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

EVIDENCE-IN-CHIEF OF RAYMOND BRIAN O'CALLAGHAN FOR WESTON LEA LIMITED

Dated: 12 April 2019

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SUMMARY OF EVIDENCE

1. My name is Raymond Brian O'Callaghan and I am a senior civil engineer. I summarise my evidence, according to the key headings in this statement, as follows:

On-site engineering works *(Page 7)*

(a) The construction of the Amberfield development will involve earthworks of approximately 700,000m^3 cut to fill. This will be completed as balance cut to fill, thus meaning no import or export of fill material is required. The earthworks are modest in industry terms, with soils suitable for proposed earthworks. Construction will be managed by a Construction Management Plan (**CMP**).

(b) The internal roading within the site comply with Hamilton City Council's (**HCC**) Regional Infrastructure Technical Specifications (**RITS**) documentation, with no matters of concern;

(c) The stormwater solutions adopted for the site reflect the specific characteristics of the site and include on-site stormwater treatment and disposal to soakage across the site for majority of the site, treatment systems to manage quality, and communal basins to minimise in-road stormwater treatment devices. These will mitigate the increase in surface water flows resulting from intensive development and the treatment components will provide an appropriate level of protection for the downstream receiving waters.

(d) The water supply will be connected to existing HCC reticulation, with no expected influence on existing connections. The system will meet standards for flow, pressure and fire-fighting capacity.

(e) Wastewater will be collected in a gravity system, with 3 small pump stations to convey parts of the site to a large pump station that will convey wastewater off-site to HCC's reticulation system. Pump stations include emergency storage, fully monitored systems, stand-by pump facilities and the main pump station includes emergency

power generator for back-up power supply. All facilities will be designed to best practice standards.

(f) Amberfield has been split into 33 stages. Several stages may be constructed together. Staging will be influenced by infrastructure, topography and market conditions.

Off-Site infrastructure *(Page 18)*

(g) The supply main from the existing reticulation near the water treatment plant is to be installed to the northern entrance of Amberfield to supply potable water to Amberfield. There will be no effects on the network. An off-site water main is required for Stage 1.

(h) The development will require wastewater to be pumped to HCC's Far Eastern Interceptor (**FEI**) on the northern side of the Waikato River. Amberfield is expected to connect to this prior to HCC's full Peacocke Structure Plan Area (**PSPA**) Transfer Pump Station and Transfer Pipeline being operational as that requires the new bridge to be largely completed. Early connection will require Amberfield to install an interim pipe beneath the river to connect into the pipeline to the FEI. The interim pipeline is to be abandoned as soon as the full Transfer system is operational.

Peacockes Road Upgrade to Minor Arterial *(Page 24)*

(i) HCC propose to upgrade a section of Peacockes Road adjacent to Amberfield to a minor arterial standard. The design ground levels at the common boundary have been designed to suit both the development and the new road. Some further refinement of those levels may be required once HCC have progressed their minor arterial road design, but this will not create any issues for the development. Ideally completion of the minor arterial prior to Amberfield having completed beyond the first few stages would suit Amberfield but actual progress on the two projects will not be known for some time. Engineering matters can be resolved for the different scenarios without great difficulty.

Issues Raised in Submissions *(Page 25)*

(j) All of the matters raised in submissions that relate to engineering have in my opinion been adequately addressed and I have not summarised these further.

Issues Raised in the Section 42A Report *(Page 25)*

(k) Areas of disagreement with the Section 42A Report are outlined and comment on conditions relating to those items is provided. The areas of disagreement largely relate to the roading infrastructure, the upgrade of Peacockes Road to a minor arterial road, undergrounding of overhead powerlines in Peacockes Road, water main works in Peacockes Road, and stormwater management.

Conclusion *(Page 36)*

(l) I conclude that the engineering infrastructure solutions proposed for the Amberfield development will provide the required levels of service. I also consider that the engineering solutions developed as part of the Amberfield proposal are sound solutions that meet good industry practice and do not create any notable areas of risk for the receiving environment.

INTRODUCTION

2. My name is Raymond Brian O'Callaghan.

Qualifications and experience

3. I am currently working as a sole practitioner providing civil engineering services as O'Callaghan Design Ltd to a range of clients.

4. Up until March 2016, I was a Senior Principal Engineer at Cardno NZ Limited, a consultancy practice of approximately 90 staff in New Zealand that provides civil, wastewater and water supply treatment, hydraulic and coastal engineering services and land surveying and resource management services to private and local authority clients. I have lived and worked in Wellington for 40 years, of which I was a Director of Cardno (and formally Truebridge Callender Beach Limited) for the last 25 years and the NZ manager of the company for 15 years up until 2014.

5. I have been in practice as a Registered Engineer and Chartered Professional Engineer (CPEng) for 35 years. I hold a Bachelor of Engineering (Civil) degree and a post-graduate Diploma of Hydraulics and Coastal Engineering (Hons) from Delft, The Netherlands.

6. I am a Fellow of Engineering New Zealand (formally the Institute of Professional Engineers NZ) and an Honorary Life Member of the Association of Consulting Engineers New Zealand (**ACENZ**). I am also a certified independent Resource Management Act 1991 (**RMA**) commissioner to Chairperson level.

7. Over the past 38 years I have been involved in the field of civil engineering. I have worked predominantly in the field of engineering infrastructure services, dealing mainly with earthworks, roading, stormwater collection and disposal, wastewater treatment and disposal, water supply and coastal engineering and dealing with RMA issues associated with these elements of projects. These services have been to both local authority and commercial clients.

8. As the most senior practising engineer in Cardno, I was responsible for over-viewing a range of projects and managing and delivering the larger projects

to key clients. I continue to provide project management and project over-view to several projects across New Zealand.

9. I have been involved, at a detailed level in both the design and the management of construction, in a number of land development schemes over the last 30 years and am currently actively involved in several of these. These have included major residential developments in Wellington, Hutt Valley, Kapiti Coast, Christchurch, Nelson, Hamilton, Hawkes Bay and Taupo. I am currently involved in land development projects in all these areas except Nelson.

10. I have investigated, designed and/or managed the construction of several hundred projects involving several hundred kilometres of sewer, water and stormwater reticulation, numerous pump stations, well over a dozen wastewater treatment plants and associated treated effluent disposal systems to water and to land. I have managed the construction and certified the construction of in excess of ten million cubic metres of earthworks in the Wellington area over the last 26 years and continue to manage earthworks projects in Wellington, Hawkes Bay and Taupo.

11. I was the primary author of Section E1 of the New Zealand Building Code, which was first issued in 1991, and which deals with Surface Water. I continue to advise the Department of Building and Housing on updates and amendments to that section of the Building Code and I have been engaged to provide Determinations in cases of dispute.

Involvement in the proposed development

12. I have provided an overview role on the preliminary engineering design work for the Amberfield development since early 2016. I have led the assessment of bulk off-site infrastructure to service the development and I have provided specific engineering expertise on these matters to Weston Lea Limited (**Weston Lea**) and the Hamilton City Council (**Council** or **HCC**) for their discussions on a potential Private Developers Agreement.

13. I have been retained by Weston Lea to provide evidence on its application for land use and subdivision consent from the Council for the Amberfield

development. I prepared the Civil Infrastructure Report accompanying the Application.

14. I am familiar with the application site and surrounding environment. I have had several site visits, many of which have included HCC officers (and their advisors) and Waikato Regional Council (**WRC**) officers to explain the proposed works and how they would fit/sit on the site. This has included likely changes to the landform from earthworks, how the proposed bridge to The Island integrates with the gully area, likely locations of wastewater pump stations and where the various stormwater treatment basins and outlet structures would be located.

CODE OF CONDUCT

15. I have read the Environment Court Code of Conduct for expert witnesses and agree to comply with it.

16. I confirm that the topics and opinions addressed in this statement are within my area of expertise except where I state that I have relied on the evidence of other persons. I have not omitted to consider materials or facts known to me that might alter or detract from the opinions I have expressed.

OVERVIEW OF ENGINEERING MATTERS

17. The Amberfield development will involve earthworks and the construction roading, services, reserve areas and landscape planting within the Amberfield site, to form the various lots. It will also require integration of the road connections from within the subdivision on to Peacockes Road and off-site infrastructure to connect wastewater and water supply to the Council's infrastructure, some kilometres from the site.

18. HCC also have a significant infrastructure programme associated with their Housing Infrastructure Funding (**HIF**). Their programme includes a new bridge over the Waikato River, construction of new arterial and minor arterial roads and a new wastewater conveyance system that will discharge the wastewater flows from the Peacocke Structure Plan Area (**PSPA**) to the Far Eastern Interceptor, approximately 6km on the northern side of the Waikato River. The roading associated with their HIF program includes the upgrade of a large section of Peacockes Road to a minor arterial standard.

