1.0 INTRODUCTION

1.1 The Proposed Development

The Schofield Trust proposes to rezone Lots 9501 Cheriton Road , Gingin (the site) from General Rural to Rural Living under the Shire of Gingin Local Planning Scheme No. 9 to enable its subdivision into Rural Living lots with a minimum size of two hectares.

The site has a total area of approximately 24.02ha. The proposed subdivision will create 12 new lots with areas between 2.1ha and 3.26ha as well as 2.24ha of new road reserve. The new lots will enable 12 new residences to be built, which will be serviced with scheme water and on-site effluent disposal.

Planning consultant Harley Dykstra has prepared a structure plan and conceptual plan of subdivision for the site. Figure 1 shows the proposed subdivision layout. Figure 2 shows an aerial view of the site and its surroundings.

Bayley Environmental Services was commissioned in August 2021 to undertake site investigations and to prepare a Local Water Management Strategy (LWMS) in support of the structure plan. Due to the apparent lack of significant environmental constraints to the proposal, the Department of Planning, Lands & Heritage (DPLH) has agreed (____, 2021 corresp.) that the requirement for an Environmental Assessment & Management Strategy (EAMS) report to support the rezoning may be satisfied by an expanded LWMS.

1.2 Relevant Policies and Guidelines

1.2.1 State Planning Policy 2.9

State Planning Policy 2.9: *Water Resources* (WAPC, 2006) lists the following key principles for total water cycle management:

- Consideration of all water sources (including wastewater) in water planning, maximising the value of water resources.
- Integration of water and land use planning.
- Sustainable and equitable use of all water sources, having consideration of the needs of all water users including the community, industry and the environment.
- Integration of water use and natural water processes.
- A whole-of-catchment integration of natural resource use and management.

SPP 2.9 also lists the following general objectives for water-sensitive urban design:

- to manage a water regime;
- to maintain and, where possible, enhance water quality;
- to encourage water conservation;
- to enhance water-related environmental values; and
- to enhance water-related recreational and cultural values.

Element 5 of *Liveable Neighbourhoods* Edition 3 (WAPC, 2004) identifies specific objectives and requirements for Urban Water Management. These are based on Best Planning Practices which are defined as the best practical approach for achieving water resource management objectives within an urban framework.

1.2.2 Better Urban Water Management

Better Urban Water Management (WAPC, 2008) sets out the following objectives for water sensitive urban design:

Water Conservation

- Consumption of 100kL/pp/yr including less than 40-60 kL/p/yr scheme water.

Water Quantity

- Ecological Protection – Maintain pre-development flow rates and volumes for the 1 year ARI event. Maintain or restore desirable environmental flows and/or hydrological cycles.

- Flood Management – Maintain pre-development flow rates and volumes for the 100 year ARI event.

Water Quality

- Maintain pre-development nutrient outputs (if known) or meet relevant water quality guidelines (e.g. ANZECC & ARMCANZ, 2000).

- Treat all runoff in the drainage network prior to discharge consistent with the Stormwater Management Manual.

- As compared to a development that does not actively manage stormwater quality, achieve:

  - at least 80% reduction of Total Suspended Solids;
  - at least 60% reduction of Total Phosphorus;
  - at least 45% reduction of Total Nitrogen; and
  - at least 70% reduction of gross pollutants.

Mosquitoes and Midges

- Design detention structures so that, between the months of November and May, stormwater is fully infiltrated within 96 hours.

- Design permanent water bodies (where accepted by DWER) to maximise predation of mosquito larvae by native fauna.

1.2.3 Government Sewerage Policy

The Government Sewerage Policy (2019) requires that all new subdivision and development should be deep-sewered unless it is exempt for one of several reasons. For exempt developments, the policy establishes minimum site capability requirements and, where appropriate, density limits. In these cases, on-site effluent disposal may be approved where the responsible authority is satisfied that:

- each lot is capable of accommodating on-site sewage disposal without endangering public health or the environment; and
- the minimum site requirements for on-site sewage disposal as set out in the Policy can be met.

The Policy designates certain areas as Sewage Sensitive Areas (SSAs), including land:

- within the coastal catchment of the Swan Estuary; and
- within 1km upgradient or 250m downgradient (or overall 1km where the groundwater gradient is unknown) of a significant wetland.

Approximately the eastern half of the site is within an SSA due to its proximity to Gingin Brook.

Additional restrictions and requirements apply to on-site effluent disposal in SSAs, including:

- a minimum lot size of one hectare (unless exempted on a case-by-case basis);
- minimum vertical separation of 1.5m from the discharge point of effluent disposal systems to the highest groundwater table level; and
- secondary effluent treatment systems with nutrient removal.

