

**BEFORE INDEPENDENT HEARING COMMISSIONERS
APPOINTED BY THE HAMILTON CITY COUNCIL**

IN THE MATTER of the Resource Management Act 1991 (**Act**)
AND

IN THE MATTER of an application for subdivision and land use
consent for the Amberfield development
pursuant to the Act.

APPLICANT Weston Lea Limited

CONSENT AUTHORITY Hamilton City Council

**STATEMENT IN ANSWER TO QUESTIONS OF THE HEARING PANEL
RAISED IN DIRECTION NO. 9**

Dated: 24 July 2019

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INTRODUCTION

1. We, Mark Kessner, Weston Lea Limited's (**Weston Lea**) lighting expert and Georgia Cummings, one of the ecologists advising Weston Lea, have jointly prepared this statement in answer to questions raised by the Hearing Panel in Direction No. 9 dated 10 July 2019.
2. Ms Cummings has assisted Mr Kessner with the preparation of this statement, as some of the questions raised by the Hearing Panel are outside Mr Kessner's area of expertise.
3. We have stated where an answer is provided by either Mr Kessner or Ms Cummings.

ANSWERS TO HEARING PANEL'S QUESTIONS

A. Can he provide examples of lighting conditions that would protect bats or fauna?

Mr Kessner:

4. I have not been involved in any project where conditions of consent have been imposed to specifically protect the bats or other fauna and, therefore, cannot provide any relevant examples. Where I have advised clients on lighting controls, they are generally to minimise obtrusive light for amenity reasons and reduce light pollution.
5. I understand from Ms Cummings that light is a factor associated with the Amberfield development that is likely to influence long-tailed bat behaviour. Accordingly, I understand that Weston Lea's ecologists have worked closely with Weston Lea's landscape architects to create a planting plan that includes vegetated buffers to block light spilling into key bat habitats. In order to assist Weston Lea's ecologists with ways in which light spill can be further reduced, I have provided advice on common sources of ambient light in residential setting and ways in which these can be controlled.
6. My advice is summarised in my evidence-in-chief dated 24 May 2019. In short, streetlights are a large source of light spill in the residential and rural environments. External feature lights, security lights and access wall lights are also a key source of additional light.

7. I understand that Weston Lea are proposing conditions that contain restrictions on both streetlights and security / spotlights and access wall lights in bat sensitive areas, specifically:
 - (a) A bat sensitive street lighting regime will be prepared and submitted to Hamilton City Council for certification prior to implementation of the consent. The proposed lighting design calculations for the perimeter roads around the development show the that potential light spill will be very well controlled.¹ In particular, light spill reduces to zero lux at 12.2 meters from the light source (this does not rely on any further screening from buffer planting).
 - (b) There will be restrictions on the residential lots directly adjacent to the river corridor and the East-West shelterbelt to ensure that any security / spotlights and access wall lights need to conform to best practice specifications for zero upward light spill.
8. Light spill from internal residential lighting sources can also add to ambient light, although in my experience these lighting sources cannot be controlled in any consistent manner. In any case, I consider that light spill from houses will attenuate to low levels very quickly. In order to better illustrate how quickly measurable light attenuates I have produced a Lux Spill Distance Analysis Report. I attach my analysis as **annexure A**.
9. My analysis, under annexure A, shows that if there is light spill measuring 3 lux at the boundary then at 7.4m from the boundary it would measure 0.1 lux, at 17.9m from the boundary it would measure 0.01 lux, and at 37.8m from the boundary it would measure 0.001 lux. Light levels at 0.001 lux are regarded as darkness.
10. My analysis has been prepared to reflect the relevant rules within the Hamilton District Plan. The District Plan states that in a residential zone the spill of light onto another site shall not exceed 3 lux when measured at points 1.5m within the boundary of any other site.² To err on the side of caution, I have assumed

¹ The detailed design will ensure that luminaries shall be of LED type, and lighting subcategory P5 of Table 2.6 of AS/NSC 1158.3.1:2205.

