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Kororoit Precinct Structure Plan

Amendment C147 Melton Planning Scheme

Development Assessment Report

JOB NUMBER:	**219259**
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Amendment C147 Melton Planning Scheme

173-177 Deanside Drive, Rockbank
Future Development Assessment

Expert Evidence for Panel Hearing

1.0 Introduction

This report is prepared as expert evidence by David Fairbairn, Senior Engineer and Town Planner at FMG Engineering Pty Ltd. Mr Fairbairn's CV showing his qualifications and experience is attached to this report as Attachment 10.

The aim of this report is to assess the effects of the proposed Kororoit PSP on the development potential of this property, particularly in relation to the area indicated as to be set aside for growling grass frog (GGF) habitat.

173-177 Deanside Drive, Rockbank, the subject site, is currently within an area included within the urban growth boundary and is the subject of the Kororoit Precinct Structure Plan (PSP) prepared by the Metropolitan Planning Authority. Within this plan large areas of the subject site have been identified as being required to be set aside for conservation purposes for habitat for the growling grass frog.

The scope of this report is to cover the management of water resources on the subject site, and determine whether this management will support the proposed growling grass frog habitat.

The authority responsible for water management within the area is Melbourne Water. They are currently investigating the requirements of a proposed development services scheme (DSS) for the catchment within which the subject site occurs. We are advised that the investigation into this scheme is in the preliminary stages and the form of infrastructure that will make up the scheme is not determined in detail. Attachment 8 shows the preliminary boundaries of the scheme.

Melbourne Water have also cited the preparation of a survey by Rakali Consulting, of potential natural wetland sites in the region, as being of use in the preparation of the Kororoit PSP and the Melbourne Water Development Services Scheme (DSS). Our understanding is that this report does not look at the water management aspects of these wetlands but will assist more in the determination of management strategies for the existing wetlands when preparing the PSP and DSS.

In support of the PSP process, a report has also been prepared by STORM Consulting Pty Ltd on the Whole of Water Cycle analysis. This report examines the various catchments within both the Kororoit and Plumpton PSP areas with a view to the management of the management of the water cycle to meet the following objectives:

- Identify alternative water supply sources aiming to reduce conventional drinking water use and provide more resilience.
- Protect and enhance the values of urban waterways minimising stormwater volumes and improving quality.
- Improve liveability and community health.
- Provide efficiencies and benefits to managing all the elements of the water cycle mentioned above from a holistic point of view.

Based on these objectives it would be expected that this report would examine the suitability of the area set aside for the growling grass frog habitat to determine the sustainability of the water management of the proposal. While the report does recognise that there is a proposal requiring the support of wetlands for this habitat, the water requirements of these wetlands are not addressed.

It would therefore seem that important information on water management within the PSP area should be available before the elements of the PSP are finalised. This is particularly applicable to

the proposed growling grass frog habitats which are very dependent on availability of sufficient water.

2.0 Description of the Land and Development Constraints.

The terrain of the subject site consists of typical western Melbourne basalt plains modified for grassland farming with a local watercourse and associated floodplain, Kororoit Creek, excised into the plains. The sides of the watercourse vary from moderately sloping grassland on the northern section of the site to a steep escarpment along the watercourse on the eastern section of the site. The depth of topsoil on the site is shallow with underlying hard basalt rock.

Constraints on development of the subject site for urban purposes consist of the following:

- Land subject to flooding
- Land with slopes in excess of 10%
- Land with environmental significance overlay (growling grass frog habitat)

Attachment 1 shows the subject site with contours.

3.0 Land Subject to Flooding

Attachment 2 contains the Melbourne Water plan showing the extent and level of the 1 in 100 year flood in Kororoit Creek. The estimated width of the flood plain, based on this plan, is quite narrow across the site varying from 60 meters in the northern section of the site to 30 meters on the eastern side. The section of flood plain on the eastern side of the site is bordered by a small escarpment approximately 8 metres high with a very steep rocky surface (Attachment 7 photograph12). The flood plain on the northern boundary is bounded more by a moderately sloping rocky grassland (Attachment 7 photograph11).

The level of flooding varies from 88.5 m. AHD in the northwest corner to 87.0 m. AHD in the southeast corner. Therefore the flat upper grassland basaltic plain which forms more than 50% of the site is over 8 meters above the flood level. Much of the currently proposed growling grass frog metapopulation habitat node is located over this upper grassland area (Attachment 7 photograph 4).

4.0 Land with slopes greater than 10%

The section of the site with slopes greater than 10%, the rocky escarpment running along the entire eastern side of the site, is readily identifiable on the contour plan at Attachment 1.

5.0 Growling Grass Frog Habitat

As part of the works in preparing the Kororoit PSP, a study has been carried out by Biosis Research Pty Ltd, to prepare a category 1 habitat detail for the growling grass frog. The plan of this habitat identifies 173-177 Deanside Drive Rockbank as the location for a proposed metapopulation node. Attachment 3, Fig 2c from the Biosis Research report, shows the location of all existing and proposed category 1 habitats identified. As a response to this proposal, further reports have been prepared by Brett Lane and Associates, examining the suitability of the subject site for this proposed metapopulation node. For a detailed assessment of the suitability of the terrain as habitat we cite these reports as reference. The conclusion contained in these reports is that of the area of suitable existing habitat on the subject site is able to be covered by a 100 meter wide band following the creek precinct and covering; the creek, the adjacent flood plain areas adjacent to the creek and the rock escarpment that generally follows the outside extremity of the flood plain of the creek. The Brett Lane & Associates report concludes that: “Suitable habitat [for the Growling Grass Frog] is considered to occur along the section of Kororoit Creek in the study area (subject site)….As no offline water bodies occur within the study area (subject site), there is a low likelihood that individuals would travel beyond the escarpment area and utilise the elevated rocky grassland and modified pasture/crop areas south west of the creek”. Based on this conclusion it is difficult to envisage that the large area of the upper grassland on the subject site, that has been identified as part of the future growling grass frog metapopulation area, is suitable for this purpose in its current state. If this area is to remain as the preferred metapopulation node, it will be necessary to carry

out significant works to adapt this part of the subject site to growling grass frog habitat. The BLA report indicates that this will involve the following essential items:

- Permanent and semi-permanent wetlands;
- Diverse aquatic vegetation, including higher covers of emergent, submergent and floating vegetation (this tends to occur mostly in semi-permanent and permanent wetlands);
- Wetland depth of 1.5 metres or more across a significant proportion of the wetland to ensure that the maintenance of water suitable for the favoured higher cover of diverse aquatic vegetation;
- Clusters of wetlands within hundreds of metres of one another are more likely to support the species than isolated clusters;
- Wetlands greater than c. 3,800 square metres in area have a greater probability of supporting the frog;
- Still and very slow flowing water;
- Water salinity not exceeding 10,000 uS/cm; and
- Suitable dispersal habitat (waterway or open space but not built up area) linking the wetland to other wetlands.

Critical to this list of requirements is the availability of sufficient water of a suitable quality. If the source of water for the additional habitat is to be the catchment area upstream of the subject site, then this is likely, in the future, to be an urban area. Therefore while this urban catchment will be a source of greater runoff it will also be affected by reduced water quality.

6.0 Catchment Assessment

Attachment 4 contains a plan and aerial photograph provided by Melbourne Water showing the existing watercourses and wetlands within the PSP study area and is derived from the Rakali Consulting study. This plan shows that there are several wetlands in the vicinity upstream of the subject site. A site inspection showed that, of these two wetlands, the westernmost is fed by the main culvert under the Ballarat freeway and has an outlet channel which crosses Deanside Drive running in a westerly direction to a large existing wetland in the vicinity of the proposed freeway reserve that is an existing growling grass frog metapopulation node (see Attachment 3 and Attachment 7 photographs 1, 2 & 3). The easternmost existing wetland is possibly fed by the overflow from the westernmost wetland but has a limited direct catchment. The outlet from the easternmost wetland runs in a northerly direction and flows along the western boundary of the subject site. Both these wetlands are not holding any water as of the date of this report.

