seeks to import up to 370,000m³ of material to site.



4.3 Salinity Management

As part of detailed design, a salinity management plan is to be prepared by a suitably qualified person prior to issuance of a Construction Certificate. The Geotechnical Investigation Report identifies that generally the upper 1.0m of soils are low in salinity potential with some portions of the site with moderate to high salinity potential below 1.0m deep. A salinity identification plan is provided in the Enspire drawing package and it is anticipated that the following will be implemented in addition to the Geotechnical Investigation Report preliminary recommendations to manage saline soils:

- Salinity conditions can be made no worse than existing conditions due to the works;
- Where excavation is to occur in high salinity zones, excess material is to be placed in high salinity zones to be filled or exported from site if such conditions are not available;
- Where excavation is to occur in moderate salinity zones, excess material is to be placed in either moderate or high salinity zones to be filled or exported from site if such conditions are not available;
- Placed soils of moderate to high salinity are to be buried at least 1.0m below finished surface; and
- All imported material is to be low in salinity.

4.4 Site Access

Haulage access is proposed off Luddenham Road at the existing lead in road established as part of Phase 1 of DA 16/0176. **Figure 4** provides a locality plan of the proposed haul road.



Figure 4 – Haulage Access Intersections

4.5 Dam Dewatering

As part of DA 17/0784 most of the existing dams within the Sydney Science Park are proposed to be removed. This earthworks proposal assumes works under the dam dewatering application have been completed or will be completed in parallel with this application.





5 Sediment and Erosion Control

The objectives of the erosion and sediment control for the development site are to ensure:

- Adequate erosion and sediment control measures are applied prior to the commencement of construction and are maintained throughout construction; and
- Construction site runoff is appropriately treated in accordance with Penrith City Council requirements.

As part of the works, the erosion and sedimentation control will be constructed in accordance with Council requirements and the NSW Department of Housing Manual, "Managing Urban Stormwater Soil & Construction" 2004 (Blue Book) prior to any earthworks commencing on site. Concept sediment and erosion control measures are documented in the Enspire drawing package.

5.1 Sediment Basin

Temporary sediment basins will be incorporated into the sediment and erosion control design to capture site runoff during earthworks operations. Sediment basins will typically incorporate a 0.9m deep sediment storage zone and 0.6m deep settling zone with the overall depth of water to not exceed 1.5m. Sediment basins are to be fenced at all times as a safety precaution. The conceptual locations and sizes shown in the Enspire drawing package are minimum requirements and it may be necessary for the contractor to implement additional controls to suit the nature of the works at any time.

To ensure the sediment basins are working effectively, regular maintenance will be required for the duration of earthworks operations and for a period following completion of earthworks. Maintenance includes ensuring adequate settlement times or flocculation and pumping of clean water to reach the minimum storage volume at the lower level of the settling zone. The settling zone will be identified by pegs to clearly show the level at which design storage capacity is available.

The pumped water from the sediment basin can be reused for dust control during earthworks operations.

Overflow weirs are to be provided to control over flows for rainfall events in excess of the design criteria.

5.2 Sediment and Erosion Control Measures

Prior to any earthworks commencing on site, sediment and erosion control measure shall be implemented generally in accordance with Construction Certificate drawings and the "Blue Book". The measures shown on the drawings are intended to be a minimum treatment only as the contractor will be required to modify and stage the erosion and sediment control measures to suit the construction program, sequencing and techniques. These measures will include:

- A temporary site security/safety fence is to be constructed around the site, the site office area and the proposed sediment basins;
- Sediment fencing provided downstream of disturbed areas, including any topsoil stockpiles;
- Dust control measures including covering stockpiles, installing fence hessian and watering exposed areas;



- Provision of intermediate catch drains to divert disturbed catchment flows to sediment basins;
- Placement of straw bales along proposed catch drains;
- The construction of temporary sediment basins as noted in **Section 5.1**; and
- Stabilised site access at the construction vehicle entry/exits.