19. These components (on-site engineering works, Peacockes Road upgrade, off-site Amberfield water supply and wastewater connection) are discussed in detail below.

ON-SITE ENGINEERING WORKS

20. The construction of the Amberfield development will involve modest earthworks (relative to the scale of the development), new roads and services, stormwater treatment and disposal infrastructure, improvements to parts of Peacockes Road (in addition to the planned minor arterial works by HCC) and landscape planting and associated landscape works. These works will be constructed in stages. These are discussed below. In preparing this statement of evidence I have focussed on the engineering matters that have been raised in the Section 42A report, submissions and/or the issues of most relevance. Other matters are covered briefly in **Appendix 1** of this Statement of Evidence and are described in more detail the technical reports attached to the Application.

Earthworks

21. The earthworks required to form the development will involve stripping topsoil in the earthworks affected areas of the site and the excavation of approximately 700,000m^3 of cut material, which will be placed in engineered, compacted fills across the site to form the required roading and building platforms. Topsoil will be re-spread on the lots and landscape areas at the completion of cut to fill operations and regrassed/planted for stabilisation of the disturbed areas.

22. The earthworks will be carried out in stages. These stages differ from the development staging plan (drawing 141842-1046 Rev 6) as earthworks stages will cover several combined development stages. The earthworks staging will be determined from final detailed design and is based on achieving a staged cut/fill balance with earthworks completion being well ahead of the roading and services/lot completion areas. This ensures subsequent house building and occupation is not affected by close-by earthworks construction activity. It is envisaged that there will be approximately seven earthworks stages for the whole Amberfield development.

23. Earthworks for each stage will be carried out under a management regime controlled by a Construction Management Plan (**CMP**). This Plan sets out the methodology, restrictions, standards and environmental control requirements so that the work is completed in a manner that achieves the required outcomes.

24. I consider that the nature of the soils on the site, combined with the preliminary design for the Amberfield development and the proposed use of the CMP framework will enable the earthworks to be carried out without causing significant adverse effects on the surrounding/receiving environment.

Roading

25. The Amberfield development will require the construction of approximately 12km of internal road and 8 connections onto Peacockes Road. The offsite infrastructure upgrades associated with the upgrade of Peacockes Road to a

minor arterial standard are addressed separately below, and also by Mr Penny.

26. The internal roading network has been designed to achieve the urban design form adopted for the site. Mr Mentz will describe the urban design aspects of the roading infrastructure. Mr Penny will describe specific traffic engineering aspects of the roading system adopted for Amberfield.

27. In general, a multidisciplinary approach has been adopted to the roading infrastructure design for Amberfield to ensure it provides for appropriate traffic movement, parking, pedestrian/cyclist use, landscape amenity, infrastructure needs (corridors for drains, services etc), stormwater infrastructure, space for other needs such as rubbish bins at collection times etc.

28. The site's main Local Road network has been designed with road formation widths of 20m in accordance with HCC's District Plan requirements.

29. The detailed design of the roads will be based on HCC's Regional Infrastructure Technical Specifications (**RITS**) and will be submitted for approval prior to construction.

30. The Amberfield development requires the construction of a bridge across the main gully to gain access to The Island (containing development Stages 10 to 16 lots). A concept design for the bridge is shown on drawings 141842-1181 & 1185.

31. Detailed design of the bridge structure will be completed when the development advances to The Island area. That detailed design process will finalise the span, pile location, abutment and column configuration and vertical geometry of the bridge. The final design will require a building consent prior to construction.

Stormwater Treatment and Disposal

32. The Amberfield development will result in a large change in the land surface runoff characteristics, which will result in an increase in stormwater runoff collecting on the site. The change in land-use from farming to urbanisation also creates a potential for additional contaminants to become entrained in the stormwater runoff. This combined additional volume and potential

contaminant load creates a risk of potential adverse effects on the existing waterways and Waikato River (adjacent to the site), during large rainfall events.

33. The stormwater treatment and disposal solution adopted for the Amberfield development has therefore been assessed in detail to ensure that these potential adverse effects are avoided in the design event and minimised in rainfall events exceeding the adopted design event (being a 2-year rainfall event for the piped system and public treatment and disposal systems and 10-year event for the private on-lot systems dealing with roof water and on-lot collected water).

34. The investigations and assessment of suitable stormwater management solutions for Amberfield are described in both the Sub-catchment Integrated Catchment Management Plan (July 2018, Appendix N to the Application) (**Sub-catchment ICMP**) and the Amberfield Civil Infrastructure Report (May 2018, Appendix O to the Application) and the "Civil Infrastructure Responses to HCC Further Information Request" dated August 2018 (Appendix J to the response to the request from HCC for further information). Some further refinements of the stormwater solution at the north-east corner of the site are also described in the report titled North-East Area Alterations – Civil Engineering Infrastructure, dated February 2019 (Appendix E to the Assessment of Environmental Effects Addendum).

35. As described in the Sub-catchment ICMP, the preferred solution is to manage stormwater runoff on-site by discharge to ground and incorporate appropriate treatment solutions to prevent contamination of subsurface groundwater systems. This solution avoids increased risk of flooding to downstream waterways and avoids increased pollutant load and consequential deterioration of water quality in the downstream receiving waters.

36. Discharge to ground is also encouraged by HCC's planning framework and the RITS, where it is practical and feasible to use.

37. The results from site investigations confirmed that the soils on the site were suitable for disposal to ground for the adopted design event. This enabled the assessment to focus on the most appropriate treatment solution for the site, taking into account the topography of the site, the soil soakage characteristics,

the underlying soil stability characteristics, the catchment areas and associated stormwater flows for the design event and the desire to optimise future operation and maintenance of the system.

38. The Application was originally prepared on the basis of a stormwater solution involving a relatively large number of small bio-retention treatment devices located within the road corridor.

39. Following the lodgement of the Application, HCC raised some concerns about the number of small stormwater treatment devices and requested an assessment of the feasibility of some larger centralised treatment basins to reduce the overall number of the small devices. That assessment led to a change in the solution, with the adoption of some larger treatment basins, as described in the report "Civil Infrastructure Responses to HCC Further Information Request" dated August 2018 (Appendix J to the response to the request from HCC for further information). The stormwater related responses are covered in items 1 – 4, 10, 12 – 23 and 25 – 28 in that document.

40. Further discussions with HCC in late 2018 led to the adoption of a stormwater system involving six communal treatment basins to replace a number of the smaller devices. Drawings 141842-SK314 & 315 (Rev 5) show the location of these basins. These drawings also show the various sub-catchments within the site and contain a table showing the size of the sub-catchments serviced by the basins and the proportion of each sub-catchment serviced. Details of the basins are also shown on drawings 141842-SK291 – 296 (Rev 3).

41. In early 2019, as part of the re-design of the north-east area to provide additional bat mitigation, a larger stormwater treatment basin was incorporated into the overall stormwater solution allowing the amalgamation of two smaller proposed basins to the north (ex-basin numbers 2 and 3), resulting in five communal basins now being proposed. This new, larger basin is shown on drawing 141842-2001. This drawing shows a 900m^2 treatment basin located in the north-east area of the side, adjacent to the Waikato River.

42. The final stormwater solution that has evolved, both in response to feedback from HCC and as a result of other design changes occurring, can therefore be summarised as follows:

(a) Stormwater will be controlled at its source on private lots using on-site water efficiency measures to minimise demand on water supply and wastewater disposal and to enable re-use for gardens and as an emergency supply;

(b) Roof water from the houses will be directed to a rain tank connected via an overflow to on-lot soakage devices. Where feasible, runoff from driveways and other hard stand areas will also be directed to soakage devices. These soakage systems to be designed to deal with the 10-year design event as required by Section E1 of the Building Code;

(c) Remaining overland flow from private lots will discharge to the downstream land and be collected within the nearest downstream road corridor;

(d) Stormwater runoff from roads, footpaths, berms and planted areas within road corridor will be collected and discharged to treatment devices sized to deal with the 50% AEP (2-year ARI event);

(e) The treatment devices will be a mix of smaller bio-retention devices within the road corridor and 5 large communal basins within the Amberfield development;

(f) Primary flows from the 50% AEP will be discharged to ground at the smaller devices within road reserve and from two of the five larger communal basins;

(g) In the early phase of each stage of development, the overflow structure from the bio-retention treatment devices to the subsurface soakage bed system, within the road corridor, will be blanked off to prevent sediment laden stormwater from house construction sites entering the subsurface soakage bed system, to eliminate the risk of clogging of the subsurface soakage system. Once the house construction phase within a piped sub-catchment area has reached near completion, the entry to the sub-surface soakage beds associated with the bio-retention treatment devices will be made operational.

(h) A piped system will convey the stormwater collected in the road corridor, in the early house construction phase when the smaller bio-retention treatment devices within the road corridor are blanked off, to a discharge outlet.

