Shire of Serpentine Jarrahdale

Assessment Report – Sports Lighting at Kalimna Reserve

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Client: Shire of Serpentine Jarrahdale

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Use of this Document:

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Executive Summary

This report outlines the assessment of the existing site i.e. Kalimna Sport Reserve and simulate the sports lighting feasibility at conceptual level for AFL and Soccer playing fields in Byford and providing the cost estimate for budgeting purposes as part of the assessment report scope.
The report also includes the details of the major sports lighting items based on three different Light Emitting Diode (LED) flood light options along with electrical and control assets that need to be part of the proposed installation.

The proposed new lighting assets shall include the new LED flood lights installed on new light poles to achieve the desired lux levels as per AS2560.2:2021 for respective playgrounds as detailed below:

1. Soccer Playing Field – 50 & 100 lux
2. AFL Playing Field – 50 & 100 lux

Briefly, the lighting project shall be based on following steps as analysed and assessed with lighting and electrical calculations to achieve above mentioned lux levels:

1. Install New LED flood lights - Numbers vary based on Manufacturer.
2. Install new 30m high light poles (rigid) – minimum four light poles.
3. Install one new Electrical Distribution Switchboards
4. Install new electrical Circuits and protection devices to connect new LED flood lights.
5. Install new control circuits and devices to operate LED flood lights.
6. For 100 Lux AFL & Soccer - Minimum 16 LED fittings required.
7. For 50 Lux AFL & Soccer - Minimum 10 LED fittings required.

The approximate cost estimate based on the concept design for two lux levels as applicable to AFL and soccer playing area shall be as given below:

1. AFL and Soccer 50 lux - $ 455 k
2. AFL and Soccer 100 Lux - $ 565 k

Glossary

Acronym	Definition
AFL	Australian Football League
SMSB	Site Main Distribution Board
LV	Low voltage
DALI	Digital Addressable Lighting Interface
UG	Underground
OH	Overhead
WP	Western Power
LED	Light Emitting Diode
CAD	Computer Assisted Design
AC	Alternating Current
DC	Direct Current
DB	New Distribution Switchboard

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1. Introduction

1.1 Project

The Shire intends to undertake an estimate of the lighting project at one of the sports ovals. The Shire as part of project needs an assessment report concerning the installation of lighting at Kalimna Sporting Reserve – Ovals in Byford. This report is required to support the Shire's submission to the Club Night Lights Program.

The assessment report shall include a concept design, cost estimates for at least two different LED flood lighting options for two lux levels as applicable to Training and competition level of Sports as per AS2560.2:2021. The lighting specifications should be suitable for both training and competition levels for Australian football or soccer. The report is based on CAD files and other information provided by the Shire in addition to third party sources.

1.2 Scope

The scope of the project shall be do detailed assessment of the proposed sports lighting at Kalimna Sport Reserve in Byford. current report details the assessment of proposed new electrical and lighting assets that shall be required to be installed on site should this project be going ahead.

The project includes the lighting simulation of the defined and agreed playing field boundaries for required illuminance levels as per AS2560.2:2021 (Refer to Table 1 for details). Lighting design simulations have been considered for three different type LED flood light fittings from three different suppliers in the current sports lighting commercial market. Based on the results of the three different LED flood light to options, preliminary electrical simulations and calculations have been completed as part of the project assessment. The scope of the proposed sports lighting shall allow for following playing areas.

1.2.1 Soccer

1. Training (50 Lux) – Refer to Table 1 (highlighted blue for required parameters)
2. Semi Professional Level (Match Practice – 100 lux) - Refer to Table 1 (highlighted red for required parameters)

1.2.2 AFL

1. Training (50 Lux) - Refer to Table 1 (highlighted blue for required parameters)
2. Semi Professional Level (Match Practice – 100 lux) - Refer to Table 1 (highlighted red for required parameters)

1.3 Site

Location – Kalimna Sports Oval, Kardan Boulevard, Byford WA 6122.

The site layout includes the new proposed Soccer and AFL playing fields that shall form the base of the lighting design scope. The proposed Soccer and AFL playing fields as proposed and considered to undertake the lighting concept design simulations are shown in the site layout image shown by Figure 1.