Any stockpiled material, including topsoil, shall be located as far away as possible from any associated natural watercourses or temporary overland flow paths. Sediment fences shall be installed to the downstream side of stockpiles and any embankment formation. All stockpiles and embankment formations shall be stabilised by hydroseeding or hydromulching on formation.



6 Stormwater Management

6.1 Existing Local Flooding Extents

The proposed earthworks is anticipated to encroach upon existing 1% AEP stormwater runoff contours as shown in **Figure 5** extracted from the Water Cycle Management Strategy Report. While the proposed works will generate changes to flow patterns the impact on flood storage will be minimal as the affected areas do not strictly provide flood storage. That is, the stormwater runoff contours shown represent predominantly flow conveyance levels in the 1% AEP event, which upon completion of bulk earthworks will be conveyed through the catch drain and sediment basin system and ultimately through the future road minor and major drainage network.

Further details of the estimated impacts on local flooding for a site wide bulk earthworks are provided in **Appendix A**. It is noted that the letter details are based on a site wide earthworks strategy with this proposal limited to the First Precinct and borrow pit only. This reduced earthworks strategy remains consistent with the findings of the site wide assessment letter.



Figure 5 – Existing 1% AEP Stormwater Runoff Contours Water Cycle Management Strategy Report, JWP, September 2017

6.2 Existing Dam Storage

The two major farm dams within the Sydney Science Park have been identified as critical elements in the management of stormwater runoff under existing conditions and replication of these mechanisms is to be incorporated in a post development scenario. Storage within Dam 21 and Dam 28 is to be unaffected by the proposed earthworks and as such no criteria for passive storage apply.

All other existing farm dams within the Sydney Science Park provide minimal passive storage and are to be removed within the works extent.



6.3 **Riparian Corridors**

In preparation of this earthworks proposal, existing water courses have been mapped and classified in accordance with the NSW Office of Water Guidelines for Riparian Corridors on Waterfront Land. Recommended corridors of 20m, 30m and 40m have been applied to second, third and fourth order streams respectively as shown on the Enspire drawing package.

Riparian corridors of second order or greater are not to be directly affected by the proposed earthworks.

First order riparian corridors within the proposed works extent are proposed to be declassified and removed.

Riparian corridors are to be protected from site stormwater runoff through the implementation of sediment and erosion controls.

6.4 **Stormwater Quantity and Quality**

The proposed works will not introduce new land uses into the Sydney Science Park, and the existing pervious nature of the site is to be generally maintained following land disturbance operations. Further, the proposed grading of the site is to generally follow existing topography to maintain flow regimes.

On this basis no stormwater quantity control measures are proposed as part of the bulk earthworks.

Long term management of stormwater quality from the site is to form part of future infrastructure development applications and no permanent water quality treatment is proposed as part of the earthworks. During and following earthworks operations, it is proposed to construct and maintain temporary sediment basins to meet the intent of stormwater quality management objectives. Sediment basins are to be sized and operated in accordance with best industry practice as described in **Section 5**.



7 Summary

This report has detailed the design considerations in support of a bulk earthworks proposal that applies to land on Lot 2, 3 & 4 of DP 1242470. Based on concept grading for the planned First Precinct of the Sydney Science Park, it is anticipated that the importation of large quantities of material will be required to achieve ultimate finished surface levels, with the value of importation a commercial risk and opportunity for the development. The objective of this proposal is to provide a mechanism to effectively manage these risks and opportunities by enabling Celestino the ability to adjust earthworks operations to suit conditions in the earthworks market in a timely manner.

The bulk earthworks proposal seeks to:

- 1. Conduct bulk earthworks operations for a portion of the Sydney Science Park to an earthworks surface based on an anticipated ultimate design surface;
- 2. Conduct cut to fill operations within the site;
- 3. Provide opportunity to win fill from an onsite borrow pit;
- 4. Provide opportunity to import up to 370,000m3 of material to the site; and
- 5. Provide opportunity to stage earthworks as part of detailed design to suit market conditions.

