
**Report on Preliminary Groundwater
Impact Assessment (HV Underbore)**

Proposed Data Centre

78 Lockwood Road, Erskine Park NSW

**Prepared for Stack Infrastructure Australia
(78 Lockwood Road) Top Pty Ltd ATF The
Stack Infrastructure Australia (78
Lockwood Road) Unit Trust c/o Linesight**

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature

Date

Author

p.p.



20 March 2026

Reviewer

p.p.



20 March 2026

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Report on Preliminary Groundwater Impact Assessment (HV Underbore)

Proposed Data Centre

78 Lockwood Road, Erskine Park NSW

1. Introduction

This report, prepared by Douglas Partners Pty Ltd (Douglas), presents the results of a preliminary groundwater impact assessment (GIA) for a portion of high-voltage (HV) services connecting the site at 78 Lockwood Road, Erskine Park to the Transgrid Sydney West Substation and Switchyard, located at the corner of Lenore Drive and Old Wallgrove Road in Erskine Park.

The assessment was commissioned by Stack Infrastructure Australia (78 Lockwood Road) Top Pty Ltd ATF The Stack Infrastructure Australia (78 Lockwood Road) Unit Trust c/o Linesight and was undertaken in accordance with Douglas' proposal 207476.10.P.003.Rev0, dated 10 March 2026.

The purpose of this preliminary GIA is to assess the inflows during horizontal directional drilling (HDD) (i.e. underboring) for the HV services based on a desktop study of relevant information and a review of provided reports, to support the submission of a State Significant Development Application (SSDA) (SSD-82211208). Additionally, this document aims to assist in obtaining the necessary approvals for the disposal of extracted groundwater, where applicable.

Douglas have been provided with the following documents:

- Review of Environmental Factors report (reference Sydney Case No.172727PW, dated 23 October 2019) prepare by Ecologique Australia Pty Ltd (EA) (Ecologique Australia Pty Ltd, 2109) (Appendix B);
- Geotechnical investigation report (reference PSM1541-390L, dated 14June 2019) prepared by PSM Pty Ltd (PSM) (PSM, 2019) Appendix B;
- Sesign drawings (reference CAB-ERSKINE PARK DC-SKT, dated 5 February 2026) prepared by Transgrid (Appendix C); and
- HV Construction methodology supplied by Linesight on 18 March 2026 (Appendix D).

2. Proposed development

The site is located along Lenore Drive with Ropes Creek running centrally through the site which is crossed by Bunda Bridge. The neighbouring land is vacant with medium dense vegetation.

Based on the provided information, it is understood that a portion (approximately 188 m) of a HV service will cross beneath Ropes Creek via horizontal directional drilling (HDD) between two launch/receive pits (refer to Figure 1).

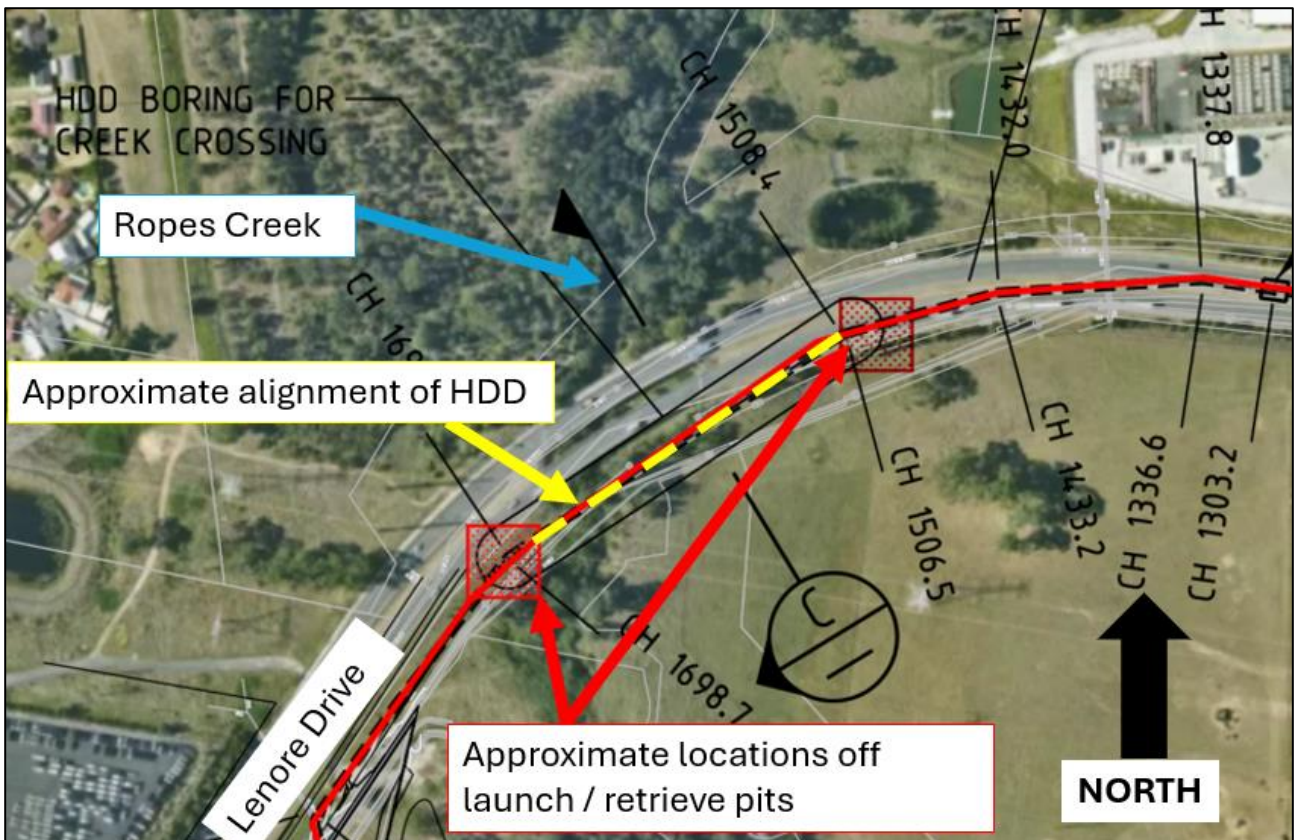


Figure 1 – Approximate alignment of HDD below Ropes Creek (excerpt from provided Transgrid drawing, dated 5 February 2026)

The proposed dimension of the square launch/receive pits are up to approximately 6 m width and up to 6 m depth. The HDD will commence / finish from the launch/receive pits and reach a depth of up to 15 m below Ropes Creek.

The arrangement of the HDD will comprise six bores of 350 mm diameter and one bore of 250 mm diameter. The arrangement is shown in Figure 2.

Drilling muds, consisting of a bentonite-based slurry, would be used to stabilise the bore, reduce groundwater ingress, lubricate the drill string, and facilitate removal of spoil material. Drilling muds would be managed at the launch and receive pits with control measure implemented.

Excavated spoil from launch and receive pits would not be stockpiled at work sites but rather placed directly into trucks for transport to either the construction laydown areas for temporary storage or to an offsite waste facility, appropriately licensed for disposal.

It is assumed that only one HDD underbore will be carried out at any time and understood to be made watertight on completion before drilling subsequent bores.

Upon successful installation of conduits, pits would be backfilled and compacted in layers in accordance with project specifications and relevant authority standards.

The construction period for the launch/receive pits and HDD underbore is currently unknown. In this regard we have assumed that the works will take no longer than three months to complete.

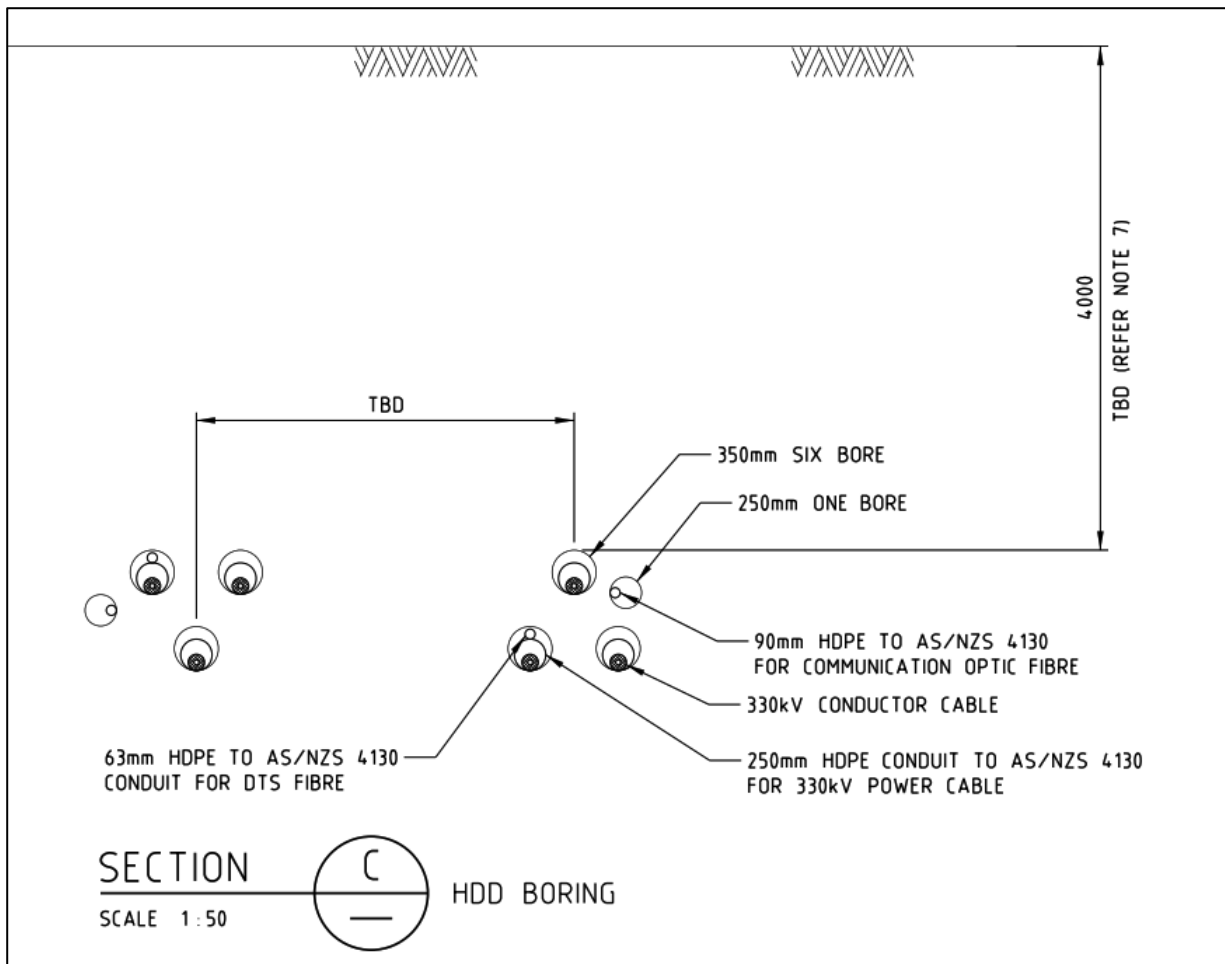


Figure 2 – HDD boring arrangement (excerpt from provided Transgrid drawing, dated 5 February 2026)

3. Hydrogeological setting

3.1 Hydrology and topography

Ropes Creek runs through the central portion of the proposed HDD alignment. It is a mapped watercourse within the Cumberland Plain, and its riparian corridor are likely to support vegetation communities that may also access shallow groundwater systems, particularly where alluvial sediments and shallow water tables are present.

The site is characterised by gently undulating topography that naturally slopes towards Ropes Creek, with an overall gradient to the northwest. Based on the NSW 2 m Elevation Contour Mapping data, surface levels across the site are between approximately Reduced Level (RL) 48 m and RL 50 m, relative to Australian Height Datum (AHD).

3.2 Climate

The region experiences a generally subtropical climate, characterised by mild winters and hot, humid summers. The average annual rainfall is approximately 1.2 m.

3.3 Geology

Reference to the Penrith 1:100,000 scale Geological Series Sheet indicates that the site is underlain by sediments of Quaternary age. The Quaternary sediments comprise sands, silts and clays that have been deposited in an alluvial environment associated with Ropes Creek (stream deposited).

The Quaternary sediments are underlain by Bringelly Shale of Triassic age. Bringelly Shale typically consists of interbedded layers of siltstone and claystone with alternating fine-grained sandstone and laminite (interbedded sandstone and siltstone) layers. The siltstone and claystone layers range from 3 m to 15 m thick while the sandstone and laminite layers are typically less than 2 m thick. The Bringelly Shale typically weathers to form a residual clay profile of medium to high plasticity and reactivity with the soils known to be highly susceptible to erosion and dispersion.

The surface geology mapping is shown in Figure 3.



Figure 3: Geological map and approximate location of site (in red)

3.4 Hydrogeology

Based on the hydrogeological setting, the site is assumed to underlain by the following groundwater systems:

- Unconfined aquifer within the alluvium; underlain by
- Minor fractured aquifers hosted by the underlying Bringelly Shale bedrock. Groundwater in the Bringelly Shale is usually characterised by shallow seepage at the soil and rock interface and secondary permeability where defects are present in the rock mass.

Groundwater is anticipated to be relatively shallow in the alluvium. Groundwater flows in the area are anticipated to generally follow site topography and flow towards Ropes Creek.

Aquifer recharge is likely to occur via high rainfall infiltration and surface water flow in the alluvium, and through low rainfall infiltration and vertical seepage in the bedrock.

3.5 Groundwater receptors

A review of the Groundwater Dependent Ecosystems (GDE) Atlas indicates the presence of vegetation associated with Ropes Creek that is classified as having a high potential for subsurface groundwater dependence. This classification suggests that the vegetation communities along Ropes Creek are likely to rely, at least in part, on groundwater to meet their water requirements, particularly during periods of low rainfall or surface water availability.

A groundwater bore search of the WaterNSW database was conducted for any bores registered within 1 km radius of the site. There are no registered bores and available public groundwater data within 1 km radius of the site.

3.6 Acid sulfate soils

Acid Sulphate Soil (ASS) mapping indicates that the site is located in an area of “no known occurrence of acid sulphate soils”. ASS is generally associated with alluvial and estuarine soils in coastal areas at elevations less than RL 12 m. The site is unlikely to be affected by ASS as the site soils encountered are residual in origin and at an elevation above RL 50 m.

3.7 Salinity

The Department of Infrastructure, Planning and Natural Resources (DIPNR) Map of Salinity Potential in Western Sydney 2002 suggests that the site is in an area of “moderate salinity potential”. Higher potential salinity areas are mapped further to the east along the creek lines where water accumulation is high.

4. Desktop review of nearby projects

4.1 Douglas Investigations

Based on a search of the Douglas projects database, Douglas have carried out a geotechnical investigation around 40 m to the southwest of the proposed HV service which included the drilling of two boreholes to depths between 10.4 m (RL 39.9 m) and 11.2 m (RL 39.3 m).

The boreholes generally encountered shallow depths of topsoil of up to 0.3 m thick underlain by firm to very stiff, alluvial silty clay and gravelly sandy clay to depths of approximately 6 m, and then very stiff residual silty clay or extremely low to very low strength shale to depths of up to 8.6 m. Below the residual clays encountered siltstone which was typically in the low to medium strength range. The siltstone was typically slightly fractured.

Free groundwater flow was observed at depths between 3.8 m and 3.6 m (RL 46.7 m).

No long-term groundwater monitoring or permeability testing of the soils or bedrock was carried out during the investigation.

4.2 Geotechnical Investigation carried out by PSM

In 2019, PSM carried out the drilling of five boreholes along the HV alignment (PSM2019). The approximate locations are shown in Figure 4.



Figure 4 – Approximate PSM borehole location plan (excerpt from PSM2019)

The boreholes encountered fill within BH4 and BH5 to depth of 5.4 m and 3.5 m, respectively. Natural clays were encountered below the fill within PSM's boreholes BH1 to BH4 between depths ranging from 5.8 m (BH3) and 10.3 m (BH4). The clays were underlain by siltstone bedrock.

Groundwater observations were recorded at the time of the drilling. The recorded groundwater levels are presented in Table 1.

Table 1 – Observed groundwater levels during PSM2019 investigation

BH Location	Recorded Groundwater Observations during Drilling (bgl) (m)
BH1	3.75
BH2	4.05
BH3	3.6
BH4	8.4
BH5	NE

Notes bgl – below ground level
NE – Not encountered

No long-term groundwater monitoring or permeability testing of the soils or bedrock was carried out during the investigation.

It should be noted that no long-term groundwater monitoring was carried out and therefore groundwater levels may not have stabilised.

5. Conceptual hydrogeological model

The site is underlain by Quaternary alluvial sediments associated with Ropes Creek, underlain by Bringelly Shale bedrock. Based on the available information, two hydrostratigraphic units are interpreted within the site:

- Alluvial aquifer (unconfined): The alluvial sediments are assumed to host an unconfined aquifer system. Groundwater levels within the alluvium are therefore anticipated to respond to climatic conditions and creek level.
- Bedrock unit (low permeability with localised fracture flow): The underlying Bringelly Shale is anticipated to act predominantly as an aquitard or aquiclude, with groundwater movement largely restricted to secondary permeability associated with defects such as fractures, joints or weathered zones. Where present, these features may host minor fractured rock aquifers.

Groundwater within the alluvial aquifer is assumed to be hydraulically connected to Ropes Creek. Under typical (non-flood) conditions, groundwater is likely to discharge into the creek. Conversely, during periods of high creek flow (e.g. following significant rainfall or flooding), the hydraulic gradient may reverse locally, resulting in recharge from the creek into the adjacent alluvial aquifer.

Groundwater flow is anticipated to generally follow surface topography, with flow directed towards Ropes Creek and trending to the northwest. Recharge to the groundwater system is assumed to occur primarily via rainfall infiltration across the site, with additional contributions from surface runoff and episodic creek recharge during high flow events. Discharge mechanisms are likely to include evapotranspiration from riparian vegetation along Ropes Creek and baseflow discharge to the creek under typical conditions.

Groundwater observations recorded during nearby geotechnical investigations indicate groundwater levels within the alluvial profile at depths of up to approximately 3.6 m below ground surface. However, no long-term monitoring data are available to characterise seasonal variability, hydraulic gradients, or connectivity with Ropes Creek.

It should be noted that groundwater levels are transient and fluctuate with climatic variations and other factors (e.g. adjacent excavations, pumping). Therefore, the water levels will temporarily rise during periods of heavy or prolonged rainfall and fall during dry periods. Groundwater levels in the vicinity of the site can also be affected by nearby dewatering activities and existing drained basements.

6. Groundwater inflow assessment

6.1 Numerical modelling methodology

A 2-dimensional (2D) numerical model was developed for the proposed HDD underbores and launch pits using SEEP/W, a component of GeoStudio 2023.1.2 R2 (version 23.1.2.11) developed by GEOSLOPE International Ltd. Transient analysis was undertaken to assess the potential dewatering rates and volumes for dewatering during construction.

Douglas selected two vertical cross-sections intersecting the works which are described as follows:

- Section A – launch/receive pit;
- Section B – midway between launch/receive pits and deepest point of HDD underbore (i.e. at 10 m depth assumed to be within the alluvium soils); and

6.2 Assumptions

The following assumptions were made for the inflow analysis:

- The HDD underbore construction period is three months, i.e. the launch pits will remain open and require dewatering for this duration.
- One HDD underbore will be carried out at any one time during the construction period, therefore only one 350 mm diameter underbore has been modelled to obtain inflow results.
- Continuous circulation of a bentonite-based slurry through the drill string to the drill bit will be undertaken during HDD, that will help stabilize the borehole, seal it against groundwater and transport cuttings to the launch pits. It was assumed that only the last excavated meter would produce groundwater inflow.
- The ground profile can be simplified and simulated as a two-layered numerical model to represent the alluvium sediments and bedrock.
- Due to the small size and shape of the launch/receive pit, an axisymmetric model was adopted which simulates the excavation as a circle with an equivalent radius of 3 m. This method better simulates the concentrated inflows at the corners of the excavation.

6.3 Model layers

The hydrogeological units were simulated as two layers to simulate the alluvium and bedrock profiles. Surficial soils were excluded from the model and considered negligible for the purpose of this assessment.

Adopted hydraulic properties are presented in Table 2. Parameters were selected based on ranges of values documented in the available literature for similar lithologies (e.g. Hoek & Bray 1981 and more recently Pells 2019) and previous experience with similar materials. These values are considered to be conservative.

Table 2: Summary of material parameters for groundwater inflow analysis

Geological Unit	Saturated Kh (m/s)	Anisotropy Ratio (Kv/Kh)	Residual Water Content (%)	Saturated Volumetric Water Content (%)	Material Model Adopted
Alluvium	1×10^{-6}	1.0	7	40	Unsaturated / saturated
Bedrock	1×10^{-7}	0.3	5	20	Unsaturated / saturated

Notes: Kh: Horizontal hydraulic conductivity
 Kv: Vertical hydraulic conductivity

6.4 Model calibration

The boundaries of the model extended to the north and south of the model around 20 m to simulate constant recharge from Ropes Creek. Groundwater levels were established in the model by setting a constant head boundary condition along the far end boundaries.

Constant head boundary conditions were applied along the lateral extents of the model, set at approximately 3.6 m below ground level. This level is slightly above the highest groundwater observation in the area of approximately 3.6 m below existing ground levels.

A 'free flow' boundary or 'drained' boundary condition was applied to the sides of the launch/receive pit and the HDD underbore excavations to model a 'dry' excavation to simulate dewatering which will be required during construction.

6.5 Groundwater modelling results

A transient seepage analysis was adopted to predict inflow rates during the assumed three-month construction period. The inflow results represent the estimated total rate of groundwater flowing into the excavations and the volume (per unit time) requiring extraction via the dewatering system during construction.

6.5.1 Predicted groundwater inflow

The predicted groundwater inflows for the launch and receiving pits are presented in Table 3.

Table 3: Section A - Launch/receive pit: Predicted Groundwater Inflow Rates with time for one pit

Elapsed Time (days)	Dewatering Inflow Rate		
	Accumulative Inflows (m ³)	Inflow rate (L / min)	Total over 90 days (m ³)
1	5	3.4	303
2	9	3.3	
4	22	3.1	
7	33	2.9	
11	48	2.8	
18	73	2.6	
27	103	2.5	
40	149	2.4	
60	211	2.3	
90	303	2.3	

The linear (per meter) inflow results for the HDD underbore drilling for section B are presented in Table 4.

Table 4 – Section B - Linear (per meter) predicted inflow results for one HDD underbore (in alluvium)

Elapsed Time (days)	Dewatering Inflow Rate		
	Accumulative Inflows (m ³ /m)	Inflow rate (L / min / m)	Total over 90 days (m ³ /m)
1	0.5	0.3	27
2	1.0	0.2	
4	2.4	0.3	
7	3.7	0.3	
11	5.2	0.3	
18	7.7	0.3	
27	10.6	0.3	
40	14.6	0.3	
60	19.7	0.3	
90	26.9	0.4	

Total groundwater inflows have been estimated by considering the following components:

- Section A – Launch and retrieval pits: Two pits assumed to be open simultaneously during construction.
- Section B – Underbores: Based on the assumptions listed in Section 6.2, only a 1 m length of a single underbore is assumed to contribute to groundwater inflow at any given time.

The calculated total inflow results are presented in Table 5.

Table 5 – Results of total inflow calculations for the Assumed Construction Period of 3 Months

Section	Inflow (m ³)
A	606 note 1
B	54 note 2
Total	660

Notes:

1 - The reported value has been doubled from that presented in Table 3 to account for both the launch and retrieval pits.

2 - As all seven bores will be drilled and lined (i.e. made watertight) within the construction period and only the final metre of drilling is expected to contribute to inflows. Accordingly, this is considered equivalent to a single bore with the final 1 m with the cutting face area (at the time of drilling) contributing to inflows over the construction period. Inflow value was increased to 200% of value from the 2D plane-strain model (Model Section B) to account for the 3D effects.

It should be noted that these volumes are 'estimates' of the average inflows. It is possible that localised zones of higher permeability may be present within the site, through which the rate of inflow could be significantly higher, and considering the subsurface heterogeneity and fractured aquifer system, a safety margin for application in the field should be considered.

Also, simulated dewatering rates and drawdown are dependent on the dewatering scheme adopted for the site included in the numerical models. If the depth of the excavation / drilling levels and dewatering systems were to change then the currently predicted dewatering rates may change, in which case further modelling would be required.

6.5.1 Predicted groundwater drawdown

Drawdown of the groundwater levels will depend on the proposed time to construct the launch/retrieval pit, execute the HDD underbore and backfill.

Groundwater levels immediately outside of the pit excavations will be drawn down to bulk excavation levels. A drawdown of the groundwater level of 0.4 m is predicted at around 10 m from the pit excavation.

As HDD will be undertaken with a bentonite-based slurry, groundwater seepage and resulting drawdown are likely to be minimal.

7. Impact assessment

7.1 Assessment criteria

Potential impacts of the HDD underboring activities on groundwater resources and receptors have been assessed against the minimal impact thresholds defined in the NSW aquifer interference policy (AIP).

Under the AIP's definitions, the two aquifer systems within and in the vicinity of the site are considered as follows:

- Confined rock (bedrock): "less productive" fractured rock aquifer; and
- Unconfined alluvium: "less productive" (low water yield) alluvial aquifers.

The applicable AIP minimal impact considerations for both aquifer systems are presented in Table 6.

Table 6: Minimal impact considerations for "less productive" aquifers (DPI, 2013)

Water table	Water pressure	Water quality
1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any high priority receptors listed in the schedule of the relevant water sharing plan; or A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any high priority receptors if appropriate studies demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than a 2 m decline cumulatively at any water supply work then make good provisions should apply.	1. A cumulative pressure head decline of not more than 40% of the "post-water sharing plan" (alluvial) or a cumulative pressure head decline of not more than a 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long term viability of the affected water supply works unless make good provisions apply.	1) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. 2) If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long term viability of the dependent ecosystem, significant site or affected water supply works.

7.2 Risk assessment of impacts

Risks associated with potential groundwater impacts is summarised in Table 7.

Table 7: Risk assessment

Potential impact mechanism	Impact / event	Rating reasoning	Pre-mitigation risk
Impacts on nearby GDEs	Potential long term loss of water dependent ecosystem viability	Drawdowns at the nearby GDE's are expected to be negligible. Any dewatering or groundwater seepage would be of short duration and would not adversely impact GDEs associated with Ropes Creek.	Low
Drawdown at third-party water bores exceeds assessment criteria	Reduction in available groundwater at third-party bores.	No third-party bores are present within 1 km of the site. Therefore, impacts are not anticipated.	Low
Groundwater contamination / changes in water quality	Water quality deterioration impacting GDEs and Ropes Creek	Groundwater seepage into the underbores and launch pits will be mixed with the drilling muds and taken off-site to a licensed disposal facility.	Low

8. Mitigation measures

Although impacts are considered unlikely, mitigation measures should be implemented to ensure best practice and to avoid risks to groundwater and surface water resources associated with HDD underboring beneath Ropes Creek and dewatering of launch and retrieval pits. These measures may include:

- Designing the HDD alignment to maintain adequate separation beneath the creek and avoid highly permeable zones where practicable;
- Maintaining continuous circulation of bentonite-based drilling fluid to stabilise the borehole, and limit groundwater ingress;
- Monitoring drilling fluid pressures and returns in real time to detect potential losses or inadvertent returns; and
- Storing drilling fluids and cuttings in above ground tanks or trucks and disposal to a licensed off-site facility.

9. Approvals and licensing

This section outlines the approvals, licences and other authorisations required for the proposed dewatering activities, consistent with the *Water Management Act 2000*, WaterNSW requirements, and any relevant local council or EPA obligations.

9.1 Water Access Licence (WAL) and entitlements

Dewatering of groundwater for construction purposes constitutes an aquifer interference activity under the *Water Management Act 2000* and may require a Water Access Licence (WAL) and appropriate water entitlement units (share and extraction components), depending on the water source and proposed take.

In accordance with the Water Management (General) Regulation Act 2018, extraction of water from the greater metropolitan region groundwater source for the purpose of construction dewatering are currently exempt from requiring a Water Access License (WAL) under the coastal construction of infrastructure exemption clause.

As there are no long-term dewatering activities, a WAL is not required.

Actual inflow volumes will only be known at the time of excavation and allowances for variation in the inflow rate should be made. In this regard, inflow volume records during construction when actual inflows are known should be maintained and reported to DCCEEW within 28 days of the water year finishing (i.e. Before 28 July).