Attachment 5 is a plan showing the approximate catchments of the existing watercourses and wetlands in the vicinity of the subject site. This plan shows that the direct catchment leading into subject site is approximately 33 hectares and that the catchment leading into the westernmost wetland is approximately 156 hectares. Based on the information contained in the STORM Consulting Pty Ltd report, the section of the catchment feeding the growling grass frog (GGF) habitat wetlands within the Deanside DSS corresponds with these boundaries. The soils of the area consist of a thin layer of clay over a layer of hard basalt. The clays in the area are highly reactive and therefore combined with high evaporation rates will result in high levels of water losses within the existing wetlands. The losses to groundwater contribute significantly to the base flow in the Kororoit Creek and therefore to the quality of the existing growling grass frog habitat within the creek.

Discussions with the owner of the subject site have confirmed that this assessment of likely water losses within the wetlands in the upper grassland areas of the catchment corresponds with their experience. A dam was constructed on the eastern section of the site above the escarpment and found that it could not hold water and has been subsequently abandoned. The owner also confirmed that the existing ephemeral wetlands nearby are mostly dry for all of the summer months.

7.0 Water Balance Assessment

A preliminary water balance assessment has been carried out based on the estimated 33 hectare catchment which feeds into the subject site to determine whether this catchment can sustain the wetlands required for the adaptation of the subject site for a suitable growling grass frog habitat. If it is assumed that the 33 hectare catchment is developed as an urban area, that mean rainfall and evaporation rates are applicable, that base losses typical of clay soils apply to the wetlands and that wetlands occupy approximately 50% of the area allocated for habitat, then table 7.1 shows the approximate water balance figures.

Table 7.1 Water Balance Analysis

Month	Mean monthly rainfall (BOM) (mm)	Estimated Runoff generated to storage – urban catchment (cum.)	Mean monthly pan evaporation rate (BOM) (mm)	Estimated Evaporation losses from storages (cum.)	Estimated infiltration losses from storages (cum.)	Estimated total losses from storages (cum.) **	Residual storage
Jan	42.5	8,414	285.4	10,274	3,870	14,144	-5,730
Feb	43.0	8,690	223.8	8,056	3,870	11,926	-3,236
March	33.8	6,692	223.6	8,049	3,870	11,919	-5,227
April	38.2	7,562	106.4	3,830	3,870	7,700	-138
May	38.0	7,505	95.2	3,427	3,870	7,297	208
June	35.4	6,990	47.2	1,699	3,870	5,569	1,421
July	34.9	6,893	69.4	2,498	3,870	6,368	525
August	42.7	8,432	98.2	3,535	3,870	7,405	1,027
Sept	47.4	9,352	131.2	4,723	3,870	8,593	759
Oct	53.3	10,526	178.6	6,429	3,870	10,299	227
Nov	53.5	10,565	161.2	5,803	3,870	9,673	892
Dec	45.4	8,966	205.8	7,409	3,870	11,279	-2,313
Total	515.8	100,587	1,826	65,732	46,440	112,172	-11,587

** Total losses will ultimately depend on volume of water stored

It should be noted that the values shown in Table 7.1 are indicative only. They do, however, demonstrate that, based on mean figures, the size of the catchment is insufficient to permanently hold water within any wetlands constructed as part of the adaptation of the site to suit growling grass frog habitat. We estimate that, based on the mean figures, the wetlands will be completely dry for at least 4 months of the year, between January and April, and as a consequence the suitability of the site as future habitat is limited. We estimate that it would require at least a 100% increase in catchment area to ensure that the wetlands are able to be filled and then hold water year around. The only other option for permanent water would be to augment the water harvesting with a pumped system from either the Kororoit Creek or the available groundwater resource below the site, during the dry months. Such a system, however, has the potential to negatively impact on the quality of the habitat in the creek itself and/or impact of the users of the valuable groundwater resource in the area.

The approximate minimum volume of water required to be stored in the wetlands when full is estimated to be 60,000 cum.

8.0 Alternative Water Resources for GGF Habitat.

Discussions with the DELP have indicated that, although they have not commenced an assessment of the water management requirements for the PSP area as they relate to the sustainability of water within the GGF habitat wetlands, they intend utilising groundwater to supplement any shortcoming of harvested water on the subject site.

It would, in the opinion of this report, be premature to finalise details of the PSP without consideration of an integrated water management assessment. Such an integrated water management assessment would include a water yield and water balance analysis for all options for habitat wetlands.

There are three possible sources available for supplementing the water available to the proposed habitat wetlands on the subject site, these are:

- Diverting runoff from other catchments;
- Pumping from the Kororoit Creek; or,
- Pumping from the groundwater resource found on the site.

All of these options have the potential to adversely affect the viability for creating or maintaining suitable habitat for the growling grass frog.

The only alternative catchment from which runoff could be harvested and diverted to the subject site, currently feeds the existing metapopulation node KRC12, located further to the west. Therefore the diversion of this runoff has the potential to adversely affect the viability of this existing metapopulation node as it would reduce the available catchment yield by over 30%. For this reason this option has not been considered by this report as a viable alternative.

The option of supplementing the deficit in the water balance by pumping from the Kororoit Creek during, on average, the period December to April, a period of low creek flow and high evapo-transpiration, has the potential to adversely affect the creek riparian and aquatic environment and therefore adversely affect the important existing habitat. This option would also require; a licence to divert water from the creek, approval from Melbourne Water to install a suitable offtake and pumping system, and the implementation of works within the creek environment to install the infrastructure required. The potential for disruption to the existing habitat by such works and the long term effects of extracting water from the creek for use in the wetlands would indicate that this option is also not supportable.

It is also noted that Melbourne Water, in its published waterway diversion status information, classifies the Kororoit Creek as ‘high risk’ in terms of long term potential for diversion of water for other uses. This means that the low flow trigger level of 2Ml/day is likely to be regularly reached and restrictions on pumping from the creek applied during these periods. Over the last 12 months the weekly flow figures have indicated that minimum daily flow has dropped below this threshold on 6 occasions. While this did not trigger off restrictions it does indicate that pumping from the creek is unlikely to be a reliable long term permanent source of additional harvested water. Melbourne Water has a policy of not granting new licenses other than in exceptional circumstances for any other waterways under its control.

Sections 40(1)(b) and 40(1)(c) of the Water Act would require a full consideration by the Minister of the existing and projected availability of water from this source and its effect on existing users if a new application for a diversion license was made.

The option of the use of groundwater has the potential to locally deplete base flow into the creek and create higher concentrations of salinity in the habitat wetlands. While this option would be a costly solution, it is technically feasible to implement, provided the groundwater is available in sufficient quantity and quality. We have requested that Southern Rural Water provide an opinion indicating as to whether, based on its policies, a license would be granted for the extraction of groundwater in the quantities required. To date no response to this question has been received.

As concluded elsewhere in our report, an alternative to supplementing the harvesting of water for the proposed habitat wetlands on the subject site, is to select an alternative site of similar area within the PSP which has a sufficiently large catchment available to harvest runoff in a sustainable manner and has a more suitable topography. Three alternative sites have been identified.