It is anticipated that the ultimate design surface is likely to change as part of detailed design of each precinct and this earthworks proposal seeks flexibility in bulk earthworks levels to accommodate such variances. Variances are unlikely to significantly alter work extent, catchments or the adopted grading principles of the site and are intended to capture the slight modifications that occur as part of design development.

This report and supporting documents demonstrate that the proposed earthworks can comply with the relevant environmental and design criteria with detailed design of earthworks operations to generally follow the conceptual framework provided.



Appendix A Stormwater Management Letter

JWP October 2018





ABN 67 002 318 621

Our Ref: 109765_07_Ltr1A_BEW DA DC:tm

2 November 2018

Celestino SSP Pty. Ltd. c/o Enspire Solutions Pty. Ltd. 205/275 Alfred Street N, North Sydney, NSW, 2060

Attn: Lauren Connors

Subject: Bulk Earthworks DA – Stormwater Management Support Letter

Dear Lauren,

This letter has been prepared in support of the proposed Bulk Earthworks (BEW) DA for the Sydney Science Park (SSP) development. This letter aims to provide Council with the confidence that the BEW grading will not create any adverse flood impacts external to the site.

1.1 Bulk Earthworks Grading

The Bulk Earthworks surface has been generated with the aim of delivering the outcomes of the 'Sydney Science Park – Water Cycle Management Strategy Report' (WCM Strategy) (JWP, 2017). The BEW surface for the site can be seen in Plate 1.1 below and for further detail refer to Figure 1.1.



PLATE 1.1 – BULK EARTHWORKS GRADING AND STAGING

The Bulk Earthworks surface grading deliver flows to the outlets of the site generally consistent with the catchments proposed in the WCM Strategy (JWP, 2017). This ensures that the outcomes of the hydrologic and hydraulic assessments undertaken within this strategy align with the staged delivery of the development.

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1.2 Passive Storage

Significant passive storage is provided in two (2) large farm dams that exist on the site. The larger, western dam is approximately 9.8 ha in footprint and provides approximately 125,000 m³ of storage above the permanent water surface of the dam while the smaller, eastern dam is approximately 7.8 ha in footprint and provides approximately 22,500 m³ of passive storage. See Plate 1.2 Below for dam locations.



PLATE 1.2 – EXISTING DAM LOCATIONS

The smaller of the two dams is proposed to be removed as part of the Bulk Earthworks DA (refer to DA 17/0784 Engineering Plans 80216007-DA-05-CI), with passive storage and flow attenuation to be provided in a temporary dam, already approved as part of a previous dam dewatering development application DA 17/0784.

This dam dewatering DA (DA 17/0784) was submitted to facilitate the decommissioning of various existing farm dams located on the eastern half of the SSP site. In order to provide the necessary flow attenuation and passive storage to compensate for this change, a temporary farm dam (located immediately downstream of the "eastern dam") was proposed. For details of the storage calculations and hydrological assessment that was completed as part of the Dam Dewatering DA refer to the *'Dam Removal Assessment'* Letter (JWP, 2017).

It is our understanding that Precincts 6 and 7 (see Figure 1.1 for locations) earthworks are proposed to encroach on the temporary dam proposed within DA 17/0784. This encroachment will result in a loss in passive storage, however, this will be provided by the partial construction of regional Basin B3 proposed to be formed as part of Precinct 5.

The BEW DA provides approximately 19,000 m³ of storage within the future Basin B3 (see Figure 1.1). 4,600 m³ of this storage (together with the upstream channel formation) will be used for sedimentation management for the catchment, allowing the remaining storage of 14,400 m³ to provide the required passive storage. This results in a total passive storage being available for the combined BEW Basin (B3) and Dam Dewatering basin in excess of the required 22,500 m³.

The larger of the two existing dams (western dam) is proposed to be retained as part of the BEW DA.