² Rule 25.6.4.1, Hamilton District Plan (*"For any activity in any Residential or Special Character Zones, or the Future Urban or Community Facilities Zones, the spill of light from artificial lighting (excluding street and navigation lights and traffic signals) on to any other site shall not exceed 3 lux (horizontal and vertical) when measured or calculated at points 1.5m within the boundary of any other site."*)

3 lux at the boundary. I note it was quite difficult to create a theoretical 3 lux spill at the boundary. In order to show 3 lux spill at the boundary, my analysis assumed a window the full width of a room 3.3m metres away from the boundary. I would not anticipate that 3 lux spill at the boundary would be normally reached in a standard residential setting.

11. Boffa Miskell have also translated my analysis onto the cross section of bat sensitive areas, in particular, the North-Eastern Terrace and East-West Shelterbelt. These diagrams are attached as **annexure B**.
12. To confirm, these diagrams only show the light spill from a house. If the proposed streetlights were to be added to the streetscape, their light spill would be added to the lux spill from the houses (i.e. a cumulative effect). However, as noted above, the proposed lighting design calculations for the perimeter roads, such as the one depicted on the North-Eastern Terrace Cross section, shows the light spill being very well controlled. Light spill reduces to zero lux at 12.2 meters from the light source which will be within the vegetated buffer (adjacent to the road reserve).
13. I also note that these diagrams illustrate the anticipated light spill without the effect of the vegetated buffer that will effectively block light.

Ms Cummings:

14. To my knowledge, no residential subdivision in New Zealand has applied lighting conditions to protect long-tailed bats. Conditions have been included in roading projects to minimise light spill to protect bats. Examples from Hamilton-based projects are listed below:
 - (a) The Southern Links conditions include provisions for long-tailed bat management including “...*reducing the effect of road lighting by creating ‘dark zones’ at key bat habitats, aligning streetlights in certain ways or installing baffles on lighting columns to reduce the ‘spill’ of light away from the road*”³.

³ Southern Links Notice of Requirement Condition 15.5(c)

(b) Additional to the above, the Southern Links conditions also include monitoring to determine *“the effects of lighting and roads on the movement of bats”*⁴.

(c) The Hamilton Section of the Waikato Expressway includes the requirement for a Bat Management Plan detailing *“...how the bats will be protected from light generated by road construction and operation”*⁵ and measures to minimise fragmentation including *“...reducing the effect of road lighting by creating 'dark zones' at key bat habitats, aligning street lights in particular ways or the installation of baffles on lighting columns to reduce the 'spill' of light away from the road, accepting that lighting design for the benefit of bat movement must not conflict with the primary function of lighting for safety reasons along the Expressway.”*⁶

15. To my knowledge, Southern Links is the first condition set that requires monitoring to determine the effect of lighting on bat activity (refer Condition 15.5(f)(i) summarised above).
16. Southern Links is in early stages of construction and therefore only the baseline monitoring is available. This baseline light monitoring provides valuable data on how long-tailed bats are using the existing environment in relation to light levels in Hamilton (Wildlands, 2019).
17. Wildlands (2019) detected the highest levels of bat activity (median of more than 50 bat passes per night) in areas with lux levels less than 0.5 lux. For context, the highest level of bat activity measured at Amberfield during two seasons of monitoring was an average of 26 passes per night.
18. As shown the light diagram attached as Annexure B the light from a dwelling can be attenuated to 0.1 lux at 7.4 m from the source without buffering.
19. As stated by Mr Kessner above at paragraph 7(a), light spill from streetlights will be reduced to 0 lux in 12.2 m from the back edge of the footpath, again this was modelled without considering the buffer planting.

⁴ Southern Links Notice of Requirement Condition 15.5(f)(i)

⁵ Tamahere East-West Link Condition 7.4(i)

⁶ Main Expressway alignment - AUTH 13061.01.01 - Condition 48(f)(iii)

20. Given the above, I consider that there is strong evidence that light can be maintained on the dark-side of the buffer planting to a level that is consistent with 'high activity' areas bats are currently using⁷ and will protect bats from the adverse effects of artificial lighting.

B. In respect of any examples provided, further explain:

- i. Whether the proposed lighting conditions as originally conceived in those examples in fact offered adequate protection; or**
- ii. Did the lighting conditions originally proposed require adjustment to offer suitable protection or to address other concerns?**
- iii. If adjustments were made, what were the triggers for the changes?**

Mr Kessner:

21. As noted above, I am unable to provide any other examples of lighting controls that have been specifically designed to protect bats or other fauna, and so cannot answer these questions. However, I can provide some comment in relation to (ii) relevant to the lighting controls proposed for Amberfield.
22. While the proposed streetlights will produce a very low light spill (zero lux at 12.2 meters from the light source), the streetlights will be able to be adjusted to even lower levels should it be necessary. The lighting control and glare control of modern street lighting is substantially improved with modern technology. Streetlights are now able to be adjusted after they have been installed. This would enable a further adjustment to minimise light spill even further if this proved necessary. Although I note that current codes and standards include minimum levels for pedestrian safety would need to be considered.