9.2 Water Supply Works Approval (WSWA)

As the project is an SSD, a separate water supply works approval for construction dewatering is not required.

9.3 Council and EPA approvals

Discharge off-site: A licensed contractor must be engaged, and records of transport and disposal must be maintained.

10. Conclusion

A portion of the proposed HV alignment is proposed to be constructed beneath Ropes Creeks via the construction and excavation of two launch / retrieve pits connected by a series of HDD excavations. The proposed pits could be up to 6 m in depth with the HDD reaching a total depth of around 15 m.

Excavated spoil from launch and receive pits would not be stockpiled at work sites but rather placed directly into trucks for transport to either the construction laydown areas for temporary storage or to an offsite appropriately licensed waste facility for disposal.

The 2D seepage analysis for the proposed development model was based on the highest groundwater levels recorded from nearby investigative works with permeability values based on well documented and Douglas' previous experience with similar materials.

The results of the analysis indicate that the predicted inflows during a construction period of 90 days could be up to 0.7 ML.

Given the limited extent of predicted drawdown, the temporary nature of the works, and the implementation of appropriate mitigation measures, no adverse impacts are anticipated on Ropes Creek or any associated groundwater dependent ecosystems.

11. References

DPI. (2013). *NSW Aquifer Interference Policy*. Document No. Jobtrack 12268_F4.3: Department of Primary Industries - Office of Water.

Ecologique Australia Pty Ltd. (2109). *Review of Environmental Factors report (reference Sydney Case No.172727PW, dated 23 October 2019)*. EA.

PSM. (2019). *Geotechnical investigation report (reference PSM1541-390L, dated 14 June 2019)*.

12. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report (or services) for this project at 78 Lockwood Road, Erskine Park NSW in line with Douglas' proposal (reference 207476.10.P.003.Rev0, dated 10 March 2026) and acceptance received from Stack Infrastructure Australia (78 Lockwood Road) Top Pty Ltd ATF The Stack Infrastructure Australia (78 Lockwood Road) Unit Trust c/o Linesight. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Stack Infrastructure Australia (78 Lockwood Road) Top Pty Ltd ATF The Stack Infrastructure Australia (78 Lockwood Road) Unit Trust c/o Linesight for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface and groundwater conditions on the site only at the specific sampling and testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface and groundwater conditions can change abruptly due to variable geological and weather processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

Appendix A

About This Report

Introduction

These notes are provided to amplify DP's inspection report in regard to the limitations of carrying out inspection work. Not all notes are necessarily relevant to this report.

Standards

This inspection report has been prepared by qualified personnel to current engineering standards of interpretation and analysis.

Copyright and Limits of Use

This inspection report is the property of DP and is provided for the exclusive use of the client for the specific project and purpose as described in the report. It should not be used by a third party for any purpose other than to confirm that the construction works addressed in the report have been inspected as described. Use of the inspection report is limited in accordance with the Conditions of Engagement for the commission.

DP does not undertake to guarantee the works of the contractors or relieve them of their responsibility to produce a completed product conforming to the design.

Reports

This inspection report may include advice or opinion that is based on engineering and/or geological interpretation, information provided by the client or the client's agent, and information gained from:

- an investigation report for the project (if available to DP);
- inspection of the work, exposed ground conditions, excavation spoil and performance of excavating equipment while DP was on site;
- investigation and testing that was carried out during the site inspection;
- anecdotal information provided by authoritative site personnel; and
- DP's experience and knowledge of local geology.

Such information may be limited by the frequency of any inspection or testing that was able to be practically carried out, including possible site or cost constraints imposed by the client/contractor(s). For these reasons, the reliability of this inspection report is limited by the scope of information on which it relies.

Every care is taken with the inspection report as it relates to interpretation of subsurface conditions and any recommendations or suggestions for construction or design. However, DP cannot anticipate or assume responsibility for:

- unexpected variations in subsurface conditions that are not evident from the inspection; and
- the actions of contractors responding to commercial pressures.

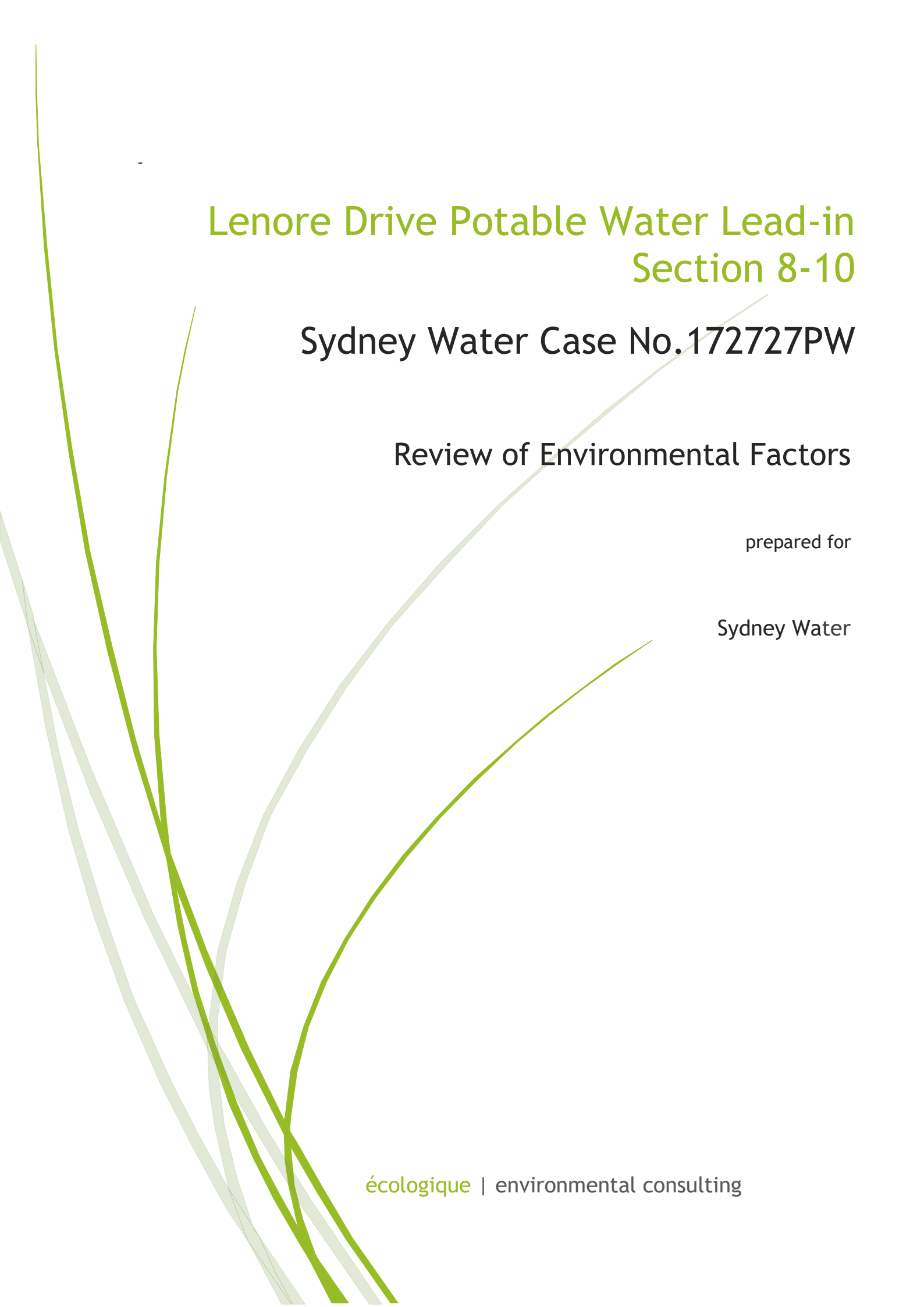
Should these issues occur, then additional advice should be sought from DP and, if required, amendments made.

This inspection report must be read in conjunction with any attached information. This inspection report should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions from review by others of this inspection report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this inspection report.

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Appendix B

Review of Environmental Factors Report



Lenore Drive Potable Water Lead-in Section 8-10

Sydney Water Case No.172727PW

Review of Environmental Factors

prepared for

Sydney Water

Lenore Drive Potable Water Lead-in Section 8-10 Sydney Case No.172727PW Review of Environmental Factors

Determination Summary

This Review of Environmental Factors (REF) assesses potential environmental impacts of the proposal to construct a lead in potable water main to service the Oakdale West Industrial Estate. The proposal has been assessed under Part 5 of the Environmental Planning and Assessment (EP&A) Act.

The proposal is unlikely to have a significant impact on the environment or a threatened species, population or ecological community, and is not on land that is critical habitat, and accordingly, an Environmental Impact Statement is not required.

Sydney Water is the proponent and determining authority for the proposal. Under section 111 of the Environmental Planning and Assessment Act 1979 (EP&A Act), Sydney Water must examine all matters likely to affect the environment from this activity. The below signatories certify that the REF:

- examines and takes into account all matters affecting or likely to affect the environment as a result of activities associated with the proposal
- is accurate and does not omit any material information
- subject to the implementation of the safeguards, it is unlikely that there will be any significant environmental impacts associated with the proposal
- considers the proposal in accordance with the principles of Ecological Sustainable Development
- will be adhered to by the Developer, including undertaking the proposal as described, implementing the safeguards, and managing construction risks

Prepared by:	Reviewed by:
 Kat Duchatel BSc. Env. CEnvP EIANZ #691 Principal, écologique Date: 23/10/2019	 Bijan Mehrani AT&L Senior Civil Engineer Accredited Sydney Water Provider Date: 23/10/2019
Endorsed by Water Servicing Coordinator:	Approved by Development Manager:
Date:	Date:
Endorsed by Sydney Water Environment Rep:	Approved by Sydney Water:
Date:	Date:

Lenore Drive Potable Water Lead in Section 8-10 Sydney Case No.172727PW

Review of Environmental Factors

prepared for

Sydney Water

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Document control

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Revision Schedule

Rev No	Date	Description	Issued to
1	06/09/2019	Draft for Client Review	AT&L
2	12/09/2019	Final Draft for Sydney Water Review	AT&L
3	23/10/2019	Final REF -amended to include new sign off section	AT&L

Abbreviations

ACHAR	Aboriginal Cultural Heritage Assessment Report
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
BC Act	<i>Biodiversity Conservation Act 2016 (NSW)</i>
Biosecurity Act	<i>Biosecurity Act 2015 (NSW)</i>
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CLM Act	<i>Contaminated Land Management Act 1995 (NSW)</i>
DCP	Development Control Plan
EEC	Endangered Ecological Community
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EP&A Regulations	<i>Environmental Planning and Assessment Regulation 2000 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
EPI	Environmental Planning Instrument (NSW)
ESCP	Erosion and Sediment Control Plan
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
NES	National Environmental Significance
NP&W Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
OEH	Office of Environment and Heritage
PCT	Plant Community Type
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy (NSW)
SHR	State Heritage Register
WM Act	<i>Water Management Act 2000 (NSW)</i>
WSC	Water Servicing Coordinator

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1. Introduction

1.1 Background

The Lenore Drive potable water lead in Section 8-10 is required to service the Oakdale West Industrial Estate (Oakdale West). Oakdale West is part of the larger Oakdale Industrial Estate being developed by Goodman in Precinct 8 (South of the Warragamba Pipelines) of the Western Sydney Employment Area (WSEA).

Assets required to service the Oakdale Industrial Estate were identified in a Local Area Servicing Plan (LASP) for potable water prepared for Sydney Water (GHD 2016). The LASP identified the need for the following lead in water main sections to service Oakdale West:

- Section 7-9 located within Oakdale West; and
- Section 7-8 located within land being developed by Fitzpatrick to the north of Oakdale West within Precinct 7 (Erskine Park Employment Lands) of the WSEA.

Section 7-8 was intended to connect to an assumed existing main within Lenore Drive fed by the Minchinbury elevated reservoir. However, during engineering investigations undertaken by AT&L for the proposal, it was discovered that the existing main within Lenore Drive terminated approximately 1.4 km to the east of the planned Section 7-8 connection.

Subsequently AT&L on behalf of Goodman and Sydney Water, have designed this section of water main (herein identified as Section 8-10) in order to enable the intended servicing strategy.

The Section 8-10 water main would traverse both Precinct 6 (Ropes Creek) and Precinct 7 (Erskine Park Employment Lands) of the WSEA, which are located to the north of the Warragamba pipelines and Precinct 8 of the WSEA (see Figure 1-1).

1.2 Existing Approvals

Section 7-8 and Section 7-9 and the connection of the proposed Section 8-10 with Section 7-8 do not require assessment in this REF as detailed below.

1.2.1 Oakdale West

Oakdale West is a State significant development (SSD7348), which includes the construction of the Section 7-9 water main and the Western North South Link Road (WNSLR). The WNSLR will connect Lenore Drive (WSEA Precinct 7) with Oakdale West (WSEA Precinct 8). The WNSLR has been designed to accommodate a range of utilities including the Section 7-8 water main.

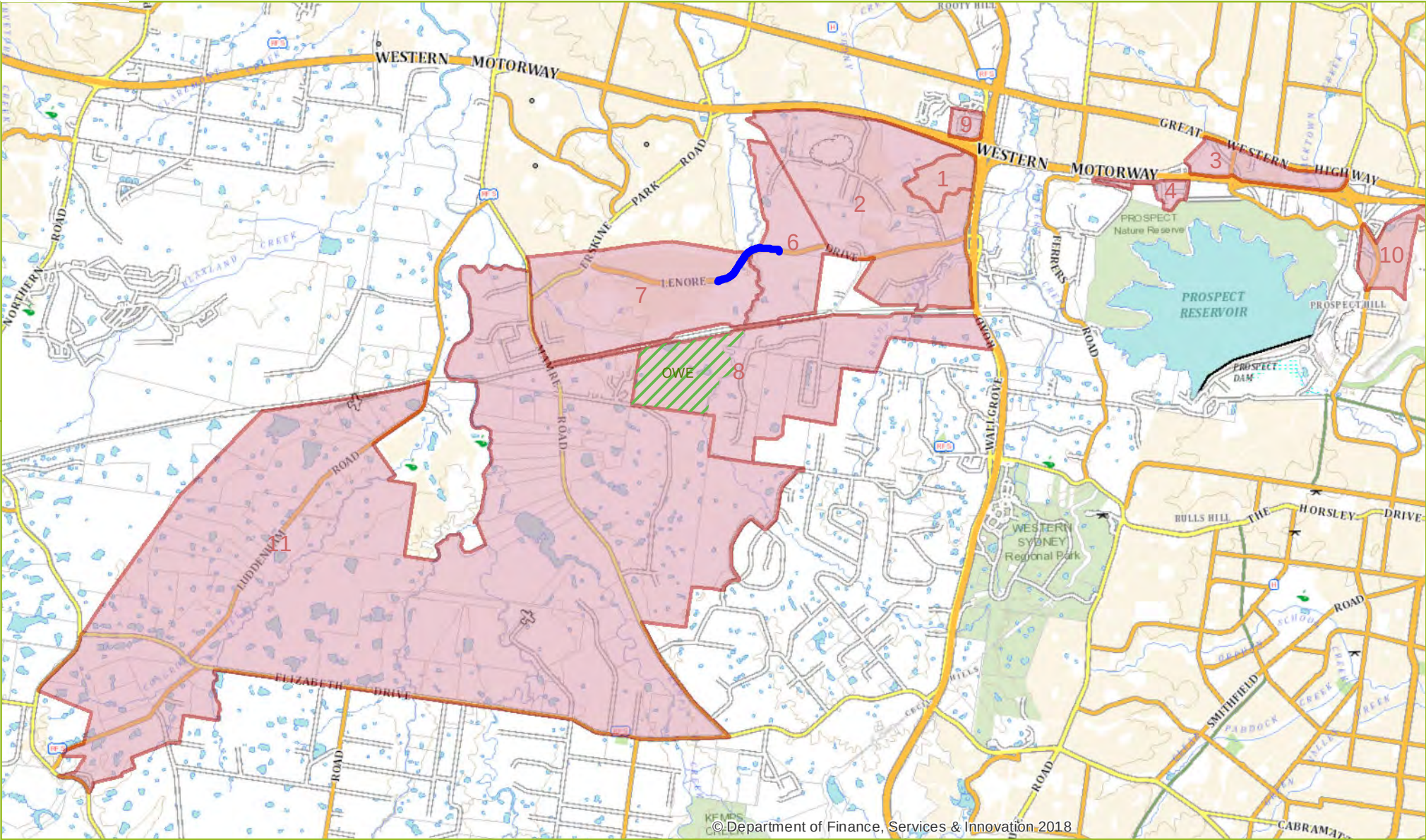
Subsequently the construction of the Section 7-9 water main and the Section 7-8 water main within the boundary of the WNSLR works area does not require assessment in this REF.

1.2.2 Fitzpatrick Investments

The proposed Section 8-10 water main will connect with Section 7-8 on Lot 2 DP 1215268, which is owned and currently under development by Fitzpatrick Investments (Fitzpatrick). All developable land within Lot 2 DP 1215268 was the subject of a previous environmental impact assessment and development approval granted to Fitzpatrick.

Subsequently the construction of the Section 8-10 water main and its connection to the Section 7-8 water main within the boundary of Lot 2 DP 1215268 does not require assessment in this REF.

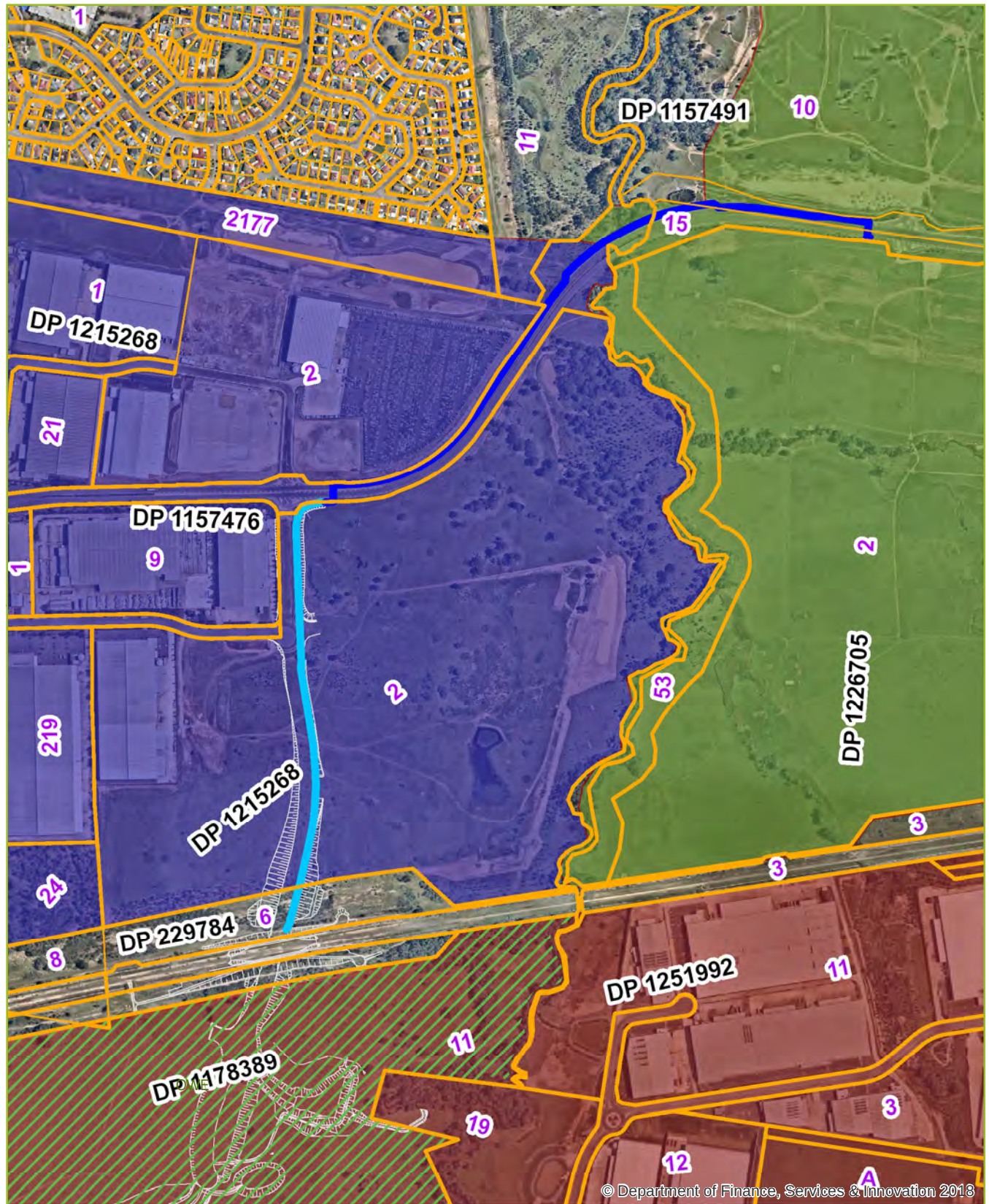
Figure 1-2 shows the location of the proposed Section 8-10 water main in the context of Oakdale West and Lot 2 DP 1215268 (Fitzpatrick land).



- Proposed Section 8-10 water main
- Oakdale West
- WSEA Precincts

Lenore Drive Potable Water Lead in Section 8-10

Figure 1-1. Location Map



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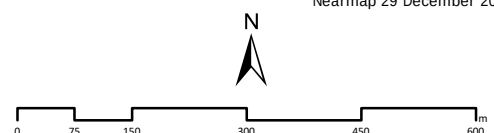
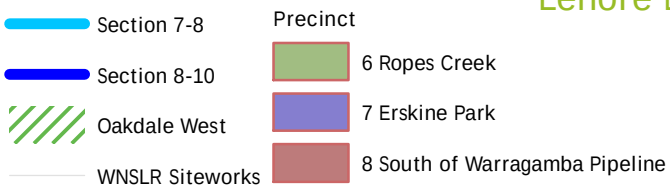
Lenore Drive Potable Water Lead in Section 8-10

Figure 1-2. Existing approvals

Coordinate System: MGA Zone 56 (GDA 94)

Image sources:

Nearmap 29 December 2018



1.3 Purpose of the REF

The purpose of this Review of Environmental Factors (REF) is to assess the potential environmental impacts associated with the construction and commissioning of the Section 8-10 water main (the proposal).

A description of the proposal is provided in Section 2 and the statutory framework under which the proposal has been assessed is detailed in Section 3.

Potential environmental impacts of the proposal are discussed in Section 4 and a summary of environmental safeguards provided in Section 5.

The environmental safeguards provided in Section 5 are to be incorporated within both the tender specifications and the awarded tenderer's Construction Environmental Management Plan (CEMP) that is to be prepared and approved by Sydney Water prior to commencement of the works.

2. Proposal Description

2.1 Overview

The proposal involves the construction and operation of an approximate 1.4 km lead in water main, which will connect with an existing 300mm main constructed in 2014 along Lenore Drive to the east, and the proposed Section 7-8 water main (located on Fitzpatrick land) to the west. The proposed water main route is shown in Figure 2-1.

The majority of the proposed Section 8-10 water main will be constructed using open trench excavation within the Lenore Drive road easement.

Lenore Drive is bridged over Ropes Creek and the creek's riparian corridor, with a stormwater culvert and stormwater wetland basin located to the east of the bridge.

Trenchless technology will be employed to avoid disturbance to traffic on Lenore Drive, impacts to stormwater infrastructure and impacts to areas of environmental sensitivity associated with Ropes Creek and riparian corridor.

2.2 Construction

2.2.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) will be prepared by the construction contractor and submitted to Sydney Water's project environmental representative for review and endorsement prior to the commencement of construction activities and site establishment.

2.2.2 Preconstruction activities

Preconstruction activities include:

- Preparation and approval of the Project CEMP
- Preparation and approval of a Traffic Management Plan
- Preparation and approval of a Landscape Management Plan
- Consultation with relevant stakeholders / landowners to:
 - gain permission to access and undertake works, and
 - provide notifications of any proposed interruptions to pedestrian or other access as a result of the works
- Installation of environmental controls in accordance with the CEMP

2.2.3 Construction activities

The majority of the civil works associated with the Section 8-10 water main installation will be carried out by a contractor appointed by Sydney Water. The contractor will be responsible for the planning and carrying out of construction activities.

The anticipated construction program is expected to include:

- Preliminary site establishment works - the contractor will be responsible for locating and establishing a permanent or mobile compound area; setting up erosion and sediment controls around the works areas; location of any affected services; and implementation of any other environmental controls as guided by the Project CEMP.
- Establishment of traffic control - traffic control will be established around each work site in accordance with the approved Traffic Management Plan.
- Excavation of trenches and laying of pipeline- the majority of works will be carried out by standard open trenching methods. The trench will be dug with an excavator and once the water main is laid, the trench will be backfilled with a layer of sand / cement mix, concrete and soil.

The excavation will be carried out in stages and will be of a length that will enable the trench to be excavated, water main installed and backfilled prior to the end of each day's work.

- Trenchless technology - the proposed alignment of the Section 8-10 water main will run at a 10m offset from the existing bridge on Lenore Drive for approximately 300m of directional drilling up to a depth of 10m below the creek level at the crossing and will gradually come to the surface at both sides of the Ropes Creek riparian corridor (approximate chainage 642.9 to 944.4).
- Additional underground boring will be used to install the water main beneath Lenore Drive at the following locations:
 - Approximate chainage 14.1 to 45.2
 - Approximate chainage 1226.7 to 1253.9
- Restoration and rehabilitation - at completion of the works, the ground surface will be restored, work site cleaned up and temporary controls removed, and landscaping undertaken in accordance with the approved Landscape Management Plan.

The width of the corridor disturbed by pipeline construction will vary with ground conditions and the excavation required would be generally less than 6 m in width and up to 3.6m in depth.

2.3 Timing

Construction to operation is anticipated to take up to four months (80 days), which includes:

- Approximately 12 to 14 weeks (70 days) for construction (dependent on whether works include Saturdays or are limited to weekdays only);
- Approximately one week for disinfection; and
- Less than one week (approximately three days) for connection.

The duration of the works may vary dependent on weather conditions and whether the works are required to temporarily cease due to any unexpected delays.

2.4 Access and Site Compound

2.4.1 Access

Access to the works area will be from Lenore Drive. The alignment and road easement of Lenore Drive has been constructed to accommodate future road connections identified in the Erskine Park Road Network Concept approved by State government (Department of Planning, 2009). Relevant to the proposed works area are turning lanes established for the WNSLR and the Archbold Road extension (see Figure 2-1).

2.4.2 Site compound

Due to the temporary and linear nature of the proposed works it is anticipated that a portable compound will be used, which would be relocated along the linear extent of the works area as the works progress.

However, approval for the establishment of a site compound for the duration of the works will be sought in consultation with relevant landowners.

2.4.2 Stockpiles

Open trench installation

Excavation material will be stockpiled next to the trench and filled back as much as required at the end of each day. The residual soil will be removed off site at the end of the day.

Trenchless installation

Trenchless boring slurry will be stockpiled on site until dry enough to be removed and disposed of appropriately offsite.

Figure 2-1 provides indicative access routes and potential stockpile sites for the works with photographic plates provided in Appendix B. These sites will be determined through consultation and approval by relevant landowners with designated areas finalised in the proposal CEMP.

2.5 Options Considered

2.5.1 Do nothing

The WSEA was established by the New South Wales Government to provide businesses in the region with land for industry and employment, including transport and logistics, warehousing and office space. The proposed Section 8-10 water main is required to service newly developing industrial areas within the WSEA. Therefore to 'do nothing' option is not a feasible option.

2.5.2 Potential alternative options

The proposed Section 8-10 water main is constrained by its location within a highly used classified road, which is bridged over Ropes Creek and its riparian corridor.

Open trench excavation for the entire length of the proposal would result in disruption to traffic on Lenore Drive and require clearing of native vegetation within the Ropes Creek riparian corridor.

2.5.3 Preferred option

The preferred option (as detailed in Section 2.2) avoids disturbance to both Lenore Drive, Ropes Creek and the Ropes Creek riparian corridor.



- Section 8-10
- Under boring
- Section 7-8
- Existing Sydney Water mains
- Indicative access
- Indicative stockpile areas
- Section 8-10 in E2 zone

Lenore Drive Potable Water Lead in Section 8-10

Figure 2-1. Proposed water main alignment

Coordinate System: MGA Zone 56 (GDA 94)
Image sources:
Nearmap 21 July 2019

3. Permissibility and Statutory Requirements

3.1 Statutory Framework

This REF has been prepared in accordance with the requirements of the NSW environmental and planning framework. This section provides a discussion of the relevant legislation, environmental planning instruments and approvals applicable to the proposed activity.