8.1 Groundwater Quality

There is an existing groundwater bore approximately 20m deep on the subject site. This bore is used for stock watering and domestic purposes and, according to the owners, is significantly saline. A sample was taken from the bore and sent to ALS Environmental for testing. The test results are contained in Attachment 11 and show that the borewater has a pH of 8.4, a TDS of 3320mg/L and an electrical conductivity of 5770 uS/cm. This would confirm that the borewater is significantly saline.

Discussions with Brett Lane & Associates indicate that an upper threshold for salinity of 10,000uS/cm is applicable to habitat suitable for the growling grass frog with a desirable maximum of less than 5,000uS/cm. Therefore based on the test results the water quality of the available groundwater at the subject site would be suitable for this use.

8.2 Use and Availability of Groundwater

The use of groundwater at the subject site would be subject to a license agreement which would be administered by Southern Rural Water. The groundwater in the vicinity is not, according to Southern Rural Water, the subject of any cap on usage. Therefore the suitability of the use of the groundwater to supplement the supply to the proposed habitat wetlands would depend on whether an entitlement under the Water Act is available in the quantity and quality required and whether there is a more suitable and economic alternative available.

It is estimated that the supplementation of the water supply would be required to be at a rate equivalent to 120 litres per minute for 24 hours each day for 5 months of the year to sustain the proposed wetlands. This is equivalent to a daily requirement of between 75Kl and 180 Kl. This is a significant demand to place on the groundwater resource. We have requested that Southern Rural Water confirm that this is an appropriate use of the groundwater resource and to confirm at what cost this water could be extracted. To date no response answering these questions has been received.

In the absence of a hydrogeological analysis of the potential groundwater extraction, it is not possible to determine the exact impact of the potential extraction on the aquifer which supports the local groundwater regime. However, it may be said that there are several other bores close to the subject site and that there is likely to be an effect on the use of these existing bores. Section 40(1)(d)(i) and 40(1)(d)(ii) requires that before a new license can be granted, the Minister must determine whether there is any adverse effect that the allocation or use of water under the entitlement is likely to have on both existing authorised uses of the water and on the waterway or aquifer.

The National Atlas of Groundwater Dependent Ecosystems covers the subject site. This Atlas confirms that the area along the creek frontage of the subject site is shown as being occupied by vegetation which has a high potential for groundwater interaction and that the creek itself also has a high potential for groundwater interaction. Therefore, localised harvesting of groundwater at significant rates close to the creek could affect the quality of the vegetation along the creek and the ecosystems within the creek and the flow regime of the creek itself. As this area is identified in the BLA report as high quality core habitat for the growling grass frog, the extraction of groundwater could locally adversely affect the quality of this core habitat. The Water Act, Section 40(1)(g), requires that the Minister consider, among other things, the effect of any application for allocation of water on the need to protect the environment including the riverine and riparian environment. Therefore a careful consideration of the effects on the creek environment of groundwater and creek water extraction for the maintenance of created habitat wetlands on the subject would be required before this use could be confirmed.

It would therefore seem premature to decide that groundwater supplementation is an appropriate means of addressing the shortfall in harvested water available to the habitat wetlands proposed for the subject site.

8.3 Future Water Quality

The total volume of water that would be required to be stored in the proposed wetlands is estimated to be between 40,000cum. and 60,000cum. Therefore the initial filling and sustaining of the proposed wetlands will require supplementation from groundwater or other sources. Given that the groundwater is saline and that there is a deficit in the mean water balance figures, there is also the potential for accumulation over time of TDS in the water contained in the wetlands. It is estimated, based on an accumulation of the total TDS load from the groundwater source over time, that the TDS of the water within the proposed wetlands would double in four years if excess fresh water is not available for flushing. The implications of this are twofold.

1. There is a direct impact on the water quality of the aquatic habitat of the growling grass frog in the proposed wetlands that could push it to beyond the frog's threshold salinity level.
2. There is an impact of the range and type of vegetation available to the proposed habitat as salinity increases.

These types of changes can have a significant impact on the continuing suitability of the habitat contained within the proposed wetlands.

The only source for suitable flushing water, given that there is a deficit in harvested water, is to pump the required water from the creek. The rate of water usage for flushing is estimated to be approximately 15Ml per annum. A license would be required for this extraction, however it is noted, from the Melbourne Water diversion information that the current status of Kororoit Creek is high risk even though there are no current restrictions in place. Therefore long term extraction from the creek is likely to be subject to a high risk of restriction and is therefore questionable as a reliable source of flushing water.

9.0 Water Quality

Water quality becomes an issue when the catchment becomes highly modified such as is likely to occur as a result of the proposed PSP. Any adaptation of the existing rural catchment to future urban landuse will result in a significant change in the water quality of runoff. To maintain water quality that is suitable for growling grass frog habitat a suitable treatment system will be necessary. This would become part of a larger assessment of the water quality requirements for the PSP area as outlined in the STORM Consultants Pty Ltd report. However it is noted that such a treatment system area for the catchment within which the subject site occurs, could take up an area as much space as 1.5 hectares. This area would not be considered as suitable habitat for the growling grass frog and therefore will impact on the space available on site for suitable habitat.

10.0 Construction of Wetlands on Site

The suitability of the upper sections of the subject site for construction of wetlands is not just limited by the availability of suitable amounts and quality of water. The following further limitations impact on the suitability of the site for the construction of proposed wetlands:

- The whole of the upper area of the site consists of a thin clay layer over a layer of hard basalt rock. Excavation for construction of wetlands is generally most applicable in areas where underlying soils are thick low permeability clays. Adaptation of sites for wetlands in rocky areas is mostly done through work on existing waterways and low wetland areas.
- Wetlands are also more suited to low flat areas such as occur in floodplains. Construction of wetlands on moderate to steeply sloping areas often creates hydraulic problems associated with flow velocities and management of retention times.

It is the general opinion of this report that the subject site is not a suitable location for the economic construction of wetlands where other more suitable locations are available (Refer Attachment 9). Photograph 10 in Attachment 7 shows how an existing watercourse has been adapted for construction of wetlands in the adjacent Caroline Springs area.

11.0 Connectivity between Existing Creek Based Habitat and Proposed Adapted Habitat Area

The report by Brett Lane & Associates quotes Heard et al. 2008 indicating that 90% of growling grass frog activity takes place either in water or within 5 metres of water. Therefore, as the proposed area on the subject that is required to be adapted to a suitable habitat as part of a metapopulation node is estimated to be dry for at least 4 months of each year under the current catchment arrangement, this area will not be suitable as habitat during these periods. If this is not addressed through other water sources there will be a change in the overall area of available habitat within the metapopulation node for this period of the year requiring a connectivity between the creek environs and the adapted habitat. The presence of the escarpment and the unsuitability of the moderately steeply sloping land in the northern area of the site for construction of wetlands means that provision of suitable corridors through to the existing creek habitat are limited.

12.0 Estimated Costs

Adaption of the upper area of the subject site to growling grass frog habitat will generally involve the following main works:

- Excavation of 1-2 metre deep ponds in basalt rock including blasting where required;
- Lining of ponds with imported clay liner;
- Construction of water management infrastructure;
- Construction of water treatment wetlands;
- Construction of water augmentation pumping system from Kororoit Creek; and
- Installation of habitat vegetation and associated works.

We estimate that the total cost of this work is in the range $10,000,000 to $15,000,000. This figure is very preliminary and based on the assumptions contained in section 7.0.

13.0 Options for More Suitable Areas for Metapopulation Node

It is the general conclusion of this report and the BLA report that there are other areas within the PSP which would be more suitable for adaptation to growling grass frog habitat. The criteria for selecting suitable locations are as follows:

- Location on an existing watercourse or gully that is more readily able to be adapted for wetlands and preferably has some base flow into the watercourse.
- Location within a catchment of at least 50 Ha that will enable wetlands to be filled within a reasonable period of time and with a permanent water level.
- Location in close proximity to the creek habitat with permanent connectivity.
- Location that is suitable for economic construction of wetlands.