Ms Cummings:

23. To the best of my knowledge, the monitoring for the Hamilton Section of the Waikato Expressway has not demonstrated a significant adverse effect on the

⁷ Based on Wildlands (2019) that monitored activity at 31 sites across Southern Hamilton.

acoustic activity of long-tailed bats. To date the project has not undertaken monitoring to investigate bat activity specifically in relation to light levels. It is my understanding that this may be incorporated into the bat acoustic activity model in the operational phase of the project.

24. Only the Southern Links conditions include the requirement to monitor light levels in relation to bat activity. As Southern Links is in early stages of construction and only the baseline monitoring is available, it is too early to comment on whether those conditions provide suitable protection. I note that there is no requirement under the Southern Links conditions to define trigger levels for light spill or to adjust light conditions in response to monitoring outcomes.

C. If the lighting conditions from the examples did not offer adequate protection explain:

- i. why not; and
- ii. were there examples that should have had measures and were not, causing fauna loss?

Mr Kessner:

25. Similar to above, I am unable to answer these questions as I cannot provide any other examples of lighting controls that have been specifically designed to protect bats or other fauna.

Ms Cummings:

26. I am not aware of any projects that have demonstrated a reduction in bat activity in relation to light levels, but as noted above, the only project that I am aware of that requires bat activity to be monitored, specifically in relation to light, is Southern Links. As noted above, because Southern Links is in the early stages of construction, I am unable to provide comment on whether the lighting conditions have provided suitable protection.

D. In this case, does he consider that the mitigation proposed by the applicant would provide sufficient protection for a bat species at the threat level?

E. If so, or if not, please explain why.

Mr Kessner:

27. I do not consider that I am qualified to assess whether the mitigation proposed would provide sufficient protection for a bat species at the threat level. However, I can state the light spill from the streetlights and houses will be managed to a very low level. In my opinion, the proposed lighting controls, along with the proposed buffer planting, will effectively minimise light spill on key bat habitats.

Ms Cummings:

28. Previous city-wide bat surveys have demonstrated bat activity is negatively correlated with increasing urbanisation. This has been linked to increased housing, road, and streetlight density.⁸ The Wildlands (2019) report is the first research I am aware of that specifically investigates bat activity in relation to lux levels.
29. The general studies discussed above, in combination with experimental research undertaken on bat species overseas, strongly suggest that light is a key parameter affecting bat activity.
30. When responding to questions from submitters' experts (issued to Commissioners on 5 June 2019), advice received from Mr Kessner included the distinction between visible light and measurable light (see paragraphs 42 and 43). Bats may be responding to the perception of increased light levels, and therefore increased predation risk, as opposed to a measurable increase in light.
31. Based on the light diagram, light will be attenuated to 0.1 lux before it reaches the retained bat habitat without the requirement for buffer planting in most cases. In addition to screening measurable light, the physical barrier created

⁸ Refer to Paragraph 9 in my EIC

by the planting will also block visible light. The height of the planted buffer, and therefore its efficacy to block visible light, will increase over time.

32. If light spill is in fact the key factor we need to control in order to facilitate the continued use of the site by bats, I consider that the proposed light spill management measures will limit light spill to below 0.5 lux and block visible light, hence adequately protecting long-tailed bat habitat.

F. In considering the above, what overall recommendations would he make about lighting conditions (either as to suitable conditions or other plan) to ensure the threshold of either no net loss or improved habitat for the bats is achieved?

Mr Kessner:

33. Similar to above, I do not consider that I am qualified to assess whether the lighting conditions will ensure a threshold of no net loss or improved habitat of the bats is achieved. However, in my opinion, the lighting controls already proposed by Weston Lea will effectively minimise light spill on key bat habitats. I do not recommend any further light controls to be imposed beyond those conditions that are already proposed.