The various markings in the image below are detailed as follows:

1. Red dotted lines - Pole Exclusion Zone
2. Pink Outline - New Proposed Soccer playing field.
3. Blue Outline - New proposed AFL playing field.
4. White Lines - Centre lines - AFL
5. Yellow Lines - Light Pole Location zones as per AS2560.2
6. Red Circles - Proposed Location of New Light Poles

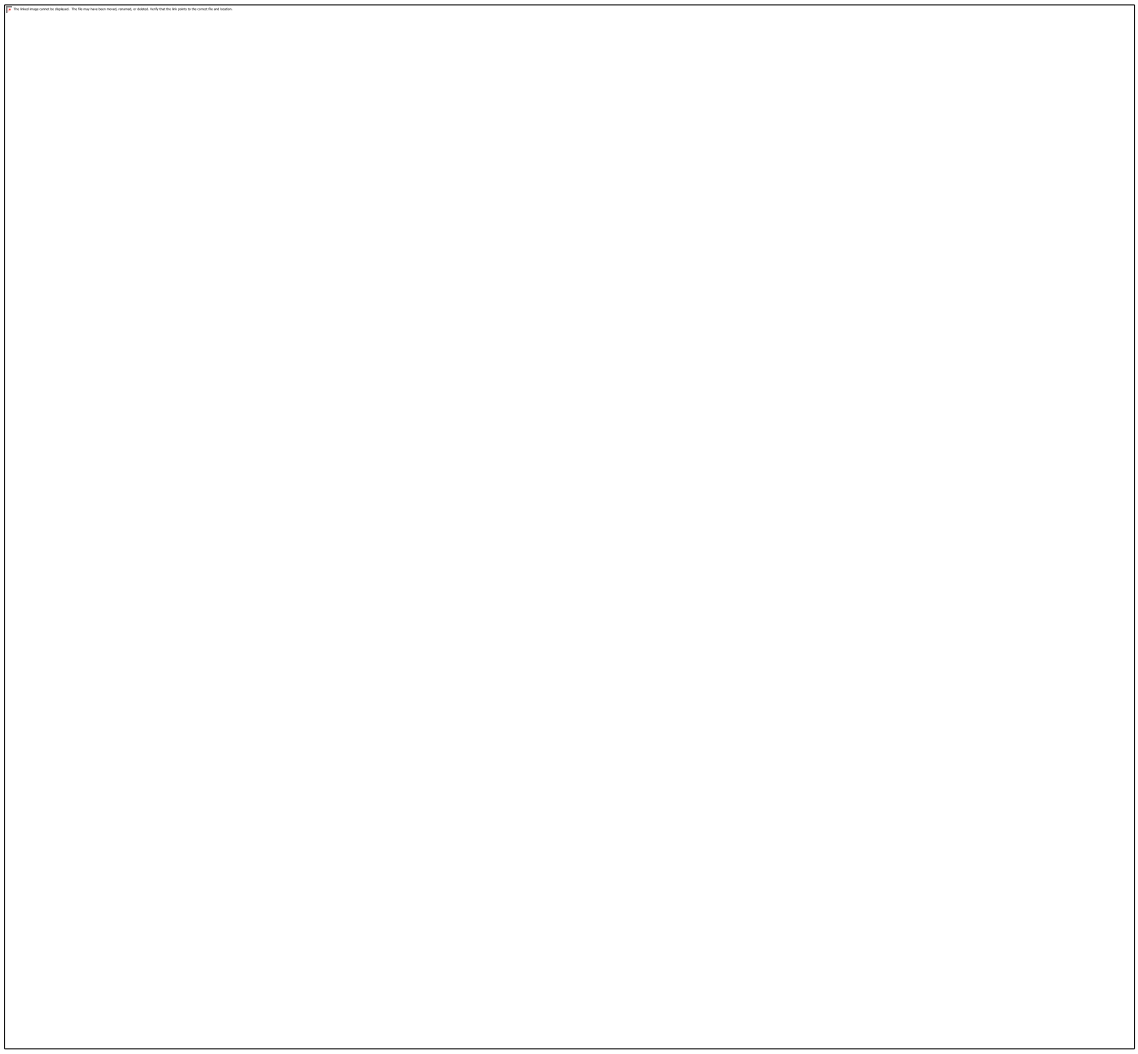

Figure 1: Site Layout with Existing and Proposed assets

2. Standard

2.1 Light Technical Parameters

The sports field under current scope i.e., Training level and Competition Levels of play are applicable to both proposed Soccer and AFL principle playing areas as per AS2560.2:2021. Refer to Table 1 for the applicable level of play (marked red for Training and marked blue for Competition level) and respective light technical parameters that needs to be achieved.