(i) Of the 11 discharge outlets within the Amberfield development, six will discharge to a temporary pre-treatment basin to provide treatment of the stormwater in the early house building phase of those sub-catchment areas. These will be abandoned once the house building phase has been completed and the soakage beds associated with the bio-retention devices in the road corridor have been made operational. The other 5 sub-catchments will discharge to the communal basins with their associated outlet discharge;

(j) Once the road corridor bio-retention treatment devices are operational, the pipe systems in the road corridor will convey excess stormwater runoff from the bio-retention devices (i.e. flows greater than the 2-year design rainfall event) to discharge outlets, which will effectively act as an initial secondary flow path to the downstream communal basins;

(k) Extreme rainfall event secondary flow will be managed within road corridors and discharged to the discharge outlet structures, with appropriate velocity and erosion control.

43. The bio-retention treatment devices, including the sub-surface soakage bed element, and the communal treatment basins have been sized using good industry standards and are expected to provide a high degree of treatment. Additional treatment will also be provided by the discharge to ground, as the stormwater travels through the soils.

44. As identified in the geotechnical report appended to the Application, there are areas within the site, adjacent to the Waikato River, where the strata within the soil layers are such that the Factor of Safety for stability would be reduced if concentrated stormwater was discharged to ground in these areas. The communal basins along the river edge will therefore not discharge to ground due to the increased risks of instability. These basins will discharge directly to their respective outlet structures, which will direct the treated stormwater to

the Waikato River. Basins 5 and 6, which are located in the base of the gully in the southern end of the site, will discharge to ground, with an overflow to the main gully when the design event is exceeded.

45. The solution adopted for stormwater collection, treatment and disposal is consistent with the Sub-catchment ICMP and is supported by officers of both HCC and WRC.

46. All stormwater solutions are designed to cater for the flows from the adopted 2-year return period design event and to incorporate appropriate flow management in extreme events to avoid loss of life. In an extreme event the capacity of the primary system (the soakage and the piped system) will be exceeded, resulting in surface flows, called secondary overland flow. These secondary flows are managed by ensuring that they are conveyed within the road corridor system, and/or walkway systems to prevent them flowing across private property in an uncontrolled manner. These secondary flow paths ensure damage to private property is minimised. The Amberfield development has been designed to provide secondary flow paths to the Waikato River, in accordance with good industry practice.

47. The overall stormwater solution adopted for Amberfield uses best practice for treatment and disposal of the stormwater generated on the site and for on-going operation of the system. In my opinion, the stormwater solutions adopted for the Amberfield development will minimise adverse effects on stream/river water quality and on ground water quality. It will also avoid increased instantaneous flows to downstream systems in the design event, and thus avoid increased risk of flooding to downstream areas.

48. The stormwater management solution includes provision for extreme flood water levels in the Waikato River and has adopted a minimum development level on the site of RL19.5m to avoid any impact of extreme flood flows on roads and residential property within Amberfield. Our assessment included an allowance for climate change.

49. At the Amberfield site the river flood levels are influenced by the upstream Karapiro hydro-electric dam on the river. We have considered the likely effects from floodwater levels in the north-east corner of the site in a dam break scenario. The assessment is described in the Waikato River Adare Flood

Hazard Report, dated May 2018, which formed part of the Application. The WRC model has predicted a possible floodwater level of RL26.3m in the north-east area of the site in a dam burst of the Karapiro Dam, assuming a worst case burst sequence (a catastrophic collapse within a 6-minute period). The minimum development levels in this area are approximately RL21.5m at the lowest point of the development.

50. As the risk of a dam burst occurring, particularly in the manner modelled, is extremely low and lower than that requiring avoidance, WRC and the HCC planning framework does not limit or prevent development within the dam burst flood flow path. Much of the developed Hamilton area is within the dam burst flow path. Therefore, the risk is managed by an appropriate civil emergency response plan, involving emergency public notification to move to higher ground, similar to emergency response plans to the risk of tsunami events. WRC have such a plan in place for the Waikato area and this mitigates this risk on this site.

Water supply

51. The Amberfield development will be connected to the water reticulation system with appropriately sized water mains to ensure suitable flow and pressure for both domestic demand and fire-fighting purposes. Technical details are described in Appendix 1.

Wastewater Collection and Disposal Within Amberfield

52. The Amberfield development will require 3 small internal pump stations and reticulation to deal with the topography of the site and convey the wastewater generated by the development to a single large pump station (pump station 4 at the northern part of the site), from where it will be conveyed to the Council's existing wastewater network.

53. The Amberfield main pump station (Pump Station 4) effectively collects all flows from the Amberfield development and will pump these to the Council's network via the off-site system. The Amberfield pump station is expected to also be designed to cater for the wastewater flows from land beyond the Amberfield site that naturally drains to this catchment. Council has indicated their intention to require some up-sizing of the pump station and rising main

to cater for these additional flows beyond Weston Lea's land holdings. Any up-sizing, if required, will not create any engineering challenges to the system proposed.

54. The Amberfield pump station will be a large pump station in terms of Council's overall wastewater reticulation system and will form part of Council's core PSPA infrastructure. As such, this pump station will be provided with additional resilience infrastructure to cater for emergency situations.

55. The Amberfield pump station will be completed with the inclusion of approximately 370m^3 of wastewater storage to cater for additional storage for Amberfield, particularly in wet weather. Storage capacity is required by HCC's RITS, for emergency and for a situation involving power and/or pump failure.

56. As the Amberfield pump station is an important infrastructure component, and as operational failure could lead to wastewater overflows from the pump station to the Waikato River (which must be avoided - particularly given that the pump station is only a couple of kilometres upstream of Council's potable water treatment plant), emergency stand-by generation will be provided at the pump station. This emergency electrical supply will ensure that power failure will not occur. The risk of pump failure will be managed by the provision of stand-by pumps that will operate if a pump fails to run. The pump station will also be constructed with all the modern data recording, electronic monitoring of flows, water levels in the well, storage levels, pump operation status and alarm systems to the operator. These provisions are further backed up by the emergency storage, which is a greater level of resilience than at Council's other pump stations.

57. Based on the above, it is therefore expected that the Amberfield pump station will provide a high level of resilience and will not create a risk of wastewater overflows to the Waikato River.

58. The other three smaller pump stations will also incorporate emergency and stand-by facilities to prevent an overflow in an emergency. Each pump station will include emergency storage sized to deal with up to 9 hours wastewater flow, a stand-by pump that automatically starts as soon as a pump fails to start, full electronic control and alarm systems that notify the operator of a high water level situation and any pump failure/problem (with the monitoring

system operating 24 hours per day). Each pump station will also have the facility for a mobile generator to be connected to it if a prolonged power failure occurs.

59. These three smaller wastewater pump stations will therefore provide a high level of resilience that is best practice within the wastewater industry.

Other Services

60. The Amberfield development will require supply of electricity, telecommunications and possibly gas services. These will be constructed within each stage as part of the normal subdivision construction activity.

Staging of Amberfield

61. The Amberfield development will be carried out in stages to suit the market take-up of the developed lots. It is expected that up to 100 lots per year could be achieved, however, market cycles are likely to affect this average rate over the development period.

62. The proposed staging is shown on Drawing 141842-1046 Rev 7. This drawing shows the development being separated into 33 stages. This separation is influenced by location on the site, topography, ability to connect to critical infrastructure such as internal wastewater pump stations, bridge access, connectivity to Peacockes Road, HCC progress with upgrading a section of Peacockes Road to minor arterial standard, and the desire to commence development at the northern end. Multiple stages may be constructed in a single construction phase to make up a suitable sized lot package, or range of lot size, to meet market demand at that time.

63. Conditions of consent will provide for the proposed staging of the development. The proposed conditions require a specific stage to have the appropriate connection to critical infrastructure, such as wastewater, water supply and stormwater treatment/disposal before gaining a section 224(c) certificate for that stage. This will ensure a pragmatic construction phasing of Amberfield is achieved.

64. As set out above, the earthworks are separately staged for the reasons I have described.

OFF-SITE INFRASTRUCTURE

Water Supply

65. The potable water reticulation required to service the Amberfield development includes the bulk supply mains to the Amberfield site (from the existing reticulation network in the urban area, near the water treatment plant) and the internal reticulation within the site (which I have outlined above).

66. The assessment of the off-site water supply system needed to supply Amberfield with the required Level of Service, from the existing network to the site, has included detailed modelling by HCC's modelling consultants (Mott MacDonald Ltd), an assessment of the model output by Amberfield's water supply consultant (Jacobs Ltd) and a review and overview by myself.