Ms Cummings:

34. As explained in my above responses, I consider that the proposed lighting controls and buffer planting will effectively avoid or mitigate adverse lighting effects in the bat habitat provided on the site. Accordingly, the extent of high value bat habitat to be retained and enhanced within the site will ultimately exceed that currently present and will therefore achieve the threshold of no net habitat loss.

Annexure A - Lux Spill Distance Analysis Report



eCubed Building Workshop Ltd
Auckland

Amberfield Lighting Design Boundary Light Spill 3 Lux to 0.001 Lux Resource Consent

July 2019 Rev 1

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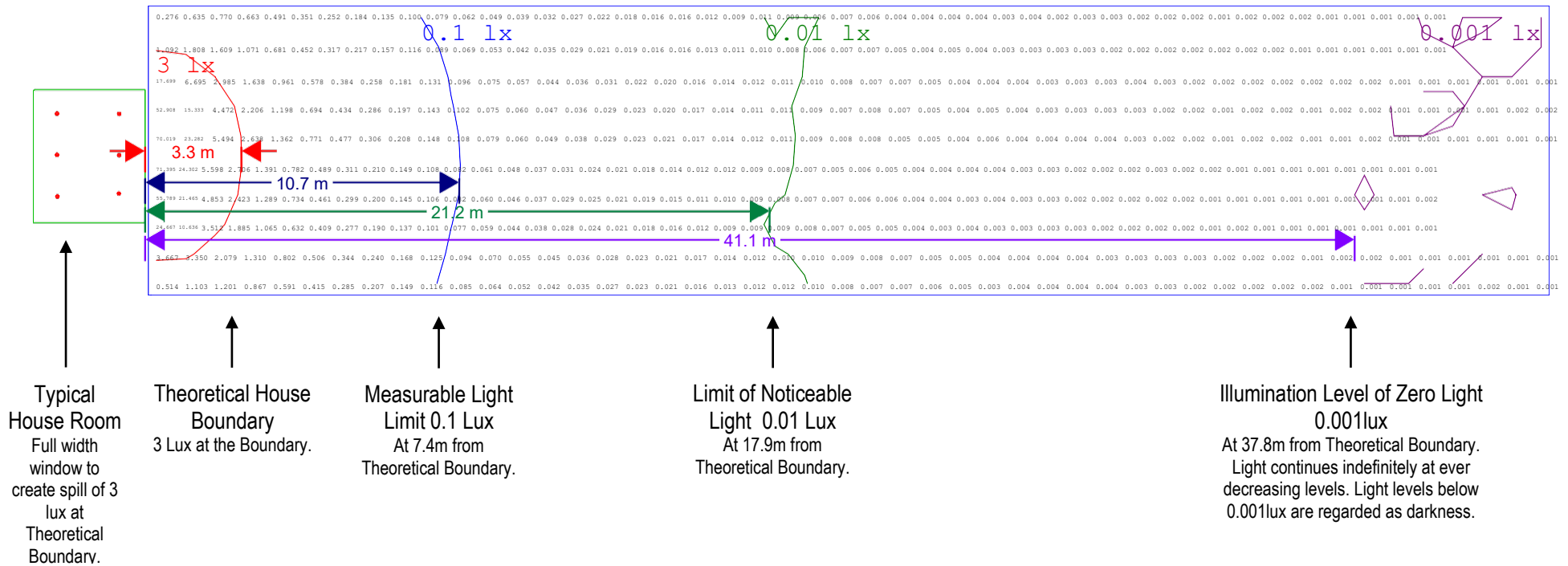
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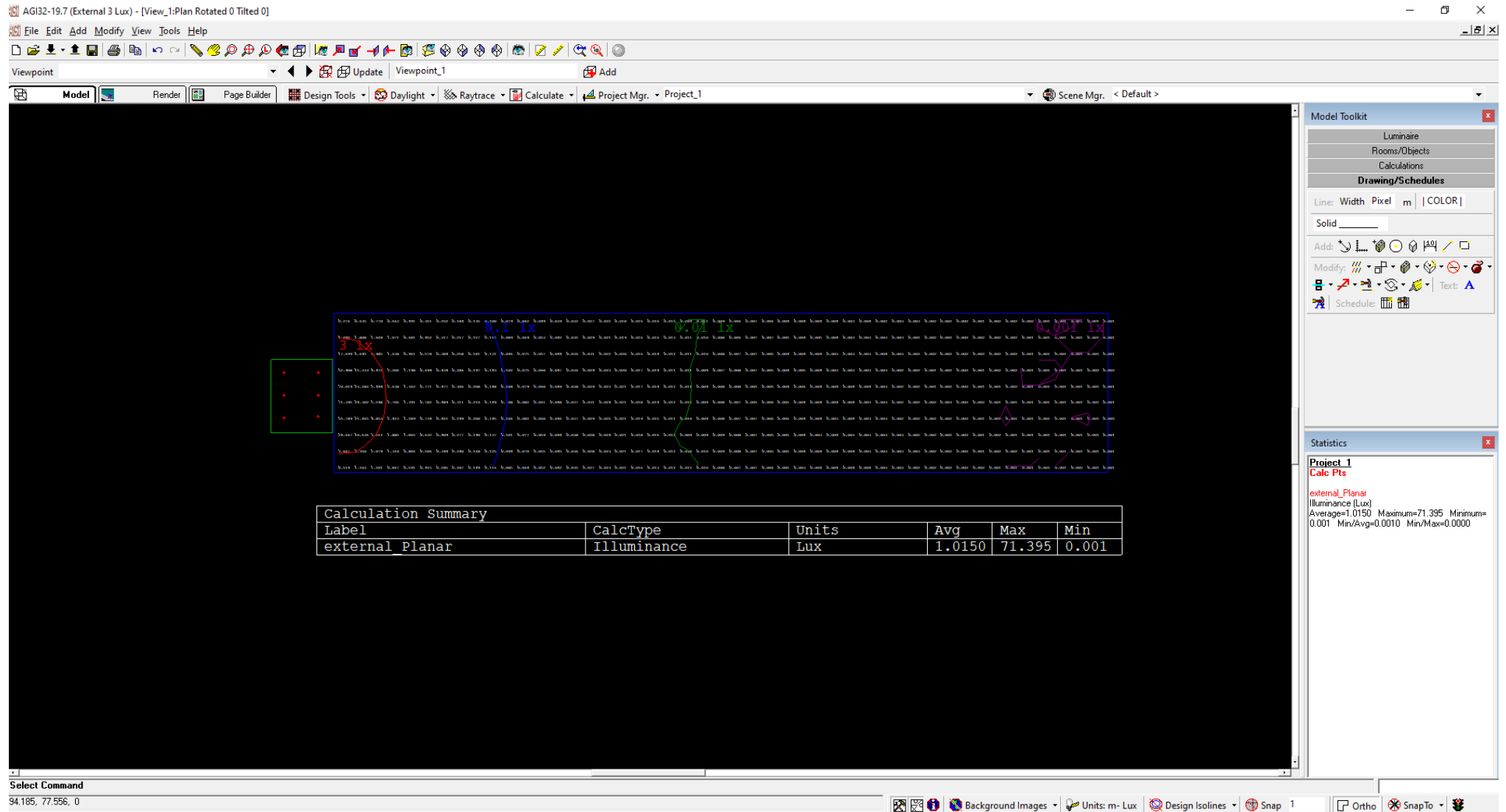
Lux Spill Distance Analysis