Table 2.6.1 — LTPs for football

Level of play	Average horizontal maintained illuminance ($\bar{E}_h$)	Minimum horizontal uniformity		Maximum uniformity gradient per 5 m[e]		Max. glare rating (GR)	Minimum colour rendering index (R_a)
		($E_{hmin}/\bar{E}_h$) (U_1)	(E_{hmin}/E_{hmax}) (U_2)	G	UG		
Amateur level							
Touch and tag	50	0.30[b]	N/A	N/A	N/A	N/A	65
Ball and physical training	50	0.30	N/A	N/A	N/A	N/A	65
Club competition and match practice	100[a]	0.50	0.30	50 %	2	50	65
Semi-professional level							
Ball and physical training	50	0.30[b]	N/A	N/A	N/A	N/A	65
Match practice	100	0.50	0.30	50 %	2	50	65
Semi-professional competition	200	0.60	0.40[c]	40 %	1.67	50	65
Professional level							
Ball and physical training	100	0.50	0.30	50 %	2	50	65
Match practice	200	0.60	0.40[c]	40 %	1.67	50	65
Professional competition	500	0.70	0.50[d]	25 %	1.33	50	65

Table 1: required Technical Parameters to be achieved for Compliance (Marked above)

3. Proposed Lighting Options

3.1 LED Flood Lights

Three different LED sports lighting flood light suppliers have been contacted to provide the details of the photometric files and other relevant details in addition to preliminary design simulations of the proposed playing fields for required lux levels and achieve compliance as per AS2560.2. The lighting design simulation has been completed for all three suppliers as detailed below in Table 2:

LED Flood Light	Supplier	Manufacturer	Control
Dark Licht	SII Light	DC Bright	DALI
Raptor Gen 3	Sylvania Schreder	Sylvania	HYBRID/DALI
OptiVision Gen 3.5	HI Lighting	Philips	DALI

Table 2: Three LED Flood Light Options

All three LED flood lights are remote LED driver based i.e. the LED driver shall be installed within the local electrical distribution board away from the LED flood light installed on pole top.
The information provided by the suppliers for respective (except Sylvania) LED flood light has been given in Table 3 below:

LED Flood Light Options for Soccer and AFL (50 lux and 100 lux)			
Options (Remote Driver Type only)	**Option 1 (Dark Licht)**	**Option 2 (OptiVision)**	**Option 3 (Raptor)**
Light Type	DL1200	BVP528	Raptor Gen 3
Wattage	1200W	1500W	1200W
Efficacy	160+	157 lm/W	135 lms/w
Indicative Cost (in $) Excl. GST	$ 4500.00	$ 4000.00	$ 4200.00
CRI	70+	>70	>70
Glare Control Option	Full Cut Off Reflector	YES	Yes
Manufacturer	DC Bright	PHILIPS	Sylvania Schreder
Lead Time (in weeks)	4-8 weeks	10 weeks	10-12 weeks
Weigt (in kg) Remote Driver	25.0	25.0	28.3

Voltage (in V)	240/415	240/415	240/415
IP Rating	IP67	IP66	IP66
IK Rating	IK07	IK08	IK06
Colour Temperature Options (CCT)	2200K / 2700K / 4000K / 5000K	5700K / 4000K / 3000K	5700K OR 4000K
Availability In Australia	Yes	Yes	Yes
Availability in 1-2 years' time	Yes	Yes	Yes
Dimmable	0-10v / DALI	YES/DALI	DALI/Hybrid
Warranty Period	7 Years	5 Years	5 Years

Table 3: Detailed Comparison for three different LED Flood Lights

Refer to appendix under section 7 for details of the concept designs and data sheets for each type of Led flood light fittings.