The subject site meets none of these criteria.

Attachment 4 is the Rakali Consulting plan of the existing watercourses and wetlands provided by Melbourne Water. It shows there to be other sites within the PSP area which do appear to meet the above criteria and are therefore considered by this report to be more suitable than the subject site.

14.0 Alternative Sites

Based on this report, the costs of the construction and operation of habitat wetlands on the subject site are likely to be significantly higher than those applicable to the other alternative sites investigated.

Site 1 is the subject site.

Site 2 is located opposite the subject site and is centered on a watercourse that has an estimated catchment of more than 225Ha. The watercourse has an outlet to the creek which is at flood level

and a moderate to flat grade between Taylors Road and the creek. This site could be adapted for the proposed metapopulation node in an economic manner. Photographs 5 and 7 in Attachment 7 show this area.

Sites 3 and 4 are located at the downstream end of the PSP area and incorporates an existing wetland and has an estimated catchment of 128 Ha. The existing wetland appears to be highly modified but would be able to be adapted to a suitable wetland in much the same manner as the other existing wetlands in the vicinity of the proposed freeway reserve. Photograph 9 in Attachment 7 shows a view of this area with photograph 8 in Attachment 7 showing the creek at the outlet.

These sites are shown in more detail in Attachment 9. They are described as follows:

Site 1 – subject site, flat grassland;

Site 2 – gully/depression area on north side of Kororoit Creek opposite subject site; and

Sites 3 & 4 – gully/depression area on north side of Kororoit Creek east of subject site.

We have carried out more detailed water balance investigations of these alternative sites and have concluded that, based on mean figures, while Site 1(the subject site) has an annual deficit of harvested water over losses of approximately 10,000cum., Site 2 has an estimated annual excess of harvested water over losses of 575,000cum. and Site 3 has an annual estimated excess of 280,000cum. We have also investigated an alternative catchment at Site 3, Site 4, which also had an estimated excess of 1,000,000cum. Therefore, based on mean rainfall and loss figures, all these alternative sites would not require any supplementation from other sources.

It expected that these sites are more suited to the construction of wetlands as;

1) They are on land that is directly connected to the creek environs;
2) They do not require the use of saline groundwater; and
3) They have a greater potential for replication of the habitat that is already available within the creek environs.

In addition all of the alternative sites are located within watercourses that are designated as ‘waterway/retarding basin’ and/or drainage asset in the Future Urban Structure Concept Plan. Therefore the integration of the habitat function with the waterway function for these areas could be added to compatible proposed uses within the PSP and therefore considered at the early planning phase of these assets.

The alternative site estimated costs for infrastructure supporting the GGF wetlands are as follows:

Site 2 - between $7,000,000 and $10,000,000;

Site 3 – between $4,000,000 and $6,000,000; and

Site 4 – between $5,000,000 and $8,000,000.

Therefore these preliminary costs would indicate that the capital costs of the equivalent proposed wetlands on the alternative sites are at least 50% less than those on the subject site. It should be noted that the inclusion of a borewater requirement, as proposed for the subject site, would also result in much higher on-going operations and maintenance costs relative to the alternative sites.

Note that estimated costs do not include any costs associated with land acquisition.

Therefore any of the alternative sites would be a much better ‘best value for money’ habitat creation scenario than the subject site.

According to the Guidelines for managing the endangered Growling Grass Frog in urbanising landscapes (Arthur Rylah Institute for Environmental Research Technical Report Series No 208), high connectivity is an important factor in determining the probability of decolonisation and occupancy of purpose built wetlands. This report also concludes that it is vital that purpose built habitat wetlands display the same characteristics as those being replicated for the existing

populations, otherwise the occupation by the new populations for which they have been designed to support may be short lived.

Sites 2, 3 and 4 all have the potential for greater connectivity with and replication of the creek environs than Site 1 (subject site). As concluded in this report the subject site has a significant barrier to connectivity with an 8 meter high escarpment over much of the creek frontage on the site. Sites 2, 3 and 4, as they are located on watercourses that discharge to the creek, all have a gradually sloping topography which is more able to address the connectivity issue.

Attachment 7 has a set of photographs which show some of these areas as well as the existing site. Attachment 6 has a key to the location of these photographs.

15.0 Conclusions

1. The subject site is unsuitable as a proposed metapopulation node for the following reasons
    - Its catchment is not large enough to sustain a permanent system of wetlands within the area allocated.
    - The topography of the site is unsuitable for adaptation to a suitable growling grass frog habitat if permanent water is not always available.
    - The presence of rock at the surface makes the site unsuitable for economic construction of wetlands.
2. There are other more suitable locations within the PSP area for adaptation of habitat for growling grass frog metapopulation nodes.

16.0 Declaration

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

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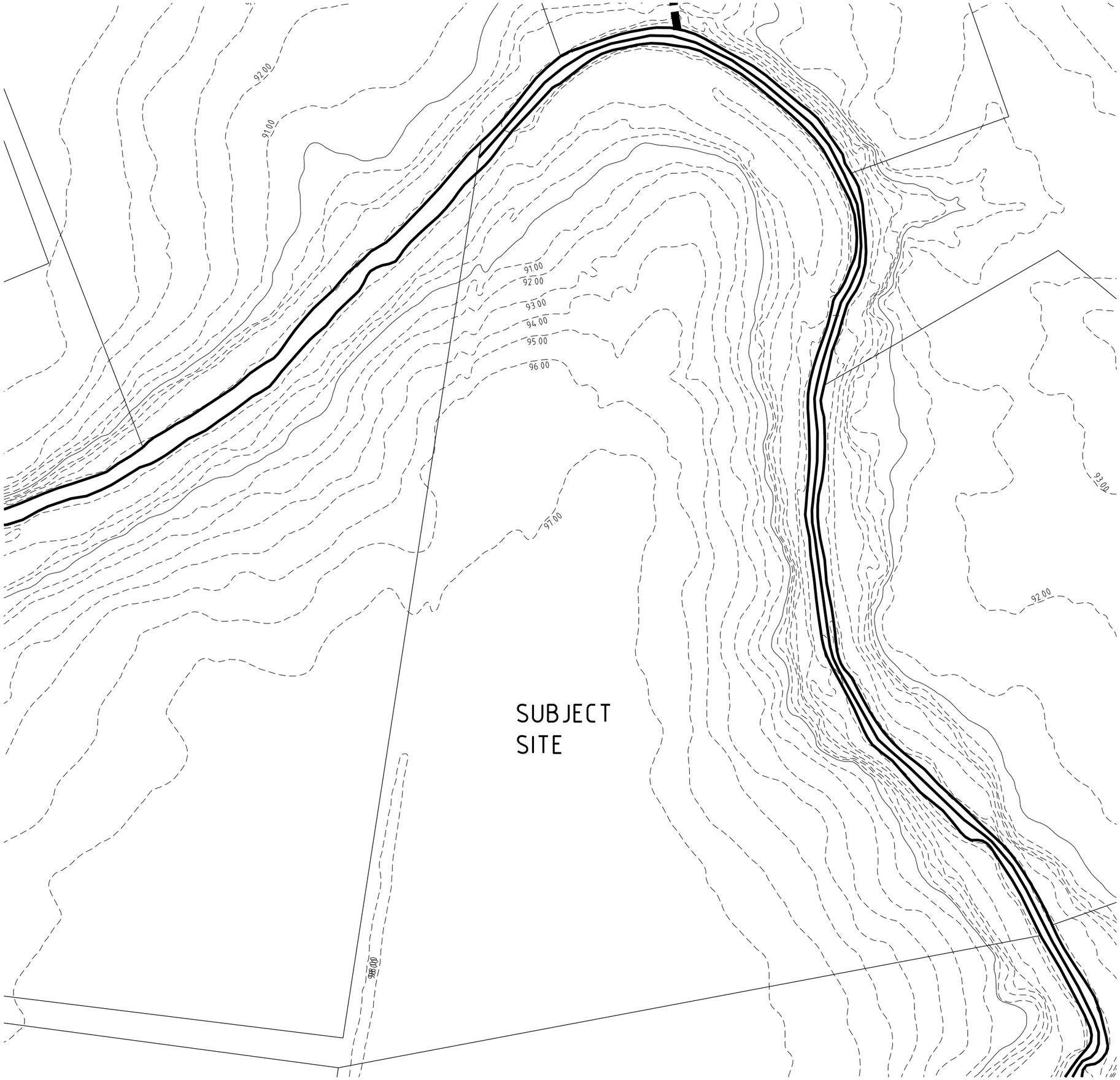
Attachment 1