3 Lux - 3.3m
 0.1 Lux - 10.7m
 0.01 Lux - 21.2m
 0.001 Lux - 41.1m

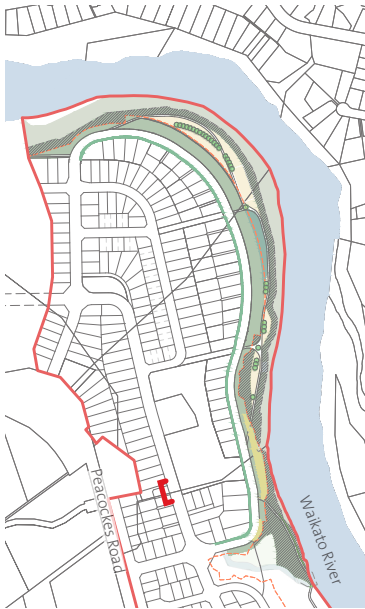
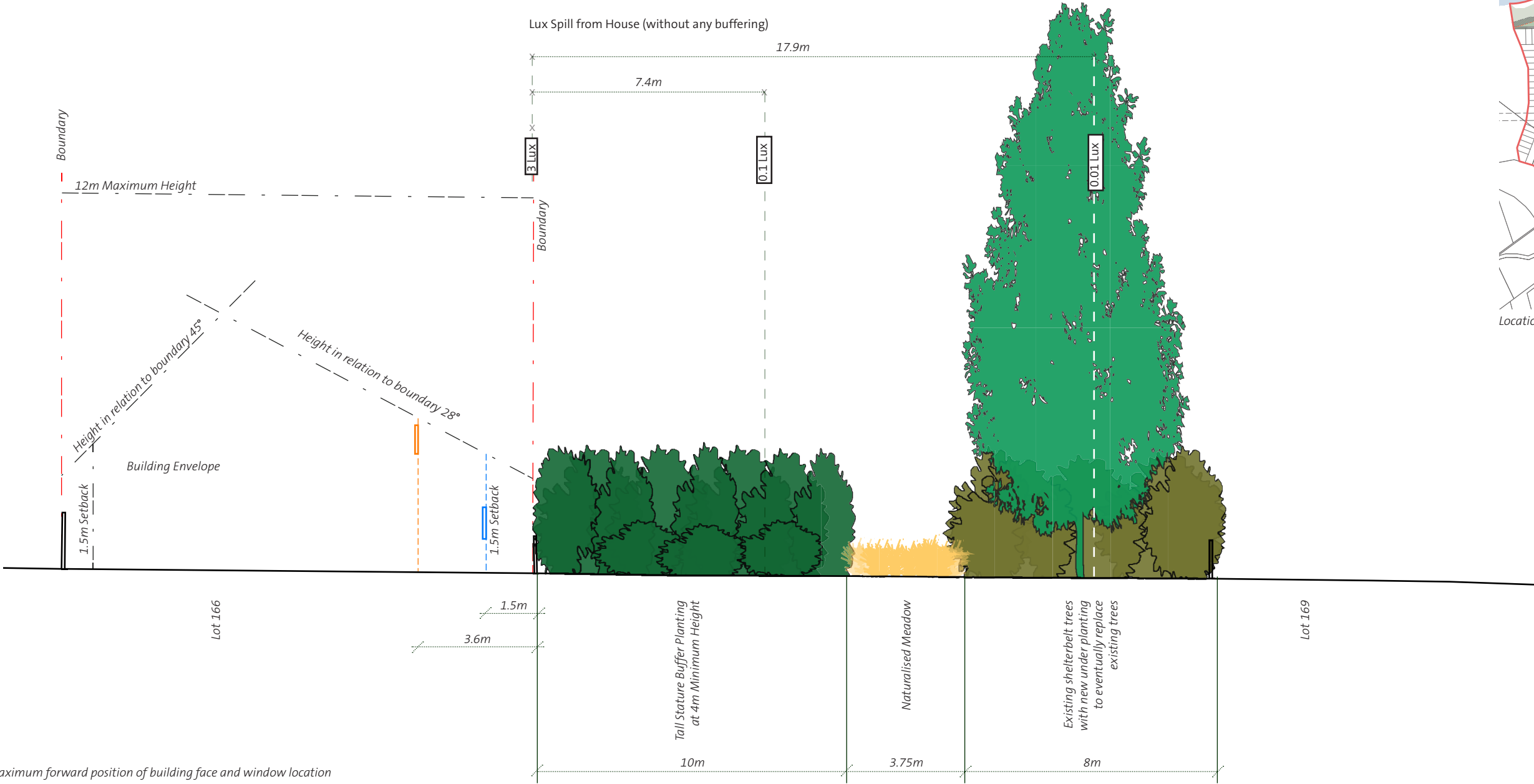


Calculation Summary					
Label	CalcType	Units	Avg	Max	Min
External_Planar Calculation	Illuminance	Lux	1.0150	71.395	0.001