Based on the concept design simulations undertaken for all three LED flood lights, the comparison between three fittings is given in the Table 4 below:

Design Outcome	Option 1	Option 2	Option 3
LED Flood Lights	DL1200	BVP528	Raptor Gen 3
Application	Soccer and AFL Playing Areas		
Number of Fittings (Soccer) – 100 Lux	8	12	12
Number of Fittings (AFL) – 100 Lux	12	16	16
Number of LED Fittings – 50 Lux Soccer	6	8	8
Number of LED Fittings – 50 Lux AFL	8	10	10
Obtrusive Light Compliance	Non-Curfew Level L1 Hours	Non-Curfew Level L1 Hours	Non-Curfew Level L1 Hours
Light Loss Factor (LLF)	0.88	0.90	0.92
Max Glare (AFL)	41.4	38.6	47.0
Light Pole Height (in m)	33	28	28
No. Light Poles	4	4	4

Table 4: LED Flood Light Output Performance

3.2 Light Poles

New light poles proposed for the two playing fields on site shall be four in number and pole locations shall be as per AS2560.2 AFL requirements.

Four Light Poles – 30m taken as average mounting height for the calculation purposes.

All light poles considered for the project shall be based on following constructional elements (refer to section 7.4 for typical details):

1. Rigid Type Octagonal Light Poles with one cross arm
2. Cage Rag Bolt Type Concrete Footing

The light pole footings shall be cylindrical shape and approximate dimensions shall be as given below:

1. Diameter - 1.2 to 1.5m
2. Depth - 4.0 to 4.5m

The footing design shall subject to changes with respect to pole top loading and soil conditions based on Geotech Report of the site.

4. Proposed Electrical Assets

4.1 New Site Switchboard

The new LED flood lights is remote LED driver type and hence LED drivers of each LED flood light shall be installed inside the new proposed electrical site main distribution switchboard (SMSB) as indicatively shown in the site layout In addition to Site Main Switchboard, one new electrical distribution switchboard shall be installed to extend the electrical power to other lights installed on the new light poles. (Refer to Figure 2 for the location of new proposed Switchboards).

The temperature and humidity need to be maintained within allowed limits depending on the type of LED driver.

New switchboard shall have all new lighting AC and DC circuits connected to complete electrical connections and control system of the new LED flood lights.

4.2 Consumer Mains

New consumer mains shall be required to be installed from Western Power nearby LV network to provide the power supply to new proposed sports distribution switchboard. With current lead time conditions at Western Power, the installation of new LV connection for new sports distribution switchboard shall be around 9-12 months.

As part of the future design scope, new proposed sports switchboard needs to be fed from network supply using consumer mains 3 phase cable from nearest LV supply point known as point of connection. Point of connection can be existing Western Power Unipillar or new Unipillar on site.

To undertake above mentioned supply installations, Western Power application needs to be submitted for power supply connection and fed through WP pillar. The cost of power supply installation shall be based on Western Power design. Western Power design shall be subject to Network load conditions and Network layout at the time of design undertaking. The cost for installation for current assessment shall be based on approximate cost of consumer main cable and new pillar installation.

4.3 New Cables

As per concept design, new circuits shall be installed between SMSB and each new installed lights on each new light pole.

New electrical circuit cables between SMSB and light poles shall be installed by open trenching method and new circuits will not cross the playing area or play area boundaries. New circuit cables shall be connecting remote LED drivers installed within new SMSB and LED flood light fitting on top of the light pole. (Refer to Table 5 for proposed cable schedule)

4.4 Control System

All LED flood lights shall be controlled for different level of illuminance and for different playing areas using DALI 0-10V DC system and DALI based digital control devices. All DALI control cables and devices shall be insta within the new SMSB.

4.5 Remote Operation

All LED flood lights shall be controlled using remote operation control devices such as Halytech or Cloudmaster controllers as preferred by the Shire. The controllers Halytech and Cloudmaster have same basic concept of remote operation of electrical devices based on text message customised for each operation of flood lights at site.