1.3Flooding Impacts1.3.1Upstream

It is important that the conveyance of external catchments through the SSP site is maintained following bulk earthworks. This will ensure that no detrimental impacts will be experienced in neighbouring, upstream properties. Refer to Plate 1.3 for reference to areas of interest to be discussed further below and Figure 1.2 for further details.



PLATE 1.3 – EXISTING 1% AEP FLOOD AND AREAS OF INTEREST

"Area 1" highlights the upstream boundary of Precinct 1 and the existing 1% AEP flows that enter the site from an upstream catchment. As can be seen in the proposed BEW grading, the flow path has been adjusted to redirect flows to the channel that bisects Precincts 1 and 5 via a catchdrain running west to east. This will ensure that the relatively minor "sheet" flows being generated by the external catchment can be accepted into the SSP site redirected and result in no adverse impacts upstream.

"Area 2" shows that the existing flow path through Precinct 2 has been shifted via the introduction of a catch drain to deliver flows to the downstream watercourse. Importantly, retention of this flow path means that flows from the external catchment are still being conveyed through the site and it is unlikely that impacts will be created upstream.

"Area 3" shows the main flow path from the large upstream catchment that enters the SSP site. It is proposed that the flow path in this area, as well as the watercourse that continues through the site, will be maintained as part of the BEW DA to ensure that flood behaviour in this area will not be altered.

"Area 4" shows the northern-most flow path of an external catchment that enters the SSP site. As can be seen, the existing watercourse in this area is proposed to be retained, with the exception of a minor key-line swale that connects to the large "western" dam. It is not anticipated that the removal of this swale will create any adverse impacts to upstream properties given its small size and locality (approximately 420 m from the upstream property). The existing farm dam at the boundary of the site is also proposed to be retained.

As part of the Construction Certificate assessment all diversions/catchdrains will be sized to convey the 1% AEP event flow likely to enter the site.

1.3.2 Downstream

The size of catchments that discharge to downstream properties experience minor changes as a result of the proposed SSP bulk earthworks. The overall catchment draining to the existing "western outlet" in existing conditions is approximately 664.5 ha while the catchment under post-BEW conditions is approximately 660 ha. This equates to a decrease in catchment of 0.7%. Further to this, the main watercourse draining to the western outlet is proposed to be retained as part of the BEW DA as well as the existing farm dams and passive storage along its reach.

The catchment draining to the "eastern outlet" experiences a minor change from 83.5 ha under existing conditions to 85.5 ha under post-BEW conditions. This equates to an increase in catchment of 2.4%. This is not anticipated to create any adverse impacts downstream considering that excess passive storage is being provided by the partial construction of Basin B3 (see Section 1.2 for further detail).

Sediment basins / OSD basins will be strategically positioned along the eastern boundary of the site (Luddenham Road frontage) to ensure that no increased flows are experienced across the boundary. Further assessment of the OSD requirements will be undertaken at CC stage.

Refer to Figure 1.3 for further details of the shift in catchment extents.

It should be noted that flow attenuation is not required in the catchments draining to the western outlet of the site. This is due to the timing of flows off the site relative to the significant upstream regional (South Creek) catchment. Details to support this can be found in the Sydney Science Park Water Cycle Management Strategy (JWP, 2017).

1.4 Conclusion

This letter investigates the proposed DA submission of the Bulk Earthworks across SSP. The proposed BEW surface does not preclude the eventual implementation of the precinct-wide Water Cycle Management Strategy (JWP, 2017) and consists of catchment alignments generally consistent with those outlined in the WCMS Report.

Further to this, the earthworks proposed in the DA submission are generally clear of existing riparian zones. This allows for the existing flood capacity in the western watercourse to be maintained throughout the course of bulk earthworks. Therefore, it is anticipated that no detrimental flood impacts will be generated external to the site.

Should you have any queries regarding this matter please do not hesitate to contact me.

Yours faithfully

J. WYNDHAM PRINCE

Cuft

DAVID CROMPTON Manager – Stormwater and Environment

APPENDIX A – FIGURES