1.2.4 DoW Interim Guideline: Developing a Local Water Management Strategy

The DoW LWMS guideline was published in 2008 and sets out the DoW's preferred format and content for LWMS documents. The guideline expands on the LWMS guidance provided in *Better Urban Water Management* (2008).

This LWMS has been prepared in accordance with the principles set out in the DoW guideline.

1.2.5 Shire of Gingin Local Planning Scheme No. 9

The Shire of Gingin Local Planning Scheme No. 9 contains the following objectives for Rural Living zones:

a) protect the rural environment and landscape;
b) accommodate single dwellings at very low densities on individual allotments beyond the urban areas;
c) restrict and limit the removal of natural vegetation and encourage revegetation where appropriate;
d) prevent threats to the amenity of the zone and impacts on wildlife and native vegetation caused by the grazing of livestock;
e) avoid increased fire risk to life and property through inappropriately located and designed land use, subdivision and development; and
f) provide for a suitable level of physical and community infrastructure.

1.3 Scope of the LWMS

The scope of this LWMS is to:

- Document the existing environment on the site, in relation to soils, drainage, erosion, watercourses, groundwater and water-dependent ecosystems.
- Briefly describe the proposed development in relation to water management.
- Examine the capability of the site for on-site effluent disposal.
- Address relevant regulatory requirements and design criteria for water harvesting, setbacks to watercourses, groundwater management and drainage.
- Describe the strategies to be implemented for water conservation, watercourse protection, groundwater management and stormwater drainage.

This LWMS also includes relevant elements of an Environmental Assessment and Management Strategy (EAMS) in support of the Scheme amendment, by agreement with the DPLH (_____, 2021 corresp.)

1.4 Design Objectives

Table 1.1 summarises the water-related design objectives for the site and the means by which they will be achieved in the LWMS and subsequent management plans.

Table 1.1 Design Objectives

Design Aspect	*Design Objective*	*How Objective is to be Achieved*
Water Conservation	Ensure efficient and sustainable use of water resources	Use water efficient fixtures. Use non-potable water for irrigation. Use water-efficient native species for landscaping. Irrigate landscape plantings only for 2 years.
Groundwater Management	Minimise impacts on groundwater level and flows Minimise impacts on groundwater quality	Treat runoff from minor storms in bioretention basins and swales.
Surface Water Management	Minimise impacts on surface water flow rates, volumes and quality	Retain and infiltrate runoff from 1-year ARI 1-hour storms in bioretention basins and swales. Detain runoff from larger storms and control release from lots and overall site to pre-development flow rates. Set effluent disposal facilities at least 100m back from natural waterways.

2.0 EXISTING ENVIRONMENT

2.1 Rainfall

Gingin, like the rest of the near-Perth region, has a strongly seasonal rainfall, with most of the annual rain falling between May and September in association with winter cold fronts. Occasional heavy falls may occur from summer thunderstorms. The long-term average annual rainfall for RAAF Gingin (located 14.3km south of the site) is 620.7mm, of which 80% falls between the months of May and September.

Figure 3 shows a rainfall occurrence chart for RAAF Gingin. Table 2.1 shows rainfall intensity, frequency and duration for Gingin.

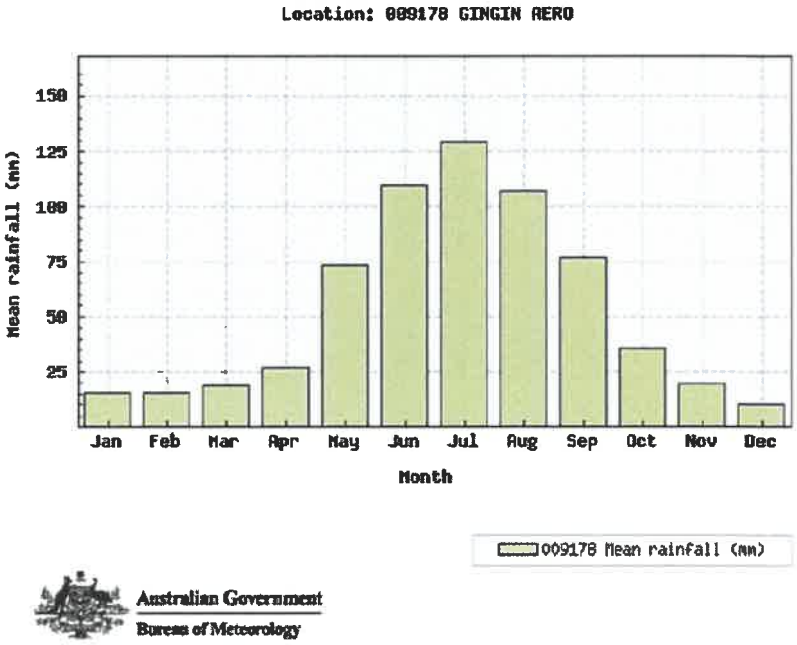

Figure 3 RAAF Gingin Mean Rainfall

IFD Design Rainfall Depth (mm)