All remote operation control devices shall be installed within the new proposed SMSB and DB as per electrical connections shown in the electrical layout.

5. Electrical Concept Design

5.1 Electrical Circuit Layout

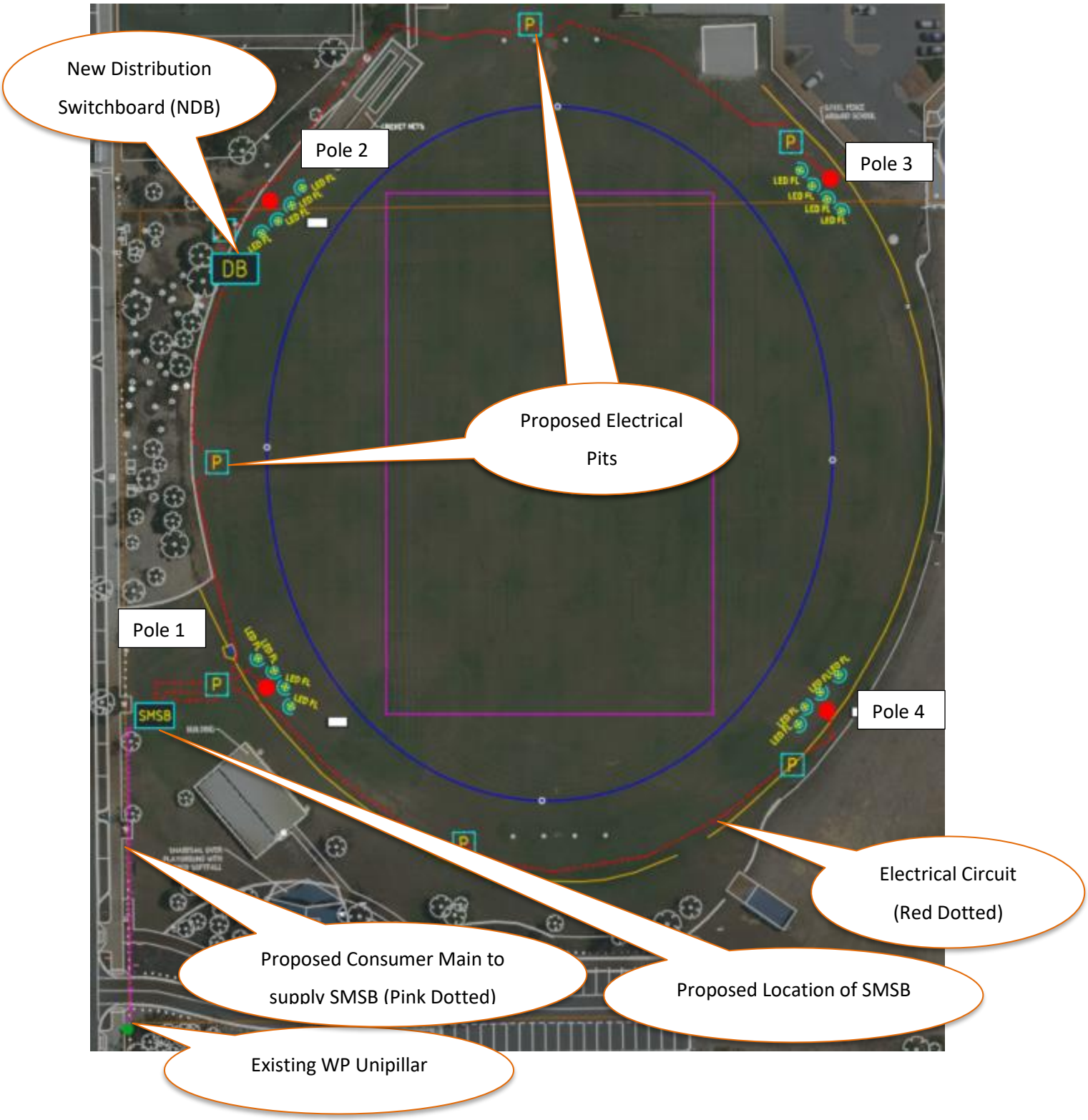

Figure 2: Electrical Layout based on Concept Design

Legend:

