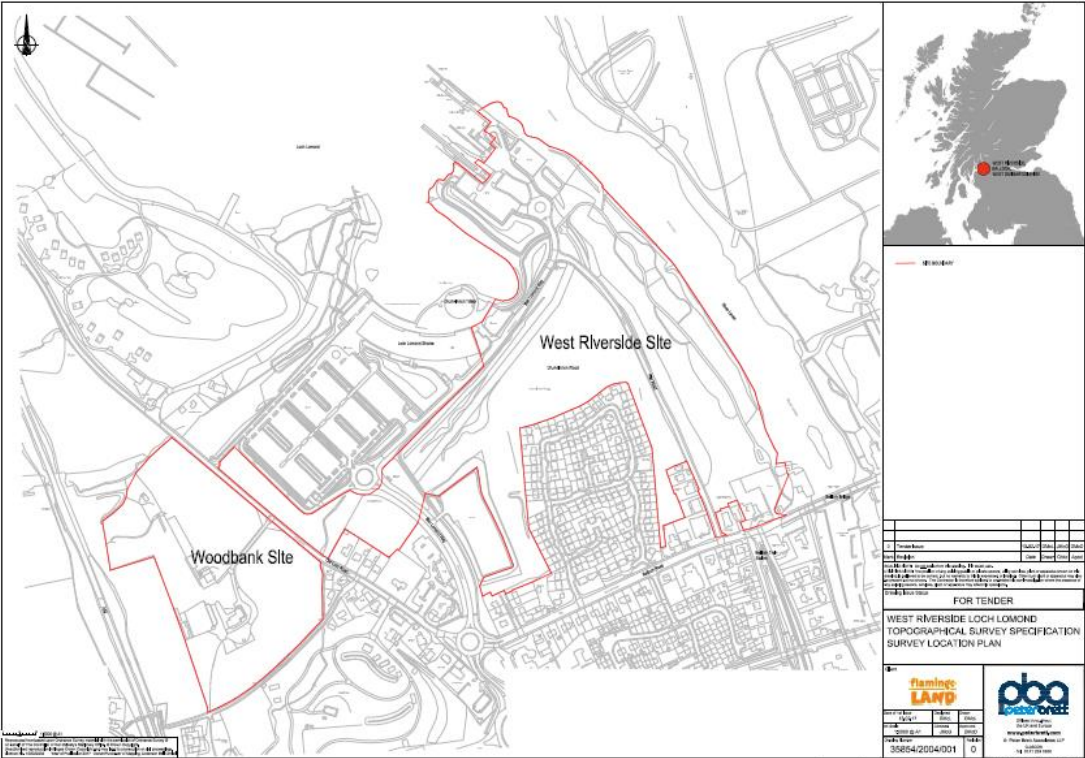


Job Name: West Riverside Development
Job No: 35854
Note No: 35854/2007/TN/002
Date: 24/03/2018
Prepared By: Derick Macleod
Reviewed By: Jim McGuire, Dougie McDonald
Subject: Drainage Assessment

Item	Subject
1.	<p>Introduction</p> <p>Peter Brett Associates LLP (PBA) has been appointed by Flamingo Land to support it with progressing plans to develop the West Riverside site at Loch Lomond, West Dunbartonshire.</p> <p>The purpose of this Technical Note is to document the developing foul and surface water strategies for the site.</p> <p>The Note also documents the feedback received from key stakeholders on the current proposals and provides recommendations for the next steps to be taken in order to progress the plans for the site.</p>
2.	<p>Site Location</p> <p>The location of the proposed development is illustrated in Figure 1 below.</p> 

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	<p>Figure 1 - Site Location Plan</p>
<p>3.</p>	<p>Foul Water Strategy</p> <p>Much of the existing foul drainage in the area is captured in combined sewers, which carry wastewater to the Ardoch Wastewater Treatment Works in Dumbarton. The intention for the proposed development is for the foul and surface water drainage to be captured separately, with only foul drainage entering the wastewater network.</p> <p>The site is approximately 33.5Ha and therefore significant lengths of new wastewater infrastructure would be required to service the various facilities proposed for the site.</p> <p>The intention would be for Scottish Water to adopt the new wastewater drainage infrastructure on the site. All foul drainage would therefore need to be designed to the standards contained in Sewers for Scotland, 3rd Edition, 2015.</p> <p>The Woodbank, and Drumkinnon Wood sections of the site can be drained under gravity and it is proposed that the foul sewers would connect into Scottish Water’s existing combined sewers on Old Luss Road and Pier Road respectively. However, this would be subject to confirmation that there is sufficient capacity in the existing network to accept the flows from the development. The proposed network would generally follow the alignments of proposed and existing access roads and tracks before tying into the existing combined sewer network.</p> <p>The riverfront section of the site presents a challenge for foul drainage as this area is extremely flat. The ground undulates with levels ranging between 10.0m and 11.0m AOD across the length of the Riverfront development area (approx. 500m). The gradients across sections of this area are as flat as 1:750 (0.13%). Providing a gravity sewer at an appropriate gradient for the expected flows, which can tie into the invert levels of the existing sewer network, is not possible without land raising or Scottish Water’s approval to use oversize pipes laid at shallower gradients. This presents an issue, as SEPA has advised that they would oppose any proposal for land raising which encroaches on the fluvial flood plain of the River Leven.</p> <p>Impacts on the flood plain could be avoided by reducing the platform areas such that the earthworks do not extend beyond the modelled extents of the flood plain. However, this would reduce the developable area. In addition, Scottish Water is unlikely to approve the use of oversize pipes laid at shallower gradients when the expected flows are unlikely to generate self-cleansing velocities in the sewer.</p> <p>As a gravity based system is unlikely to be a practical solution for connecting into the existing combined sewer network, it would be necessary to install a pumping station in the riverfront section of the site. A gravity sewer would capture foul drainage from the Riverfront and Pierhead areas of the site and direct it to the pumping station. This would pump the wastewater up a rising main to a connecting manhole on the existing combined sewer network at Balloch Road.</p> <p>The existing pumping station on site is owned by Scottish Enterprise (SE) but is managed on their behalf by Saltire Property Management Ltd (SPM), who have a service agreement with the proprietors of Loch Lomond Shores. There may be an opportunity to connect the new drainage to this existing pumping station, thereby potentially removing the requirement for a new pumping station.</p> <p>Limited information is however available on the capacity or service agreements for the existing pumping station. The strategy therefore makes provision for a new pumping</p>