3.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the statutory planning context for environmental assessment and approval of development. It also provides for the making of Environmental Planning Instruments (EPIs) including the *State Environmental Planning Policy (Infrastructure) 2007*, which defines the permissibility of the proposed development (refer Section 3.3.1).

Sydney Water is a statutory state-owned corporation and is classified as a public authority under Section 4 of the EP&A Act and the determining authority for the proposal under Part 5 of the EP&A Act.

As the determining authority, Sydney Water must 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity' pursuant to Section 5.5 of the EP&A Act.

Clause 228 of the EP&A Regulation 2000 provides details of what must be taken into account when considering the impact of any activity on the environment. A summary response to Clause 228 of the EP&A Regulation 2000 is provided in Section 6.

3.3 Environmental Planning Instruments

3.3.1 State Environmental Planning Policy (Infrastructure) 2007

The aim of State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) is to facilitate the effective delivery of infrastructure across the State by:

- a) Improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services, and
- b) Providing greater flexibility in the location of infrastructure and service facilities, and
- c) Allowing for the efficient development, redevelopment or disposal of surplus government owned land, and
- d) Identifying the environmental assessment category into which different types of infrastructure and services development fall (including identifying certain development of minimal environmental impact as exempt development), and
- e) Identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure development, and
- f) Providing for consultation with relevant public authorities about certain development during the assessment process or prior to development commencing, and
- g) Providing opportunities for infrastructure to demonstrate good design outcomes.

Under clause 125, development for the purpose of water reticulation systems may be carried out by or on behalf of a public authority without consent on any land.

Relationship to other environmental planning instruments

Under Part 1 Clause 8 of the ISEPP if there is an inconsistency between the ISEPP and any other environmental planning instrument, whether made before or after the commencement of this Policy, the ISEPP prevails to the extent of the inconsistency. Except if there is an inconsistency between a provision of the ISEPP and any of the following provisions of another environmental planning instrument, the provision of the other instrument prevails to the extent of the inconsistency:

- a) Clauses 10, 11 and 19 of State Environmental Planning Policy (Coastal Management) 2018:
NOT APPLICABLE: site not located within relevant areas mapped under this SEPP
- b) All of the provisions of State Environmental Planning Policy (State Significant Precincts) 2005:
NOT APPLICABLE: site not located within a State Significant Precinct

Although the proposal is permissible without consent, it does not remove the requirement under other Acts to obtain approvals, licences or permits where required (refer Section 4.4).

3.3.2 State Environmental Planning Policy (WSEA) 2009

State Environmental Planning Policy (WSEA) 2009 (SEPP WSEA) aims to protect and enhance the land to which this Policy applies for employment purposes, in particular:

- a) Promote economic development and the creation of employment in the SEPP WSEA by providing for development including major warehousing, distribution, freight transport, industrial, high technology and research facilities,
- b) Provide for the co-ordinated planning and development of land in the SEPP WSEA,
- c) Rezone land for employment or environmental conservation purposes,
- d) Improve certainty and regulatory efficiency by providing a consistent planning regime for future development and infrastructure provision in the SEPP WSEA,
- e) Ensure that development occurs in a logical, environmentally sensitive and cost-effective manner and only after a development control plan (including specific development controls) has been prepared for the land concerned,
- f) Conserve and rehabilitate areas that have a high biodiversity or heritage or cultural value, in particular areas of remnant vegetation.

The proposal is located in both Precinct 6 (Ropes Creek) and Precinct 7 (Erskine Park Employment Lands) of the WSEA and will also provide potable water to the Oakdale West Industrial Estate which is located in Precinct 8 (South of Sydney Catchment Authority Warragamba Pipelines).

Relationship to other environmental planning instruments

In the event of an inconsistency between SEPP WSEA and an LEP or deemed environmental planning instrument that applies to the land to which applies, SEPP WSEA prevails to the extent of the inconsistency.

3.3.3 State Environmental Planning Policy No 55—Remediation of Land

The State Environmental Planning Policy No 55—Remediation of Land (SEPP 55) aims to ‘provide a State-wide planning approach to the remediation of contaminated land’. Clause 7 requires a consent authority to consider whether the land is contaminated and if it is suitable or can be remediated to be made suitable for the proposed development, prior to the granting of development consent (refer Section 4.2).

3.3.4 Local Environmental Plans

Local Environmental Plans (LEPs) are prepared by councils to guide planning decisions in their local government areas and establish the requirement for the use and development of land. Through zoning and permissible land uses they allow councils to supervise the ways in which land is used.

The proposed works are located within the Penrith City Council and Blacktown City Council local government areas (LGAs). The relevant local planning instrument is the Penrith Local Environmental (LEP) 2010 and Blacktown LEP 2015.

Subclause 8(1) of the ISEPP prevails over these local planning instruments and as such, the works can be carried out without consent on these lands.

3.3.5 Development Control Plans

Development Control Plans (DCPs) contain specific controls to guide certain types of development and achieve particular development outcomes within certain areas. A DCP is a supplementary development guideline that supports each Council's LEP.

Regardless that the ISEPP prevails over LEPs, the provisions of both Blacktown and Penrith DCPs have been considered within Section 4 of this REF.

3.4 Other Relevant Legislation

Commonwealth and State legislation that have been considered in this REF are outlined in Table 3-1.

Table 3-1. Other relevant legislation considered in this REF

Act, Plan or Policy	Relevance	Document reference
Commonwealth		
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna and ecological communities – defined in the EPBC Act as matters of national environmental significance (MNES). No matters of NES would be impacted on as a result of the proposal.	Section 4.5
State		
<i>Biodiversity Conservation Act 2016</i> (BC Act) and <i>Biodiversity Regulation 2017</i> (BC Regulation)	The BC Act commenced on 25 August 2017, introducing new mandatory requirements for biodiversity assessment, reporting and thresholds that when triggered requires a development to be assessed under the NSW Biodiversity Offset Scheme (the Scheme). Relevantly, threshold testing must be used to determine when a proposed development must be assessed under the Scheme. The threshold has two key elements: 1) Whether the amount of native vegetation being cleared exceeds a threshold area, based on lot size, or 2) Whether the impacts occur on an area mapped on the Biodiversity Values map published by the Minister for the Environment. If neither threshold is triggered a 'test of significance' further assesses whether entry into the Scheme is required. This includes clearing of vegetation commensurate with threatened ecological communities or habitat for threatened	Section 4.5

Act, Plan or Policy	Relevance	Document reference
	species, or other impacts to threatened species or populations. The proposal is located within areas of biodiversity value identified under the BC Regulation and vegetation commensurate with threatened ecological communities. However construction of the proposal will use boring technology to avoid clearing of vegetation and therefore not trigger assessment under the Biodiversity Scheme.	
<i>Biosecurity Act 2015</i>	The <i>Biosecurity Act 2015</i> commenced on 1st July 2017 at which time the <i>Noxious Weeds Act 1993</i> was wholly repealed and the <i>Fisheries Management Act 1994</i> (Aquatic Biosecurity) partly repealed. The Greater Sydney Region Strategic Weed Management Plan (LLS 2017) provides the framework for managing weeds in the Greater Sydney Local Land Services (LLS) Region, in accordance with the <i>Biosecurity Act 2015</i>. No priority weeds were observed within the proposal footprint area.	Refer Section 4.5
<i>Contaminated Land Management Act 1995</i> (CLM Act)	Development is required to consider and assess contamination hazards on the land to be developed in accordance with the CLM Act and SEPP 55 - Remediation of Land (refer Section 3.3.3).	Refer Section 4.2
<i>Fisheries Management Act 1994</i> (FM Act)	Part 7 of the FM Act deals with the protection of aquatic habitats. Relevant to the proposal the issues that are dealt with in Part 7 (protection of aquatic habitats) include: • Dredging and reclamation; • Alteration of flows; and • Obstruction of free fish passage. Part 7A of the FM Act provides for the licensing of actions that are likely to result in: • Harm to a threatened species, population or ecological community; • Damage to critical habitat; or • Damage to a habitat of a threatened species, population or ecological community. The proposal does not involve works within aquatic habitat and will not trigger consideration under either Part 7 or Part 7A of the FM Act.	NOT APPLICABLE
<i>Heritage Act 1977</i>	The Heritage Act aims to conserve non-Aboriginal heritage items such as buildings, works, relics and places of historic, cultural, scientific, social, archaeological, architectural, natural or aesthetic significance.	NOT APPLICABLE

Act, Plan or Policy	Relevance	Document reference
	Any development or work that may affect an item listed on the State Heritage Register (SHR) or items identified as non-Aboriginal settlement relics, can only be undertaken with approval from the Heritage Branch of the OEH. No items listed on the State Heritage Register or identified as non-Aboriginal settlement relics occur within or proximal to the proposed work sites.	
<i>National Parks and Wildlife Act 1974 (NP&W Act)</i>	Where new infrastructure is required on land reserved under the NP&W Act, authorisation under the NP&W Act is required and the National Parks and Wildlife Services would be a co-determining authority for the REF. The proposal is not located on land reserved under the NP&W Act.	NOT APPLICABLE
	The NP&W Act is the principle statutory control for the protection for all Aboriginal places and relics. Section 86 of the NPW Act states that it is an offence to damage or desecrate an Aboriginal place or relic without the prior written consent of the Director-General of the NSW OEH. No items of Aboriginal places or relics occur within or proximal to the proposed work sites.	Refer Section 4.6
<i>Protection of the Environment Operations Act 1997 (POEO Act)</i>	The POEO Act provides for the regulation and authorisation of discharges to the environment through the issuing of an Environment Protection Licence (EPL) for “scheduled” developments and activities (as listed on Schedule 1 of the POEO Act). The proposal is not listed in Schedule 1 of the POEO Act and an EPL is not required.	NOT APPLICABLE
<i>Roads Act 1993</i>	Where proposals involve works on a major road, a Road Occupancy Licence is required under the <i>Roads Act 1993</i>. The proposal will involve works within the road easement of Lenore Drive, a major road	Refer Section 4.7
<i>Water Act 1912</i>	In NSW, the taking of water and its subsequent use has historically been managed through a licensing framework under the <i>Water Act 1912</i>. This licensing framework is transitioning to a new licensing and approval framework under the <i>Water Management Act 2000</i>. This transition occurs for particular water sources when a water sharing plan which applies to those water sources commences. This transition process is largely complete. Relevant to the proposal the <i>Water Act 1912</i> still applies to:	Refer Section 4.4

Act, Plan or Policy	Relevance	Document reference
	• aquifer interference activities in all areas of NSW. Dewatering of excavations >3ML per year requires a licence under the <i>Water Act 1912</i>.	
<i>Water Management Act 2000</i> (WM Act)	Certain types of activities carried out on waterfront land are defined as a controlled activity under the WM Act. 'Waterfront land' means the bed of any river, lake or estuary, and the land within 40 m of the river banks, lake shore or estuary mean high water mark. As a public authority, Sydney Water is exempt from requiring a controlled activity approval (under Part 3 Division 2 Subdivision 4 Clause 41 of the <i>Water Management (General) Regulation 2018</i>). Regardless, the proposal will not be located on waterfront land. Launching trenches for boring beneath waterfront land will be located >100 m from of Ropes Creek.	NOT APPLICABLE

4. Environmental Assessment

4.1 Land use

4.1.1 Existing environment

The landscape within the WSEA precincts has been substantially altered as a result of past agriculture and extractive activities, the construction and maintenance of electricity easements, the more recently constructed Lenore Drive and industrial development.

The proposal will be predominantly located within the Lenore Drive road. Land adjacent to the road easement comprises existing development, areas that will be developed in the future, a Transgrid electricity easement, Ropes Creek and a vegetated riparian corridor either side of Ropes Creek.

Under the WSEA, the proposal would be located predominantly within land zoned as General Industrial (IN1) and partially within land zoned as Environmental Conservation (E2).

Zone E2 objectives are to:

- protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values
- prevent development that could destroy, damage or otherwise have an adverse effect on those values

Zone IN1 objectives are to:

- facilitate a wide range of employment-generating development including industrial, manufacturing, warehousing, storage and research uses and ancillary office space.
- encourage employment opportunities along motorway corridors, including the M7 and M4.
- minimise any adverse effect of industry on other land uses.
- facilitate road network links to the M7 and M4 Motorways.
- encourage a high standard of development that does not prejudice the sustainability of other enterprises or the environment.
- provide for small-scale local services such as commercial, retail and community facilities) that service or support the needs of employment-generating uses in the zone.

Table 4-1 provides a summary of the proposed construction methods and approximate chainages as relevant to the land tenure and zoning.

Table 4-1. Land tenure

Approx. chainage		LEP zoning	Land tenure	Proposed construction method
0.0	14.1	IND1	Fitzpatrick land (Lot 2 DP 1215268)	Connection with existing
14.1	45.2	IND1	RMS road easement	Trenchless technology
45.2	514.9	IND1	RMS road easement	Open trench
514.9	637.9	IND1	RMS road easement	Open trench
637.9	642.9	E2	Transgrid easement	Open trench / launch pit
642.9	650.9	E2	Transgrid easement	Trenchless technology
650.9	834.0	E2	Ropes Creek and riparian zone	Trenchless technology
834.0	916.7	IND1	RMS road easement (Lot 15 DP 1157491)	Trenchless technology
916.7	946.6	IND1	RMS road easement (Lot 15 DP 1157491)	Trenchless technology
946.6	1226.7	IND1	RMS road easement (Lot 16 DP 1157491)	Launch pit / open trench
1226.7	1242.4	IND1	RMS road easement (Lot 16 DP 1157491)	Trenchless technology

Approx. chainage		LEP zoning	Land tenure	Proposed construction method
1242.4	1253.9	IND1	RMS road easement (Lot 15 DP 1157491)	Trenchless technology
1253.9	1258.9	IND1	RMS road easement (Lot 15 DP 1157491)	Connection with existing

4.1.2 Potential impacts

Excavation for a short section of open trenching and a boring launching pit will be located on land zoned as E2 within the Transgrid electricity easement (see Figure 2-1). The easement is maintained through regular slashing to minimise vegetation for safety reasons. The works have been located within cleared areas. Consequently, the proposal would not adversely impact on the objectives of this zone.

The remainder of the proposed Section 8-10 water main will be installed within land zoned as IN1 and is consistent in facilitating the objective of this zone. In particular, the supply of potable water necessary for employment-generating development within the WSEA.

Short term impacts to the existing land uses will occur during the construction phase of the proposal, including traffic and pedestrian disruption and noise impacts (refer Section 4.7 and 4.8 respectively). Once completed, the proposal would be unlikely to have any residual impacts to current land uses.

4.2 Soil hazards

4.2.1 Existing environment

Soil

Both the road easement and riparian zone either side of the road bridge has been subject to substantial earthworks; compacting of subgrade base; application of cement, asphalt and rock rip rap.

The underlying soil landscapes in the proposal area are Blacktown and South Creek soils. Blacktown soils are characterised by moderate erodibility, poor drainage and expansive subsoils. South Creek soil areas are typified by floodplain on Quaternary Alluvium (alluvium, shale, sand and silt) in the Cumberland Plain. Erosion hazards include localised sheet and gully erosion and widespread streambank erosion.

Salinity

The proposal area is mapped as having moderate potential for salinity (DIPNR, 2002). PSM (2019) classes soils from four bore locations as slightly to moderately saline (refer geotechnical report provided in Appendix C).

Acid sulfate soil

The proposal is not located within the areas covered by the Acid Sulfate Soil Risk Map Data (2013), and PSM (2019) consider the risk of acid sulphate soils as low.

Contaminated lands

A search of the EPA Contaminated Land Record for the suburbs of Erskine Park and Eastern Creek did not find any recorded contaminated sites. Previous investigations for the Ropes Creek DCP on behalf of the Department of Planning Industry and Environment (DoPIE) also found no evidence for widespread contamination (Geotechnique, 2005, WSP | Parsons Brinckerhoff 2016).

4.2.2 Potential impacts

Due to the highly modified nature of the proposal area is it considered that impacts as a result of disturbance of potentially saline soils, acid sulfate soils or contamination are unlikely, providing environmental safeguards are in place.

Potential impacts that may occur due to erosion of soils exposed during the excavation of trenches and any stockpiling required is also considered to be a low risk, due to:

- The majority of the works being located within existing hardstand areas;
- Staging of the works to allow backfilling of open trenches prior to the end of each day's work;
- All works are located outside of flood prone areas mapped by Penrith and Blacktown Councils; and
- Implementation of environmental safeguards.

4.3 Water quality

4.3.1 Existing environment

Surface disturbance required for the proposal is located approximately 100m to the east and 175m to the west of Ropes Creek and is located outside of flood prone areas. No other drainage lines occur within the works area.

4.3.2 Potential impacts

Activities that have the potential to impact on the water quality of Ropes Creek include: the disturbance to soils and risk of erosion; and sediment and contaminant laden run-off during the construction phase of the proposal. In particular these risks can arise as a result of:

- Rain events occurring whilst holes / trenches are open;
- Fluid such as fuels, oils, hydraulic fluid, solvents etc. used in machinery and by workers on the site; and
- Inadequate erosion and sediment controls.

4.4 Groundwater

4.3.1 Existing environment

Geotechnical investigations conducted by PSM in May 2019 drilled five boreholes to a maximum depth of 15.0 m (refer Appendix C). Figure 4-1 shows the approximate locations of each borehole and Table 4-2 provides a summary of borehole locations and depths at which ground water was encountered.

Table 4-2. Detection of groundwater in boreholes

Borehole ID	Depth (m) water encountered	Construction method within vicinity of borehole
BH01	3.75 m	Under boring approximately 22 m towards Ropes Creek from proposed launch pit excavation at chainage 642.9 m
BH02	4.05	Under boring approximately 58 m towards Ropes Creek from proposed launch pit excavation at chainage 642.9 m
BH03	3.60	Under boring approximately 108 m towards Ropes Creek from proposed launch pit excavation at chainage 642.9 m
BH04	8.40	Under boring approximately 67 m towards Ropes Creek from proposed launch pit excavation at chainage 946.6 m

Borehole ID	Depth (m) water encountered	Construction method within vicinity of borehole
BH05	Not observed (terminated at 4.70 m)	Open trench excavation approximately 95 m east from proposed launch pit excavation at chainage 946.6 m.

4.3.2 Potential impacts

Based on the results from the geotechnical assessment provided in Appendix C, temporary dewatering of the proposed excavations is unlikely to be required.

Risks associated with the potential for groundwater to enter excavations are being avoided through the following:

- Maintaining excavation depths for trenching above anticipated groundwater levels; and
- Directional drilling beneath Ropes Creek and adjacent riparian corridor.

4.5 Biodiversity

4.5.1 Existing Environment

Native vegetation

The proposal's footprint is predominantly existing hardstand areas of the road easement. The surrounding environment, which has the potential to be impacted indirectly comprises the following areas:

- A small stand of native vegetation located within the Transgrid electricity easement;
- Ropes Creek and native vegetation associated with the Ropes Creek riparian corridor;
- Native trees planted as part of landscaping works associated with the construction of Lenore Drive; and
- Native macrophytes (aquatic and semi aquatic plants) located within a wetland constructed by the RMS to treat stormwater runoff discharging from Lenore Drive.

Threatened ecological communities

Mapping of remnant vegetation in the western Cumberland subregion (OEH, 2013) identifies Cumberland Plain Woodland and River-flat Eucalypt Forest within the proposal alignment.

Cumberland Plain Woodland is a critically endangered ecological community (CEEC) in NSW under the BC Act and nationally under the EBPC Act. River-flat Eucalypt Forest is an endangered ecological community (EEC) in NSW under the BC Act.

The construction of Lenore Drive and associated drainage infrastructure and other industrial development has cleared substantial areas of native vegetation mapped by OEH (2013) as is evident in Figure 4-1.

High biodiversity values

The proposal site also contains areas mapped as containing high biodiversity values identified under the BC Regulation (refer Section 3.4).

The construction of Lenore Drive and associated drainage infrastructure has cleared areas mapped as containing high biodiversity values, which is assumed to have been based on native vegetation mapped by OEH (2013). Figure 4-1 shows the extent of high biodiversity values in relation to the existing environment.

Threatened species

Six threatened fauna species and one migratory species were recorded during field surveys undertaken by Eco Logical (2016 within the Ropes Creeks Precinct north of Lenore, including:

- *Ardea ibis* (Cattle egret), listed as migratory under the EPBC Act
- *Falsistrellus tasmaniensis* (Eastern Freetail-bat) listed as vulnerable under the BC Act
- *Hieraaetus morphnoides* (Little Eagle) listed as vulnerable under the BC Act
- *Miniopterus schreibersii oceanensis* (Eastern Bent-wing Bat) listed as vulnerable under the BC Act
- *Myotis macropus* (Large-footed Myotis) listed as vulnerable under the BC Act
- *Pteropus poliocephalus* (Grey-headed Flying Fox) listed as vulnerable under the BC Act and EPBC Act
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) listed as vulnerable under the BC Act

Due to the highly disturbed nature of the road easement, the likelihood of any of the above listed species occurring within the proposal area is considered unlikely.

Introduced species

Vegetation within the proposal footprint is dominated by *Cynodon dactylon* (common couch) and introduced grasses such as *Chloris gayana* (Rhodes grass), *Eragrostis curvula* (African lovegrass) and *Paspalum dilatatum* (Paspalum).

No State or Regionally priority weeds identified in the Greater Sydney Region Strategic Weed Management Plan (LLS 2017-2022) are evident within the proposal footprint.

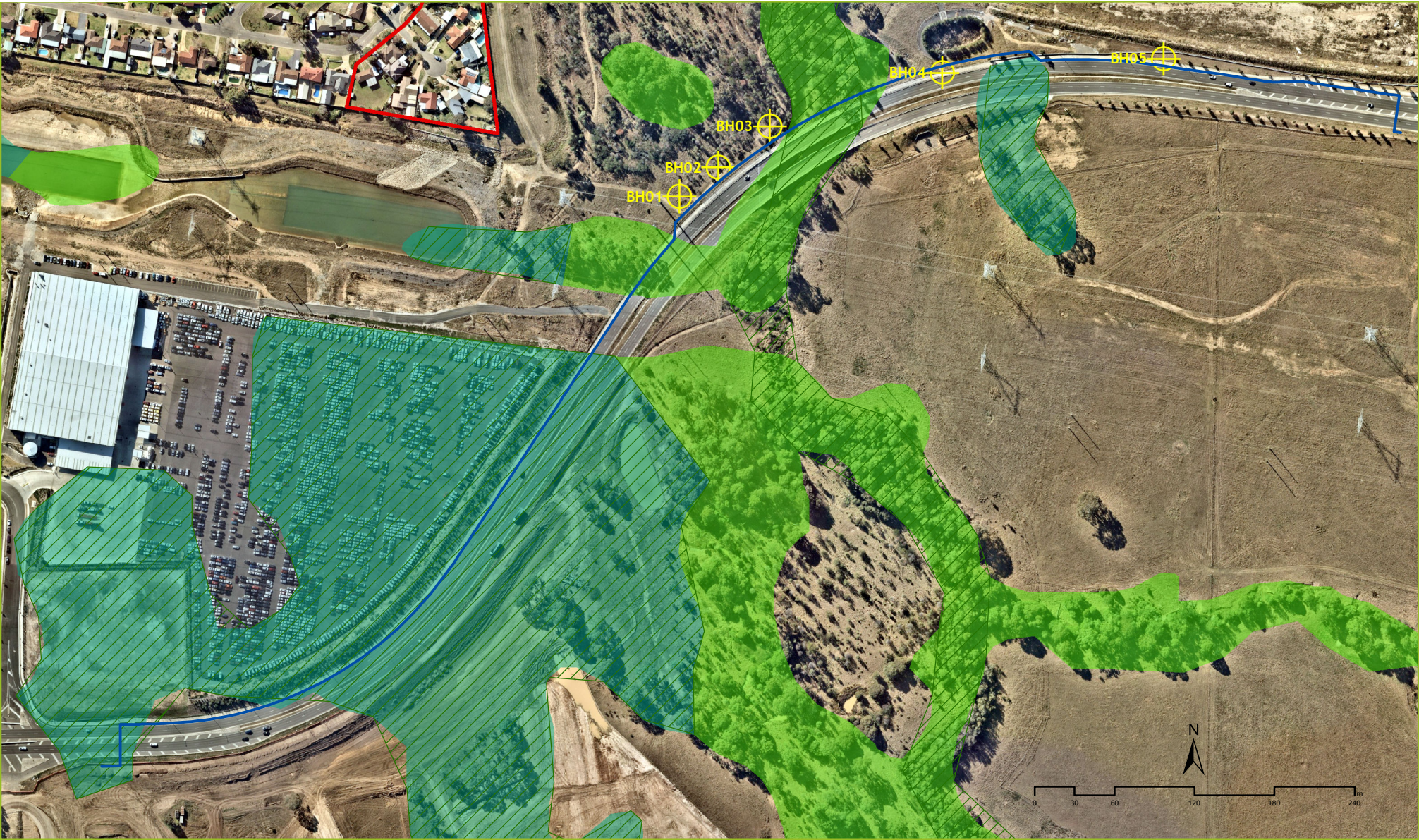
4.5.2 Potential impacts

No remnant native vegetation or fauna habitat would be cleared for the proposal.

The potential for native fauna to be harmed or be killed during construction activities is considered to be unlikely.

Notwithstanding, there is a potential for fauna to become trapped or take refuge in excavations.

The risk of indirect impacts to native vegetation (e.g. sedimentation, dust emissions, introduction/spread of introduced weed species) is considered low providing environmental safeguards are implemented.



- Section 8-10
- Borehole approx. location
- Residential_receivers
- Mapped areas of biodiversity value
- River-flat Eucalypt Forest
- Cumberland Plain Woodland

Lenore Drive Potable Water Lead in Section 8-10

Figure 4-1. Native vegetation and mapped high biodiversity values

Coordinate System: MGA Zone 56 (GDA 94)
Image sources: Nearmap 21 July 2019
Data: Cumberland Plain West 2013 E 4207

4.6 Heritage

4.6.1 Existing environment

The following databases were searched relevant to the proposal location:

- State Heritage Register (29 March 2019);
- Australian Heritage Database (29 March 2019); and
- NSW Aboriginal Heritage Information Management System (15 March 2019).

No registered sites were found within or proximal to the proposal site.

Review of an Aboriginal and historical heritage study prepared for the draft Ropes Creek DCP (Eco Logical Australia, 2016) found twenty items of indigenous heritage significance and the locally significant Chatsworth Estate homestead site within the Ropes Creek Precinct. All sites are located approximately 700 m north of the proposal.

4.6.2 Potential impacts

The proposal would involve excavation within the Lenore Drive road easement and under boring beneath Ropes Creek north of the Lenore Drive bridge.

Both the road easement and riparian zone either side of the road bridge has been subject to substantial earthworks; compacting of subgrade base; application of cement, asphalt and rock rip rap. Consequently, the risk of impacting on any previously unidentified heritage items as a result of the proposal is considered highly unlikely.

4.7 Traffic

4.7.1 Existing environment

Lenore Drive is a classified road managed by RMS. The alignment and road easement of Lenore Drive has been constructed to accommodate future road connections identified in the Erskine Park Road Network Concept approved by State government (Department of Planning, 2009). These include the Archbold Road extension and the Western North South Link Road.

Lenore Drive provides a shared path for pedestrian and cycling access y located along the northern side of the road.

There are no access roads to or from Lenore Drive within the proposal's footprint site nor is there any parking available.

A driveway and gated access to the Transgrid electricity easement is located at approximate chainage 553.2.

4.7.2 Potential impacts

No full road closures would be required for the proposal, however traffic control may be required to allow the movement of construction plant and equipment to and from the works areas.

Should any partial road closure or traffic controls (i.e. reduced speed limits), the proposal has the potential to temporarily increase travel time along Lenore Drive.

Access to the Transgrid electricity easement may be temporarily interrupted for up to 3 days, although there is alternative access to the easement

The public shared pathway would be temporarily impacted during construction. Redirecting pedestrians and cyclists to the other side of Lenore Drive is not possible.

4.8 Noise

4.8.1 Existing environment

The area around the proposal site is zoned industrial and with the majority of the location yet to be developed and currently vacant. Background noise in the area is dominated by traffic noise from Lenore Drive, including a high range of heavy vehicle movement.

At the closest point to the proposal works area, the nearest sensitive residential receivers are located approximately 160m away (Weaver Street and Cetus Place, Erskine Park) as shown on Figure 4-1.