1. Pink Dotted Line - Consumer Mains Cable (Connecting WP POC to proposed SMSB)
2. Red Dotted Line - Electrical Circuit (Connecting LED flood light driver to LED Light on pole top – different cable sizes)
3. Blue Solid Line - Playing Field Boundary (AFL)
4. Pink Solid Line - Playing Field Boundary (Soccer)
5. SMSB - Site Main Switchboard
6. DB - New Distribution Switchboard

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5.2 Estimated Cable Schedule

The calculations and simulations for cable sizing and other electrical accessories have been based on the locations of the proposed new electrical assets and details of the lighting concept design.

From	To	Cable Type	Size (sqmm)	Length (in m)	Conduit (in mm)	Depth (in mm)	Application
Unipillar	SMSB	Circ Orange XLPE/PVC 4C+E	35.0	85.0	2 x 63 HD	700	Consumer Mains
SMSB	DB		35.0	120.0	3 x 50 HD	700	Supply Cable
SMSB	Pole 1	Circ, Multi Core 12C+E	2.50	80.0	2 x 50 HD	700	DC Cable
DB	Pole 2		2.50	65.0	2 x 50 HD	700	DC Cable
DB	Pole 3		2.50	210.0	2 x 50 HD	700	DC Cable
SMSB	Pole 4		2.50	210.0	2 x 50 HD	700	DC Cable

Table 5: Estimated Cable Schedule for Lighting Concept Design

6. Cost Estimate

6.1 Budget Cost Estimate – 100 Lux

The budget cost estimate based on the concept design of the proposed sports lighting installations and electrical assets at site has been detailed in Table 6 below for AFL 100 lux:

Item No	Item	Qty	UOM	Unit Cost	Total Cost (Excl GST)
1	Location of Services	1.0	Lot	$ 5,750.00	$ 5,750.00
2	Survey and Pegging of New poles	4.0	Each	$ 345.00	$ 1,380.00
3	Mobilisation & Site Preparation	1.0	Lot	$ 5,175.00	$ 5,175.00
4	Geo Tech on pole locations	4.0	Lot	$ 1,725.00	$ 6,900.00
5	Structural Certification for new poles	4.0	Lot	$ 575.00	$ 2,300.00
6	Supply and Installation of New DB	1.0	Each	$ 11,500.00	$ 11,500.00
7	Supply and Installation of New SMSB	1.0	Each	$ 23,000.00	$ 23,000.00
8	Supply and Installation of 35sqmm 4C+E Cable & Conduit	120.0	m	$ 104.54	$ 12,544.20
9	Supply and Installation of 2.5sqmm 6core Control Cable	565.0	m	$ 34.50	$ 19,492.50
10	Storage on Site (20 feet Containers)	1.0	Each	$ 5,750.00	$ 5,750.00
11	Supply and Installation of Electrical Pits Class D (HD)	8.0	Each	$ 862.50	$ 21,562.50
12	Concrete Testing (4 Batches)	4.0	Each	$ 575.00	$ 2,300.00
13	Temporary Fencing 2 months	8.0	Each	$ 460.00	$ 3,680.00
14	Supply of new 30m Rigid Pole	4.0	Each	$ 28,750.00	$ 115,000.00
15	Install LED Light	16.0	Each	$ 230.00	$ 3,680.00
16	Supply of LED Fittings	16.0	Each	$ 5,175.00	$ 82,800.00
17	Excavate for Footings	4.0	Each	$ 4,600.00	$ 18,400.00
18	Sleeves for Footings	4.0	Each	$ 575.00	$ 2,300.00
19	Concrete for Pole Footings	56.5	m3	$ 575.00	$ 32,499.00
20	Standing of the Light Poles	4.0	Each	$ 1,725.00	$ 6,900.00
21	Termination and Commissioning	16.0	hrs	$ 172.50	$ 2,760.00
22	Nighttime Lux Audit	1.0	Lot	$ 1,725.00	$ 1,725.00
23	Control System DALI Interface	1.0	Each	$ 2,875.00	$ 2,875.00
24	DALI Controller	6.0	Each	$ 2,300.00	$ 13,800.00
25	Wire & Terminate LED lights	16.0	Each	$ 546.25	$ 8,740.00
26	Grass reinstatement (New Cable Only)	400.0	m	$ 23.00	$ 9,200.00
27	Compaction Reinstatement Area	400.0	m	$ 23.00	$ 9,200.00