Issued: 17 December 2021

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	1.47	1.66	2.28	2.74	3.22	3.92	4.49
2 min	2.54	2.84	3.83	4.55	5.31	6.41	7.33
3 min	3.43	3.84	5.21	6.21	7.27	8.81	10.1
4 min	4.18	4.68	6.39	7.65	8.98	10.9	12.5
5 min	4.82	5.41	7.41	8.90	10.5	12.7	14.6
10 min	7.09	8.00	11.0	13.3	15.7	19.1	21.8
15 min	8.60	9.69	13.4	16.1	19.0	23.0	26.4
20 min	9.74	11.0	15.1	18.2	21.4	26.0	29.7
25 min	10.7	12.0	16.5	19.9	23.4	28.3	32.4
30 min	11.5	12.9	17.7	21.3	25.0	30.3	34.7
45 min	13.4	15.0	20.6	24.7	29.0	35.2	40.4
1 hour	14.9	16.7	22.8	27.4	32.2	39.2	45.1
1.5 hour	17.4	19.4	26.4	31.7	37.4	45.9	53.1
2 hour	19.3	21.6	29.4	35.4	41.9	51.6	60.0
3 hour	22.5	25.1	34.2	41.4	49.3	61.3	71.9
4.5 hour	26.3	29.2	40.0	48.7	58.4	73.3	86.5
6 hour	29.3	32.6	44.7	54.6	65.7	83.0	98.4
9 hour	34.0	37.8	52.0	63.8	77.2	98.0	117
12 hour	37.6	41.8	57.6	70.7	85.8	109	130
18 hour	43.0	47.8	65.8	80.7	97.7	124	147
24 hour	47.0	52.3	71.6	87.4	105	133	157
30 hour	50.2	55.7	76.0	92.3	111	138	162
36 hour	52.8	58.6	79.4	96.1	115	142	166
48 hour	57.1	63.2	84.8	102	120	146	169
72 hour	63.7	70.3	92.5	109	126	151	171
96 hour	69.3	76.2	99.0	115	132	155	174
120 hour	74.6	81.9	105	122	138	161	179
144 hour	80.0	87.7	112	129	146	169	188
168 hour	85.6	93.7	120	137	155	180	199

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Table 2.1 Rainfall Intensity for Gingin

2.2 Physiography

2.2.1 Topography

The site lies on the gently undulating Gingin Scarp, on the north-facing slope of a low hill. The elevation ranges from 109.5m AHD at the north-east corner to 155m AHD at the south-west corner. Figure 2 shows an aerial view of the site. Figure 4 shows topographic contours over the site.

The slope ranges from less than 4% in the central west to 16% in the south-west corner. The average slope over the site is about 8%.

2.2.2 Geology, Landforms and Soils

The Geological Survey of Western Australia (Hockey *et al.*, 1975) mapped most of the site as Colluvium, soil and undifferentiated sand (Qpo): Varicoloured (white-cream-brown), poorly sorted, partly rounded sand.

The far south-west was mapped as - Gingin Chalk (Kug): White, friable, richly fossiliferous and slightly glauconitic chalk in a layer 12-28m thick. The far south-east was mapped as Leederville Formation (Kll): Continental to shallow marine sequence of sandstone with minor shale, micaceous siltstone and claystone. Figure 4 shows the GSWA mapping.

Test pits to depths of up to 3.9m at twelve locations (Figure 4) mostly found a dark red loam over orange-red mottled clay-loam or lateritic clay. In the south-west the test pits found very dark loam over a white chalk layer about 1.5m thick over clay. Two test pits (GT4 and GT9) encountered granite at 2.9m and 1.9m respectively. Appendix A shows soil logs from the test pits.

Chalk outcrops and loose rocks were visible on the surface in the south-west. Figure 4 shows the area interpreted to contain the chalk layer.

2.2.3 Land Units

DPIRD (www._____) maps the site as part of the Dandaragan System (222Da): "Subdued dissected lateritic plateau, undulating low hills and rises with narrow alluvial plains, variable deep sands and sandy gravels plus minor earths, duplexes and clays; *Melaleuca* woodlands and shrublands."

2.2.4 Soil Permeability

Constant-head permeability tests in accordance with AS1547:2012 at 0.5m depth at eight locations (Figure 4) found saturated hydraulic conductivities (Ks) ranging from 0.5m/day to 9.2m/day, with an average Ks of 3.5m/day and a median of 2.4m/day. Appendix B shows the permeability test results.