67. The modelling carried out by Mott MacDonald and reviewed by Jacobs, has confirmed that the Amberfield development can be supplied from the existing water reticulation network in the Fitzroy area. The watermains required to supply potable water to the site will consist of a 250mm diameter water main from near the water treatment plant to the northern entrance into the Amberfield site.

68. HCC is intending to upgrade some of this section of road to a minor arterial standard. It is anticipated that the new 250mm diameter water main will be constructed within the designation corridor of these road upgrades to fit with the new road construction/infrastructure when it is constructed.

69. The 250mm diameter water main will be augmented with a 150mm diameter water main on the opposite side of the road to provide a resilience main in case the primary main is damaged or shut down for servicing.

70. These two water mains will connect into the Amberfield development, at the northern most intersection on to Peacockes Road, and will be installed as part of the construction of the first stage of Amberfield to provide suitable flow and pressure to Amberfield. The 250mm diameter main will extend south along Peacockes Road, as part of the minor arterial road upgrade works and the reticulation within Amberfield will be connected into this 250mm diameter main. Weston Lea will install this section of 250mm diameter main if the minor

arterial works are delayed and Weston Lea proceeds with a collector standard upgrade of this section of Peacockes Road.

Wastewater Connection to HCC's Wastewater Reticulation

71. The PSPA was advanced through Council's planning framework, based on a long-term wastewater disposal connection to the Far Eastern Interceptor (**FEI**), on the northern side of the Waikato River, near Crosby Road. This FEI has enough capacity to convey the additional wastewater flows from the PSPA to the Hamilton wastewater treatment plant without notable risk of overflows during extreme wet weather.

72. This solution requires a large Transfer Pump Station located in the general vicinity of the lowest part of the PSPA catchment (near the water treatment plant) and a Transfer Pipeline (rising main) from the Transfer Pump Station to the FEI. This permanent Transfer Pipeline will be constructed on the proposed new Waikato River bridge. The Transfer Pump Station, Transfer Pipeline and new bridge are planned to be constructed by Council, as part of their HIF program of works.

73. In the earlier phase (2015 – 2017) of assessing the feasibility of an interim discharge from the Amberfield development to the Western Interceptor, detailed modelling was carried out. I became deeply involved in these investigations from late 2015 and managed the work carried out within the Weston Lea team, liaising with HCC staff and their consultants.

74. The modelling focussed on assessing what capacity storage at Amberfield might be necessary to enable pumping from the Amberfield subdivision to cease during times of wet weather in order to avoid additional overflow of wastewater from the Western Interceptor system, to the Waikato River. The option was seen as an interim option until Council completed the Transfer Pump Station and Pipeline system to the FEI.

75. The modelling confirmed that approximately 3,000m^3 of storage would be required to prevent additional overflows within the Western Interceptor system from the fully developed and occupied Amberfield development. This volume, whilst large in storage terms, was potentially feasible in terms of construction, operation and cost effectiveness. With this quantity of storage, the pumps at

the Amberfield pump station could be turned off for several hours during wet weather, when the flows in the Western Interceptor system were at their greatest.

76. The modelling therefore indicated a possible interim solution, however, other potential operational issues associated with the solution were raised by Council. These potential operational issues included confirmation that time delay of the flow through the storage tanks could be managed in a manner that avoided problems with septicity developing in the wastewater, effective cleaning of the storage tanks after use and emptying the storage tanks in time to have them available for the next rainfall event.

77. These issues were not fully explored because the investigations began to consider a possible, longer term, connection to the FEI.

78. Whilst these potential issues were not resolved in detail, in my opinion, I considered the modelling results gave enough information and confidence to demonstrate that the operational issues were solvable. By the first quarter of 2018 Council was advancing their possible HIF works program and it seemed the likely delivery of the PSPA Transfer Pump Station and Pipeline may be available well before Amberfield was completed and some could be available for the first stage of Amberfield.

79. Therefore, notwithstanding the above described in paragraphs 72 – 77, I led an assessment of a possible connection to the FEI that could occur prior to Council's completion of the Transfer Pump Station and Pipeline in case Weston Lea elected to proceed with their development before the full Transfer system was operational. This solution involved drilling a temporary pipe beneath the Waikato River that would connect into the northern section of the Transfer Pipeline at Cobham Drive. Council generally supported the concept of the northern section of the Transfer Pipeline being constructed from Cobham Drive to Crosby Road to facilitate the Amberfield development progressing before the Transfer Pump Station and section of Transfer Pipeline up to, and across the bridge, was completed.

80. This option would require Weston Lea to construct the Amberfield pipeline from the Amberfield pump station to the future connection point to the Transfer Pipeline, at Weston Lea Drive, plus the section of pipeline from that

connection point to the River, beneath the River and on the northern side of the River to Cobham Drive. The section of the pipeline from the Amberfield pump station to Weston Lea Drive would be permanent. The section of the pipeline under the Waikato River and on to Cobham Drive would be abandoned and decommissioned once the Transfer Pump Station and full length of Transfer Pipeline became operative.

81. The Application has been based on this solution and is shown in the plans attached to the Application (drawings 141842 WW 500 – 514).

82. Council has now further advanced their HIF works program and the Transfer Pump Station and full length of Transfer Pipeline are likely to be completed in 2023.

83. In the short-term, if Weston Lea decide to proceed with the development before the Transfer Pump Station and full-length Transfer pipeline were operational, Weston Lea would construct and use the interim pipeline beneath the River to Cobham Drive and discharge into the Transfer Pipeline at that point. Council have indicated that they would have the northern section of the Transfer Pipeline from the FEI to Cobham Drive completed in 2021, to enable the first stage of the Amberfield development to discharge to the FEI.

84. The above solution relies upon Council completing the northern section of the Transfer Pipeline in time for the first stage of Amberfield to gain its 224(c) certificate.

85. The above interim solution under the River has some technical issues relating to the pump station infrastructure and the need for a temporary pipeline beneath the Waikato River, which may only be required for about 2 years. The pump station issues relate to the pump selection needing to deal with two different pump requirements – initially to pump an extra 6km to the FEI and then a long term operation to just pump to Weston Lea Drive where it will discharge in to a gravity system that will gravitate to the Transfer Pump Station. Whilst these issues are solvable without undue technical complexity, we explored if they could be avoided.

86. In February 2019, I began to explore with Council the possibility of an alternative temporary connection of the Amberfield pump station to the

Western reticulation system, just to cater for the first few hundred lots within Amberfield. This solution would utilise the storage chambers at the Amberfield pump station (approximately 370m^3) to enable the Amberfield pumps to be turned off during wet weather when the existing Western system might be overflowing, thus avoiding any notable increase in overflows to the Western reticulation system.

87. The investigations included detailed modelling of the expected flows within the Western system both with and without the Amberfield connection. However, the investigations concluded that a temporary connection to the Western system, in the vicinity of Peacocke Rd/Plateau Drive intersection, would not be feasible due to existing flows in the network. It may be feasible to avoid a notable increase in wet weather flows if the connection were made near the intersection of Bader Street and Willis Street, but this is almost 2.5km from Weston Lea Drive.

88. It is not desirable, nor cost effective to construct a 2.5km pumping main for such a short period of operation.

89. It is therefore proposed to proceed with a connection to the FEI, involving the interim pipeline under the Waikato River until the Main Transfer Pipeline on the bridge has been completed.

90. The pipeline under the Waikato River will only need to cater for the first few hundred houses within Amberfield and will be abandoned before 2025. It will be constructed by directional drilling from one side of the river to the other. This form of construction is common throughout New Zealand and I have had specific discussions with an experienced contractor about the construction of this pipeline. The contractor has successfully completed other pipelines beneath the Waikato River and with pipes much larger than that required for the interim Amberfield pipeline.

91. Directional drilling a pipe beneath the river involves a drilling pit from where the drilling machine begins the drill. The pit is expected to be 50 – 100 metres back from the river edge so that a suitable curve down beneath the river can be achieved. The drilling operation follows an alignment down through the soils within the bank of the river, beneath the bed with at least 10m cover between the pipe and the river bed and then curving back up through the soils

on the bank on the other side to the launch pit, which is also expected to be 50 – 100m back from the river. The total drilled length is expected to be 250 – 300 metres, which is not long in terms of directional drilling construction.

92. Once the drill exits the opposite side of the river, the drill is pulled backwards through the hole to expand it out to the required size, using drilling mud in the hole to avoid it collapsing. While this operation is being carried out, the full length of pipe is welded into a continuous length and pressure tested to confirm all welds are water tight and to the required standard. Once the hole is the required diameter, the full length of pipeline is pulled backwards across the river from the launch pit and retrieved at the drill pit, resulting in a complete length of pipe beneath the river.

93. The drilling operation is expected to take a few days once drilling commences and the pipe welding and testing will take a couple of weeks. Once these are completed, the pulling operation is completed in less than a day. The installed pipe is then re-tested to ensure the installation process has not caused any damage (however, pull pressures are controlled/limited to avoid over-stressing the pipe) or loss of integrity of the pipeline.