4.8.2 Potential impacts

Typical noises arising from the proposal would be associated with excavation machinery, boring equipment, small machinery typical of building contractors, hand tools, compression equipment and generators as well as small and large trucks and on-site communications between personnel.

Additional noise may be generated from heavy vehicles having to slow down and/or stop due to traffic controls.

Potential noise impacts are not anticipated to be significant due to the existing background traffic noise and temporary nature of the works.

Once operational, the proposal will not result in any change to the acoustic environment.

4.9 Air Quality

4.9.1 Existing environment

The main sources of particulate matter in the vicinity of the proposal would predominantly be that from motor vehicle exhaust emissions. Other emissions from industrial activities may also impact on ambient air quality but as most of the immediate area is yet to be developed, this would be variable in response to climatic conditions.

4.9.2 Potential impacts

Potential impacts associated with construction of the proposal may include the generation of dust and additional emissions.

Dust is typically generated through vehicle movements on unsealed surfaces and from windblown dust generated from exposed areas. The sources of dust would be temporary in nature and only occur during the construction period. The works would not be located in close proximity to residents and therefore dust emissions are unlikely to cause disturbance, affect human health and coat windows, cars etc.

Exhaust emissions from the operations of construction vehicles and plant will also generate particulate emissions. Traffic disruptions during construction works also have the potential to increase vehicle emissions in the local area. These impacts would also be short-term.

5. Environmental Safeguards

The following safeguards have been developed to mitigate against potential impacts. They are to be:

- Included in tender specifications for the proposal; and
- Incorporated into a project-specific construction environmental management plan (CEMP).

The CEMP is to be endorsed by the Water Servicing Coordinator (WSC), approved by the Developer and reviewed by Sydney Water prior to any commencement of the works.

Table 5-1. Summary of environmental safeguards

Environmental safeguards		Timing
General		
1.	All project staff and contractors will be inducted on the environmental sensitivities of the work site(s) and relevant safeguards	Pre-construction
2.	The WSC will be notified immediately of any complaints relating to management of environmental issues	During construction
3.	To ensure compliance with Section 148(3) of the PoEO the Sydney Water Case Manager must be notified of any pollution incidents that have caused or threaten material harm to the environment.	
4.	The WSC will be notified if damage occurs to an area (vegetation, etc) outside of the nominated work area	
Soil and erosion		
1.1	Prepare and implement an erosion and sediment control map	Pre-construction
1.2	Install erosion and sediment control measures before construction commences	
1.3	Develop contingency /incident measures for dealing with rain	
1.4	Divert surface runoff away from sensitive areas and stockpiles	During construction
1.5	Inspect erosion controls weekly and after rainfall. Fix damaged controls immediately	
1.6	Sweep roads/pathways at least daily, and before rainfall	
1.7	Open trench excavations are to be staged to enable progress backfilling of installed pipeline prior to the end of each day's work	
1.8	Stabilise all other disturbed areas as soon as possible	
1.9	Backfilling of the trench excavation shall ensure that subsoil and topsoil layers are replaced in the order they were removed and compacted appropriately to ensure that preconstruction surface levels are reinstated	
Contamination		
2.1	The CEMP shall include an unexpected finds procedure should suspected contaminants be encountered (e.g. asbestos, discoloured soil, chemical or petrol odours, refuse or leachate)	Pre-construction
2.2	Should any suspected hazardous materials be observed during construction activities stop works and notify the WSC /Sydney Water	During construction

Environmental safeguards		Timing
Water quality		
3.1	Develop emergency procedures for chemical/fuel spills	Pre-construction
3.2	Discharge any potable water in accordance with Sydney Water's Discharge Protocols	During construction
3.3	Keep a functioning 'spill kit' on site at all times	
3.4	Store chemicals and fuels within designated bunded areas, identified with appropriate signage. Record all stored chemicals on a register with their MSDS's	
3.5	Do not use equipment with fuel, oil or hydraulic leaks. Repair or remove equipment immediately	
3.6	Test excavation water (should dewatering be necessary) to ensure suitable quality for ground/stormwater disposal	
Heritage - Aboriginal and non-Aboriginal		
4.1	An unexpected finds / stop work protocol will be included in the CEMP	Pre-construction
4.2	If an item (or suspected item) of heritage is discovered, cease works and contact the WSC and Sydney Water as soon as possible	During construction
4.3	Stop work if human remains are found and contact NSW Police	
Flora and fauna		
5.1	Delineate no-go areas on site plans to protect flora and fauna	Pre-construction
5.2	An unexpected finds / stop work procedure will be included in the CEMP	
5.3	No native vegetation clearing is permitted	During construction
5.4	Any weeds and/or topsoil material likely to be infested with weeds will be bagged, removed from site within a week and disposed of at a licensed waste disposal facility	
5.5	Open excavations are to be checked daily to ensure they are clear of fauna	
5.6	If fauna is found on the construction site, stop work - all native fauna is protected. Do not touch animal, wait for it to leave. If it is a threatened species, call an ecologist immediately for advice. If not threatened, call WIRES or a rescue agency	
5.7	Vehicles, plant and machinery are to be clean and free of soil or vegetative materials when arriving the works areas to ensure weeds and/or pathogens are not introduced to the site	
Noise and Vibration		
6.1	Construction work and deliveries shall only be carried out during the following hours: Mondays to Fridays: 7am to 6pm; Saturdays: 8am to 1pm. Sundays and Public Holidays: No work or deliveries permitted	During construction
6.2	Equipment will have noise mufflers and be well maintained	
Air quality - dust		
7.1	Cover all loads	

Environmental safeguards		Timing
7.2	Monitor work areas and stockpiles for dust generation and seed/cover/spray to suppress	During construction
7.3	No matter of any kind is to be burnt	
7.4	Maintain equipment to ensure no exhaust particulates are visible for more than 10 continuous seconds	
7.5	Do not leave vehicles idling	
Traffic and access		
8.1	A Traffic Management Plan is to be developed for implementation during construction work to the satisfaction of RMS including: - Staging plans, including temporary traffic and pedestrian arrangements; and - Construction traffic control plan	Pre-construction
8.2	If required, a Road Occupancy Licence under the <i>Roads Act 1993</i> must be obtained before works commence	
8.3	Consultation with Transgrid is to be undertaken regarding access requirements to the electricity easement.	
Waste Management		
9.1	Waste will be reused or classified and removed as soon as practicable and disposed of in accordance with the EPA’s 2014 waste classification guidelines to a licenced waste disposal facility	During construction
9.2	Transport and disposal dockets will be kept as proof of correct disposal for everything that leaves site	
9.3	Secure all wastes to avoid pollutants escaping	
9.4	Any re-useable and recyclable materials and fittings will be removed and stored safely and securely	
9.5	Stop works and notify the WSC /Sydney Water if any contamination is discovered	
Social and visual		
10.1	Contain all work within the boundaries designated on the site plan	During construction
10.2	Restore work sites to as close to their original condition as possible	
10.3	Minimise spread of stockpiles, waste, and parking	
10.4	Notify the WSC immediately of any complaints or any accidental damage to property	
10.5	All personnel will exercise courtesy in dealing with the community	

6. Clause 228 of the EP&A Regulation

Clause 228 of the EP&A Regulation 2000 provides details of what must be taken into account when considering the impact of any activity on the environment with Subclause 2 providing the specific guidelines to be taken into account (refer Table 6-1).

Table 6-1. Response to Clause 228 (2) EP&A Regulation 2000

Subclause 2 guidelines	Response
a) Any environmental impact on a community	Construction activity may cause minor temporary impacts due to noise, dust emissions and vibration related to earthwork and construction activities. These impacts would be short term and would be controlled by implementing environmental safeguards. There will be environmental improvements by providing a reliable potable water service to local industry
b) Any transformation of a locality	The proposed work is a subsurface installation and would not result in any residual transformation of the locality.
c) Any environmental impact on the ecosystems of the locality	The proposed work will not result in environmental impacts to ecosystems of the locality. The works have been designed to avoid the need to clear native vegetation.
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	As a subsurface installation the proposed work will not result in a reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality.
e) Any effect on a locality, place, or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance of other special value for present or future generations	No non-Aboriginal localities, places or buildings of significance or special value occur within the road easement of Lenore Drive or would be affected by the proposal.
f) Any impact on the habitat of protected fauna (within the meaning of the NP&W Act)	The proposed work will not have any impact on the habitat of protected fauna. The works have been designed to avoid any impacts to habitat of protected fauna.
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	The proposed work will not be endangering any species of animal, plant or other form of life, whether living on land, in water or in the air.
h) Any long-term effects on the environment	The proposed work will be relatively short in duration and will not result in any residual or long-term impacts on the environment.
i) Any degradation of the quality of the environment	The proposed work will not cause the degradation of the quality of the environment.
j) Any risk to the safety of the environment	The proposed work is not considered to pose any risk to the safety of the environment.
k) Any reduction in the range of beneficial uses of the environment	The proposed work will not have any reduction in the range of beneficial uses of the environment.

Subclause 2 guidelines	Response
l) Any pollution of the environment	Environmental safeguards will mitigate the potential for the proposed work to pollute the environment. No pollution of the environment is expected.
m) Any environmental problems associated with the disposal of waste	The disposal of wastes will be conducted in accordance with the environmental safeguards, and no environmental problems associated with the disposal of waste are expected.
n) Any increased demands on resources (natural or otherwise) that area, or are likely to become, in short supply	The proposed work will not increase demand on resources, that are, or are likely to become, in short supply.
o) Any cumulative environmental effect with other existing or likely future activities	The proposed work will not have any cumulative environmental effect with other existing or likely future activities.
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	Not applicable. The proposed work is not located in a coastal zone.

7. References

Department of Planning (2009) Major Project Assessment - Erskine Park Link Road Network Concept Plan. Director-General's Environmental Assessment Report August 2009

DIPNR (2002) Salinity potential in Western Sydney 2002 ISBN 0 7347 5303 9

Map of salinity potential in Western Sydney 2002

Eco Logical Australia (2015) Lot 10 DP 1157491, Eastern Creek, NSW - Historical and Aboriginal Heritage Study. Prepared for the Department of Planning & Environment.

Eco Logical Australia (2015) Ropes Creek Precinct - Biodiversity and Riparian Assessment. Prepared for Department of Planning and Environment.

GHD (2016) Oakdale Industrial Development - Planning of Water Related Services. 21/25274 Report for Sydney Water July 2016

PSM (2019) Oakdale Estate - Lenore Drive, Erskine Park. Geotechnical Investigation - Potable Water Main. Report prepared for AT&L dated 14 June 2019

WSP | Parsons Brinckerhoff (2016) Land Capability, Salinity and Contamination Assessment Ropes Creek. Report prepared for the Department of Planning and Environment, NSW October 2016

Appendix A. Drawings



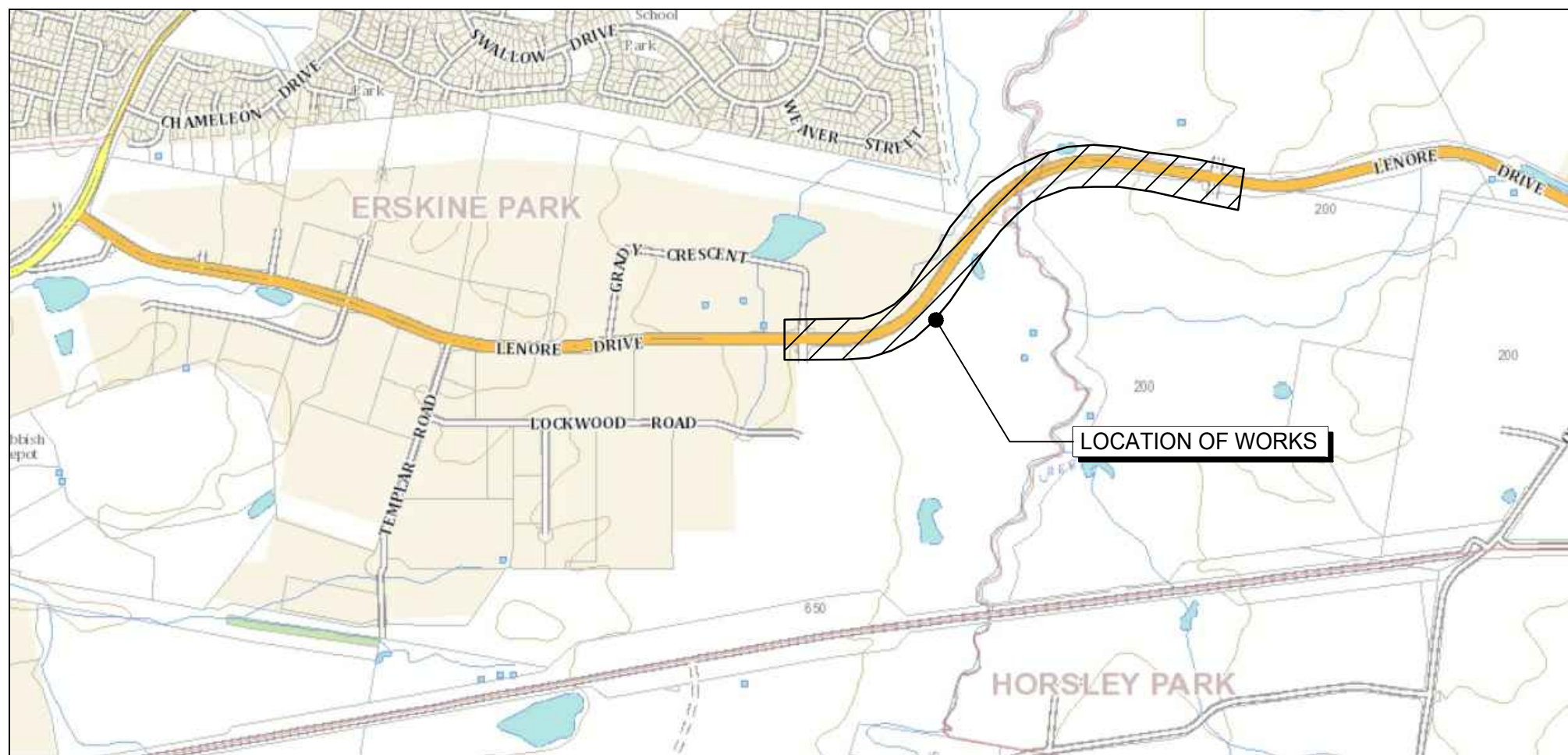
NOTES :-

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FOR: GOODMAN PROPERTY GROUP(AUST) PTY LTD
L17, 60 CASTLEREAGH ST, SYDNEY NSW 2000
PH:(02) 9230 7400

1. MAIN TO BE LAID GENERALLY 0.75m BEHIND FACE OF KERB UNLESS OTHERWISE SHOWN ON PLAN. CONTRACTOR TO LOCATE AND MARK SERVICES BEFORE CONSTRUCTION COMMENCEMENT.
2. PRECAUTIONS MAY BE NECESSARY IN THE VICINITY OF SUB-STATION EARTHING.
3. COMPACTION REQUIREMENTS UNDER RMS ROADS, FOOTPATHS AND PROPERTY TO BE IN ACCORDANCE WITH RMS STANDARD REQUIREMENTS, DETAILED IN THE ROAD WORKS SPECIFICATIONS.
4. COMPACTION TESTS SHALL BE UNDERTAKEN IN ACCORDANCE WITH CLAUSE 19.3 OF WSA 03-2011:
PIPE EMBEDMENT ZONE: (APPROVED MATERIALS TO BE USED)
TRENCH FILL ZONE - TRAFFICABLE: NIL (TOP LAYER ON TOP OF CEMENT STABILIZED SAND BACKFILLING) REFER NOTE 17.
TRENCH FILL ZONE - NON TRAFFICABLE: 10
5. ALL STOP VALVES TO BE ANCHORED IN ACCORDANCE WITH SYDNEY WATER DEEMED TO COMPLY DRAWING DTC-1115.
6. CONSTRUCTOR SHALL COORDINATE AND LIAISE WITH ALL RELEVANT SERVICE AUTHORITIES.
7. SERVICES SHOWN ARE INDICATIVE OR PROPOSED ONLY. CURRENCY, COMPLETENESS AND ACCURACY ARE NOT TO BE PRESUMED. A CURRENT SERVICES SEARCH, INCLUDING 'DIAL BEFORE YOU DIG' SERVICES PLANS, AND SITE CHECKING OF ALL EXISTING SERVICES WILL BE NECESSARY PRIOR TO COMMENCING ANY WORK. APPROPRIATE PROCEDURES, PRECAUTIONS AND CARE TO BE TAKEN WHEN IN CLOSE PROXIMITY OF ANY SERVICES.
8. MAINS TO BE RELATED TO PROPERTY BOUNDARIES FOR WORK-AS-CONSTRUCTED PURPOSES FIXTURES, TEES BENDS, EVERY CHANGE OF DIRECTION (VERTICAL OR HORIZONTAL) & PROPERTY SERVICE CONNECTIONS NOT TO BE BACKFILLED UNTIL WAC DETAILS HAVE BEEN OBTAINED AND RECORDED BY THE DESIGNER AND SURVEYED BY SITE SURVEYOR AND APPROVED BY THE WATER SERVING CO-ORDINATOR. RELEVANT SURVEYED INFORMATION SHALL BE ADDED ON A SITE PLAN BY SURVEYOR AND SUPPLIED TO DESIGNER IN AUTOCAD FORMAT FOR INCLUSION ON THE WAC DRAWINGS. FOR AREA WHERE MAINS CAN NOT BE TIED TO PROPERTY BOUNDARIES THESE SHALL BE SURVEYED AND COORDINATES PROVIDED TO DESIGNER SO MAINS CAN BE TIED TO SSM OR PM.
9. ALL SAFETY PRECAUTIONS TO BE TAKEN FOR ELECTRICAL EARTHING OF BUILDINGS WHEN DISCONNECTING/CONNECTING WATER PROPERTY CONNECTION SERVICES.
10. THRUST BLOCKS FOR BENDS, TAPERS, STOP VALVES AND VERTICAL BENDS TO BE CONSTRUCTED IN ACCORDANCE WITH SYDNEY WATER DEEMED TO COMPLY DTC-1110, DTC-1112, DTC-1113, DTC-1114 & DTC-1115.
11. SUBSURFACE CONDITIONS, INCLUDING FILL, GROUNDWATER, CONTAMINATION, AND UNRECORDED BURIED MATERIAL OR OBJECTS, MAY BE ENCOUNTERED DURING CONSTRUCTION, REQUIRING FURTHER ENVIRONMENTAL AND GEOTECHNICAL ASSESSMENT AND APPLICATION OF THE APPROPRIATE CONSTRUCTION METHODS AND STANDARDS. CONCRETE ENCASEMENT MAY BE REQUIRED ON SECTIONS OF WATERMAIN OTHER THAN WHERE INDICATED. CONDITIONS MAY REQUIRE CONSTRUCTION FOR FOUNDATIONS IN BAD GROUND.
12. WATER MAINS TO CROSS UNDER OR ABOVE THE EXISTING SERVICES WITH THE MINIMUM CLEARANCES SPECIFIED IN TABLE 5.5 OF WATER SUPPLY CODE - SYDNEY WATER EDITION. REFER TO SERVICES CLEARANCE TABLE PROVIDED IN EACH SHEET.
13. ALL ROADS, CHAMBERS, PITS AND SURFACE COVERS PROPOSED FINISHED LEVELS SHALL BE RECONFIRMED AT TIME OF CONSTRUCTION BY MAIN ROAD CONTRACTOR AND ROAD CIVIL DESIGN DRAWINGS.
14. FILLED AREAS SHALL BE FORMED TO PROPOSED FINISHED SURFACE LEVELS COMPACTED AND THEN PIPE TRENCH TO BE EXCAVATED FOR PIPE LAYING. FOR EMBEDMENT ZONE AND TRENCH DETAIL REFER TO SYDNEY WATER STANDARD DRAWING WAT-1250-S & WAT-1251-S AND PENRITH CITY COUNCIL REQUIREMENTS FOR COMPACTION.
15. CONSTRUCTOR TO PREPARE A WORK METHOD STATEMENT IN CONJUNCTION WITH THE REVIEW OF ENVIRONMENTAL FACTORS AND SUBMIT TO SWC FOR APPROVAL PRIOR TO COMMENCEMENT.
16. ALL STEEL MAINS SHALL BE F.B.P.E. COATED TO AS 4321, UNLESS ENCASED IN REINFORCED CONCRETE.
17. THE EMBEDMENT OF MAINS UNDER MAJOR ROADS AND FOOTPATHS OF MAJOR ROADS SHALL BE CEMENT STABILISED SAND UNLESS OTHERWISE SPECIFIED.
18. SYDNEY WATER REQUIREMENTS FOR CONTRACTOR ELECTRICAL SAFETY DATED 19/12/2011 TO BE APPLIED IN CONJUNCTION WITH THE PROJECT SAFETY PLAN AND THE WORK METHOD STATEMENT.

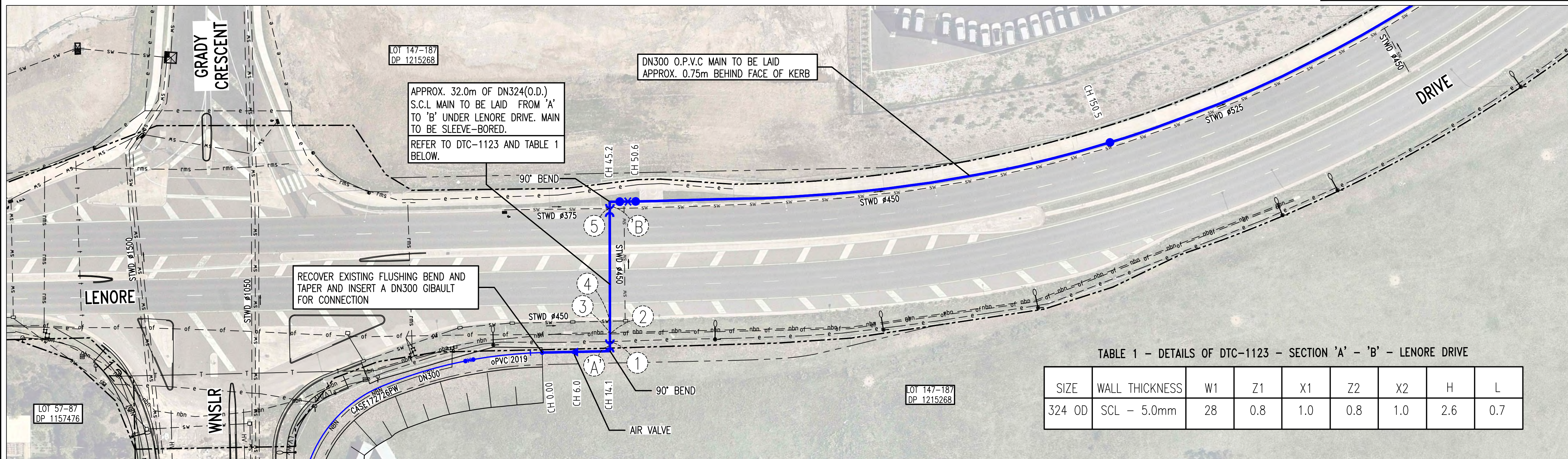


LOCALITY PLAN
NTS

THE PROPOSED WORKS DETAILED HERE ON TO BE CONSTRUCTED IN ACCORDANCE WITH WATER SERVICES ASSOCIATION OF AUSTRALIA (W.S.A.A.) NATIONAL CODES SYDNEY WATER EDITION AND SYDNEY WATER "DEEMED TO COMPLY" DRAWINGS DTC-1110, DTC-1111, DTC-1112, DTC-1113, DTC-1114, DTC-1115 & DTC-1123. THE SUB-CONTRACTOR MUST HAVE A COPY OF THESE DOCUMENTS ON SITE AT ALL TIMES. FOR THE FOLLOWING DOCUMENTS REFER: WATER SUPPLY CODE OF AUSTRALIA WSA 03-2011-3.1 SYDNEY WATER EDITION-2012, POLYETHYLENE PIPELINE CODE OF AUSTRALIA (WSA 01-2004, THIRD EDITION, VERSION 3.1), ALL RELEVANT AUSTRALIAN STANDARDS INCLUDING BUT NOT LIMITED TO AS/NZS 2566.2:2002 BURIED FLEXIBLE PIPELINES, PART 2: INSTALLATION ALL RELEVANT CURRENT SYDNEY WATER TECHNICAL SPECIFICATIONS, THE REQUIREMENTS OF ALL RELEVANT STATUTORY AUTHORITIES

CONTACT DIAL BEFORE YOU DIG

MAJOR TELECOMMUNICATION/OPTICAL FIBRE CABLES ARE LOCATED IN THIS AREA. SITE LOCATION CHECK AND FIELD VERIFICATION BY APPROVED PLANT LOCATORS IS MANDATORY PRIOR TO CONSTRUCTION. LOCATION OF SERVICES SHOWN ON PLAN IS INDICATIVE ONLY. CONTACT DIAL BEFORE YOU DIG PRIOR TO CONSTRUCTION.