28	Marker Tape (New Cable Only) 300mm wide	400.0	m	$ 17.25	$ 6,900.00
29	Inspection, Testing & Commissioning	2.0	Each	$ 2,300.00	$ 4,600.00
30	Drawings	1.0	Lot	$ 3,450.00	$ 3,450.00
31	Consumables	1.0	Lot	$ 3,450.00	$ 3,450.00
32	Protection to DBs Electronic CB	4.0	Each	$ 2,300.00	$ 9,200.00
33	Relays & Contactors	32.0	Each	$ 287.50	$ 9,200.00
34	Western Power Application	1.0	Each	$ 1,725.00	$ 1,725.00
35	Western Power Construction	1.0	Each	$ 17,250.00	$ 17,250.00
36	Halytech Remote Controller and Installation	1.0	Each	$ 4,600.00	$ 4,600.00
	Total Excl. GST				**$ 491,588.20**
34	Contingency Design (5 %)				$ 24,579.41
35	Contingency Builder (10 %)				$ 49,158.82
	Grand Total Excluding GST				**$ 565,362.43**

Table 6: Cost Estimate for Sports Lighting Task (100 lux AFL)

6.2 Budget Cost Estimate – 50 Lux

The Budget cost estimate for AFL 50 lux is detailed in Table 7 below:

Item No	Item	Qty	UOM	Unit Cost	Total Cost (Excl GST)
1	Location of Services	1.0	Lot	$ 5,750.00	$ 5,750.00
2	Survey and Pegging of New poles	4.0	Each	$ 345.00	$ 1,380.00
3	Mobilisation & Site Preparation	1.0	Lot	$ 2,875.00	$ 2,875.00
4	Geo Tech on pole locations	4.0	Lot	$ 1,725.00	$ 6,900.00
5	Structural Certification for new poles	4.0	Lot	$ 575.00	$ 2,300.00
6	Supply and Installation of New DB	1.0	Each	$ 5,750.00	$ 5,750.00
7	Supply and Installation of New SMSB	1.0	Each	$ 13,800.00	$ 13,800.00
8	Supply and Installation of 35sqmm 4C+E Cable & Conduit	120.0	m	$ 104.54	$ 12,544.20
9	Supply and Installation of 2.5sqmm 6core Control Cable	565.0	m	$ 28.75	$ 16,243.75
10	Storage on Site (20 feet Containers)	1.0	Each	$ 5,750.00	$ 5,750.00
11	Supply and Installation of Electrical Pits Class D (HD)	8.0	Each	$ 862.50	$ 21,562.50
12	Concrete Testing (4 Batches)	4.0	Each	$ 575.00	$ 2,300.00
13	Temporary Fencing 1 month	4.0	Each	$ 460.00	$ 1,840.00
14	Supply of new 30m Rigid Pole	4.0	Each	$ 23,000.00	$ 92,000.00
15	Install LED Light	10.0	Each	$ 230.00	$ 2,300.00
16	Supply of LED Fittings	10.0	Each	$ 5,175.00	$ 51,750.00
17	Excavate for Footings	4.0	Each	$ 4,600.00	$ 18,400.00
18	Sleeves for Footings	4.0	Each	$ 575.00	$ 2,300.00
19	Concrete for Pole Footings	56.5	m3	$ 575.00	$ 32,499.00
20	Standing of the Light Poles	4.0	Each	$ 1,725.00	$ 6,900.00
21	Termination and Commissioning	10.0	hrs	$ 172.50	$ 1,725.00
22	Nighttime Lux Audit	1.0	Lot	$ 1,380.00	$ 1,380.00
23	Control System DALI Interface	1.0	Each	$ 2,875.00	$ 2,875.00
24	DALI Controller	6.0	Each	$ 1,725.00	$ 10,350.00
25	Wire & Terminate LED lights	10.0	Each	$ 546.25	$ 5,462.50
26	Grass reinstatement (New Cable Only)	400.0	m	$ 23.00	$ 9,200.00
27	Compaction Reinstatement Area	400.0	m	$ 23.00	$ 9,200.00
28	Marker Tape (New Cable Only) 300mm wide	400.0	m	$ 17.25	$ 6,900.00
29	Inspection, Testing & Commissioning	2.0	Each	$ 2,300.00	$ 4,600.00