AGI32 Lux Spill Distance Analysis – Calculations



Annexure B – Light Spill Diagrams



Location Plan

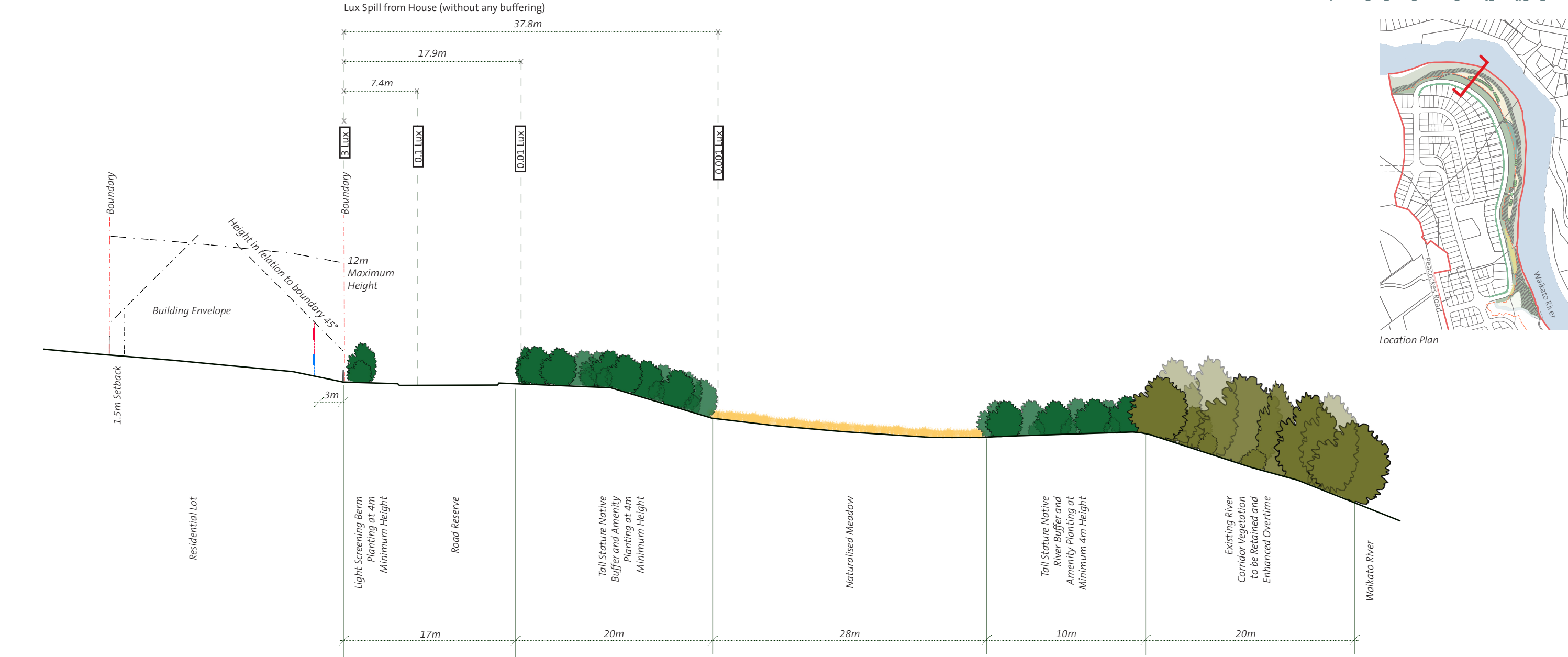
Legend:

- First storey maximum forward position of building face and window location
- Second storey maximum forward position of building face and upper window location

- House boundary
- Measurable light limit
- Limit of noticeable light

Note:

- Minimum floor-to-floor height: 2.7m, this is 2.4m ceiling height plus 0.3m construction.
- Top of window: 2m above upper floor level, with sloping roof fitting within recession plane.
- Windows shown at 1.1m above floor level and 0.9m in height.
- Permitted building envelop may allow for third and forth stories to be added.
- Lux spill from house measuring 3 Lux at boundary.



- Legend:
- First storey maximum forward position of building face and window location
 - Second storey maximum forward position of building face and upper window location
 - 3 Lux House boundary
 - 0.1 Lux Measurable light limit
 - 0.01 Lux Limit of noticeable light
 - 0.001 Lux Illumination level of zero light

- Note:
- Minimum floor-to-floor height: 2.7m, this is 2.4m ceiling height plus 0.3m construction.
 - Top of window: 2m above upper floor level, with sloping roof fitting within recession plane.
 - Windows shown at 1.1m above floor level and 0.9m in height.
 - Permitted building envelop may allow for third and forth stories to be added.
 - Lux spill from house measuring 3 Lux at boundary.