CONTINUATION ON SHEET 2

PIPE SCHEDULE

SIZE DN	TYPE	CLASS	LENGTH	PIPE JOINING METHOD / NOTES
300	O.P.V.C	PN16	890.6m	RRJ
324	SCL	5.00mm	56.7m	WELDED
150	D.I.C.L	PN35	9.0m	RRJ
300	D.I.C.L	PN35	15.0m	RRJ
400	PE100	SDR9	300.0m	BEJ, EFJ
400	RC	2	51.5m	RRJ
300	U.P.V.C	SN8	66.5m	RRJ
100	U.P.V.C	SN8	72.2m	RRJ

TABLE 1 - DETAILS OF DTC-1123 - SECTION 'A' - 'B' - LENORE DRIVE

SIZE	WALL THICKNESS	W1	Z1	X1	Z2	X2	H	L
324 OD	SCL - 5.0mm	28	0.8	1.0	0.8	1.0	2.6	0.7

01	ISSUE FOR SYDNEY WATER APPROVAL	J.H	21/08/19
No.	AMENDMENT DESCRIPTION	BY	DATE

PLAN
SCALE 1:500

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS SYDNEY WATER CORPORATION	UTILITIES						WORK AS CONSTRUCTED CERTIFICATION						PIPE SCHEDULE					AUSTRALIAN HEIGHT DATUM		NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.	SYDNEY WATER CORPORATION			
	TYPE	DATE	REF.	TYPE	DATE	REF.	DEVELOPER	WATER SERVICE CO-ORDINATOR	CONSTRUCTOR	COMPLETED	W.A.C. PREPARED	DESIGNER	I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.	SIZE DN	TYPE	CLASS	LENGTH				PIPE JOINING METHOD / NOTES	SCALES		Case No.172727PW
PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT :- DIAL BEFORE YOU DIG Ph. 1100 ELECTRICITY Ph. GAS Ph. TELECOMMUNICATIONS Ph. GIVING AT LEAST 48 HOURS NOTICE.	EX WATER:	14/06/19	14390765	PROP. WATER:																				
	EX STORMWATER:	14/06/19	14390765																					
	EX ELECTRIC:	14/06/19	14390765																					
	EX OPTICAL FIBER:	14/06/19	14390765																					
	EX OVERHEAD ELEC:	14/06/19	14390765																					
	EX NBN:	14/06/19	14390765																					
	EX GAS:	14/06/19	14390765																					
DESIGN HEAD, 120 m																			BOUNDARY TRAPS REQUIRED.		U.B. DIRECTORY MAP206, F5 (41ST ED)		WATERMAIN EXTENSION OAKDALE WEST HORSLEY PARK	
SHEET 1 OF 5																			File No. N/A		PENRITH			

REFERENCE: 15-272 F

DESIGNED: J.H

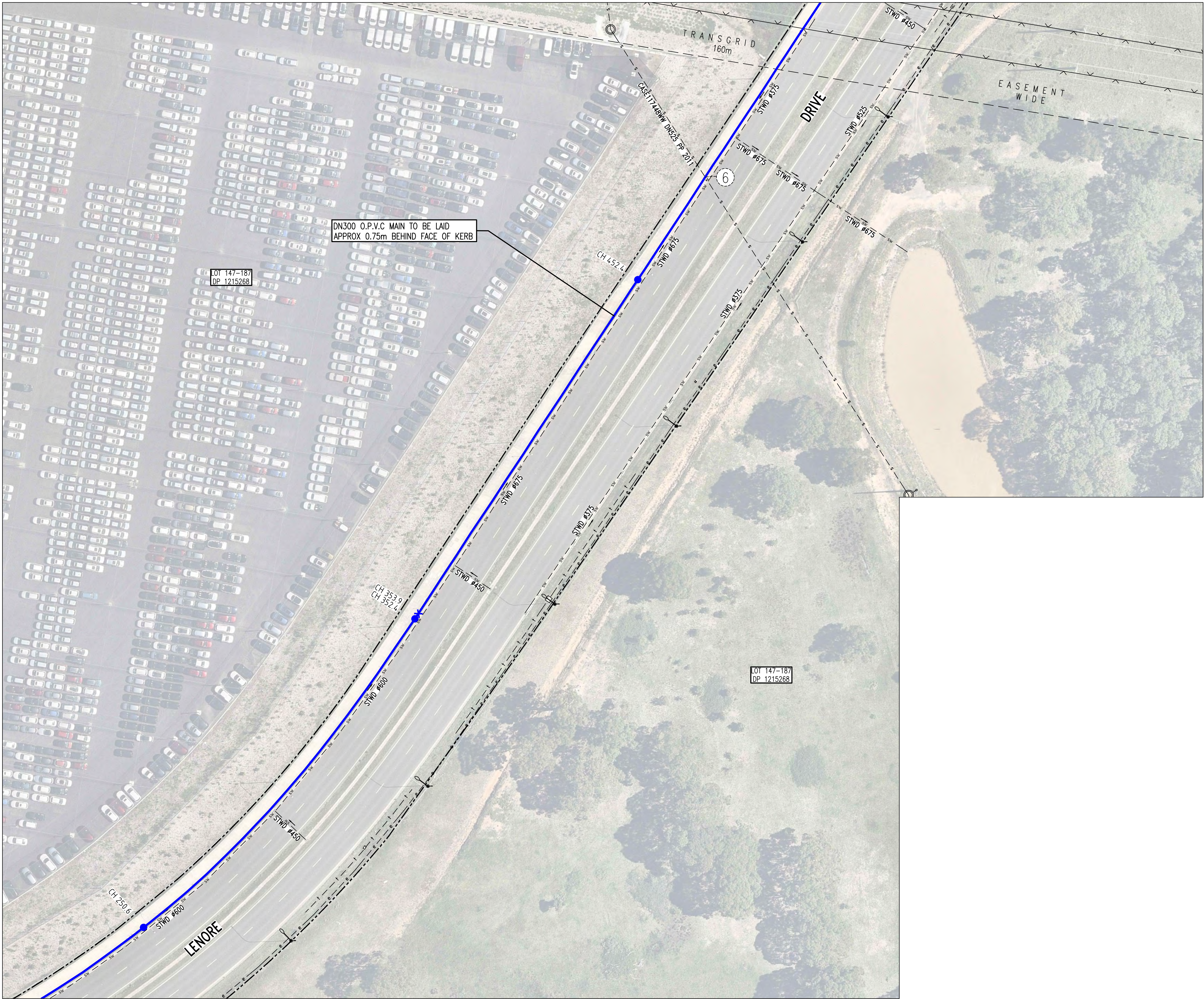
DRAFTED: J.H

VERIFIED: B.J

REVIEWED: B.J

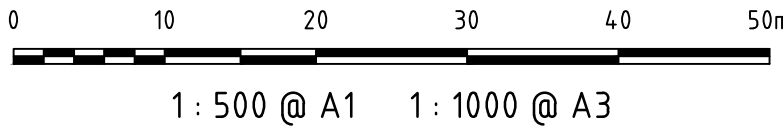
APPROVED:

DATE:



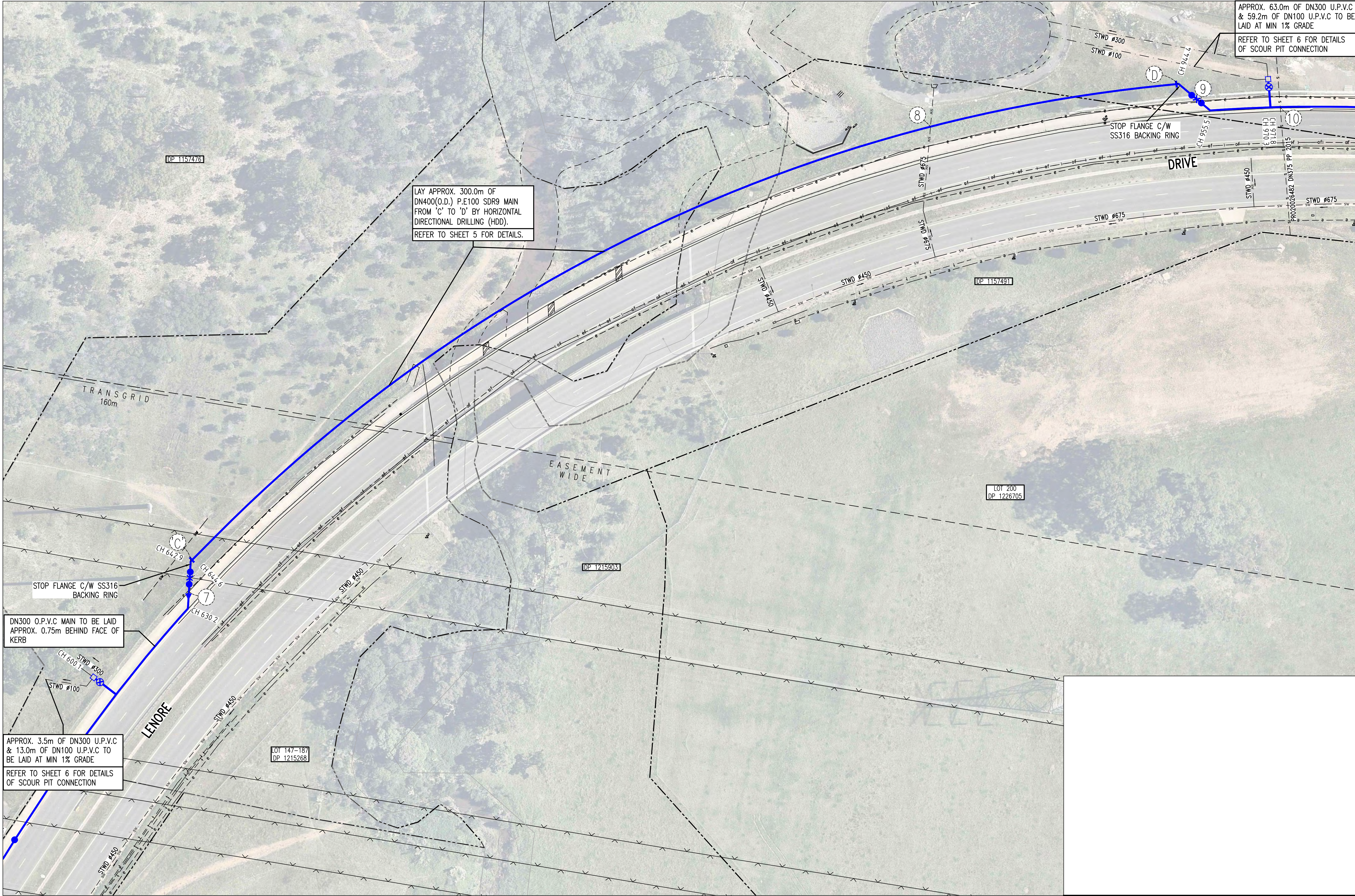
CONTINUATION ON SHEET 1

PLAN
SCALE 1:500



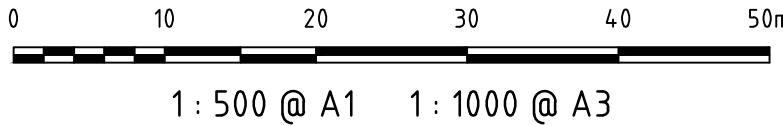
01	ISSUE FOR SYDNEY WATER APPROVAL	J.H	21/08/19
No.	AMENDMENT DESCRIPTION	BY	DATE

WORK AS CONSTRUCTED CERTIFICATION		Sydney WATER SYDNEY WATER CORPORATION	
DEVELOPER	W.S.C.	Case No. 172727PW	SHT 2 OF 6 SHTS.
CONSTRUCTOR	COMPLETED	WATERMAIN EXTENSION	
W.A.C. PREPARED		SYDNEY WATER CORPORATION	
DESIGNER		FOR DETAILS OF SERVICES SEE SHEET 1	
I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS			



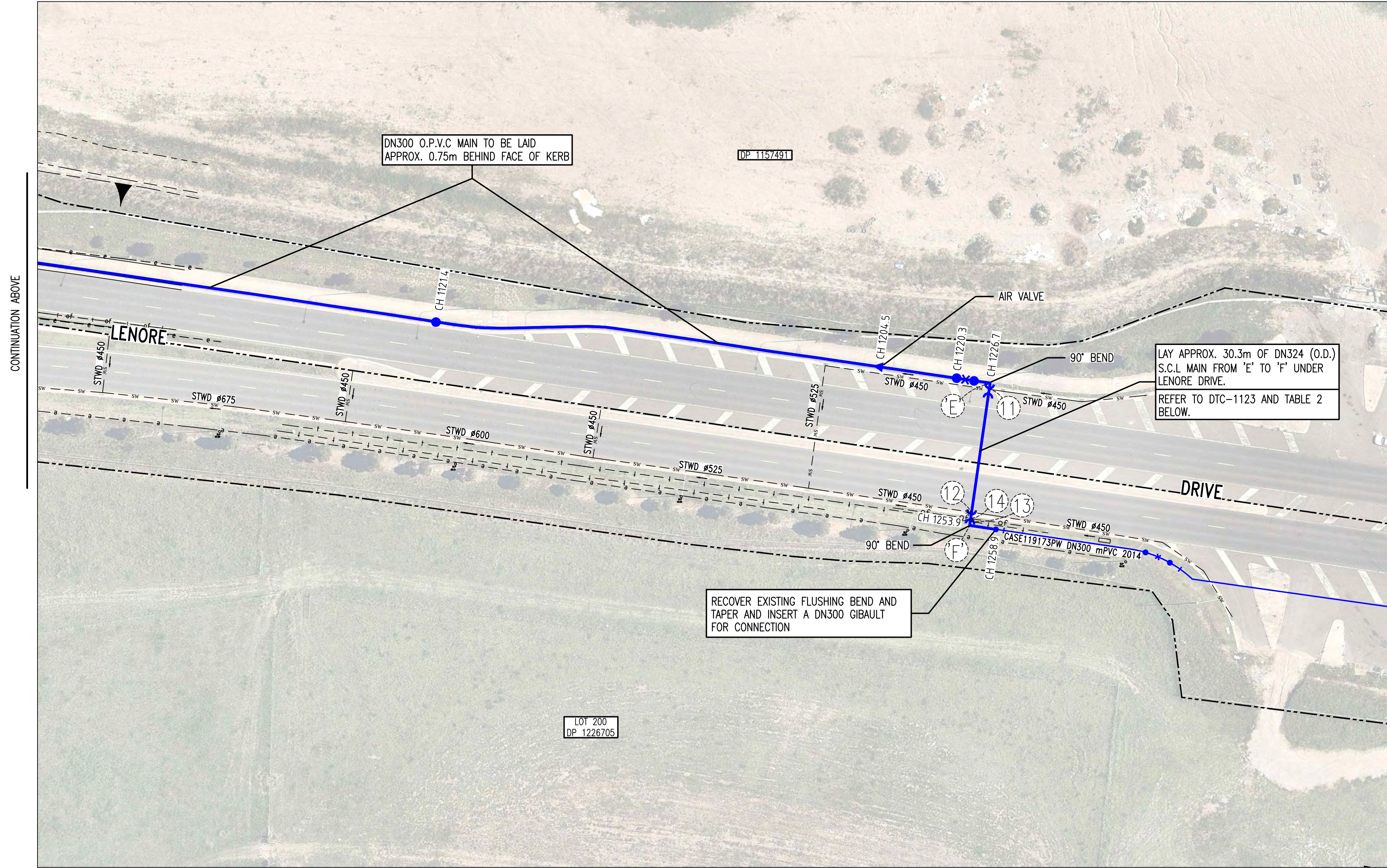
CONTINUATION ON SHEET 2

PLAN
SCALE 1:500



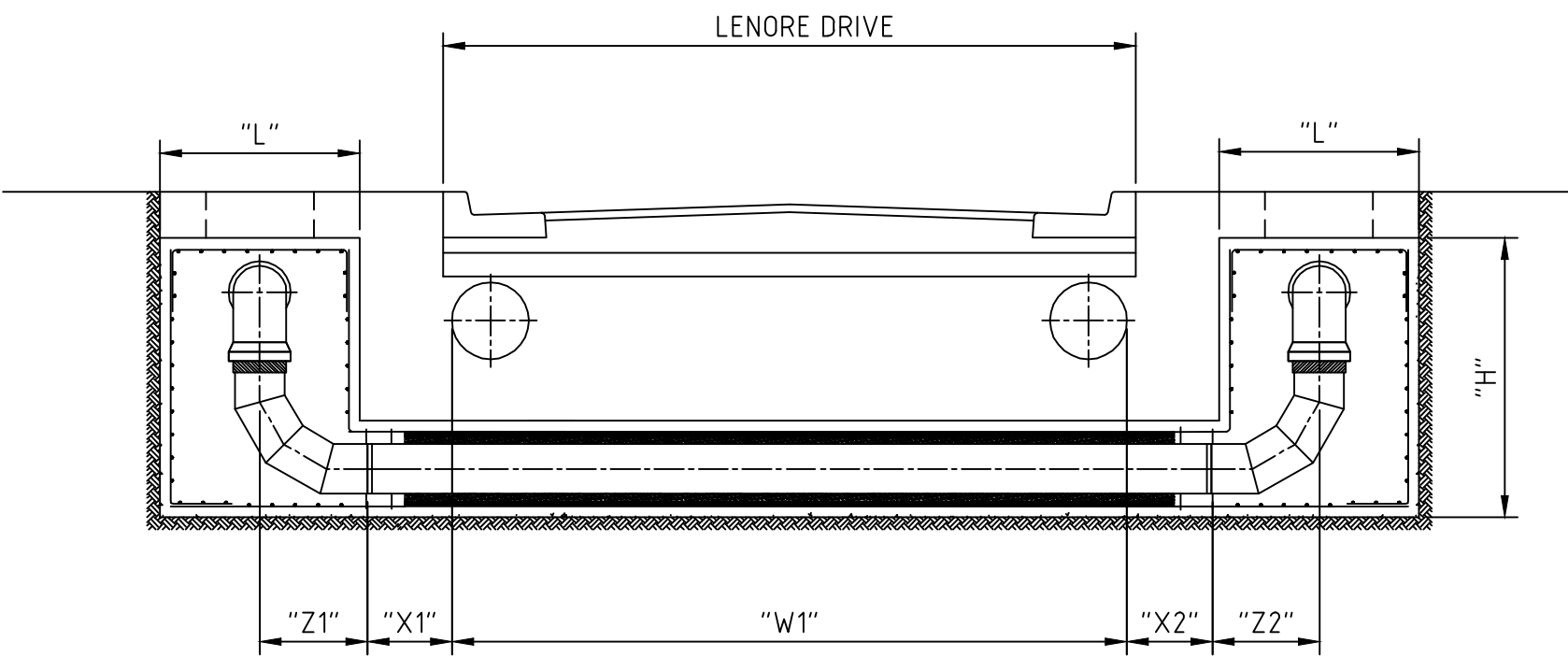
01	ISSUE FOR SYDNEY WATER APPROVAL	J.H	21/08/19
No.	AMENDMENT DESCRIPTION	BY	DATE

WORK AS CONSTRUCTED CERTIFICATION		Sydney WATER SYDNEY WATER CORPORATION	
DEVELOPER	.....	W.S.C.	.....
CONSTRUCTOR	.....	COMPLETED	.....
W.A.C. PREPARED	.....	DESIGNER	.....
I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS		FOR DETAILS OF SERVICES SEE SHEET 1	



SERVICES CLEARANCE TABLE					
CROSSING TYPE	SERVICE TYPE	SERVICE COVER	WM COVER	CLEARANCE	LAY MAIN OVER OR UNDER
1	LV	1.0m	2.5m	1.4m	UNDER
2	OPTIC FIBER	0.5m	2.5m	1.9m	UNDER
3	NBN	0.6m	2.5m	1.9m	UNDER
4	STWD (#450)	1.66m	2.5m	0.3m	UNDER
5	STWD (#375)	1.05m	2.5m	1.0m	UNDER
6	SEWER	4.15m	0.75m	3.10m	OVER
7	LV	1.0m	1.4m	0.3m	UNDER
8	STWD (#675)	2.0m	8.4m	7.4m	UNDER
9	LV	1.0m	1.5m	0.4m	UNDER
10	SEWER	8.4m	0.75m	7.4m	OVER
11	STWD (#450)	0.96m	1.9m	0.40m	UNDER
12	STWD (#450)	0.96m	1.9m	0.4m	UNDER
13	LV	0.5m	1.9m	1.3m	UNDER
14	OPTIC FIBER	1.0m	1.9m	0.9m	UNDER

PLAN
SCALE 1:500

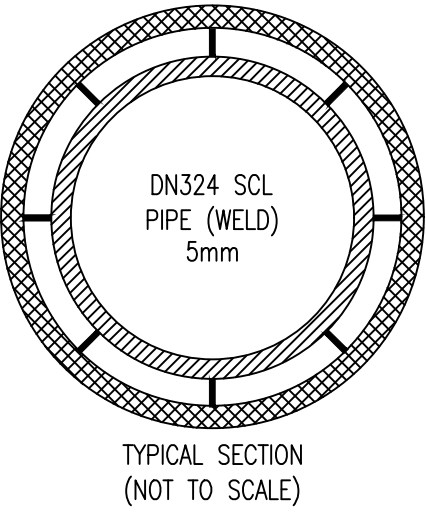


DETAIL FOR CROSSING UNDER LENORE DRIVE
NTS

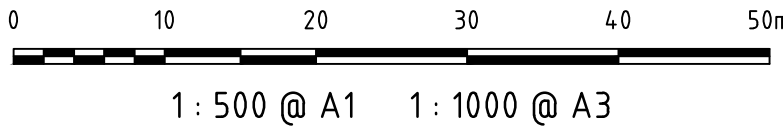
TABLE 2 - DETAILS OF DTC-1123 - SECTION 'E' - 'F' - LENORE DRIVE

SIZE	WALL THICKNESS	W1	Z1	X1	Z2	X2	H	L
324 OD	SCL - 5.0mm	25.5	0.8	2.0	0.8	1.2	2.4	0.7

MAJOR ROADWAY CROSSING - TRENCHLESS INSTALLATION
DN324 SCL MAIN LINE 1 (CH 14.1 - CH 45.2) AND
(CH 1226.7- CH 1253.9)
(COLLARED PIPE IN DN400 JACKING RC PIPE)

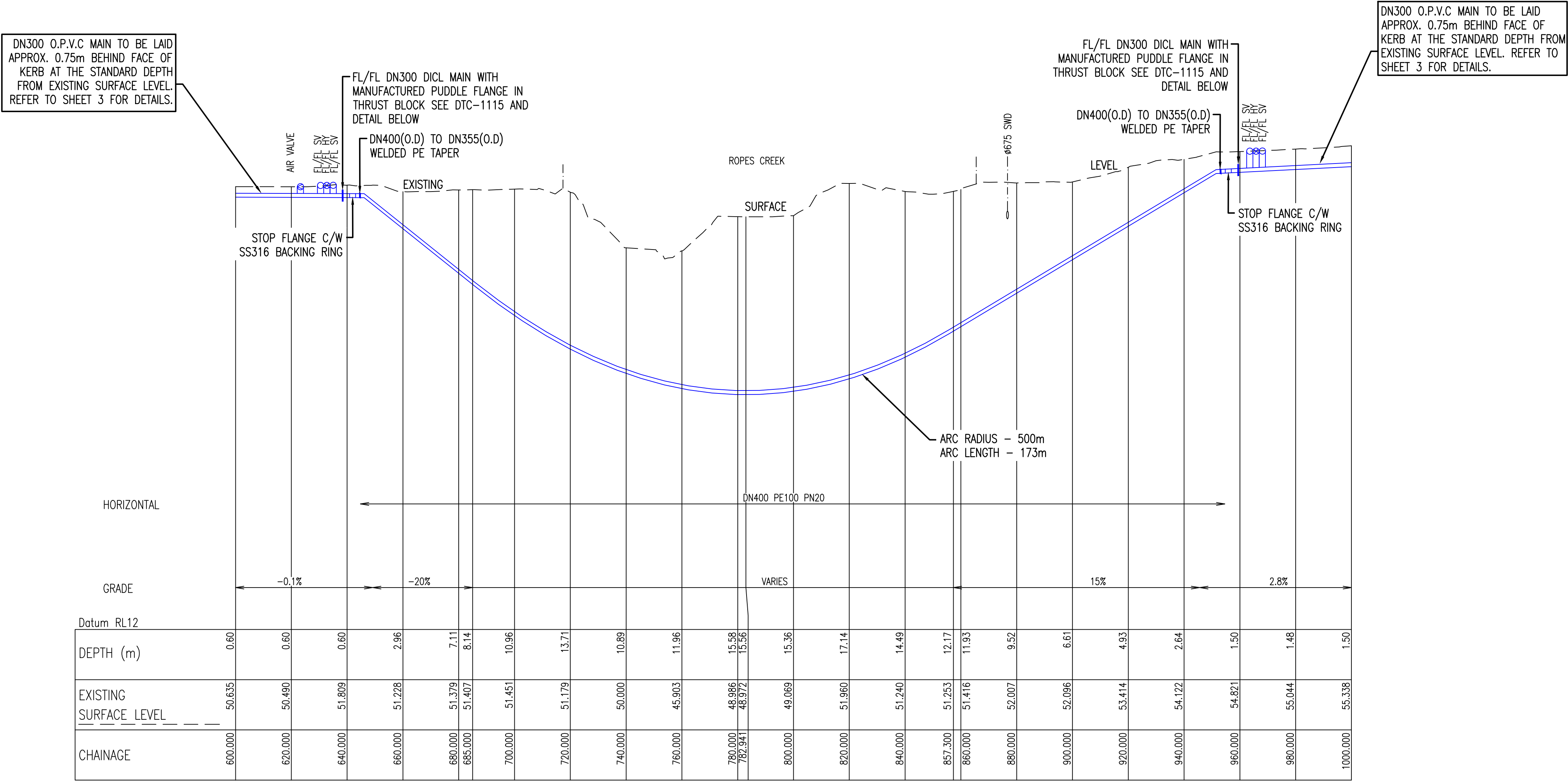


- DN324 SCL 5mm THICKNESS PIPE (FULLY WELDED PIPE) TO BE INSTALLED WITHIN ID 400(OD540) RC JACKING PIPE .
- SPACERS TO BE USED TO HOLD PIPE CENTRAL IN SLEEVE.
- SPACERS TO BE INSTALLED EVERY 2000mm FREQUENCY.
- VOID AREA BETWEEN PIPE BARREL & SLEEVE PIPE TO BE COMPLETELY FILLED WITH GROUT.
- TO PERMIT FLOW THROUGH ENTIRE VOID WITHOUT CLOGGING, GROUTING MIX TO COMPRISE A CEMENT FLY ASH FLUIDIFIER AND WATER, OR EQUIVALENT.



01	ISSUE FOR SYDNEY WATER APPROVAL	J.H	21/08/19
No.	AMENDMENT DESCRIPTION	BY	DATE

WORK AS CONSTRUCTED CERTIFICATION		SYDNEY WATER CORPORATION	
DEVELOPER	W.S.C.	Sydney WATER	
CONSTRUCTOR	COMPLETED	Case No. 172727PW	SHT 4 OF 6 SHTS.
W.A.C. PREPARED	DESIGNER	WATERMAIN EXTENSION	
I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS		SYDNEY WATER CORPORATION FOR DETAILS OF SERVICES SEE SHEET 1	



DN400 PE PW LONGITUDINAL SECTION CH:600.0 TO 1000.0
SCALE 1:1000 HORI.
1:250 VERT.

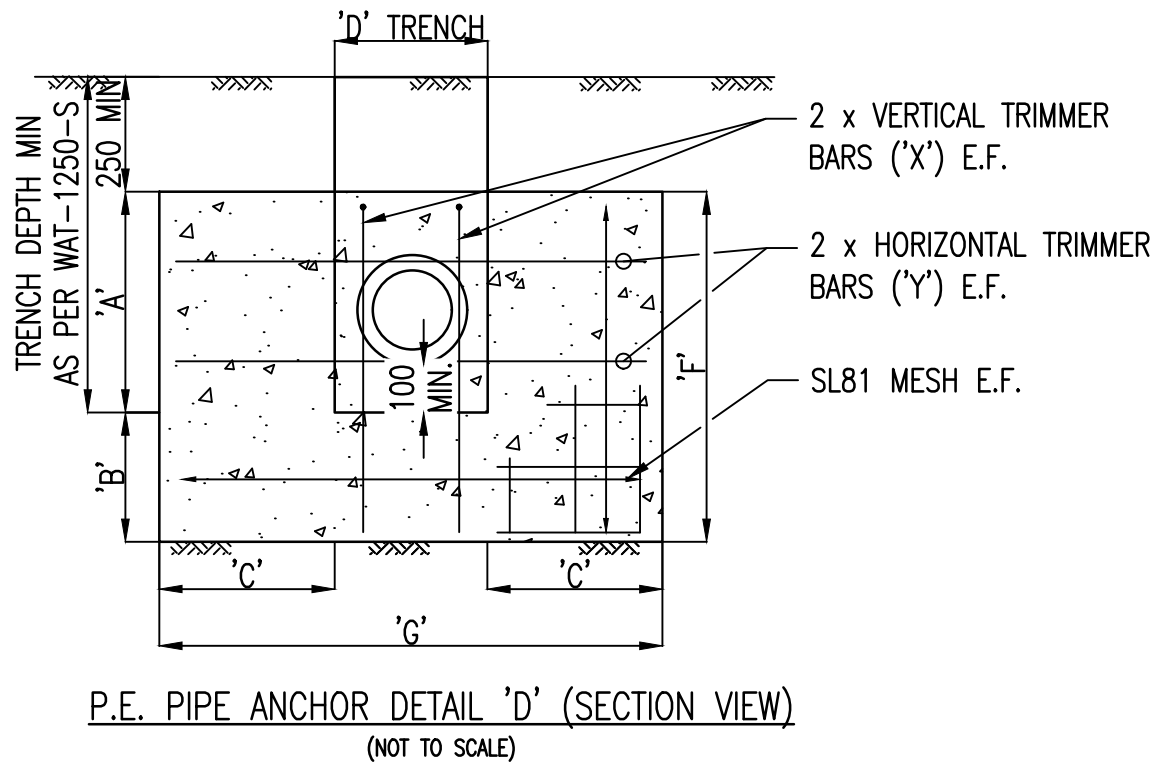
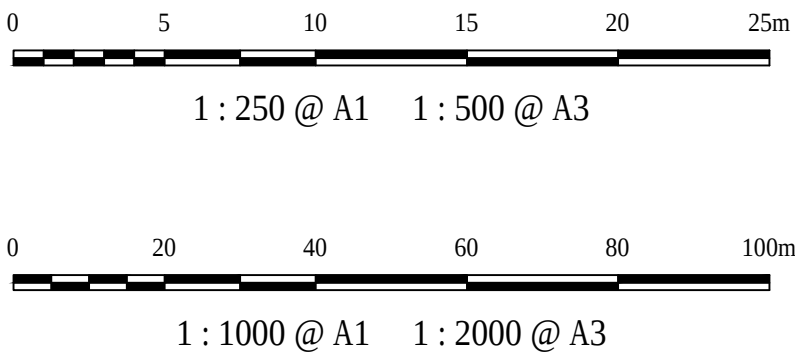


TABLE 3 - ANCHOR BLOCK AND REINFORCEMENT BAR DIMENSIONS

DESIGN FORCE (kN)	ALLOWABLE HORIZONTAL SOIL BEARING PRESSURE (kPa)	BEARING AREA (m²)	DIMENSION A' (mm)	DIMENSION B' (mm)	DIMENSION C' (mm)	TRENCH WIDTH DIMENSION D' (mm)	OVERALL WIDTH DIMENSION E' (mm)	OVERALL DEPTH DIMENSION F' (mm)	OVERALL LENGTH DIMENSION G' (mm)	PROVIDE MESH (EACH FACE)	VERTICAL BARS X' (EACH FACE)	HORIZONTAL BARS Y' (EACH FACE)	CONCRETE GRADE (f'c)
162	50	3.34	700	900	800	850	300	1600	2450	SL 81 EF	2-N16	2-N16	N25
162	100	1.67	700	600	500	850	300	1300	1850	SL 81 EF	2-N16	2-N16	N25

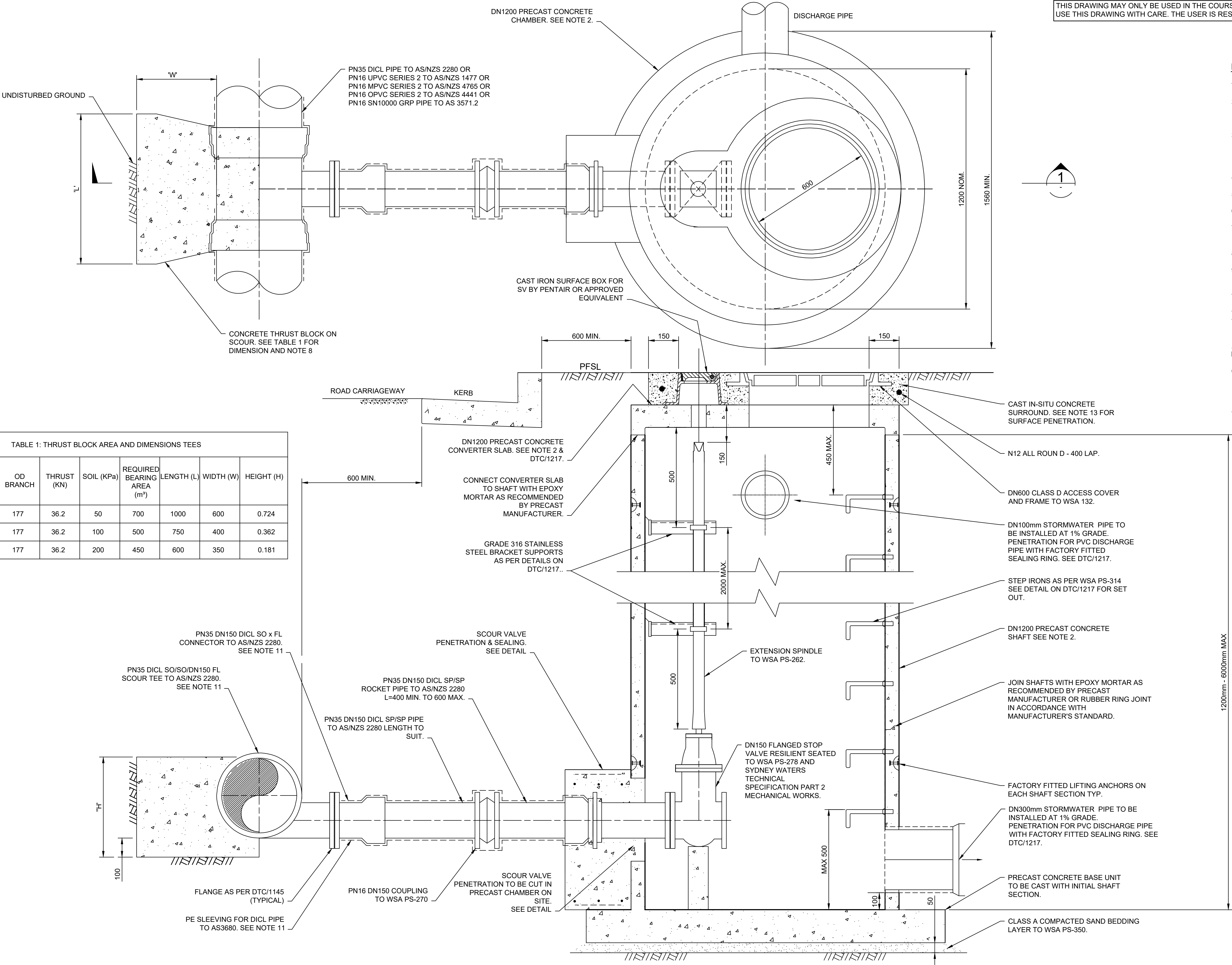
NOTE : REFER TO DTC-1115 FOR CONCRETE NOTES.