Site Plan



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fmgengineering.com.a

CIVIL | STRUCTURAL | ENVIRONMENTAL | GEOTECHNICAL | BUILDING ASSESSMENT & FORENSIC | SOIL & MATERIAL TESTING | HOUSING | COMMERCIAL | PROJECT MANAGEMENT | SURVEY

SIGNATURE

CLIENT
KELLEHERS AUSTRALIA

PROJECT TITLE
-

SITE ADDRESS
173-177 DEANSIDE DRIVE
ROCKBANK, VIC. 3335

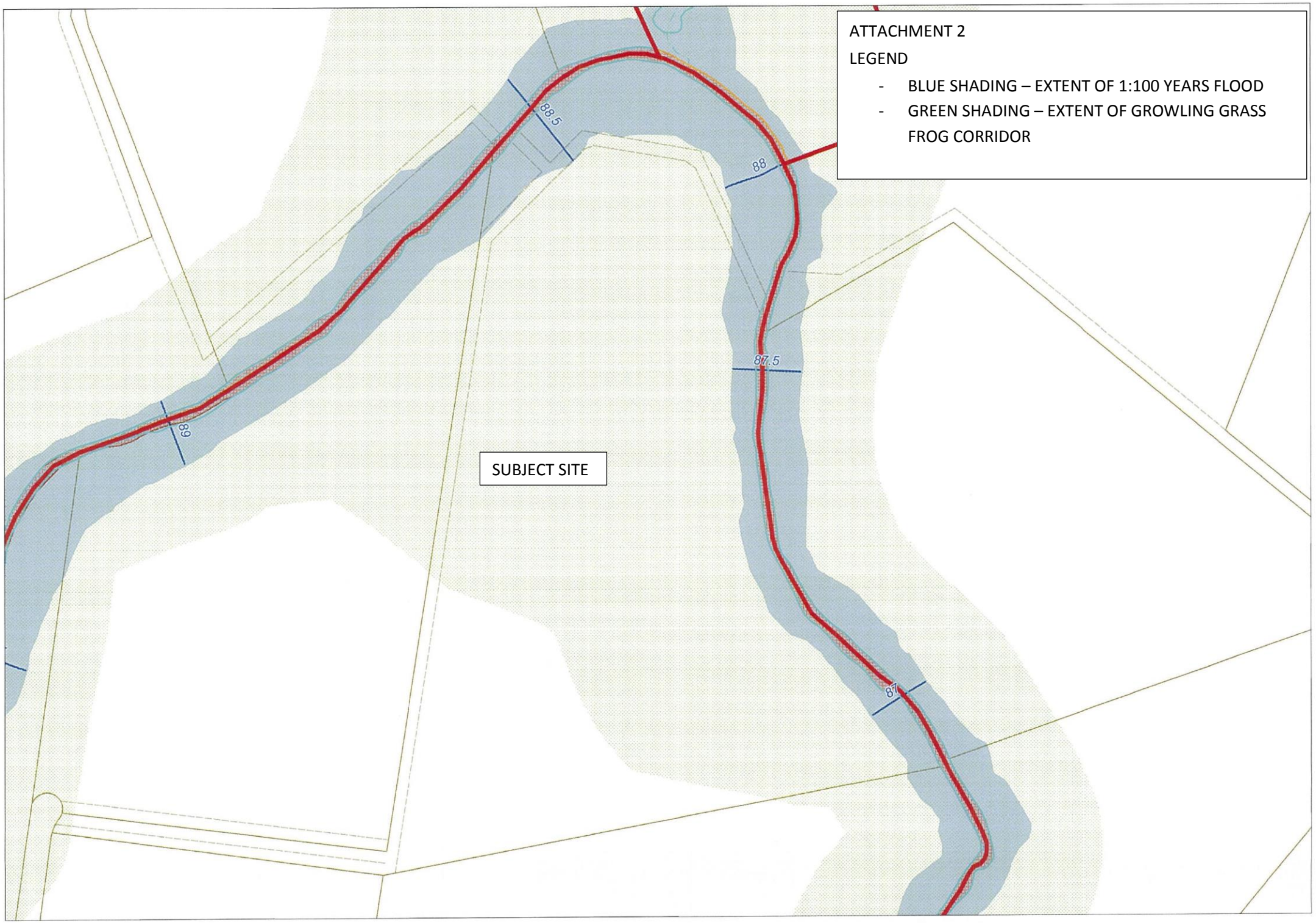
DRAWING TITLE
ATTACHMENT 1

-	SCALE 1:2000 @ A3	DATE STARTED 14/03/2
DRAWN CMB	SITE ID & JOB No. S16728-219259	REV.
DESIGNED DF	DRAWING No. Att. 1	P
CHECKED RA		