94. The pipe used for this river crossing is expected to be a 125mm outside diameter high density polyethylene pipe (HDPE) with an 11mm wall thickness. This wall thickness is very high compared to the pipe diameter, giving a very high-pressure rating for the pipe. Even though the operating pressure in the pipe is not high, high pressure, thick-walled pipe is used to ensure that the pipe is very strong and not at risk of failure or rupture.

95. HDPE pipe is now used for high pressure water, wastewater and gas projects because it is very strong, and the welding is carried out using fully computer monitored welding machines to ensure a fully ductile weld is achieved and good quality assurance is achieved.

96. I have previously installed approximately 200km of high-pressure gas mains in New Zealand using HDPE pipe with computer welding technology, plus numerous waste water pumping mains and water supply pipelines. This form of construction is well proven and has a very low risk of failure.

97. The final alignment of the pipeline, in the vicinity of the bridge, will be refined at detailed design and will involve liaison with HCC and their bridge designer/contractor. The pipeline could be constructed within the bridge designation corridor provided Weston Lea was satisfied it was not exposed to potential bridge construction activities and HCC and their contractor were comfortable that it would not inhibit their bridge building project (which would include granting consent as requiring authority to place the pipes in the designation. If it was concluded that either of these were a problem then the pipeline could be installed outside the designation corridor, which would involve other planning approval processes. As described by Mr Serjeant, there is not expected to be any issues with obtaining such an approval.

PEACOCKES ROAD UPGRADE TO MINOR ARTERIAL

98. The Southern Links program of works being undertaken by HCC includes the upgrade of Peacockes Road from the intersection with the East-West Arterial to the northern area of Peacockes Road to a minor arterial standard. Mr Penny's evidence will address the traffic related aspects of this road improvement program. I set out below aspects relating to the design and construction of Amberfield, where it transitions on to Peacockes Road.

99. The impending construction of Peacockes Road to minor arterial standard enabled a partnership approach (between Council and Weston Lea) to the design of the Amberfield development adjacent to Peacockes Road. This facilitated efficiencies in the design form of both the road and Amberfield.

100. Amberfield has adopted a design surface along the Peacockes Road boundary, in the area to be upgraded, that will provide a logical and pragmatic surface level that fits the house lots and the road. This requires Amberfield to cut and fill the road boundary margins sufficient for Council to construct the minor arterial road ahead of the construction of the Amberfield development in that zone. This approach minimises the area of land required for road because cut and fill batters between road and lots are avoided. It also enables a sensible urban design form to be constructed that achieves good access to the houses fronting Peacockes Road.

101. Mr Gray states in his evidence that Council expects to have the minor arterial works completed in 2024. This date may be too late for Amberfield to progress beyond the first few stages of development and this might require Amberfield to progress an interim collector road upgrade of Peacockes Road over sections of Peacockes Road requiring upgrading to service the additional stages if traffic related effects from Amberfield were found to exceed Peacockes Road capacity/functionality. Mr Penny discusses the sections of Peacockes Road that require upgrading to service progressive stages of Amberfield and this is also shown in the right-hand column of the table (Entrance) on the staging drawing 141842-1046.

102. The construction of the minor arterial road, in conjunction with Council's other HIF works simultaneously with the first few stages of Amberfield, will increase potential for construction traffic impacts on the local roads. I have estimated construction traffic relating to Amberfield and this sis set out in Appendix 1. The construction traffic effects are addressed further in Mr Penny's evidence.

ISSUES RAISED IN SUBMISSIONS

103. Several technical matters have been raised in submissions and these are discussed below:

Wastewater

104. The key matters relating to wastewater raised in submissions relates to the solution adopted, the proposed interim wastewater pipe beneath the river and the position of the development relative to the water treatment plant downstream.

105. A number of submissions raise some wastewater aspects as a possible concern.[1] The theme of the submissions revolves around the need for a sound solution for wastewater disposal, with some submissions seeking a delay on the development until the Transfer Pump Station and full Transfer Pipeline is operational.

[1] Submissions of Jennifer Cumpstone, Dick Kin Chang and Hua Hong Zhong, Jian Hua Lin and Xiu Zhen Zhang, Carolyn and Neil Edwards, Alison Keehan, Tangata Whenua Working Group, Graham McBride, Sean McConnell and Tania Macdonald (numbers 8, 20, 21, 26, 35, 41, 42, 46 and 76 respectively).

106. As described in the Application and in this evidence, there is an appropriate solution that can allow Weston Lea to proceed with the initial stages of Amberfield prior to the Council's full Transfer Pump Station and Transfer Pipeline being completed. This is the Weston Lea interim pipeline and the northern section of the Transfer Pipeline described above. This solution will convey the wastewater from Amberfield to the FEI until the full HCC system is operational.

107. The submission from Tangata Whenua Working Group (**TWWG**) (submission 41) seeks to have this interim solution only operative for the shortest possible time. HCC's HIF program is expected to have the bridge and Transfer Pipeline system operational in 2023. The earliest that Amberfield could have houses connected to the interim system is about mid-2021 and so this solution is only expected to operate for a 2-3-year period, but it may be less if Amberfield does not commence earthworks until the beginning of summer in 2020.

108. A concern raised in submission 46 by Mr McConnell is the integrity of the proposed interim pipeline beneath the Waikato River and hence the potential risk of a failure of the pipeline resulting in pollution of the River. I have described in paragraphs 85 - 96 above the details of the interim pipeline. I have also stated that these pipelines are very strong and are not prone to failure. I therefore consider that the risks of a failure occurring are extremely low.

109. A concern was raised in the submission of Ms Cumpstone (submission 8) relating to the potential cost of the pipeline on ratepayers. The interim pipeline would be at the developers cost and not the rate-payers.

110. The proposed construction of the wastewater pump stations in a location upstream of the water treatment plant intake has been raised as a concern in some submissions. The concern raised is that overflows of wastewater to the Waikato River in a pump station failure situation could create a risk of drinking water contamination.

111. As discussed in paragraphs 54 - 58 above, all 4 wastewater pump stations within the Amberfield development will be fitted with emergency storage chambers sufficient to store up to 9 hours of dry weather flow and they will be fully monitored with alarm systems notifying the operators of any faults. Each

pump station will have additional stand-by pumps that operate if a pump fails to run. In addition, the main Amberfield pump station will have an emergency stand-by generator to prevent pump failure in a power failure situation and the other 3 smaller stations will have a connection for an emergency electric generator to be connected to it.

112. In addition to the mitigation described in paragraph 111, the water treatment plant is designed to remove pathogens from the river water. There are several communities on the river catchment above the treatment plant and the addition of the Amberfield wastewater infrastructure does not increase the risks on the water treatment plant to any great extent. I note the points raised in the submission from Mr McBride (submission 42) where he has attempted to calculate the possible level of contamination in the river water in the event of a wastewater spill from Amberfield. In his calculation (and I accept that he clearly states that his calculation is only for indicative purposes) he has allowed a dilution factor of 10 for mixing between the Amberfield site and the Water Treatment Plant. I have been involved in several wastewater outfall projects and the dilution of a wastewater spill from Amberfield would be very different from his assessment. If a wastewater overflow occurred from Amberfield it would have a flow rate of a few litres/second and this compares to a river with a flow rate of several hundred cubic metres per second. The distance between the two is sufficient for full mixing to occur. The dilution is therefore more likely to be in the order of 10^5 not 10.

113. In my opinion, the provisions incorporated into the design of the wastewater system at Amberfield deal with the presence of the downstream Water Treatment Plant appropriately.

Stormwater

114. A number of submissions have raised some concerns relating to stormwater runoff.[2] The main areas of concern raised relates to stormwater contamination runoff to the river and possible increased risk of flooding from an assumed increased flow from Amberfield.

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2 Submissions of of Ms Cumpstone, Ms Cave-Palmer, J H Lin and X Z Zhang, Mr and Mrs Edwards, Ms Keehan and Mr Edwards (being submissions 8, 11, 21, 26, 35 & 67 respectively)

115. The stormwater solutions adopted from Amberfield are comprehensive and very technical and I think many of the submissions have not been able to fully grasp the expected outcomes, due to that technical complexity. As described in paragraphs 32 - 49 above, the surface runoff from the development will not simply be conveyed directly to the river. Each segment of the runoff (from houses, driveways, roads etc) will be captured in a range of treatment and disposal devices. The flow for the 2-year design event will be discharged to ground from these devices, not directly to the river.

116. The treatment and soakage disposal devices therefore provide a solution that avoids the discharge of contaminants in stormwater for the design event and avoids any identifiable increase in flows to the river.