01	ISSUE FOR SYDNEY WATER APPROVAL	J.H	21/08/19
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WORK AS CONSTRUCTED CERTIFICATION		Sydney WATER		SYDNEY WATER CORPORATION	
DEVELOPER	.....	Case No. 172727PW		SHT 5 OF 6 SHTS.	
W.S.C.	.....				
CONSTRUCTOR	.....	WATERMAIN EXTENSION			
COMPLETED	.....				
W.A.C. PREPARED	.....	SYDNEY WATER CORPORATION			
DESIGNER	.....				
I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS		FOR DETAILS OF SERVICES SEE SHEET 1			

THIS DRAWING MAY ONLY BE USED IN THE COURSE OF AND FOR THE PURPOSE OF CREATING SYDNEY WATER ASSETS. USE THIS DRAWING WITH CARE. THE USER IS RESPONSIBLE GOT THE CORRECT APPLICATION OF THIS DRAWING.



- NOTE:
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 - ALL PRE-CASE UNITS TO MEET REQUIREMENTS OF AS 4198 MINIMUM LIVE LOAD FOR DESIGN OF PRECAST UNITS SHALL BE SM1600 TO AS 5100.2 . ALL PENETRATIONS SHALL BE CASE BY THE MANUFACTURER.
 - FOUNDATION MATERIALS TO BE INSPECTED AND APPROVED BY AN EXPERIENCED GEOTECHNICAL ENGINEER PRIOR TO POURING OF THE BASE SLAB CONCRETE. ANY OVER-EXCAVATION OR VOID IN THE FOUNDATION MATERIALS TO BE FILLED WITH CLASS N15 MASS CONCRETE TO AS 1379. DESIGN BASED ON A 100 KPa MINIMUM ALLOWABLE SOIL BEARING CAPACITY AND GROUND WATER SURFACE LEVEL.
 - PIPELINE DESIGN BASED ON MAXIMUM DESIGN PRESSURE OF 120m AND TEST PRESSURE OF 150m OF WATER.
 - DESIGN NOT SUITABLE FOR APPLICATION IN AGGRESSIVE SOIL CONDITIONS.
 - TEST PRESSURE IS NOT TO BE APPLIED UNTIL CONCRETE ELEMENTS OF THE DESIGN HAVE REACHED AT LEAST 25MPa STRENGTH.
 - TRUST BLOCK DIMENSIONS "L", "W" AND "H" TO BE SHOWN ON WAC DRAWINGS.
 - WHERE PROPRIETARY PRODUCTS ARE SPECIFIED THE PRODUCT SHALL BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
 - ALL FLANGES SHALL BE TO DTC/1145. ALL FASTENERS SHALL BE GRADE 316 STAINLESS STEEL.
 - ALL DI FITTINGS SHALL BE FBE COATED TO AS4158.
 - THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE FOLLOWING DEEMED TO COMPLY DRAWINGS.
 - DTC/1145 - PN16 FLANGE CONNECTION DETAILS
 - DTC/1217 - SCOUR INSTALLATIONS - DETAILS
 - SCRABBLE PRE-CAST SURFACES TO EXPOSE AGGREGATE AND WIRE BRUSH CLEAN PRIOR TO CONCRETE POURING. SATURATE SURFACE WITH WATER AND REMOVE EXCESS PONDING PRIOR TO CONCRETE.
 - DESIGN HAS BEEN DEVELOPED TO UTILISE SECTIONS SPECIFIED ON SYDNEY WATER DTC-1128 FOR FABRICATION CONSISTENCY. CONTRACTOR TO CONFIRM AVAILABILITY OF THESE SECTIONS IN STAINLESS STEEL

01	ISSUE FOR SYDNEY WATER APPROVAL	J.H	21/08/19
No.	AMENDMENT DESCRIPTION	BY	DATE

WORK AS CONSTRUCTED CERTIFICATION		Sydney WATER		SYDNEY WATER CORPORATION	
DEVELOPER	.....	Case No. 172727PW		SHT	6 OF 6 SHTS.
W.S.C.	.....				
CONSTRUCTOR	.....	WATERMAIN EXTENSION			
COMPLETED	.....				
W.A.C. PREPARED	.....				
DESIGNER	.....	SYDNEY WATER CORPORATION			
I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS		FOR DETAILS OF SERVICES SEE SHEET 1			

Appendix B. Photo Plates





Chainage 0-14.1 (Fitzpatrick land) – location only



Chainage 14.1-45.2 (Lenore Drive crossing)



Transgrid easement - Shared pathway and remnant vegetation in electricity easement)



Transgrid easement - potential launching pit location



Wetland basin viewed from east



Culvert drainage in between Ropes Creek and basin



Potential launching pit location approx. 160m east from Ropes Creek



Shared pathway (viewed from near Chainage 1226.7)



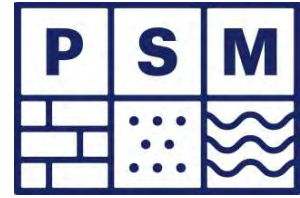
Chainage 1226.7-1253.9 (Lenore Drive crossing)



Chainage 1253.9-1258.9 (Lenore Drive easement)

Appendix C. Geotechnical Report





Our Ref: PSM1541-390L

14 June 2019

AT&L
Level 7, 153 Walker Street
North Sydney, NSW 2060

alexl@atl.net.au

Attention: Alex Lohrisch

Dear Alex

G3 56 Delhi Road
North Ryde NSW 2113
P +61-2 9812 5000
F +61-2 9812 5001
E mailbox@psm.com.au
www.psm.com.au

**RE: OAKDALE ESTATE - LENORE DRIVE, ERSKINE PARK
GEOTECHNICAL INVESTIGATION - POTABLE WATER MAIN**

1. Introduction

This report provides results of the geotechnical investigation undertaken along the Lenore Drive on both side of Ropes Creek, Erskine Park. The geotechnical investigation was undertaken in accordance with our fee proposal PSM1541-377L dated 30 January 2019.

2. Background

Prior to completing the geotechnical investigation PSM were supplied with the following documents and drawings:

- Lenore Drive Potable Water Lead in Section 8-10 - Figure A, Potential locations for underboring launch pit by écologique dated 29 December 2018.

PSM understands the following about the proposed water main:

- The proposed alignment will run at a 10 m offset to an existing bridge on Lenore Drive and through Ropes Creek.
- 300 m of directional drilling will be used to lay the pipe at the existing bridge.
- The water main could be as deep as 10 m below the creek level at the crossing and will gradually come to the surface in both sides of the creek.

At this stage, the exact positions of the boring launch pits have not been confirmed. We note two potential launching location on the East side which are being considered.

3. Fieldwork

The fieldwork was undertaken on 29 and 30 May 2019 under the full-time supervision of a PSM geotechnical engineer, who undertook the following tasks:

- Setting out test locations,
- Preparing engineering logs.

Prior to drilling, the test locations along the Lenore Drive were scanned for buried services.

The borehole locations were recorded using a handheld GPS unit with a horizontal accuracy of +/- 5 m. The borehole locations are indicated in Figure 1.

3.1 Boreholes

A total of five (5) boreholes were drilled to a maximum depth of 15.0 m using a rotary auger on a track mounted drilling rig. Two (2) boreholes were drilled to TC bit refusal at 4.7 m and 13.2 m.

Standard penetration tests (SPT) were undertaken at each borehole at 1.5 m intervals prior to coring.

Upon completion of drilling, the boreholes were backfilled with excavated spoil, lightly compacted and the concrete slab of the footpath was restored. Figure 2 and 3 presents selected photos of the site.

Appendix B presents the borehole logs.

4. Site Conditions

4.1 Geological Setting

The 1:100,000 geological map for the Penrith region indicates that the site is underlain by:

- Quaternary Alluvium (Qal) consisting of fine-grained sand, silt and clay, overlying
- Bringelly Shale of the Wianamatta Group (Rwb) consisting of shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff.

4.2 Surface Conditions

Boreholes BH01 to BH03 have been undertaken in the area to the West of Ropes Creek. BH04 has been undertaken in the footpath and BH05 was undertaken in the reserve area further East.

4.3 Subsurface Conditions

The subsurface conditions encountered within the boreholes are summarised in Table 1. Table 2 shows the elevations to the top of the inferred geotechnical units encountered in the boreholes.

Table 1 – Summary of Inferred Subsurface Conditions Encountered in Boreholes

Inferred Unit	Inferred depth to top of unit below ground surface (m)	Description
Existing Fill	0.0	SILT trace of sand; low plasticity, brown, cluster of residual soil (mottled pale grey, brown some red), dry, stiff to very stiff consistency.
Natural Soil	0.0 to 8.8	CLAY to Sandy CLAY; brown to mottled grey and brown, medium plasticity, dry to wet, firm to very stiff consistency, with possibly some ironstone. With a soft layer observed in BH 03 between 3.6 and 5.0 m.
Bedrock	3.5 to 10.8	SHALE; Mottled brown, grey and black to pale grey, extremely to slightly weathered, very low to low strength, dry.

Table 2 - Depth of the Top of Inferred Geotechnical Units Encountered in Boreholes

Inferred Unit	Depth to top of inferred geotechnical units (m)				
	BH01	BH02	BH03	BH04	BH05
Existing Fill	N.E.	N.E.	N.E.	0.0	0.0
Natural Soil	0.0	0.0	N.E.	5.4	N.E.
Bedrock	6.2	6.0	5.8	10.3	3.5
End of Hole	13.2	15.0	15.0	15.0	4.7

¹ N.E. = Not Encountered

² EOH = End of Hole

³ BGL = Below Ground Level

5. Laboratory Testing

Four (4) disturbed soil samples were retrieved at the Lenore Drive, Eastern Creek, by a PSM Geotechnical Engineer for testing in an analytical laboratory. The disturbed soil samples were sent to a NATA accredited analytical laboratory and the following tests were undertaken:

- Cation Exchange Capacity (CEC) of calcium, magnesium, potassium and sodium
- Exchange sodium percentage
- Salinity (EC 1:5, one part soil to five parts water)
- Soil pH
- Chlorides
- Sulphates

Table 3 presents a summary of the results. The laboratory result sheets are presented in Appendix A.

Table 3 – Summary of the Laboratory Analytical Testing Results

Sample ID	Material Type	pH	Electrical Conductivity [µS/cm]	Moisture Content [%]	Chloride By Discrete Analyser [mg/kg]	Soluble Sulfate by ICPAES [mg/kg]	Exchangeable Cations [meq/100g]					ESP [%]
							Ca	Mg	K	Na	CEC	
BH03 – 1.5m	CLAY	8.5	520	12.8	890	30	1.0	3.6	<0.2	1.8	6.5	28.4
BH03 – 4.5m	CLAY	8.3	533	18.6	940	60	0.5	1.4	<0.2	0.7	2.6	26.6
BH04 – 7.5m	CLAY	8.0	442	12.9	800	50	1.4	3.4	<0.2	1.3	6.1	21.3
BH04 – 9.0m	CLAY	8.4	439	19.1	800	70	1.0	2.5	<0.2	1.2	4.8	24.7

6. Salinity and Aggressivity Assessment

6.1 Salinity

Site Investigations for Urban Salinity (DLWC 2002) classify soil salinity based on electrical conductivity (EC_e). The method of conversion from EC_{1:5} to EC_e (electrical conductivity of saturated extract) is based on DLWC (2002) and given by $EC_e = EC_{1:5} \times M$, where M is the multiplication factor based on "Soil Texture Group".

The "Soil Texture Group" of the samples tested were assessed during our investigation. The salinity classification for the soil samples that were tested are presented in table 4.

Table 4 - Salinity Classification

Sample ID	EC _{1:5}	Soil Type	M	EC _e	Salinity Class
	(dS/m)			(dS/m)	
BH03 – 1.5m	0.520	Light Medium Clay	8	4.160	Moderately Saline
BH03 – 4.5m	0.533	Light Medium Clay	8	4.264	Moderately Saline
BH04 – 7.5m	0.442	Light Medium Clay	8	3.536	Slightly Saline
BH04 – 9.0m	0.439	Light Medium Clay	8	3.512	Slightly Saline

It is assessed that the soils on site are classified as "Slightly Saline" to "Moderately Saline".

Clause 4.8.2 of Australian Standard AS3600-2009 "Concrete Structures" provides an exposure classification for concrete structures in saline soils based on soil electrical conductivity (EC_e). We assess the exposure classification for this site is "A2".

6.2 Acid Sulphate Soils

The site is not located within the areas covered by the Acid Sulfate Soil Risk Map Data (2013), and the risk of acid sulphate soils is considered low within this site.

6.3 Corrosivity / Aggressivity

Table 4.8.1 of AS3600-2009 "Concrete Structures" provides criteria for exposure classification for concrete in sulphate soils based on sulphates in soil and groundwater, and pH of soil. On the basis of the sulphate and pH testing completed we assess the exposure classification for concrete in sulphate soils to be "A1".

Similarly Table 6.4.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for concrete piles based on sulfates in the soil and groundwater, soil and groundwater pH, and chlorides in groundwater. On the basis of the soil sulfates and pH testing completed we assess the exposure classification for concrete piles in the soil to be "Non-aggressive".

Table 6.5.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for steel piles based on resistivity, soil and groundwater pH, and chlorides in soil and groundwater. On the basis of the pH and chloride testing completed we assess the exposure classification for steel piles in the soil to be "Non-aggressive".

6.4 Sodicty

Sodicty provides a measure of the likely dispersion on wetting and to shrink/swell properties of a soil. Soil sodicty is classified based on the Exchangeable Sodium Percentage (ESP) which is the amount of exchangeable sodium as a percentage of the Cation Exchange Capacity (DLWC, 2002).

The Exchangeable Sodium Percentages calculated from these laboratory results, ranging from 21.3% to 28.4%, indicates that the soils on both sites are highly sodic when compared to criteria listed in "Site Investigations for Urban Salinity", DLWC (2002).

7. Discussion and Recommendations

7.1 Site Stability

The soil units encountered are assessed to be at least firm consistency around the surface.

It is considered that excavated near vertically walled trenches are unlikely to be self-supporting, and may require batters or excavation support, as discussed in Sections 7.4.

7.2 Excavation

We note that the excavation works for the proposed water main comprises 300m of directional drilling beneath Ropes Creek.

The works will involve excavation in NATURAL SOIL and BEDROCK units and should be achieved with conventional excavation equipment. We note that an experienced contractor should make their own assessment of the appropriate excavation equipment

7.3 Temporary and Permanent Batters

The batter slope angles shown in table 5 are recommended for the design of batters up to 2.0 m height and subject to the following recommendations:

- The batters shall be protected from erosion.
- Permanent batters (if required) shall be drained.
- Temporary batters shall not be left unsupported for more than a month without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events.
- No buildings, loads or services should be located within 1 batter height of the crest.

If the conditions above cannot be met, further advice should be sought.

Table 5 - Batter Slope Angle

Unit	Temporary	Permanent (If Required)
NATURAL SOIL	1.5H : 1V	2.5H : 1V
BEDROCK	1H : 1V	2H : 1V

Steeper batters may be possible subject to further advice, probably including inspection during construction.

Should there be any queries, do not hesitate to contact the undersigned.

For and on behalf of
PELLS SULLIVAN MEYNINK



JOSSELIN RIBOT
GEOTECHNICAL ENGINEER



AGUSTRIA SALIM
PRINCIPAL

Encl.	Figure 1	Boreholes Locations
	Figure 2	Selected Site Photos [1 of 2]
	Figure 3	Selected Site Photos [2 of 2]
	Appendix A	Salinity and Aggressivity Testing Results
	Appendix B	Borehole Logs



Notes:

1. Site investigation undertook on 29 and 30 May 2019

⊕ Augered Boreholes locations (Approx. only)



Pells Sullivan Meynink

AT&L Lenore Drive, Erskine Park Potable Water Main - Geotechnical Investigation SITE INVESTIGATION 29 and 30 May 2019 LOCALITY PLAN	
PSM1541-390L	Figure 1



Photo 1 - General Site Conditions - Lenore Drive Near BH05

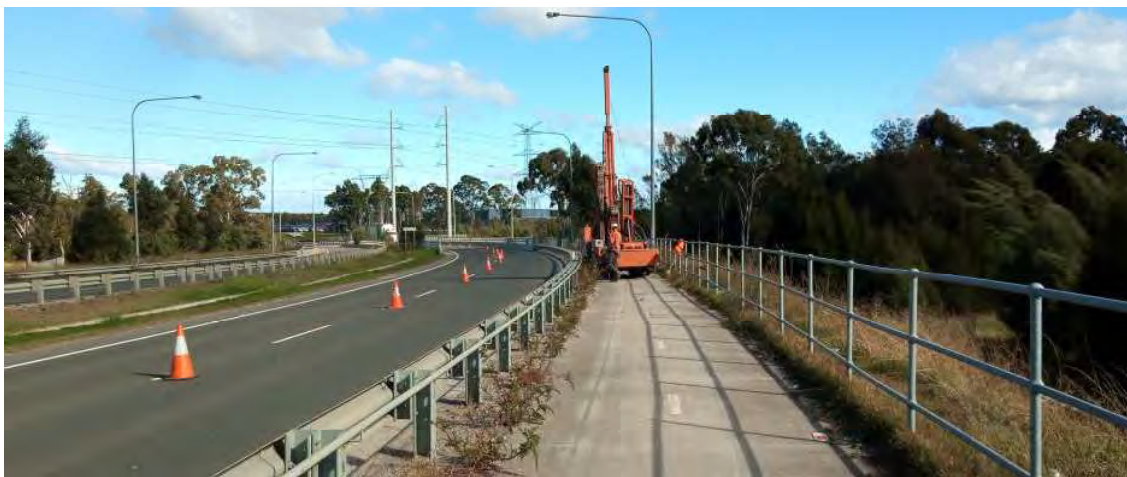


Photo 2 - General Site Conditions - Drilling of BH04



Photo 3 - General Site Conditions - View of the creek and bridge near BH03



Pells Sullivan Meynink

AT&L Lenore Drive, Erskine Park Potable Water Main - Geotechnical Investigation SITE INVESTIGATION 29 and 30 May 2019 SELECTED SITE PHOTOS [1 OF 2]	
PSM1541-390L	FIGURE 2



Photo 4 - General Site Conditions - View of the bank of the creek near BH03



Photo 5 - General Site Conditions - View of the area West of the Lenore Drive



Photo 6 - Drilling rig at BH03 Location



Pells Sullivan Meynink

AT&L Lenore Drive, Erskine Park Potable Water Main - Geotechnical Investigation SITE INVESTIGATION 29 and 30 May 2019 SELECTED SITE PHOTOS [2 OF 2]	
PSM1541-390L	FIGURE 3

Appendix A

Salinity and Aggressivity Testing Results



CERTIFICATE OF ANALYSIS

Work Order	: ES1916899	Page	: 1 of 3
Client	: PELLIS SULLIVAN MEYNINK T/A PSM Admin PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: JOSSELIN RIBOT	Contact	: Customer Services ES
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: PSM1541 - Lenore Drive	Date Samples Received	: 31-May-2019 16:45
Order number	:	Date Analysis Commenced	: 04-Jun-2019
C-O-C number	: ----	Issue Date	: 07-Jun-2019 13:56
Sampler	: ----		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 4		
No. of samples analysed	: 4		



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

Page : 2 of 3
Work Order : ES1916899
Client : PELLIS SULLIVAN MEYNINK T/A PSM Admin PTY LTD
Project : PSM1541 - Lenore Drive



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Page : 3 of 3
 Work Order : ES1916899
 Client : PELLIS SULLIVAN MEYNINK T/A PSM Admin PTY LTD
 Project : PSM1541 - Lenore Drive



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH03-1.5m	BH03-4.5m	BH04-7.5m	BH04-9.0m	----
Client sampling date / time					[31-May-2019]	[31-May-2019]	[31-May-2019]	[31-May-2019]	----
Compound	CAS Number	LOR	Unit		ES1916899-001	ES1916899-002	ES1916899-003	ES1916899-004	-----
					Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		8.5	8.3	8.0	8.4	----
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		520	533	442	439	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		12.8	18.6	12.9	19.1	----
ED006: Exchangeable Cations on Alkaline Soils									
Exchangeable Calcium	----	0.2	meq/100g		1.0	0.5	1.4	1.0	----
Exchangeable Magnesium	----	0.2	meq/100g		3.6	1.4	3.4	2.5	----
Exchangeable Potassium	----	0.2	meq/100g		<0.2	<0.2	<0.2	<0.2	----
Exchangeable Sodium	----	0.2	meq/100g		1.8	0.7	1.3	1.2	----
Cation Exchange Capacity	----	0.2	meq/100g		6.5	2.6	6.1	4.8	----
Exchangeable Sodium Percent	----	0.2	%		28.4	26.6	21.3	24.7	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		30	60	50	70	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		890	940	800	800	----

Appendix B

Borehole Logs



Borehole ID

BH01

Page 1 of 3

Engineering Log - Non Cored Borehole

Project No.: PSM1541

Client: AT&L		Commenced: 30/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297566.0 m E 6256532.0 m N MGA94 Zone 56		Checked By: AS	

Drill Model and Mounting: Hanjin		Inclination: -90°		RL Surface: No survey	
Hole Diameter: 115 mm		Bearing:		Datum: AHD Operator: BG	

Drilling Information						Soil Description						Observations		
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T		N	Water 3.75 m	SPT 1.50-1.95 m 6.9,13 N=22			1		CI	CLAY: medium plasticity, brown; with rootlets.	M	F to St	100	0.00: INFERRED NATURAL SOIL
							2		CI	CLAY: medium plasticity, mottled pale grey and brown.	M		200	
							3			SPT 3.00-3.45 m 4.7,7 N=14		St to VSt	300	
							4			Becoming pale brown with some sand	W		400	
				SPT 4.50-4.95 m 3.4,5 N=9								500		

Method AD/T - Auger drilling TC bit AD/V - Auger drilling V bit WB - Washbore SPT - Standard penetration test PT - Push tube AS - Auger Screwing	Penetration No resistance Refusal	Water Inflow Partial Loss Complete Loss	Samples and Tests U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetration Test ES - Environmental Sample TW - Thin Walled LB - Large Disturbed Sample	Moisture Condition D - Dry M - Moist W - Wet	Consistency/Relative Density VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense Ce - Cemented C - Compact
---	--	---	---	--	--

PSM 3.02.2 LIB&L Log PSM AU NOICORE BH NZ AU BH01.GPJ <<DrawingFile>> 13/06/2019 11:26 10/07/2007 Dated Fence and Map Tool Lib PSM 3.02.1 2018-03-06 Proj PSM 3.02.1 2018-03-06

Logged in accordance with AS 1726:2017 Geotechnical site investigations



Borehole ID

BH01

Page 2 of 3

Engineering Log - Non Cored Borehole

Project No.: PSM1541

Client: AT&L		Commenced: 30/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297566.0 m E 6256532.0 m N MGA94 Zone 56		Checked By: AS	

Drill Model and Mounting: Hanjin		Inclination: -90°		RL Surface: No survey	
Hole Diameter: 115 mm		Bearing:		Datum: AHD Operator: BG	

Drilling Information						Soil Description						Observations		
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T				SPT 6.00-6.45 m 2,9,22 N=31			6			Becoming pale brown with some sand (continued)	W	St to VSt		
				SPT 7.50-7.95 m 25, Refusal Rebound			7			SHALE: fine grained, dark grey and brown, distinctly thinly plane-laminated.				6.20: INFERRED EXTREMELY WEATHERED BEDROCK Description based on drill cuttings and SPT samples.
							8							
							9							

Method AD/T - Auger drilling TC bit AD/V - Auger drilling V bit WB - Washbore SPT - Standard penetration test PT - Push tube AS - Auger Screwing	Penetration No resistance Refusal	Water Inflow Partial Loss Complete Loss	Samples and Tests U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetration Test ES - Environmental Sample TW - Thin Walled LB - Large Disturbed Sample	Moisture Condition D - Dry M - Moist W - Wet	Consistency/Relative Density VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense Ce - Cemented C - Compact
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Logged in accordance with AS 1726:2017 Geotechnical site investigations



Borehole ID

BH01

Page 3 of 3

Engineering Log - Non Cored Borehole

Project No.: PSM1541

Client: AT&L		Commenced: 30/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297566.0 m E 6256532.0 m N MGA94 Zone 56		Checked By: AS	
Drill Model and Mounting: Hanjin		Inclination: -90°	
Hole Diameter: 115 mm		RL Surface: No survey	
		Datum: AHD Operator: BG	

Drilling Information				Soil Description				Observations						
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T	N						10	[Hatched pattern]		SHALE: fine grained, dark grey and brown, distinctly thinly plane-laminated. (continued)			100	
							11		Becoming pale grey with some ironstone clasts.			200		
							12						300	
							13						400	
							14			Hole Terminated at 13.20 m TC-bit refusal			500	

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
 No resistance
 Refusal

Water
 Inflow
 Partial Loss
 Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact



Borehole ID

BH02

Page 1 of 3

Engineering Log - Non Cored Borehole

Project No.: PSM1541

Client: AT&L		Commenced: 30/05/2019																																																																																							
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019																																																																																							
Hole Location: Lenore Drive		Logged By: JSR																																																																																							
Hole Position: 297597.0 m E 6256560.0 m N MGA94 Zone 56		Checked By: AS																																																																																							
Drill Model and Mounting: Hanjin		Inclination: -90°																																																																																							
Hole Diameter: 115 mm		RL Surface: No survey																																																																																							
		Datum: AHD Operator: BG																																																																																							
Drilling Information				Soil Description				Observations																																																																																	
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations																																																																											
AD/T		N		SPT 1.50-1.95 m 4,11,14 N=25			1		CI	CLAY: medium plasticity, brown.	D to M	F to St	100 200 300 400 500	0.00: INFERRED NATURAL SOIL																																																																											
				SPT 3.00-3.45 m 3,5,6 N=11			2			Becoming mottled pale grey and brown with rootlets.																																																																															
				SPT 4.50-4.95 m 8,15,11 N=26			3			Becoming sandy with ironstone.	M	St to VSt																																																																													
			Water 4.05m				4			Becoming silty.	W																																																																														
Method AD/T - Auger drilling TC bit AD/V - Auger drilling V bit WB - Washbore SPT - Standard penetration test PT - Push tube AS - Auger Screwing															Penetration No resistance Refusal															Water Inflow Partial Loss Complete Loss															Samples and Tests U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetration Test ES - Environmental Sample TW - Thin Walled LB - Large Disturbed Sample															Moisture Condition D - Dry M - Moist W - Wet															Consistency/Relative Density VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense Ce - Cemented C - Compact														



Borehole ID

BH02

Page 2 of 3

Engineering Log - Non Cored Borehole

Project No.: PSM1541

Client: AT&L		Commenced: 30/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297597.0 m E 6256560.0 m N MGA94 Zone 56		Checked By: AS	

Drill Model and Mounting: Hanjin		Inclination: -90°		RL Surface: No survey	
Hole Diameter: 115 mm		Bearing:		Datum: AHD Operator: BG	

Drilling Information						Soil Description						Observations		
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T				SPT 6.00-6.45 m 15, Refusal Rebound			6			Becoming sandy with ironstone. (continued)	W	St to VSt		
				SPT 7.50-7.95 m 25, Refusal Rebound			7			SHALE: pale and dark grey and some brown, indistinctly thinly plane-laminated.				6.00: INFERRED EXTREMELY WEATHERED BEDROCK Description based on drill cuttings and SPT samples.
							8							
							9			Becoming mostly pale grey.				