2.2.5 Phosphorus Retention Index

No soil PRI analyses have been carried out at the site. The dark red-brown loamy and clayey soils are expected to have a high to very high PRI (probably over 100).

2.2.6 Acid Sulphate Soils

The Department of Water & Environmental Regulation (DWER) maps the site as having Low to Nil risk of actual or potential ASS. The site is elevated with soils of terrestrial origin. No further consideration of ASS is proposed.

2.3 Hydrology

2.3.1 Groundwater

A shallow groundwater table probably develops in the valley north of the site in winter. Given the slopes and observed depth to granite in the area, the water table is expected to extend no further than the edges of the lots.

Seepage may occur above the granite or heavier clay layers in other parts of the site during winter. Groundwater ingress was observed at 1.8m to 2m depth in test pit GT12. Shallow groundwater (0.4m bgl) was also observed in a small area in the central south, where converging contours concentrate drainage from upslope.

2.3.2 Surface Drainage

There is no defined natural surface drainage on the site. Sheet runoff may occur under very intense rainfall.

A shallow seasonal creek flows northwest-southeast about 35-200m north of the site. The creek is dammed in several places and flows east about 750m to join Gingin Brook, then generally west to the Moore River. The creek rises about 300m north-west of the site and has a catchment of 95ha including parts of the site. Towards the north-eastern end of the site, the creek is joined by another creekline flowing from the north, which has an additional catchment of about 65ha.

Several shallow contour drains have been cut within the site and adjacent lots. Their purpose is unclear but is possibly erosion control. The drains do not discharge to the creek, but end in small ponds.

A dam is located in the north-east corner of the site. When inspected in August 2021 (following an exceptionally wet July) it was dry.

Figure 5 shows the hydrology of the site and surroundings.

2.3.3 Water Resources

The site is within the Gingin Groundwater Area, in the Cowalla Confined (Leederville) and Gingin Townsite (surficial) subareas. Water allocations in the Gingin Groundwater Area are governed by the DWER under the Gingin Groundwater Area Water Allocation Plan (DoW, 2015).

Under the Plan, the surficial aquifer in the Gingin Townsite subarea has a total of 5,000 ML/yr available for abstraction, of which 2500 ML/yr is currently unallocated (B. Kumar DWER, 2022 pers. comm.). The Leederville aquifer has a total of 19,000 ML/year, which is currently over-allocated.

The availability of groundwater on the site is expected to be generally low and will vary from place to place depending on the proximity to the northern creekline, the depth to granite and the occurrence of sandy soil horizons. Test drilling will be required to determine groundwater availability on any particular lot.

2.3.4 Wetlands

There are no wetlands mapped or existing on the site. The nearest mapped wetland is a Multiple Use Category palusplain in cleared paddocks 95m east of the site. Gingin Brook, 440m south-east of the site, is mapped as a Conservation Category palusplain.

2.4 Water Quality

No water quality information for the site or surroundings is available.

2.5 Vegetation

The site is cleared of native vegetation except for scattered mature trees, mostly Marri and Flooded Gum. Figure 4 shows the trees on the site.

2.6 Fauna and Habitats

2.6.1 Overview

The cleared site and surrounds offer little habitat for native fauna except for disturbance-tolerant birds. Birds observed on the site during the site inspections included magpies, crows, twenty-eight parrots and galahs.

2.6.2 Cockatoo Habitat

Bayley Environmental Services surveyed all of the trees on the site in September 2021 and found 35 trees larger than 0.5m dbh. All trees were photographed, located using a handheld GPS and inspected for health and the presence of hollows and evidence of black cockatoo feeding. Appendix C shows the tree survey results.

Several trees contained small hollows, including one in use by galahs. No hollows or potential hollows of suitable size or configuration for black cockatoo nesting were observed.

Marris were the only trees on the site which offered a potential food source for black cockatoos. No evidence of black cockatoo feeding (e.g. chewed nuts) was observed, although the search was hampered by the presence of long grass beneath most trees.

It is concluded that the Marri trees on site offer a potential food source for black cockatoos, but there are no actual or potential nesting hollows on the site.

No trees will require removal as part of the subdivision or development of the site with the possible exception of three Marri trees in the road reserve. Efforts will be made to retain these trees in consultation with the Shire of Gingin. Any other removal of trees on individual lots will be subject to development approval from the Shire of Gingin.

2.7 Land Uses and Potential Contamination

The site has been cleared and used for cropping and/or broadacre grazing since at least 1981 (the date of the earliest Landgate aerial photography). There is no evidence on aerial photographs or on the ground of any intensive agriculture, structures or other potentially contaminating land uses. No further investigation of contamination is proposed.