117. Some submitters have raised concerns that effects of climate change could result in higher rainfall events in the future and these effects need to be considered. The stormwater analysis has been completed with the inclusion of predicted climate change rainfall intensity storms in accordance with HCC's RITS.

118. Mr and Mrs Edwards (submission 26) have raised concerns that an existing natural water course from their neighbouring property has been interrupted by piping within the Amberfield site. I am not familiar with the circumstances however, the designed design for the stormwater elements is required to include provision for existing natural runoff from upstream catchments. Therefore, the design flow from an upstream catchment, including any catchment on Mr and Mrs Edwards' land, will be directed into the piped system dealing with that catchment. This will alleviate any existing problem with Mr and Mrs Edwards' drain.

119. Mr and Mrs Edwards also state that they consider the stormwater solutions on the Amberfield site need to cater for future land-use changes on his land and other upstream neighbouring land. The proposals for Amberfield will cater for this to the extent the existing natural runoff will be managed through the Amberfield system and the extreme event secondary flow corridors through Amberfield will be sized to cater for potential flows from fully developed land upstream of Amberfield. Any further additional upsizing beyond this, that might be requested by HCC, will be HCC's responsibility.

120. However, any development on land upstream of Amberfield must incorporate their specific on-site stormwater solutions that manage and disposes of the increased stormwater generated within their developments resulting of the change in land-use for the design event adopted. The neighbouring areas will form part of a wider ICMP that HCC is currently preparing and that ICMP is expected to set the framework for stormwater solutions on the wider PSPA.

121. Ms Keehan (submission 35) sought confirmation that the stormwater solutions deal with the maximum allowable subdivision on the land. Engineering infrastructure is designed to provide the required solution for the form of development sought, with consideration of any further development within the site. In this case a full, comprehensive development layout has been prepared and the stormwater solutions tailored for that layout. The only future changes are expected to be in the form of some comprehensive housing within some of the stages. As the stormwater collected from private property roof areas and paved/driveway areas is managed within the private lots in soak pits, there is very little potential for the stormwater runoff from public areas to change over time. The solution adopted for Amberfield is therefore a long-term solution.

Water Supply

122. Ms Cave-Palmer & Mr and Mrs Edwards (submissions 11 & 26) have raised concerns that water supply to Amberfield should not adversely affect existing water supplies. Mr and Mrs Edwards also ask that the water supply be coordinated in a manner that does not restrict or limit the supply to other land holdings.

123. The solutions for water supply have been fully investigated and the additional demand from Amberfield modelled within the existing network. The modelling has confirmed that there will not be any noticeable impact on the existing connections. The new infrastructure for Amberfield forms part of HCC's long-term water supply network system and is fully consistent with the planned expansion to the neighbouring properties within the PSPA. The concerns raised by the two submissions are therefore fully dealt with by the proposed infrastructure.

Electrical Infrastructure

124. The submission from WEL Networks (submission 69) raised concerns that the position of the above ground electrical infrastructure has not been detailed in the Application. The final location, access, legalisation of the land etc for above ground infrastructure such as transformers will be dealt with at detailed design stage. This will involve liaison and approval from WEL Networks.

Open Spaces & Facilities Unit and Strategic Infrastructure Unit, HCC

125. I have not provided specific comment on this submission because the technical matters have been dealt with throughout this statement of evidence.

ISSUES RAISED IN SECTION 42A REPORT

126. The Section 42A Officer's Report is supported by a number of supporting reports from various Officer's and advisors. I have read the Officer's Section 42A Report and the supporting reports relating to engineering matters.

127. The Officer's Section 42A Report raises some notable areas of conflict in relation to how stormwater on private lots is to be managed. In addition, there are some relatively other minor matters which I do not agree with. I address these as follows, focusing in particular on the conditions of consent.

Roading Infrastructure

128. Paragraph 26 of Mr Gray's evidence (Appendix F of the Section 42A report) refers to the roading infrastructure potentially not having sufficient space for the construction of driveways, parking bays, landscaping, bus stops, refuge islands and intersections. However, Mr Brooke (paragraph 10, Appendix G(d) of the Section 42A report) has confirmed that he is satisfied that these elements can be accommodated. I have overviewed the road design for Amberfield through the preparation of the Application and I am also confident that the roading design adopted for Amberfield is appropriate and will cater for the roading and associated uses of the roading corridor.

Peacockes Road Minor Arterial Works

129. The proposed upgrade of Peacockes Road to minor arterial standard is described in the Section 42A report. This upgrade will be carried out by HCC as part of their HIF works. As described in paragraph 16(b) of Mr Gray's statement, this work is expected to be completed by June 2024. This date is later than expected and may result in some delay of the development beyond Stage 4, if it was concluded that the existing Peacockes Road adjacent to Stages 1, 18 & 29 was not sufficient to cope with traffic generated from the completed lots. If this arose, the consent holder would likely proceed with the construction of an interim collector road in this section and potentially further to the south up to the East West arterial if Council's program was delayed. The consent conditions should therefore make provision for a potential collector road construction if the consent holder wished to proceed ahead of Council's minor arterial upgrade program.

130. There is some discussion in Mr Gray's statement regarding the alignment of the proposed minor arterial road upgrade and the preliminary alignment of a collector road standard if Weston Lea proceeded with interim collector road work. I consider that this issue will be refined at detailed design stage of the minor arterial upgrade work, which I understand HCC has currently initiated. Once that design is confirmed, any collector road works, if they were to occur, would align with the eastern kerb position and levels of the final design minor arterial. If that process led HCC to move the eastern road boundary slightly to the west then the common boundary with Weston lea would move accordingly and any extra width simply incorporated into the final s223 approval plan.

Undergrounding overhead power lines in Peacockes Road

131. Other services, such as power, are covered in paragraph 189 in the Section 42A report. However, that section is inconsistent with the HCC's minor arterial road upgrade works and condition 109, which requires Weston Lea to relocate the overhead power wires on Peacockes Road to underground. The Condition 109 reference to undergrounding power on Peacockes Road should be separated into two parts. The first part should only relate to the section of Peacockes Road south of the East West arterial as this section of road is not being re-constructed as minor arterial but is to be upgraded by Weston Lea

as a collector road. The second reference to undergrounding power on Peacockes Road should relate to the section north of the East West arterial and should only require Weston Lea to underground the overhead power in this section if Weston Lea constructs sections of collector road ahead of HCC's minor arterial works. It would not be appropriate for Weston Lea to have to underground the power in this section in isolation of HCC progressing their minor arterial works as the cost of undergrounding is a responsibility of HCC.

Watermain Works in Peacockes Road

132. The Section 42A report outlines the proposed water main service to the site, being a 250mm diameter and a 150mm diameter water main from the existing network to the northern entry into the site. To date it has been assumed that Weston Lea would proceed before HCC's HIF works, of which the 250mm water main forms part of. However, Condition 127 in the draft conditions attached to the Section 42A Report does not cover the situation where Weston Lea does not proceed ahead of the HIF works, in which case the water main installation to close to Amberfield would likely to be installed by HCC. The proposed amended condition 124 covered by Mr Serjeant deals with this matter by deleting the reference to the consent holder installing the water main.

133. In addition, in the event that Weston Lea proceed with the installation of the 250mm diameter and 150mm diameter water mains to the site ahead of the HIF works then the condition still needs to be amended to state that the water main shall be extended along Peacockes Road "to the northern entry to the site". As the site extends over 1.5km along Peacockes Road, the current wording could be read to mean that Weston Lea should provide the 250mm diameter and 150mm diameter main all the way along Peacockes Road adjacent to the development. As for the paragraph above, the 250mm diameter water main is part of HCC's HIF infrastructure works is therefore not Weston Lea's responsibility unless Weston Lea were to construct sections of upgraded Peacockes Road ahead of HCC's HIF works. The proposed amended condition 126 covered by Mr Serjeant deals with this matter by clarifying that it is only a 250mm water main required along the section abutting the Amberfield site.

Stormwater Issues

134. Paragraph 125 of the Section 42A report and paragraphs 37 & 38 in the supporting report from Mr Clarke (Appendix G(a)), discuss stormwater overland flow matters from private lots within Amberfield. Mr Clarke states in paragraph 37 that the RITS requires upslope properties to have primary systems sized for 50-year ARI events. This is a higher design event than the 10-year design event required by Section E1 (Surface Water) of the NZ Building Code. Mr Clarke states that an alternative to the 50-year design event is to provide an easement through downslope properties in favour of the upslope properties to convey stormwater secondary flows. The Section 42A report does not adopt a similar either/or approach and condition 144 proposes that the scheme provides private easements across all downslope properties to allow for the conveyance of overland flow from upslope properties.