Attachment 2

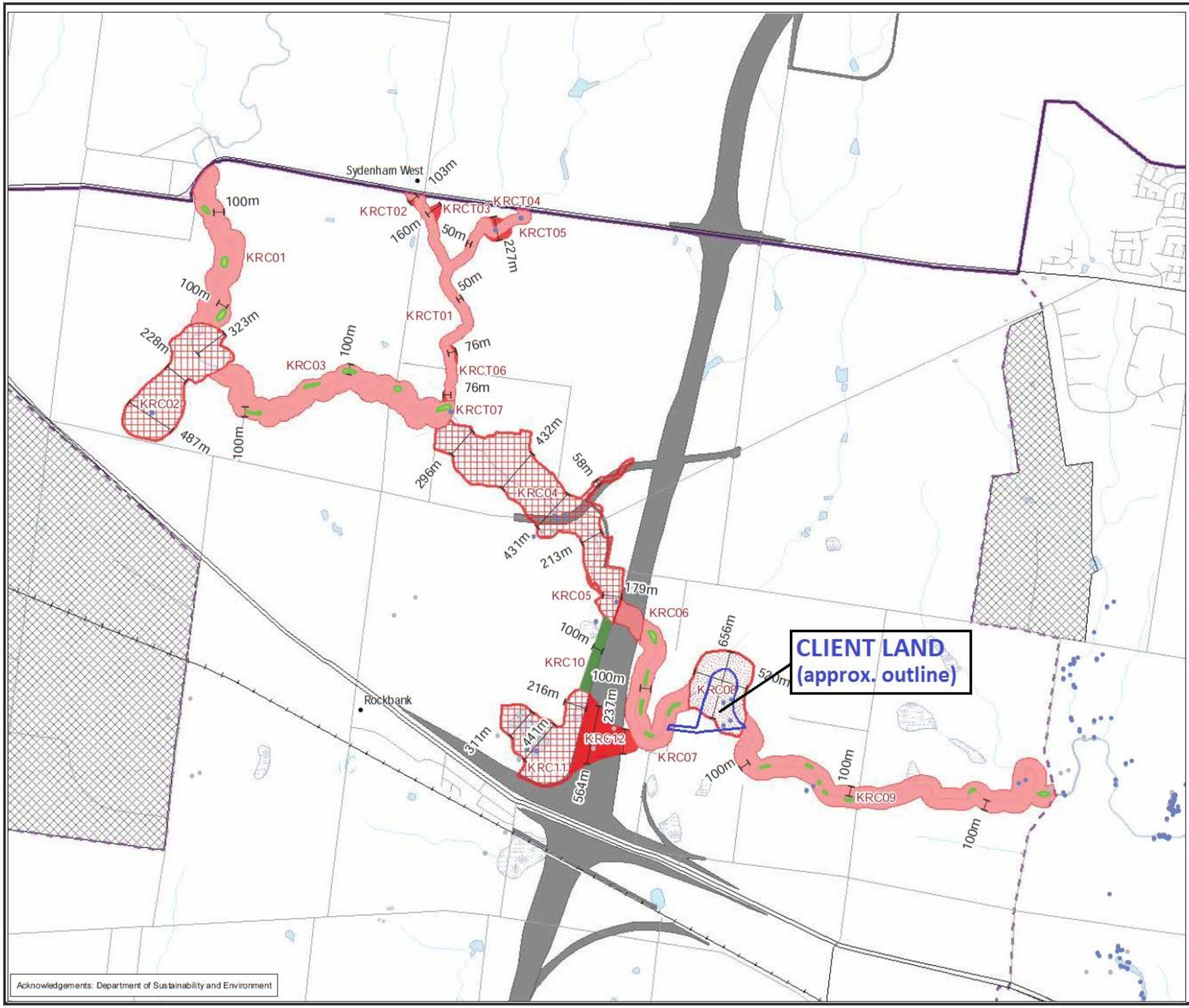
1% Flood Extents & Levels

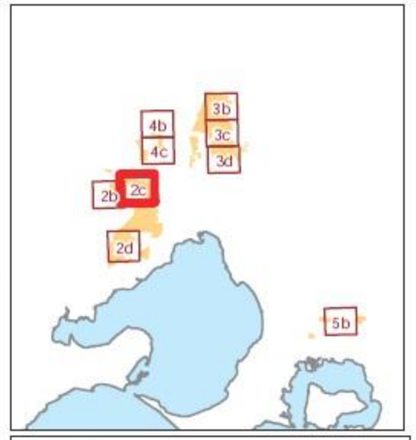
Source: Melbourne Water


ATTACHMENT 2
LEGEND
- BLUE SHADING – EXTENT OF 1:100 YEARS FLOOD
- GREEN SHADING – EXTENT OF GROWLING GRASS FROG CORRIDOR
88.5
88
87.5
89
SUBJECT SITE

Attachment 3

Fig 2c: West Growth Area Growling Grass Frog, Revised Category 1 Habitat, Detail
source: Biosis Research Pty Ltd





Legend

- Location of Proposed Internodal Wetland

Survey Records (Year of Survey)

- pre 2000
- post 2000
- Corridor Widths

Category 1 Corridors

- Existing Metapopulation
- Proposed Metapopulation
- Internodal Corridors
- Other Node (opportunity for wetland creation)

Category 3 Corridor (indicative)

- Category 3
- Current Urban Growth Boundary
- Previous Urban Growth Boundary

Precinct Structure Planning

- Complete
- Incomplete
- Transport Infrastructure

Figure 2c: West Growth Area Growling Grass Frog, Revised Category 1 Habitat, Detail

0 0.3 0.6 0.9 1.2 1.5

Kilometers
Scale: 1:33,000 @ A3
Coordinate System: GDA 1994 VICGRID94

Biosis Research Pty. Ltd.
38 Bertie Street
(PO Box 489)
Port Melbourne
VICTORIA 3207

Offices also in: Ballarat, Sydney, Wollongong, Canberra, Wangaratta & Brisbane

N

Matter: 14146 Date: 22 March 2012,
Checked by: DCG, Drawn by: JMS
Location:P:\14100s\14146\Mapping\Report Figures FINAL\14146_F6_GGFCat1_Detail_wPropHabitat_220312.mxd