Method AD/T - Auger drilling TC bit AD/V - Auger drilling V bit WB - Washbore SPT - Standard penetration test PT - Push tube AS - Auger Screwing	Penetration No resistance Refusal	Water Inflow Partial Loss Complete Loss	Samples and Tests U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetration Test ES - Environmental Sample TW - Thin Walled LB - Large Disturbed Sample	Moisture Condition D - Dry M - Moist W - Wet	Consistency/Relative Density VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense Ce - Cemented C - Compact
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PSM 3.02.2 Log PSM AU NOICORE BH NZ AU BH02.GPJ <<DrawingFile>> 13/06/2019 11:28 10/07/2007 Dated Fence and Map Tool Lib PSM 3.02.1 2018-03-06 Proj PSM 3.02.1 2018-03-06

Logged in accordance with AS 1726:2017 Geotechnical site investigations



Borehole ID

BH02

Page 3 of 3

Engineering Log - Non Cored Borehole

Project No.: PSM1541

Client: AT&L		Commenced: 30/05/2019												
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019												
Hole Location: Lenore Drive		Logged By: JSR												
Hole Position: 297597.0 m E 6256560.0 m N MGA94 Zone 56		Checked By: AS												
Drill Model and Mounting: Hanjin		Inclination: -90°												
Hole Diameter: 115 mm		RL Surface: No survey												
		Datum: AHD Operator: BG												
Drilling Information				Soil Description				Observations						
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T	N						11			SHALE: pale and dark grey and some brown, indistinctly thinly plane-laminated. (continued)			100	
							12						200	
							13						300	
							14						400	
													500	
Hole Terminated at 15.00 m Target depth														
Method		Penetration		Water		Samples and Tests		Moisture Condition		Consistency/Relative Density				
AD/T - Auger drilling TC bit		No resistance		Inflow		U - Undisturbed Sample		D - Dry		VS - Very soft				
AD/V - Auger drilling V bit		Refusal		Partial Loss		D - Disturbed Sample		M - Moist		S - Soft				
WB - Washbore				Complete Loss		SPT - Standard Penetration Test		W - Wet		F - Firm				
SPT - Standard penetration test						ES - Environmental Sample				St - Stiff				
PT - Push tube						TW - Thin Walled				VSt - Very stiff				
AS - Auger Screwing						LB - Large Disturbed Sample				H - Hard				
										VL - Very loose				
										L - Loose				
										MD - Medium dense				
										D - Dense				
										VD - Very dense				
										Ce - Cemented				
										C - Compact				



Borehole ID

BH03

Page 1 of 3

Engineering Log - Non Cored Borehole

Project No.:

Client: AT&L		Commenced: 30/05/2019																																																																																							
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019																																																																																							
Hole Location: Lenore Drive		Logged By: JSR																																																																																							
Hole Position: 297623.0 m E 6256586.0 m N MGA94 Zone 56		Checked By: AS																																																																																							
Drill Model and Mounting: Hanjin		Inclination: -90°																																																																																							
Hole Diameter: 115 mm		RL Surface: No survey																																																																																							
		Datum: AHD Operator: BG																																																																																							
Drilling Information				Soil Description				Observations																																																																																	
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations																																																																											
AD/T		N		SPT 1.50-1.95 m 6,10,12 N=22 D 1.50 m			1			CLAY: medium plasticity, mottled pale grey and brown; with rootlets.	D	St to VSt	100 200 300 400 500	0.00: INFERRED NATURAL SOIL																																																																											
			Water 3.60 m	SPT 3.00-3.45 m 3,3,5 N=8			2				M	F																																																																													
				SPT 4.50-4.95 m 1,1,1 N=2 D 4.50 m			3				W	S																																																																													
Method AD/T - Auger drilling TC bit AD/V - Auger drilling V bit WB - Washbore SPT - Standard penetration test PT - Push tube AS - Auger Screwing															Penetration No resistance Refusal															Water Inflow Partial Loss Complete Loss															Samples and Tests U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetration Test ES - Environmental Sample TW - Thin Walled LB - Large Disturbed Sample															Moisture Condition D - Dry M - Moist W - Wet															Consistency/Relative Density VS - Very soft S - Soft St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense Ce - Cemented C - Compact														



Borehole ID

BH03

Page 2 of 3

Engineering Log - Non Cored Borehole

Project No.:

Client: AT&L		Commenced: 30/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297623.0 m E 6256586.0 m N MGA94 Zone 56		Checked By: AS	
Drill Model and Mounting: Hanjin		Inclination: -90°	RL Surface: No survey
Hole Diameter: 115 mm		Bearing:	Datum: AHD Operator: BG

Drilling Information						Soil Description						Observations		
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T				SPT 6.00-6.45 m 25.0,0 HB N=0			6			CLAY: medium plasticity, mottled pale grey and brown; with rootlets. (continued)	W	F		5.80: INFERRED EXTREMELY WEATHERED BEDROCK Descriptions based on drill cuttings and SPT samples.
				SPT 7.50-7.95 m 25, Refusal Rebound			7			SHALE: pale and dark grey with some brown, indistinctly thinly plane-laminated.				
							8			Becoming mostly pale grey.				
							9							

Method AD/T - Auger drilling TC bit AD/V - Auger drilling V bit WB - Washbore SPT - Standard penetration test PT - Push tube AS - Auger Screwing	Penetration No resistance Refusal	Water Inflow Partial Loss Complete Loss	Samples and Tests U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetration Test ES - Environmental Sample TW - Thin Walled LB - Large Disturbed Sample	Moisture Condition D - Dry M - Moist W - Wet	Consistency/Relative Density VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense Ce - Cemented C - Compact
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Borehole ID

BH03

Page 3 of 3

Engineering Log - Non Cored Borehole

Project No.:

Client: AT&L		Commenced: 30/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 30/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297623.0 m E 6256586.0 m N MGA94 Zone 56		Checked By: AS	
Drill Model and Mounting: Hanjin		Inclination: -90°	RL Surface: No survey
Hole Diameter: 115 mm		Bearing:	Datum: AHD Operator: BG

Drilling Information						Soil Description						Observations		
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T							11			SHALE: pale and dark grey with some brown, indistinctly thinly plane-laminated. (continued)			100	
							12						200	
							13						300	
							14						400	
										Hole Terminated at 15.00 m Target depth			500	

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
 No resistance
 Refusal

Water
 Inflow
 Partial Loss
 Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations



Borehole ID

BH04

Page 1 of 3

Engineering Log - Non Cored Borehole

Project No.:

Client: AT&L		Commenced: 29/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 29/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297764.0 m E 6256632.0 m N MGA94 Zone 56		Checked By: AS	
Drill Model and Mounting: Hanjin		Inclination: -90°	RL Surface: No survey
Hole Diameter: 115 mm		Bearing:	Datum: AHD Operator: BG

Drilling Information				Soil Description				Observations						
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T		N		SPT 1.50-1.95 m 3.2,4 N=6			1			CONCRETE	D	F	100	0.00: CONCRETE SLAB
				SPT 3.00-3.45 m 7,7,8 N=15			2			SILT trace sand: low plasticity, brown; clusters of mottled pale grey, brown and some red, residual soil.			200	0.10: INFERRED FILL
				SPT 4.50-4.95 m 4,7,9 N=16			3				M	St	300	
							4						400	
													500	

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
 No resistance
 Refusal

Water
 Inflow
 Partial Loss
 Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact



Borehole ID

BH04

Page 2 of 3

Engineering Log - Non Cored Borehole

Project No.:

Client: AT&L		Commenced: 29/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 29/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297764.0 m E 6256632.0 m N MGA94 Zone 56		Checked By: AS	
Drill Model and Mounting: Hanjin		Inclination: -90°	RL Surface: No survey
Hole Diameter: 115 mm		Bearing:	Datum: AHD Operator: BG

Drilling Information				Soil Description				Observations						
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T	N	8.4 m	SPT 6.00-6.45 m 4,5,8 N=13	6	7	8	9		CI	SILT trace sand: low plasticity, brown; clusters of mottled pale grey, brown and some red, residual soil. (continued)	M	St	100 200 300 400 500	5.40: INFERRED NATURAL SOIL
										Becoming brown.				
										Becoming red with some dark grey.				
AD/T	N	8.4 m	SPT 7.50-7.95 m 3,4,8 N=12 D 7.50 m	6	7	8	9		CI	Becoming brown.	M	St	100 200 300 400 500	5.40: INFERRED NATURAL SOIL
										Becoming red with some dark grey.				
										Becoming brown.				
AD/T	N	8.4 m	SPT 9.00-9.45 m 1,5,6 N=11 D 9.00 m	6	7	8	9		CI	Becoming brown.	M	St	100 200 300 400 500	5.40: INFERRED NATURAL SOIL
										Becoming red with some dark grey.				
										Becoming brown.				

Method AD/T - Auger drilling TC bit AD/V - Auger drilling V bit WB - Washbore SPT - Standard penetration test PT - Push tube AS - Auger Screwing	Penetration No resistance Refusal	Water Inflow Partial Loss Complete Loss	Samples and Tests U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetration Test ES - Environmental Sample TW - Thin Walled LB - Large Disturbed Sample	Moisture Condition D - Dry M - Moist W - Wet	Consistency/Relative Density VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense Ce - Cemented C - Compact
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Logged in accordance with AS 1726:2017 Geotechnical site investigations



Borehole ID

BH04

Page 3 of 3

Engineering Log - Non Cored Borehole

Project No.:

Client: AT&L		Commenced: 29/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 29/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297764.0 m E 6256632.0 m N MGA94 Zone 56		Checked By: AS	
Drill Model and Mounting: Hanjin		Inclination: -90°	RL Surface: No survey
Hole Diameter: 115 mm		Bearing:	Datum: AHD Operator: BG

Drilling Information						Soil Description						Observations		
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T		N		SPT 10.50-10.95 m 8,24 Refusal Rebound			11		CI	CLAY: medium plasticity, brown/red; trace rootlets. (continued)	M to W	St	100 200 300 400 500	10.30: INFERRED EXTREMELY WEATHERED BEDROCK Descriptions based on drill cuttings and SPT samples.
							12			SHALE: brown to dark grey, indistinctly thinly plane-laminated.				
							13			Becoming pale grey.				
							14							
										Hole Terminated at 15.00 m Target depth				

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
 No resistance
 Refusal

Water
 Inflow
 Partial Loss
 Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations



Borehole ID

BH05

Page 1 of 1

Engineering Log - Non Cored Borehole

Project No.: PSM1541

Client: AT&L		Commenced: 29/05/2019	
Project Name: Lenore Drive, Eastern Creek		Completed: 29/05/2019	
Hole Location: Lenore Drive		Logged By: JSR	
Hole Position: 297934.0 m E 6256642.0 m N MGA94 Zone 56		Checked By: AS	
Drill Model and Mounting: Hanjin		Inclination: -90°	
Hole Diameter: 115 mm		Bearing:	
RL Surface: No survey		Datum: AHD	
Operator: BG			

Drilling Information				Soil Description				Observations						
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/T	N	Not Observed		SPT 3.00-3.45 m 28, Refusal Rebound			1			SILT trace sand: low plasticity, brown; clusters of mottled pale grey and brown with some red, residual soil.	D	St to VSt	100 200 300 400 500	0.00: INFERRED FILL
							2							
							3							
							4			SHALE: brown to dark grey, becomes paler with depth.				3.50: INFERRED EXTREMELY WEATHERED BEDROCK Description based on drill cuttings.
										Hole Terminated at 4.70 m TC-bit refusal				

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
 No resistance
 Refusal

Water
 Inflow
 Partial Loss
 Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations



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Appendix C

Transgrid Design Drawings

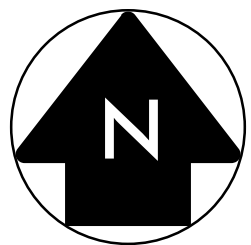
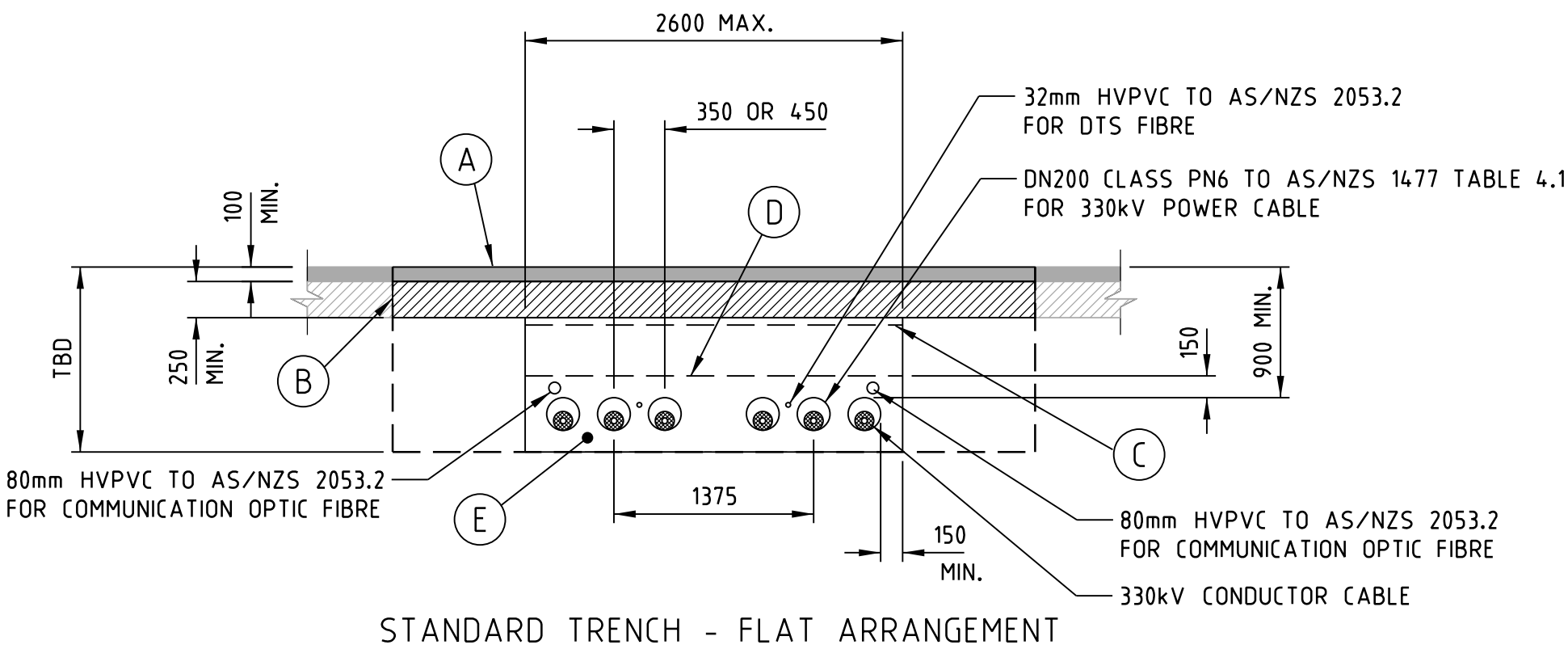
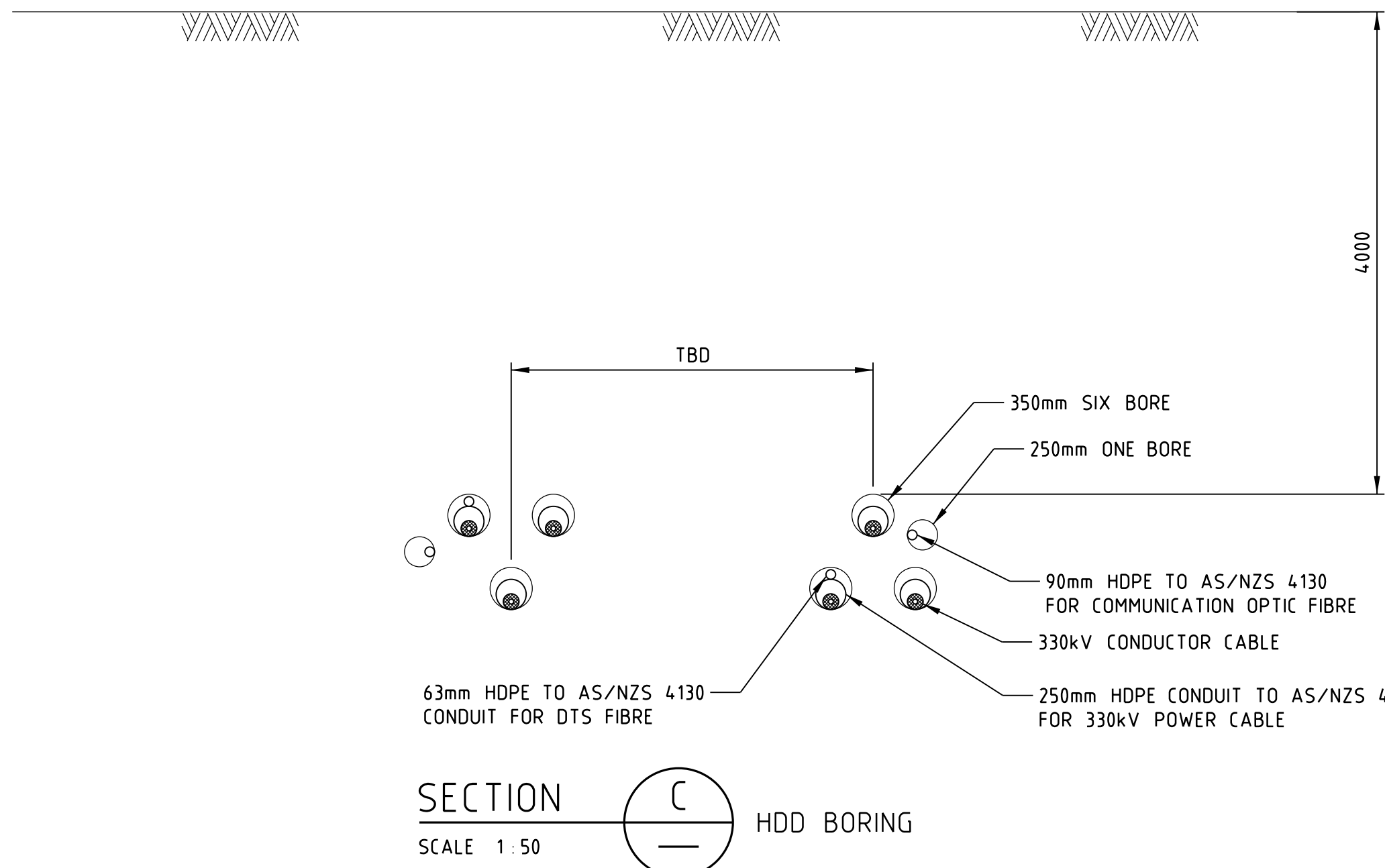
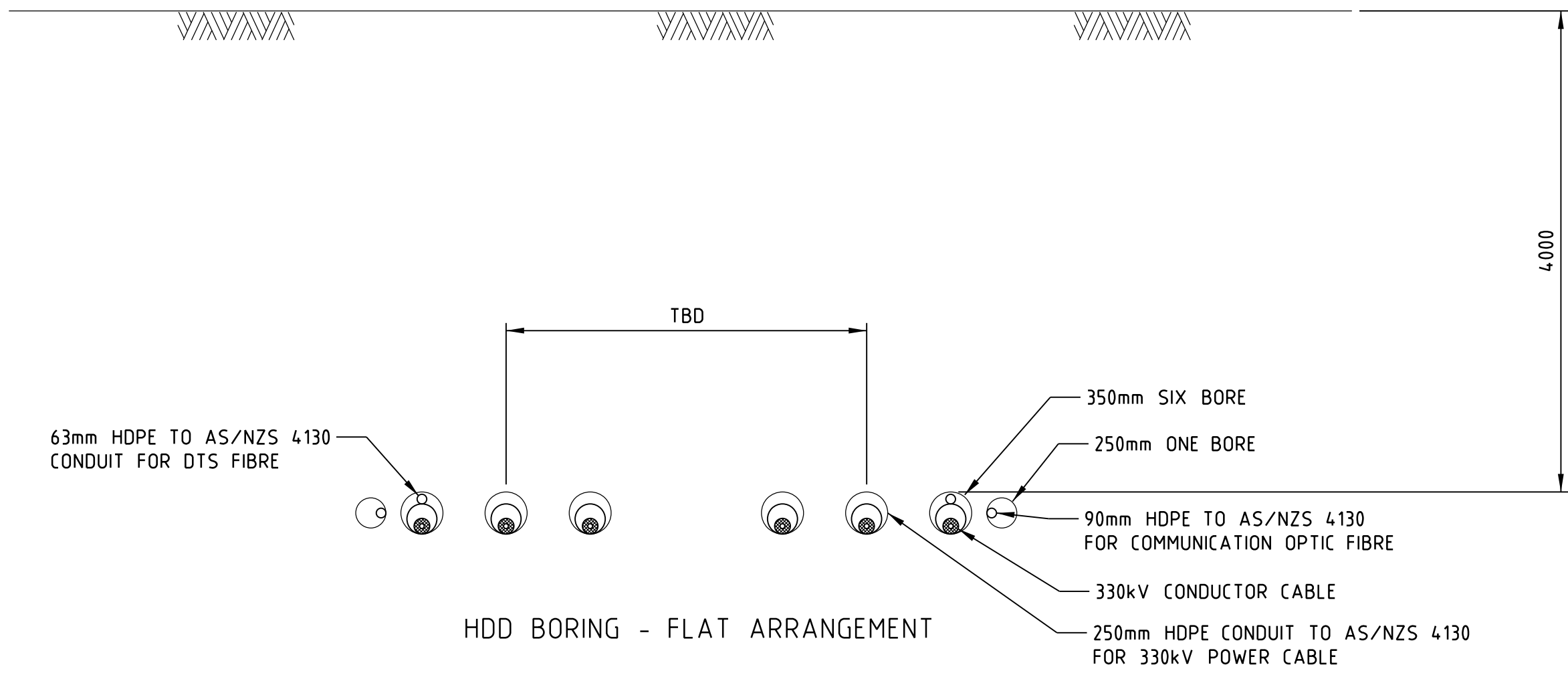
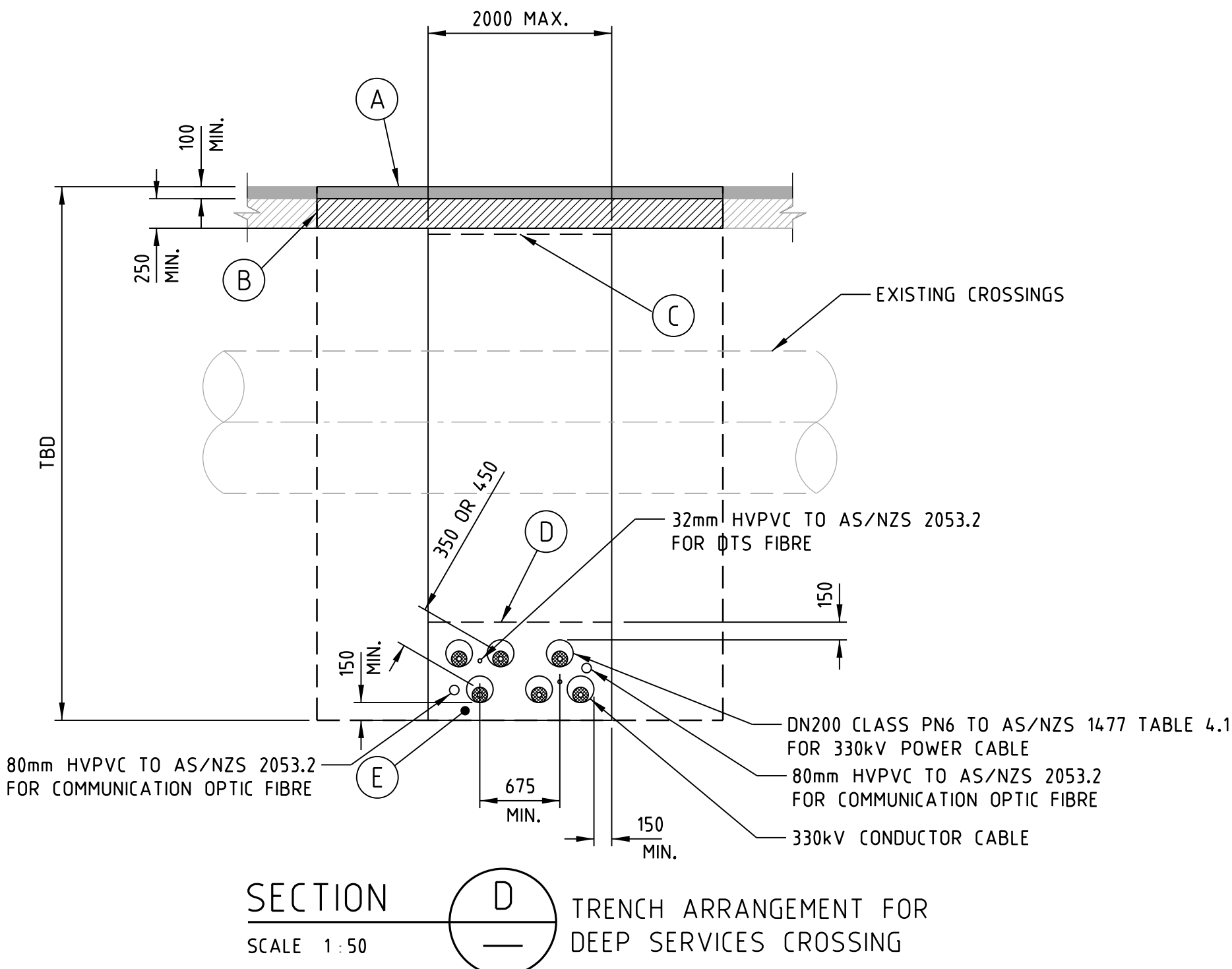
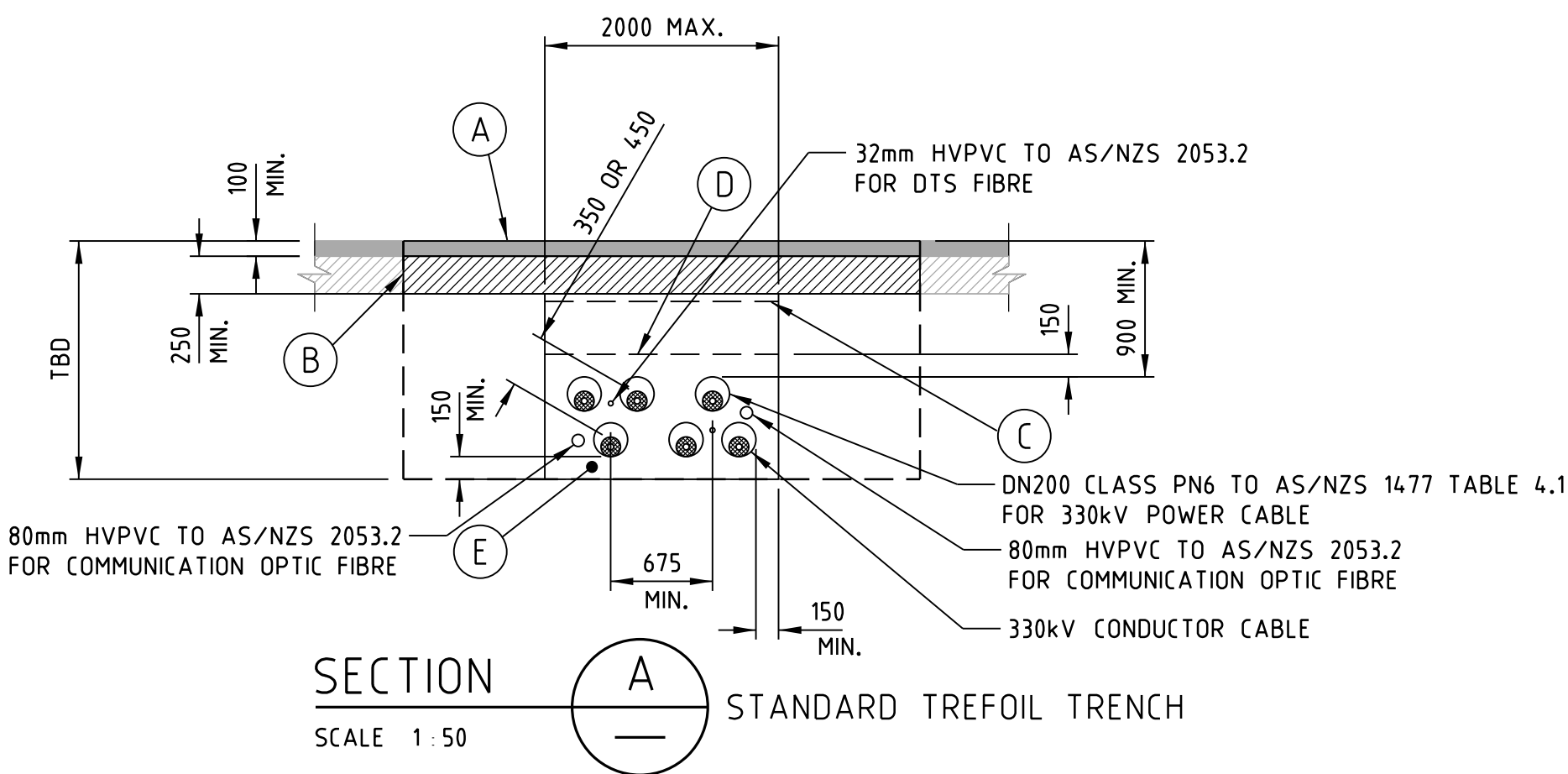