30	Drawings	1.0	Lot	$ 2,875.00	$ 2,875.00
31	Consumables	1.0	Lot	$ 2,300.00	$ 2,300.00
32	Protection to DBs Electronic CB	4.0	Each	$ 1,725.00	$ 6,900.00
33	Relays & Contactors	10.0	Each	$ 287.50	$ 2,875.00
34	Western Power Application	1.0	Each	$ 1,725.00	$ 1,725.00
35	Western Power Construction	1.0	Each	$ 17,250.00	$ 17,250.00
36	Halytech Controller and Installation	1.0	Each	$ 4,600.00	$ 4,600.00
	Total Excl GST				**$ 395,361.95**
34	Contingency Design (5 %)				$ 19,768.10
35	Contingency Builder (10 %)				$ 39,536.20
	Grand Total Excl GST				**$ 454,666.24**

Table 7: Cost Estimate for Sports Lighting Task (50 Lux AFL)

Cost Estimate is based on following points:

1. New light pole height considered to be standard 30m and pole shall be rigid octagonal type with concrete footing base.
2. Number of LED fittings vary based on final selection of the LED flood light. For assessment purposes 16 and 10 new LED flood lights have been considered for 100 lux and 50 lux AFL and Soccer lighting project respectively.
3. It's assumed the power supply for the new SMSB shall be extended from nearby Unipillar as shown in the electrical layout (Refer to Figure 2)
4. All LED flood lights to be used shall be remote type and drivers shall be installed inside switchboard and switchboard size is based on this condition.
5. Cable distances have been calculated based on proposed location of light poles and new electrical distribution switchboards on site.
6. Design and Construction contingencies have been applied as detailed in the above table.
7. Footing of the new light poles, excavation of new circuits and installation of new switchboards shall be against usual soil conditions and any rock or limestone in the ground has not been considered.
8. Lighting concept design is as per designs provided by the different suppliers and shall be subject to changes during detailed design based on type of LED fitting selected.
9. Western Power costs are based on the selection of existing point of connection as shown in the electrical layout and proposed location of the new SMSB.

6.3 Maintenance Costs

As detailed by the different suppliers of LED flood lights, there is no direct major costs involved in the maintenance of the LED Flood Lights. Maintenance costs of the LED flood lights is mainly for the cleaning of the LED flood lights at interval of 30-36 months. Depending on the pollution level in installation, cleaning interval of the LED flood lights can be more or less frequent.

Based on 36 months cleaning, annual costs of cleaning can be estimated to be around $ 4000 - $5000 for the proposed number of LED fittings and pole heights.

6.4 Operational Costs

Operational costs of the proposed sports lighting shall be directly proportional to the energy tariff applicable to the site energy meter, number of hours of sports lighting usage, power rating of each LED fitting and level of illuminance used for each operation i.e. either 100 lux or 50 lux.

Considering a generic Club pattern for AFL, as an example if proposed lighting is used for 5 hours per day 4 days per week to illuminate playing area to 100 lux then the operational annual charges shall be as calculated below:

LED Flood Light Rating	-	1500W, 240V
Energy Average Tariff (assumed)	-	$0.35 per KWH
Power Consumed (16 LED Fittings)	-	24 KW
Annual Energy Units Consumed (KWHr)	-	24,960.00 KWH
Total Annual Cost (in $)	-	$ 8,736.00

7. Appendix

7.1 Lighting Concept Design – OptiVision LED Flood Light (By Philips)

7.2 Concept Lighting Design – Raptor LED Flood Light (By Sylvania)

7.3 Concept Lighting Design – Dark Licht LED Flood Light (By DC Bright)

7.4 Typical 30m Light Pole, Cross arms, and Concrete footing Details (G & S Industries)