135. The issue of secondary flow from private lots onto other downslope lots was considered during the design process and the development of the stormwater solutions. The topography of the site is moderately steep in the west – east direction, and this is the situation where there are private lots above other lots. However, the distance between one road collection point and the next, lower, road collection point is typically 90 – 100 metres, with the worst case being approximately 150m (which occurs in stage 8). These dimensions are short in stormwater catchment terms. However, the finished developed catchment length is not the full 150m (considering the worst case) because most of the sections "stepping down the slope" are expected to have driveways cutting across the slope to the adjacent road on the north or south side and thus creating a flow path out on to the road. Therefore, the accumulated secondary flow arriving on a lot is likely to only be influenced from 2 or 3 lots above it.

136. The secondary flow generated in a modest rainfall event, from say 3 upstream properties each having a lot size of 450m^2, after the primary systems have reached capacity (designed for a 1-hour duration as per Section E1 of the NZ Building Code) is approximately 5l/s. That is, if all flow from 3 upstream properties flowed onto a 4th, lower property in the event of the primary systems on the upstream properties having had their design capacities exceeded, the 5l/s flow would be similar to a garden hose running at every metre along the

upstream boundary (30m boundary, 30 houses at 0.17l/s) assuming uniform sheet flow.

137. This scenario would not create an undue problem for the downstream property and this scenario is a pessimistic situation because, as stated above, the driveways and other north-south flow directing elements such as fences is likely to limit the upstream catchment to less than that considered above.

138. This issue of managing secondary flows onto lower properties was assessed as part of my work as the primary author of Section E1 of the NZ Building Code in 1991 and my subsequent reviews of Section E1. In preparing Section E1 it was concluded that attempting to control secondary flow within private property had the potential to create greater adverse outcomes than allowing secondary flow to follow its natural flow-path. Section E1 was therefore released (and has gone through several updates since without amendment on this issue) on the principle of not collecting, concentrating or directing collective multiple property secondary flow.

139. I therefore do not agree with the suggestion by Mr Clarke that private stormwater systems on private lots should be designed for a design event greater than that required by the NZ Building Code. Government is trying to minimise house construction costs and the NZ Building Code is the appropriate minimum standard to which houses must be constructed to and it is unnecessary for the community to be exposed to additional house construction costs imposed by HCC to meet a standard that is arbitrarily set higher than the NZ Building Code. I therefore do not agree with Mr Clarke that the private drainage elements within the lots should be designed for a 50-year event and consider that the NZ Building Code requirement for a 10-year design event is appropriate for the development.

140. I also disagree with the concept that private secondary flow paths across private property should be created and protected by easements on downstream property for this development. First, and foremost, such created specific flow paths will concentrate the secondary flow into one “channelized” path. This has the potential to create a greater risk of problems as it would be a concentrated flow, on a moderate slope, across private property that is difficult to monitor/maintain and operate and any blockage in the flow-path

would lead to uncontrolled concentrated flow. This is the very scenario Section E1 of the NZ Building Code sought to avoid. Concentrating surface flows from multiple properties is fraught with risk.

141. Therefore, I do not support condition 144 and consider that it should be removed entirely as the secondary flows will be minor and hence there is a very low risk of them creating nuisance to downstream neighbours, the presence of easements will create unnecessary restrictions on the lower properties and the maintenance and inspections of created formed secondary flow channels across private property create a greater risk of adverse effects from surface water. In addition, there is a question as to who would be carrying out the regular inspections of the form channels to ensure on-going preservation and maintenance of them.

142. The Section 42A report and Mr Clarke's report (paragraph 36) propose an obligation on Weston Lea to form the primary and secondary stormwater elements to cater for the maximum probable development flows from all adjacent sub-catchments currently draining through the Amberfield site. This is then reflected in condition 142. Whilst I agree with this with respect to secondary flows from neighbouring properties, the condition needs to be reworded to exclude any obligation on Weston Lea to deal with primary flows greater than those occurring from existing land-use and existing natural catchments. It is now industry standard that any developer must deal with/manage any additional flows generated by intensive development on their land such that downstream land owners are not required to receive greater flows resulting from upstream development. The Amberfield design has adopted this principle and it is entirely appropriate that other neighbours upstream of Amberfield be required to do the same if they choose to proceed with development. The Amberfield primary stormwater system should only have to be designed and constructed to cater for their flows and any existing natural runoff entering their site. Condition 142 should be re-worded to reflect this. The proposed amended condition 140 included in Mr Serjeant's evidence deals with this matter by clarifying that it is only secondary flows from the maximum probable development upstream that needs to be conveyed through the Amberfield site.

143. The only other remaining issue on stormwater matters is proposed condition 145. That condition states a maximum overland flow depth of 150mm. Much of the Amberfield site is fairly flat and so a maximum depth is not critical, what is critical is controlling velocities so that scour does not damage surface features. In flat areas it may be totally appropriate to have deeper flow, with low velocity, without causing problems for passage or access etc. Therefore, I consider that reference to maximum depth in condition 145 should be deleted. The proposed amended condition 142 covered by Mr Serjeant deals with this matter in the appropriate way.

CONCLUSION

144. In summary, I conclude that:

(a) The engineering infrastructure solutions proposed for the Amberfield development will provide the required levels of service.

(b) Wastewater will be discharged to the FEI. This might require an interim pipeline beneath the Waikato River if Weston Lea elect to proceed with the development before the HCC Transfer Pump Station and Transfer Pipeline are completed. The interim pipeline beneath the river will meet best practice standards for drilled pipelines and will not create a potential for adverse effects, resulting from a failure of the pipeline, that is more than minor. The pipeline will be abandoned as soon as the HCC full Transfer system was operational.

(c) The stormwater systems for the Amberfield development will provide a sound, robust treatment and disposal solution that meet industry best practice. Whilst HCC is generally supportive of the solutions proposed, the draft conditions of consent presented by HCC require amendment as described in this brief of evidence.

(d) The engineering solutions proposed are influenced to some extent by HCC's proposed HIF works. The actual completion dates for those HIF works will not be known for some years. The completion program may have some impact on the implementation of some stages of Amberfield. The conditions of consent need to incorporate some flexibility to cover scenarios where HCC complete HIF works prior to

Amberfield commencing and, alternatively, some stages of Amberfield proceeding before the HIF works are complete.

(e) I consider that, with respect to engineering infrastructure, the consent should be granted, and the conditions refined to incorporate the points raised in this statement.

Dated this 12th day of April 2019

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Raymond Brian O'Callaghan

Appendix 1 – Supplementary Information on Engineering Infrastructure

This Appendix shall be read in conjunction with the brief of evidence of Raymond Brian O'Callaghan for the Amberfield development consent Hearing. It provides background supporting information on engineering matters.

Earthworks

1. Earthworks are required on the site to transform the surface shape of the land to suit the construction of roads, infrastructure and building platforms across the site. Section 7 of the Civil Infrastructure Report, appended to the Application as Appendix O, describes the earthworks required for the Amberfield development. Section 2 of the supplementary engineering report titled "North-East Area Alterations – Civil Engineering Infrastructure" dated February 2019 (Appendix E to the Assessment of Environment Effects Addendum) provides an updated estimate of earthworks volumes in the north-east area.

2. The preliminary design earthworks have been designed to generally follow site contours to avoid deep cut and fills and reduce volumes of earth-worked material as much as possible. The existing topography is higher at Peacockes Road and falls towards the river. This natural shape has been retained within the preliminary earthworks design as much as possible, whilst still achieving the design outcomes required for good urban design, infrastructure requirements and a balance of earthworks cut to fill. Urban design matters influencing the earthworks design are addressed in the evidence of Mr Mentz.

3. The earthworks extent was influenced and limited in parts of the site to minimise, and where possible avoid, impacts on stream systems as far as practicable.

4. The soils on the site are suitable for the construction of earthworks fills. The fill operation is monitored by testing to ensure that they are constructed in accordance with NZS4431:1989 (Code of Practice for earth fill for residential development). This standard is for residential use on fill material. The standard sets out the frequency of observation and testing, minimum standards for compaction, work method standards etc. The standard requires a suitably qualified and experienced chartered professional engineer to issue a certificate at completion of each subdivision stage that the fills comply with

the standard. These requirements are covered by the draft consent conditions.

5. I have managed bulk earthworks on numerous land development projects for 30 years and have certified approximately 500,000m^3 of earthworks per year over this period. I have been quite involved in the geotechnical assessment and the preliminary design of the earthworks for the Amberfield project and, based on this work, I have no concerns about the earthworks for the Amberfield development meeting the standards set out in NZS4431:1989.

6. Sediment control measures expected to be used on this site include; clean water diversion channels, stabilised entry points, sediment retention ponds, silt fencing and sediment pits. Areas of earthworks will be stabilized with road metal or topsoil and grass as soon as those areas are complete, which will further assist with the minimisation of sediment runoff and dust generation.