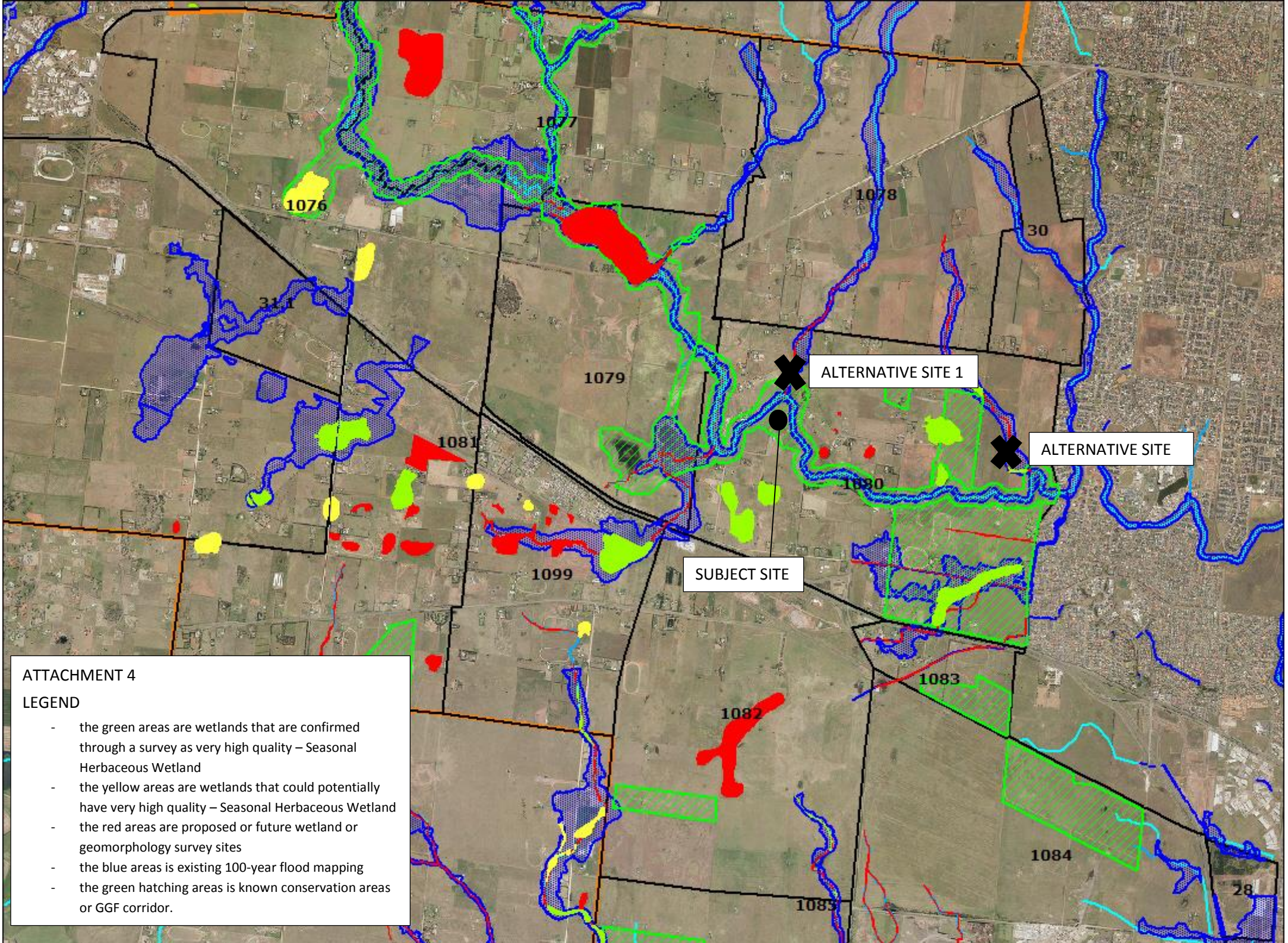
Attachment 4

Survey of potential natural wetland sites in this region

source: Rakali Consulting

Legend

- the green areas are wetlands that are confirmed through a survey as very high quality – Seasonal Herbaceous Wetland
- the yellow areas are wetlands that could potentially have very high quality – Seasonal Herbaceous Wetland
- the red areas are proposed or future wetland or geomorphology survey sites
- the blue areas is existing 100-year flood mapping
- the green hatching areas is known conservation areas or GGF corridor.


1077
1076
1078
30
311
1079
ALTERNATIVE SITE 1
ALTERNATIVE SITE
1081
1080
1099
SUBJECT SITE
1083
1082
1084
28
1085
ATTACHMENT 4
LEGEND
- the green areas are wetlands that are confirmed through a survey as very high quality – Seasonal Herbaceous Wetland
- the yellow areas are wetlands that could potentially have very high quality – Seasonal Herbaceous Wetland
- the red areas are proposed or future wetland or geomorphology survey sites
- the blue areas is existing 100-year flood mapping
- the green hatching areas is known conservation areas or GGF corridor.

Attachment 5

Catchment Plan

225Ha

369Ha

128Ha

298Ha

156Ha

33Ha

W

W

W

W

W

ALTERNATIVE SITE 1
METAPOPULATION NODE

ALTERNATIVE SITE 2
METAPOPULATION NODE

SUBJECT SITE

KOROROIT CREEK

LEGEND

- EXISTING WATERCOURSE
- CATCHMENT BOUNDARY
- W EXISTING WETLAND

N

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	INIT	APP
P1	PRELIMINARY ISSUE	N.Y.I.	CMB	RA

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SIGNATURE

CLIENT
KELLEHERS AUSTRALIA

PROJECT TITLE
-

SITE ADDRESS
173-177 DEANSIDE DRIVE
ROCKBANK, VIC 3335

DRAWING TITLE
ATTACHMENT 5 - CATCHMENT PLAN

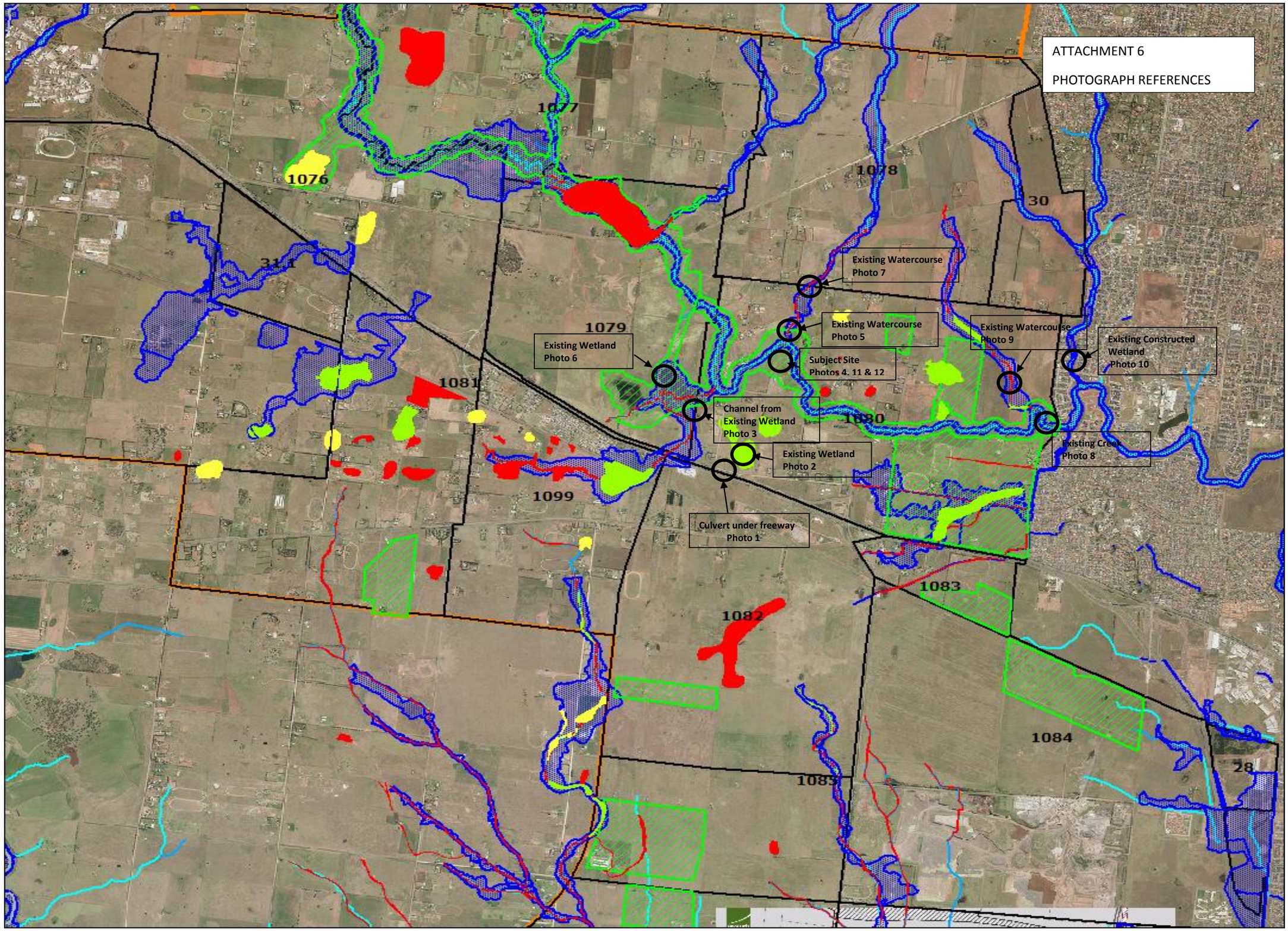
	SCALE	DATE STARTED	
	- 1:10000 @ A1	03/03/14	
DRAWN: CMB	SITE ID & JOB No. S16728-219259	REV.	
DESIGNED: DF	DRAWING No. Att. 5	P1	
CHECKED: RA			

Attachment 6

Photograph Locations

ATTACHMENT 6

PHOTOGRAPH REFERENCES



Attachment 7

Photographs

Photo 1 – Culvert under Freeway

Photo 2 – Existing Wetland – dry

Photo 3 – Channel from Existing Wetland at Deanside Drive

Photo 4 – Subject Site

Photo 5 – Existing water course at outlet to Creek

Photo 6 – Existing Wetland (in background)

Photo 7 – Existing Watercourse

Photo 8 - Existing Creek

Photo 9 – Existing Watercourse (background)