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	<p>station at this time. This is subject to change should more information on the existing pumping station become available and it can be ascertained that the proposed development can be accommodated within it. .</p> <p>Scottish Water were generally supportive of the foul drainage proposals but noted that they could not give any definitive feedback until modelling had been undertaken to evaluate the impact of the additional flows from the development on the network. Scottish Water recommend that a Pre-Development Enquiry (PDE) be lodged so that modelling of the development flows can be undertaken as part of a Network Impact Assessment (NIA). The NIA would establish whether the existing network can accommodate the increased flows from the proposed development or if network reinforcements are required. They advised that this should be undertaken as soon as possible.</p> <p>PBA has since lodged a PDE with Scottish Water.</p>
<p>4.</p>	<p>Surface Water Strategy</p> <p>As noted in the previous section, much of the existing foul drainage in the area is captured in combined sewers and it is the intention for the proposed development to capture foul and surface water drainage separately, with surface water being treated and discharged back into the water environment using a variety of SuDS techniques. This has been discussed with SEPA and Scottish Water who are supportive of the approach.</p> <p>The site is approximately 33.5Ha and therefore significant new surface water drainage infrastructure is required to service the various facilities proposed for the site.</p> <p>The current proposals for the Woodbank area of the site include lodges as well as residential development. As the proposals are for less than 50 homes it is likely that only one level of SuDS treatment will be required prior to discharge into a receiving watercourse. The proposals require a number of access roads to facilitate access to the different elements of the development and roadside swales are proposed to treat and attenuate the surface water runoff from the site before discharging to the watercourse at the southwest corner of the Woodbank site.</p> <p>Based on the current level of detail and the site uses, SEPA were unable to confirm that a single level of treatment would be acceptable but they were open to further discussion once the proposals become more defined and a layout is prepared for the development. SEPA advised that their preference would be for dry swales incorporating an underdrain.</p> <p>The Drumkinnon Wood area of the site will not be accessed by cars, with only occasional access for maintenance vehicles. SEPA agreed that surface runoff in this area would not require treatment, however, roof runoff would require one level of treatment. An infiltration trench could be constructed alongside the proposed access track to capture surface water and roof runoff and provide the single level of treatment required. An alternative solution would be for the surface and roof runoff to be conveyed to the SuDS pond which treats the car park drainage. Both are viable options which could provide the required level of SuDS treatment and attenuation.</p> <p>Surface water drainage of the Riverfront area of the site has the same issues as the foul drainage in that the site is very flat. Significant land raising would be required to provide a piped network with an outfall above the flood level. The proposed strategy</p>



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	<p>therefore is for infiltration solutions that manage treatment and attenuation of runoff, thereby avoiding land raising.</p> <p>An infiltration trench would run through the middle of the riverfront area from north to south. This would be aligned with an access road. This would capture surface runoff and provide treatment to the roof runoff from the lodges west of the access road . A second infiltration trench would be provided to the east of an access road to capture surface runoff and protect the access road from damage by water flowing towards what is a low point in the site. Each lodge would have with its own catchpit and soakaway system to allow the roof runoff to infiltrate into the ground.</p> <p>A filter drain connected to a SuDS basin would provide the two levels of treatment and the attenuation required prior to discharge into the River Leven for the surface water runoff from proposed car parking areas adjacent to Pier Road. A similar SuDS treatment approach is proposed for car parking areas at the Pierhead. The outfalls for these SuDS basins are likely to be below the 1:200 Year + Climate Change flood level but efforts would be made to achieve the highest level possible to allow free flow from the basins in most situations and limit the attenuation needed during high return period events. Non-return duckbill or flap valves would be required to prevent the basins and drainage network from being surcharged by flood waters from the river.</p>

DOCUMENT ISSUE RECORD

Technical Note	Rev	Date	Prepared	Checked	Reviewed (Discipline Lead)	Approved (Project Director)
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