7. In addition to erosion and sediment control, dust suppression measures will also be required to be available on-site during construction works. This can be provided via water carts (with polymer stabilising additives if necessary). As with erosion and sediment control measures, dust suppression measures will form part of the CMP and will need to be finalised by the successful Contractor and approved by HCC and Waikato Regional Council (**WRC**) in advance of site works commencing.

Roading

8. The Amberfield development will require the construction of approximately 12km of internal road and 8 connections onto Peacockes Road. The offsite infrastructure upgrades associated with the upgrade of Peacockes Road to a minor arterial standard are addressed separately below,

9. The internal roading network has been designed to achieve the urban design form adopted for the site. Mr Mentz will describe the urban design aspects of the roading infrastructure. Mr Penny will describe specific traffic engineering aspects of the roading system adopted for Amberfield.

10. In general, a multidisciplinary approach has been adopted to the roading infrastructure design for Amberfield to ensure it provides for appropriate traffic movement, parking, pedestrian/cyclist use, landscape amenity, infrastructure

needs (corridors for drains, services etc), stormwater infrastructure, space for other needs such as rubbish bins at collection times etc.

11. A full set of proposed Road Hierarchy Plans have been provided as Drawings 141842-1041 to 1042 (and also Boffa Miskell Plan OSF 37).

12. The site's main Local Road network has been designed with road reserve widths of 20m in accordance with HCCs District Plan requirements.

13. Predicted low volume Local Roads across the site have been designed with road reserve widths of 16.4m (Type D1) and 14.1m (Type D2). Both these proposed road reserve widths exceed the minimum standard legal road reserve width for low volume Local Roads of 9m in HCC's District Plan.

14. The 'Park Edge' roads have been designed as low volume Local Roads with road reserve widths of at least 13.5m. Due to the location of the these roads, with lots only provided on one side of the road, space allowance for rear grass berms for buried utilities services has only been provided on the one side (lot side) of the road corridor.

15. A full set of proposed Typical Road Cross Sections Plans have been provided as Drawings 141842-1401 to 1403 (and also Boffa Miskell Plans OSF 46 to 48).

16. The detailed design of the roads will be based on HCC's Regional Infrastructure Technical Specifications (**RITS**) and will be submitted for approval prior to construction.

The Bridge to The Island

17. The Amberfield development requires the construction of a bridge across the main gully to gain access to The Island (containing development Stages 10 to 16 lots). A concept design for the bridge is shown on drawings 141842-1181 & 1185.

18. The bridge will have a clear span of approximately 45m. This will be supported by columns, which will be supported by bridge piers constructed clear of the waterway in the bottom of the gully. The bridge piers and abutments will be supported by concrete piles.

19. As described in the geotechnical report accompanying the Application, a preliminary bore hole was drilled in the bridge area to confirm suitability of the soils for the piles and that investigation confirmed the soils are suitable for conventional bridge construction techniques.

20. The side abutments for the bridge are expected to be supported on piles and on a reinforced earth fill structure. This fill structure will have a moderately steep batter of approximately 1 vertical:1 horizontal. This is steeper than a natural fill batter and so stability will be achieved by using specific reinforced earth retaining methods. The proposal to use the steeper retained batter slope is because it achieves an optimum balance between minimising span of the bridge and minimising extent of fill into the base of the gully and thus minimising impact on planting and amenity values of the gully floor, yet still providing appropriate support and stability of the fill and bridge structure.

21. Detailed design of the bridge structure will be completed when the development advances to The Island area. That detailed design process will finalise the span, pile location, abutment and column configuration and vertical geometry of the bridge. The final design will require a building consent prior to construction.

22. The Amberfield development has a second crossing of the gully, to the south of the bridge, on Road 005, as shown by drawings 141842-1151 & 1323. This crossing is short, and the gully depth is relatively shallow and so it is intended to cross this with a culvert rather than a bridge because the earthworks associated with a culvert crossing are relatively small and a bridge is not cost effective for this crossing.

Water Supply

23. The Amberfield development will be connected to the water reticulation system with appropriately sized water mains to ensure suitable flow and pressure for both domestic demand and fire-fighting purposes.

24. The internal water mains within the Amberfield site will connect into the 250mm main and 150mm main within Peacockes Road, at the northern most intersection on to Peacockes Road.

25. As discussed in paragraphs 64 – 69 in my evidence-in-chief, the 250mm diameter water main will be extended south in Peacockes Road, as part of HCC's Peacockes Road minor arterial upgrade program (or as part of Weston Lea's collector road works if they proceed ahead of the minor arterial works). The internal water mains within the Amberfield development will connect on to this main at road intersections and thus provide a resilience network water main system as the development progresses south from the northern entrance.

26. The water mains within Amberfield will be sized at time of detailed design to provide the required Level of Service (as required by HCC's RITS) and to meet the NZ Fire Service Fire-Fighting Water Supply Code of Practice (SNZ PAS 4509:2008). The final sizing of the water mains for each phase of construction will incorporate the extent of 250mm main available in Peacockes Road, south of the northern most corner connection.

Construction Traffic

27. The construction of the minor arterial road, in conjunction with Council's other HIF works simultaneously with the first few stages of Amberfield, will increase potential for construction traffic impacts on the local roads.

28. Earthworks in Amberfield have been designed as a cut/fill balance resulting in no import or export of cut/fill material. Earthworks for the first stage of construction will involve about 200,000m^3 of cut to fill for earthworks associated with stages 1 – 6.

29. This volume of earthworks will take approximately 6 months to complete, involving approximately 15 individual main items of machinery (including motor scrapers, diggers, dozers, compactors, trucks and water carts). The personnel engaged on site during earthworks is therefore not expected to exceed 20, allowing for operators, supervisors, survey set out and soils testing. The majority of these will travel to work early in the morning (before 7am) and leave at about 6pm and they are usually onsite all day, apart from supervisory, survey and soils testing related personnel. It is common practice for earthworks contractors to operate a carpool/mini-van service for their operators and so not all personnel will travel individually. Therefore, I estimate approximately 25 vehicle movements per day relating to earthworks.

30. In the first stage of construction there will only be earthworks activity being carried out. This will be in the summer season as earthworks are unlikely to be able to be carried out on this site during the winter months.

31. Once the first phase of earthworks is completed, roading and services, the Amberfield pump station and rising main and the off-site water main construction would commence for the completion of Stages 1 & 2 (and possibly Stage 3). This work is expected to take approximately 15 months and involve an average of approximately 25 personnel. This will be made up of an average of about 7 people for the pump station and off-site water main and rising main construction work over the 15 month period and an average of 18 personnel on the roading and services (4 diggers, 2 dozers, 2 compactors, 4 trucks/dumpers, 1 grader (half the time) and part time contract concrete placers for kerb & channel & footpaths). The majority of these workers will travel to the site early and leave after 6pm (earlier in the winter). It is also common practice for these contractors to operate a carpool/mini-van service for their operators and so not all personnel will travel individually.

32. Therefore, the daily traffic generated by both earthworks and roading and services personnel, when both activities are being undertaken simultaneously, is approximately 30 trips to and from the site per day, being 60 vehicle movements, assuming some carpool use.

33. In addition to personnel transport to and from the site there will also be truck deliveries of pipes, drainage materials, roading basecourse, asphalt, concrete, plants, street light poles etc. A typical annual phase of construction of roading and services is expected to involve an average of approximately 1.5km of road. This will require 1,500m (40 truckloads) for materials for water main, sewer main and stormwater main, including manholes etc, approximately 1,500m^3 (150 truckloads) of trench backfill material and sand/grit bedding, approximately 1,300m^3 of concrete (300 loads) for footpath, kerb & channel & driveways, approximately 8,000m^3 (800 truckloads) of road subgrade improvement material, sub-base and basecourse and an allowance of say 30% for other incidental truck deliveries (asphalt, light poles, plants etc). This results in an estimate of approximately 1,700 truckloads over a 12-month period. Assuming a 50% peaking in some months, the average

number of truck deliveries per day, in the busier months, is therefore expected to be approximately 10 loads per day (20 truck movements).

34. Therefore, the expected construction traffic (excluding house building) when both earthworks and roading and services are under construction is 60 vehicle movements in cars and utility vehicles and 20 truck movements per day.

35. House construction related traffic is likely to involve a sequence of a maximum of approximately 20 houses under construction at any time. Assuming 4 workers per house (averaged between the different trades) that would result in approximately 80 house construction personnel on site. Truck deliveries are likely to be about 1 per week per house, resulting in 20 deliveries per week or 4 deliveries per day. Thus, house construction is likely to generate approximately 120 car/utility vehicle movements per day (assuming some will share vehicles to the site) and 8 – 10 truck movements per day.

36. Therefore, I estimate the likely construction traffic generated by earthworks, roading and services and house building activities occurring simultaneously to be approximately 180 vehicle movements in cars/utility vehicles and approximately 30 truck movements per day.