TABLE 1

TRENCH COORDINATES (COORDINATE SYSTEM IS MGA2020-56)			
CHAINAGE	COORDINATE	CHAINAGE	COORDINATE
CH 0m	E 299070.918 N 6256472.765	CH 1303.2m	E 297937.254 N 6256613.618
CH 80.0m	E 299113.316 N 6256540.606	CH 1336.6m	E 297904.134 N 6256618.271
CH 90.1m	E 299110.795 N 6256549.210	CH 1337.8m	E 297902.933 N 6256618.318
CH 361.7m	E 298892.813 N 6256659.885	CH 1432.0m	E 297807.727 N 6256612.486
CH 364.2m	E 298860.422 N 6256660.406	CH 1433.2m	E 297806.542 N 6256612.293
CH 467.5m	E 298755.587 N 6256661.149	CH 1506.5m	E 297734.009 N 6256592.545
CH 469.0m	E 298755.587 N 6256661.039	CH 1508.4m	E 297735.774 N 6256593.341
CH 567.4m	E 298660.186 N 6256637.039	CH 1698.7m	E 297577.376 N 6256488.632
CH 688.3m	E 298542.958 N 6256607.412	CH 1696.4m	E 297575.907 N 6256487.251
CH 858.1m	E 298378.740 N 6256564.150	CH 1848.3m	E 297487.639 N 6256367.459
CH 907.6m	E 298329.295 N 6256561.033	CH 1853.7m	E 297486.748 N 6256362.451
CH 1061.1m	E 298176.764 N 6256578.382	CH 1943.7m	E 297509.330 N 6256282.250
CH 1182.4m	E 298056.879 N 6256596.814		

CABLE ROUTE PLAN

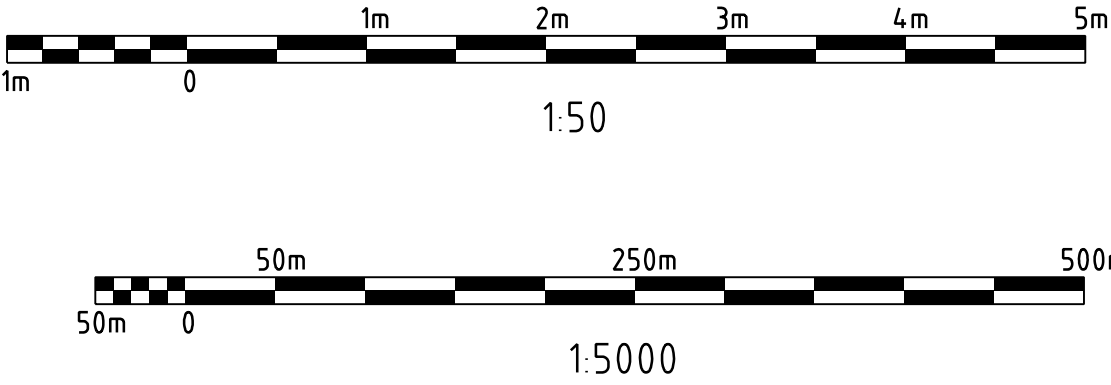


NOTES:

1. THE PROPOSED CABLE ROUTE IS INDICATIVE ONLY AND DOES NOT REPRESENT THE ACTUAL LOCATION.
2. TRANSGRID CABLE DESIGN AND INSTALLATION MANUAL (CDIM) REQUIRES MINIMUM 6m RADIUS BENDS.
3. TRANSGRID EASEMENT IS REQUIRED ON A PRIVATE PROPERTY.
4. ROAD TRAFFIC, STORMWATER DRAINAGE, SYDNEY WATER MAIN & ENDEAVOUR ENERGY UNDERGROUND CABLES TO BE MANAGED.
5. ALLOW A MINIMUM DEPTH OF 3.3m TO THE TOP COVER OF THE CONDUIT IN THE TRENCH FOR UNDERNEATH THE NEW BENCH.
6. CONDUITS FOR ECC ARE NOT SHOWN IN THE DRAWING, THEY ARE TO BE DETERMINED AT DETAILED DESIGN. CONDUITS FOR THE ECC SHALL BE 63mm (OR 80mm) HDPPVC TO AS/NZS 2053.2.
7. FINAL TRENCH AND BORING DEPTHS TO BE DETERMINED DURING DETAILED DESIGN.

LEGEND:

- (A) AC14 (100mm MIN.) OR MATCH EXISTING, WHICHEVER IS GREATER
- (B) COMPACTED ROAD BASE DGB20 TO RMS 3051
- (C) 150mm WIDE WARNING TAPE TO AS2648.1
- (D) 300mm WIDE POLYMERIC CABLE COVER STRIPS TO AS4702
- (E) THERMALLY STABLE BACKFILL



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AMENDMENT:



TBA		ERSKINE PARK SUBSTATION GA		DRAWN	SCAD	05-02-26	© Transgrid					
				REVIEWED			TRANSMISSION LINES ERSKINE PARK DATA CENTRE 330kV CABLE CABLE ROUTE PLAN & SECTIONS - OPTION 1					
				VERIFIED								
				APPROVED								
								FOR INFORMATION			A1	CAB-ERSKINE PARK DC-SKT 1	A
				APPROVAL STATUS								
				SCALE			PREFIX		NUMBER	SHEET	AMDT	
		SUPERSEDES				SUPERSEDED BY				INDEX CLASS'N		

Appendix D

HV Construction Methodology

1.0 Introduction

This report has been prepared as a supplementary report to address the inclusion of external high voltage (HV) works associated with the proposed STACK SYD01 Data Centre development at 78 Lockwood Road, Erskine Park (SSDA-82211208).

The external HV works comprise two 330kV underground transmission cables extending from the proposed STACK SYD01 Switchyard, running along Lenore Drive, and terminating at the port of entry to the TransGrid Sydney West Substation. Any augmentation works within the Sydney West Substation will be undertaken by TransGrid and subject to separate approval.

This report should be read in conjunction with the SSDA documentation prepared for SSDA-82211208.

2.0 Project Description

2.1 Scope of Work

The amended project includes the installation of two HV cables, from STACK SYD01 Switchyard, via road reserve within Lenore Drive to the TransGrid Sydney West Substation. The total route length is approximately 2.1km. The cable route extends across two LGAs, Penrith City Council and Blacktown City Council, as well as Crown land and a TfNSW State Road reserve.

Key components of the project include:

- 1) External HV Cable works extending from the STACK SYD01 Switchyard to the TransGrid Sydney West Substation, including:
 - Two x 330kV underground transmission cable circuits comprising six cables installed within six conduits
 - Two smaller conduits for optical fibre infrastructure
 - Approximately 2-4 joint bays per circuit, located at intervals of approximately 600-800 metres along the transmission route
 - Associated link boxes and sensor boxes at each joint bay to enable testing and maintenance
- 2) STACK SYD01 Customer Switchyard
 - Two x GIS buildings approximately 75 x 50 metres
 - Three x 250 MVA transformers and eight x 90 MVA transformers
 - Auxiliary electrical equipment

Associated works required to facilitate the construction of the project, such as potential utility relocations have been considered. No major utility relocations are anticipated. Where minor services require adjustment to accommodate the transmission cable circuits, these works would be limited to within the project area assessed in this EIS.

A summary of the external HV works is provide in **Table 1** below.

Table 1 – Project Summary – External HV Works

Project Element	Summary of Proposal
Excavation method	Open trenching will be undertaken along the HV route, comprising a double circuit trench up to approximately 2 metres wide and 4 metres deep. The trench configuration may vary (trefoil to flat) to accommodate utility crossings. Horizontal Directional Drilling (HDD) will be used for the Ropes Creek crossing and deep utility crossings, with an approximate depth of 15 metres.
Cable life	Minimum design life of 45 years
Cable length ¹	Total approx. length is 2.1km
Key components	• 330kV cable route: conduits, joint bays, 330kV cables and temporary laydown areas • STACK Erskine Park onsite substation: civil works, primary electrical equipment, gas insulated switchgear (within buildings), power transformers, air insulated switchgear and temporary laydown areas
Timing and duration	Energisation target is October 2027 (excluding contingency or risk allowance.
Workforce	Peak workforce is estimated around 50 personnel.
Estimated spoil volume	Cable trenching: Two x 2.1km trenches (approximately 2 metres wide and 4 metres deep), generating approx.33,600m³ of excavated material. Onsite substation: approximately 9,000m² site area with 300 mm topsoil stripping, generating ~2,700 m³ of material. Total estimated spoil volume: Approx. 36,300 m³
Hours of construction	Standard construction hours will be adopted where reasonable and feasible: • Monday to Friday 7:00 am to 6:00 pm • Saturday 8:00 am to 1:00 pm • No works on Sundays and public holidays. Works outside standard construction hours, including night works and 24-hour operations, may be required for activities

	along Lenore Drive, at cable jointing locations, and other areas as necessary or as requested by relevant authorities. TransGrid requires out of hours works for non-noise generation works during commissioning and when there are outage restrictions for the substation and lines.
--	---

2.2 Project Area

The project area for the external HV works comprises the overall potential area of direct disturbance by the project, which may be temporary (for construction) or permanent (for operational infrastructure) and extend below the ground surface.

The project area extends along the Lenore Drive road reserve and includes the crossing of Ropes Creek. Land affected by the works includes 78 Lockwood Road, Erskine Park (Lot 101 in DP 1268632) and Lots 15, 16 and 17 in DP 1157491 located along Lenore Drive.

While the project area defines the extent within which infrastructure may be located and works may occur, not all areas will be disturbed. Detailed design will refine the final alignment of the transmission cable within the road reserve and the location of joint bays and associated infrastructure within the assessed project area.

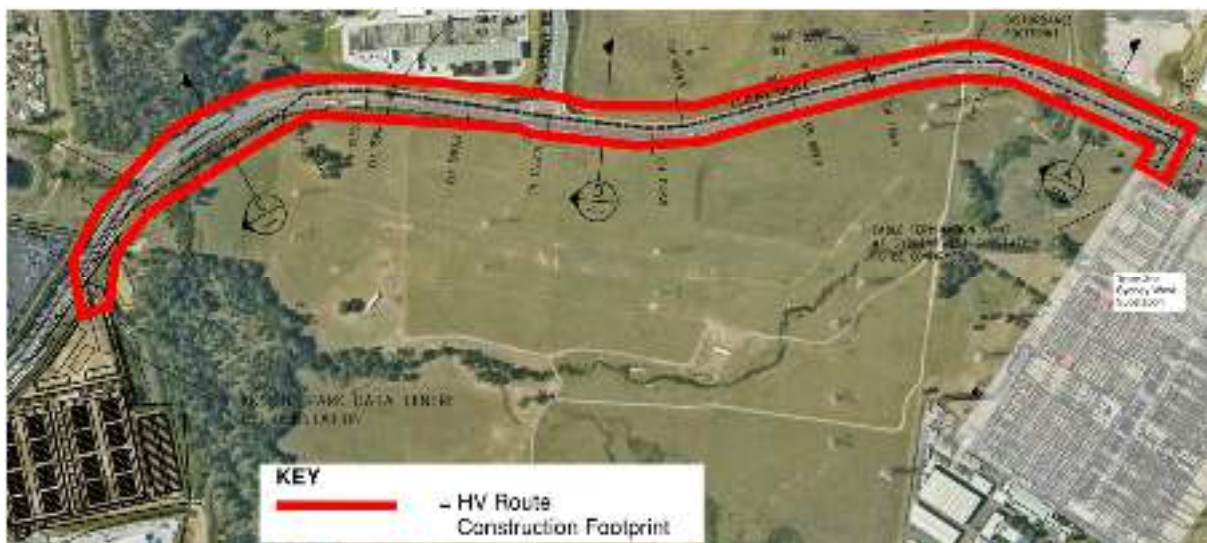


Figure 1 – Project Area Map

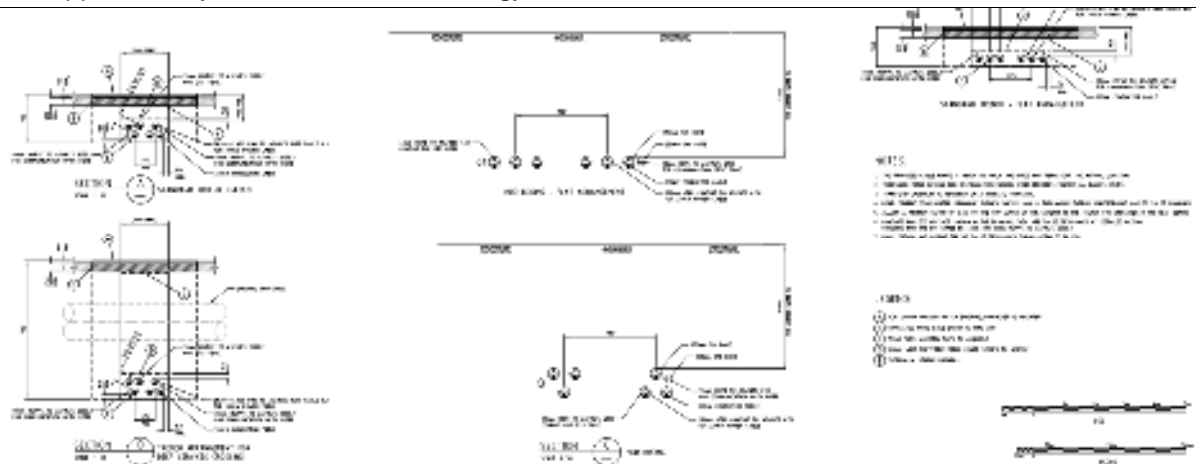


Figure 2 – Typical trench configurations

2.3 Construction Activities

2.3.1 HV Cable Route

Construction of the HV cable route will involve installation within a single double-circuit trench commencing at the STACK SYD01 Switchyard and extending along Lenore Drive.

Given the location of the works within the road reserve, construction will impact vehicle movements along Lenore Drive. The works are therefore expected to require staged traffic management measures, including sequential lane closures and re-openings, to facilitate safe construction while maintaining traffic flow.

Traffic management is anticipated to include contraflow arrangements and associated traffic control measures. Where other lane closures are in place concurrently, alternative traffic control measures or detour routes will be implemented to ensure continuity of access.

Detailed construction staging and traffic management arrangements will be developed following contractor appointment. An indicative staging program for the HV cable route works is provided in Table 2.

Table 2 – HV Cable Routes Construction Staging

Stage	Description	Duration / Timing
1	Bulk Excavation	October 2026 to March 2027
2	Installation of Trenching / HDD Underboring	January 2027 to September 2027

2.4.2 Construction Activities

Construction activities would typically include:

- Site preparation including establishment and securing of work sites and construction laydown areas
- Trenching and excavation of the transmission cable route
- Horizontal Directional Drilling (HDD) for Ropes Creek crossing. Identification and confirmation of existing services/utilities and relocation where required
- Installation of conduits
- Excavation and construction of joint bays and associated concrete pits for ancillary infrastructure
- Restoration of disturbed areas, including backfilling, surface reinstatement and rehabilitation
- Cable pulling and jointing



Figure 3; TransGrid indicative overview of typical construction activities

2.4.2.1 Site preparation

Prior to construction of the trench, site preparation activities would be undertaken, these works would include:

- Implementation of traffic management changes (such as safety barriers and road signage) to facilitate access and egress to/from the work sites;
 - Installation of environmental control measures (such as sediment barriers);
 - Minor clearing works (such as vegetation/tree removal);

- Establishing construction laydown areas and ancillary facilities including temporary offices and worker amenities, site fencing and provision of power/services; and
- Delivery and storage of plant and equipment at construction laydown areas and work sites.

Before excavation commences at each work site within the Lenore Drive Road reserve, HDD Underbore area and STACK SYD01 Switchyard, the location of the trench or excavation would be marked (with chalk or spray paint) and if required, any surface vegetation would be cleared. Non-destructive identification of utilities and services along the route would be undertaken. The recorded location of known existing services crossing the trench would be marked for reference

2.4.2.2 Trenching and excavation

Along the cable route, a single trench will be excavated - approximately 2 metres wide and up to 2 metres deep in a trefoil configuration. At utility crossings, the trench may increase to approximately 3.6 metres wide and 4 metres deep to accommodate a flat configuration.

Trenching would be undertaken in short sections (typically around 20 metres at a time), with conduit installation and backfilling occurring progressively to minimise the extent of open excavation.

Prior to excavation, saw cutting of the road surface or pavement would be undertaken. Excavation would be carried out using standard plant such as excavators and loaders. Where hard material or rock is encountered, a rock breaker may be used.

Following confirmation and relocation of services (where required), excavation would proceed to the base of the trench. Excavated material would be loaded directly into trucks for transport to designated laydown areas for temporary storage or to appropriately licensed off-site facilities for disposal.

Trench stability would be assessed during excavation, and shoring installed where required to prevent collapse, particularly in deeper sections. Open excavations would be secured with appropriate barricades and safety measures when unattended, with regular monitoring to ensure public safety.

Where feasible, works would be undertaken during periods of lower traffic volumes to minimise disruption. Traffic management measures would be detailed in a Traffic Management Plan prepared as part of the Construction Environmental Management Plan (CEMP).

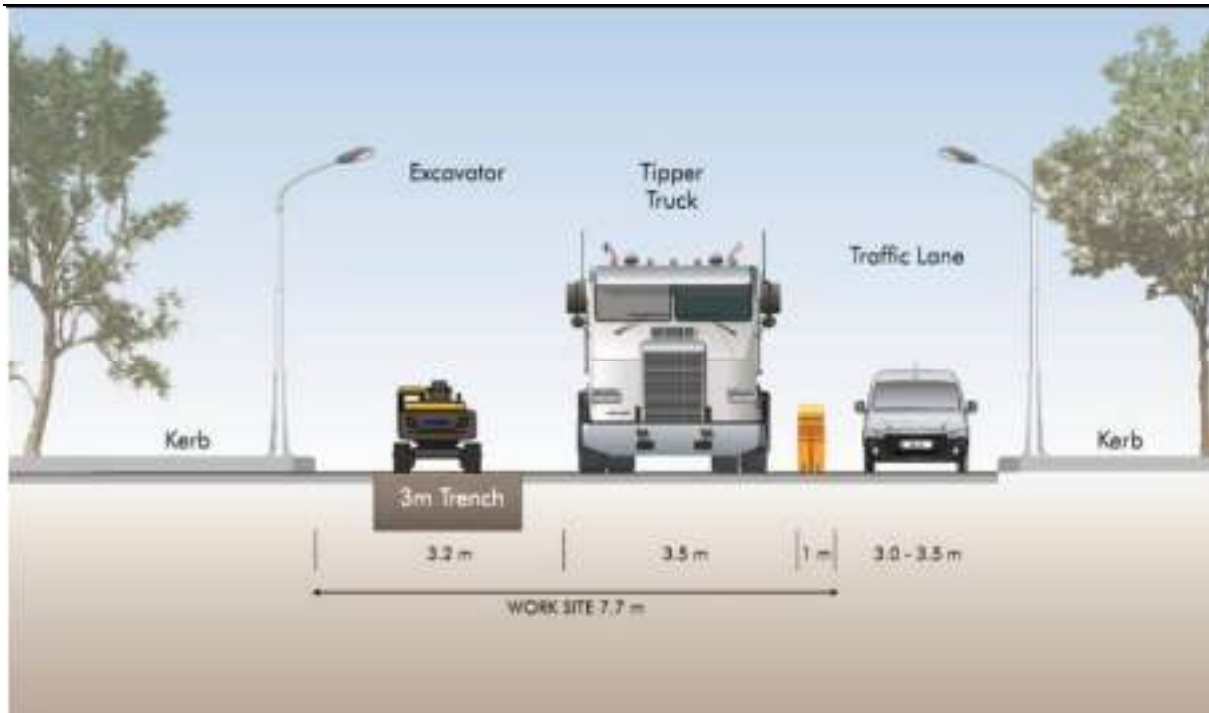


Figure 4; Indicative schematic description of kerbside trenching and excavation construction methodology

2.4.2.3 HDD Boring

Horizontal Directional Drilling (HDD) and conduit installation would be undertaken to install underground electrical conduits beneath Ropes Creek where open trenching is not feasible.

Launch and receive pits would be excavated at either end of the proposed bore alignment. Pits would typically be approximately 3–6 metres in length, 2–6 metres in width and up to 3–6 metres in depth, depending on conduit size, drilling depth, geotechnical conditions and subject to final design. Prior to excavation, saw cutting of any existing road pavement or hardstand surface would be undertaken and removed.

The HDD drilling rig would be situated at the launch pit. A pilot bore would be drilled along the designed alignment using a guided drill head with electronic tracking to maintain the specified depth and line. Drilling fluids would be used to stabilise the bore, lubricate the drill string, and facilitate removal of spoil material. Drilling fluid would be managed at the launch and receive pits with control measure implemented.

Upon completion of the pilot bore, the bore hole would be progressively reamed to the required diameter to accommodate the conduits. Conduits would be pre-assembled and stringed out where space permits, then pulled back through the enlarged bore from the receive pit to the launch pit in a single continuous operation.

Excavated material from the pits would be loaded directly into trucks and transported to designated laydown areas for temporary storage or to appropriately licensed off-site

facilities for disposal. Excess drilling fluids would be removed (for example via vacuum truck) and managed in accordance with environmental requirements.

Pit stability would be assessed during excavation, with shoring installed where required to prevent collapse. Open pits would be secured with appropriate barricades and safety measures when unattended, with ongoing monitoring to ensure public and worker safety.

Upon installation of conduits, pits would be backfilled and compacted in layers in accordance with project specifications and relevant authority standards.

Where feasible, works would be undertaken during low traffic periods, to minimise traffic impacts. Traffic management measures during construction would be outlined in a traffic management plan as part of the overarching Construction Environmental Management Plan (CEMP) for the project.

2.4.2.4 Service/utility relocation

Relevant service/utility providers within the project area will be engaged with regarding the possible interaction with and relocation of services and utilities during the construction of the project.

2.4.2.5 Conduit Installation

Installation of the conduits for the proposed and possible future transmission cable circuits would generally involve:

- Laying the conduits on plastic spacers to provide the required clearance from the side walls and bottom of the trench.
- Placing the optic fibre communication cable conduits into position.
- Covering the conduits and backfilling the trench with engineered backfill material. Backfilling would occur as soon as practicable following conduit installation to minimise the risk of erosion; and
- Laying polymeric covers and warning tape (at various levels over the conduits) marked with appropriate warnings in case of accidental excavation.

2.4.2.6 Road restoration works

Restoration activities with the road reserve would be:

- Temporary, while trenching and cable pulling is still underway; and
- Permanent once cable pulling is complete

The initial restoration of the road surface would include installing road base and a temporary road surface to allow vehicles and other road users to safely travel across the area. The temporary road surface can be used for a period of up to six months.

Permanent restoration of the road surface would involve:

- Removing the temporary road surface.
- Backfilling with road base up to surface level, where required.
- Reinstating the road surface; and
- Reinstating the remaining areas with spoil or other fill material to pre-construction levels and final finishing as appropriate (including footpath and/or kerb and gutter)

2.4.2.7 Cable Markers

Once restoration activities have been completed, cable markers would be installed along the transmission cable route to provide warning of the presence of the cables and the need to make enquiries with TransGrid before undertaking any excavation. The location of the cable circuit will also be registered on Dial-Before You-Dig prior to construction commencing. Markers may include

- Small signs attached to road kerbs.
- Concrete marker posts (between 800-900 millimetres tall) along the transmission cable route in vegetated areas where surface markers would be difficult to see; or
- Flush markers constructed of concrete that are around 50-100 millimetres thick

2.4.2.8 Cable pulling and jointing

Joint bays would be excavated via open trenching. Erosion and stormwater flow controls would be installed around the work site to prevent inundation, while hard barriers would be installed to protect the work site from traffic movements and unauthorised pedestrian access. During detailed design, the exact location of joint bays would be determined, with the aim of avoiding driveways and other access points wherever possible. However, where this is not possible and vehicle access to adjacent properties is required across open joint bays, they would be temporarily covered with trafficable steel plates.

Once the joint bays have been established, the cables can be pulled through the conduits. The cables are fed from large cable drums holding around 600-800 metres of cable (refer to Figure 5). The sections of cable on either side of the joint bays are then connected at the joint bays.



Figure 5; Example of cable pulling and cable joint works

2.6 Expected Plant & Equipment List

List of plant and equipment to be confirmed by the contractor prior to construction of the HV Route

Activity	Major Plant
Trenching	20–35t excavators, trucks, compactors
Cable Pulling	Winch, drum stands, crane
HDD	250–400t HDD rig, mud plant

Activity	Major Plant
Joint Bays	Excavator, shoring, crane
Traffic	VMS, barriers
Environmental	Sediment control, water carts