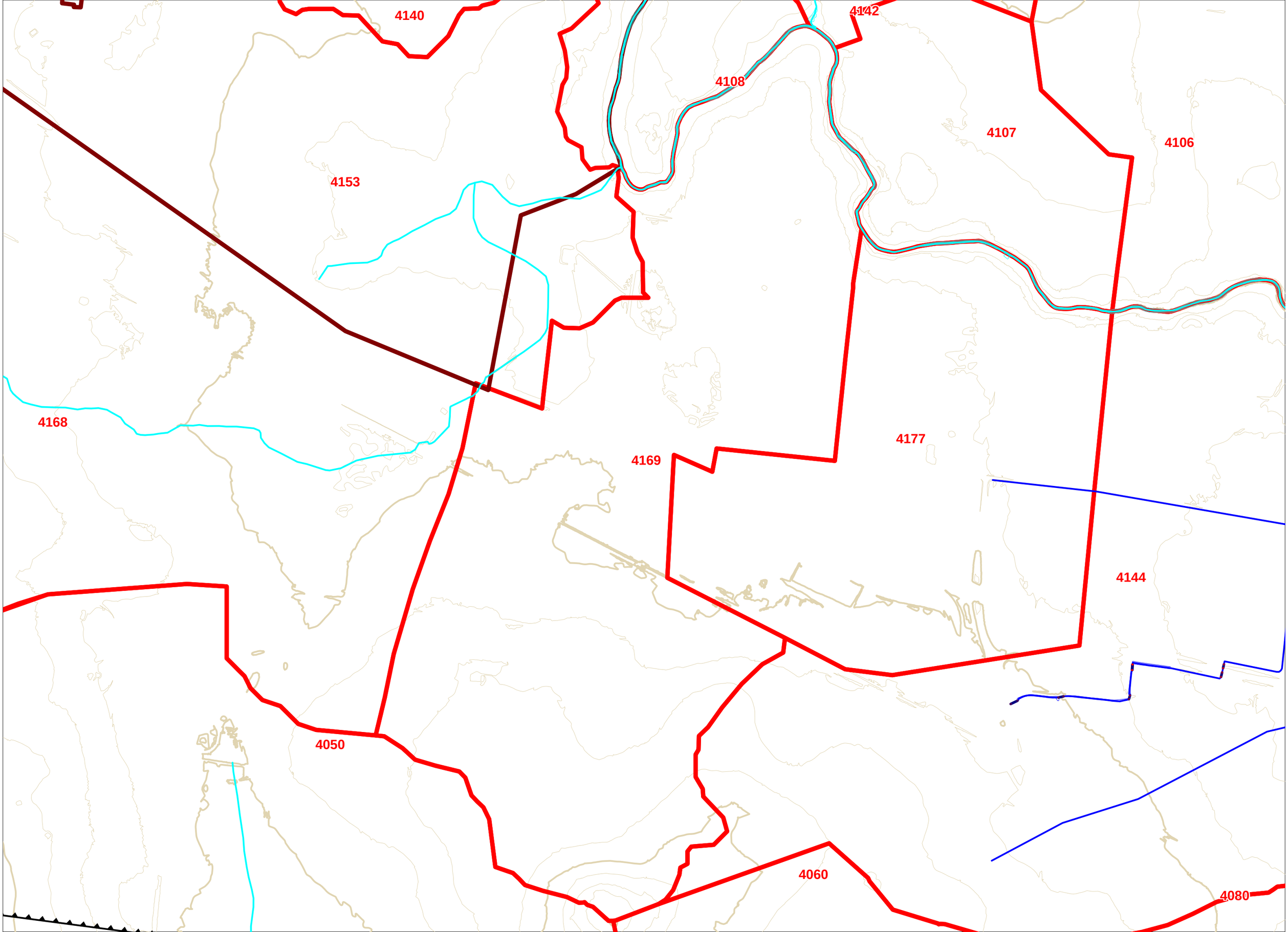
Photo 10 – Existing Constructed Wetland

Photo 11 – Creek on subject site at western boundary

Photo 12 – Creek on subject site at eastern boundary

Attachment 8

Preliminary Melbourne Water DSS boundaries


4140
4142
4108
4107
4106
4153
4168
4177
4169
4144
4050
4060
4080

Attachment 9

Alternative GGF Habitat Wetland Locations

TAYLORS ROAD
PLUMPTON ROAD
VERE COURT
SARIC COURT
SERRA W.
SINCLAIRS ROAD
REED COURT
GRAY COURT
CLARKE ROAD
MONAGHANS LANE
PLUMPTON
ROCKBANK
ALTERNATIVE SITE 1
SITE 1
SITE 2
SITE 3
SITE 4
ALTERNATIVE SITE 2
Approx Heritage Fence
Approx 1% Flood.
Approx 1% Flood.
Conservation
Reserve.
Powerline Easement
Korkorait Creek
1384 1440 1267 1200 1176 1152 1056 1012 1012 A 39 60 135 149
1331 1289 1233 1157 1149 1079 1048 58 944 920 872 85
111 42 1205 22 1053 1027
104 96 104 68 81 1027 A 961
103 131 173 90 905
106 A 87 76 112 137
104 90 84 146
121 130
46 80 140 139
2 768 734 702 676 650 624 196 237 271 502 470 462
91
SITE 2
SITE 1
SITE 3
SITE 4
391m
100m 200 300
1:10,000
ALTERNATIVE WETLAND SITES
ATTACHMENT 5

Attachment 10

David Fairbairn CV

David Fairbairn

Consulting Engineer & Planner
9 Roslyn Street, Brighton, 3186

Personal Information

Marital status: Married

Nationality: Australian

Age: 65

Place of Birth: Melbourne, Australia

Summary of qualifications

UNIVERSITY OF MELBOURNE
MELBOURNE, VICTORIA

M.Eng. Sci. (environmental) - 1988

B.Eng (civil) - 1974

Dip. Town & Regional Planning - 1977

Professional Affiliations

Member Institution of Engineers, Australia

Professional experience

2006 – present Resumed Professional Practice – Consulting Engineer/Town Planner
2004-2006 - Director The Fidus Group Consulting Engineers - land development, town planning and environmental assessment.
1988 - 2004 - Professional Practice - Consulting Engineer/Town Planner - infrastructure, building siteworks, utility services, housing, water resources and environmental assessment.
1987 - 1988 - Masters Degree
1980 - 1987 - Senior Engineer/Planner - Gutteridge Haskins & Davey Pty Ltd Melbourne and Traralgon Offices.

1979 - Acting Chief - Master Planning Branch - U.S. Military Community, Wuerzburg, West Germany.

1978 - Design Engineer - Medway Borough Council, Chatham, Kent, United Kingdom.

1974 - 1977 - Design Engineer - John Koschade & Partners Pty Ltd , Melbourne.

Languages

English

German

Attachment 11

ALS Water Test Results

CERTIFICATE OF ANALYSIS

Work Order	: **EM1402725**	Page	: 1 of 3
Client	: **FMG CONSULTING ENGINEERS**	Laboratory	: Environmental Division Melbourne
Contact	: DAVID FAIRBAIRN	Contact	: Steven McGrath
Address	: Level 2, 1 Domville Ave Hawthorn Victoria, Australia 3122	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: david.fairbairn@fmgengineering.com.au	E-mail	: steven.mcgrath@alsenviro.com
Telephone	: ----	Telephone	: +61-3-8549 9600
Facsimile	: ----	Facsimile	: +61-3-8549 9601
Project	: 219259	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAR-2014
Sampler	: DF	Issue Date	: 28-MAR-2014
Site	: S16728		
		No. of samples received	: 1
Quote number	: ADBQ/005	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Eric Chau	Metals Team Leader	Melbourne Inorganics

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

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	MW01	----	----	----	----
			Client sampling date / time	25-MAR-2014 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1402725-001	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.37**	----	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**5770**	----	----	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**3320**	----	----	----	----