The General Manger
Wingecarribee Shire Council

STRATEGIC ENVIRONMENTAL
AND ENGINEERING
CONSULTING

www.seec.com.au

our reference: 20000305
your reference:

3rd May 2022

Re: Chelsea Gardens Estate

SEEC have been invited by Aoyuan International (our client) to respond to peer reviewed comment on SEEC report 2000035-LC by 03/05/2022 to align with a scheduled meeting between the client and Wingecarribee Shire Council. The report in question has multiple revisions it is assumed the comments made relate to the latest revision 20000305-LC-03 dated 6/11/2020. Comments made by the peer reviewer and SEECs response are presented below:

Element	Review Outcome	SEEC Response
Overall irrigation strategy (reuse vs 'disposal')	The LCA makes reference to disposal of treated effluent in a number of places and utilises Design Loading Rates (DLRs) that result in the application of water above plant water requirements for extended periods. This approach (typically referred to as land application) is not typically accepted at the scale of this discharge. Irrigation is normally required to limit application to closely match plant water requirements and minimise deep drainage of recycled water.	Our land capability assessment was written with a strong focus on effluent disposal rather than effluent re-use. This is because the proposal is for an interim wastewater treatment system (IWTS) to be used while the upgrades to the Moss Vale sewerage treatment plant are undertaken. It is understood that the IWTS is not a long term solution and therefore SEEC believe a LCA geared towards effluent disposal rather than beneficial re-use is an acceptable short term solution for the site.

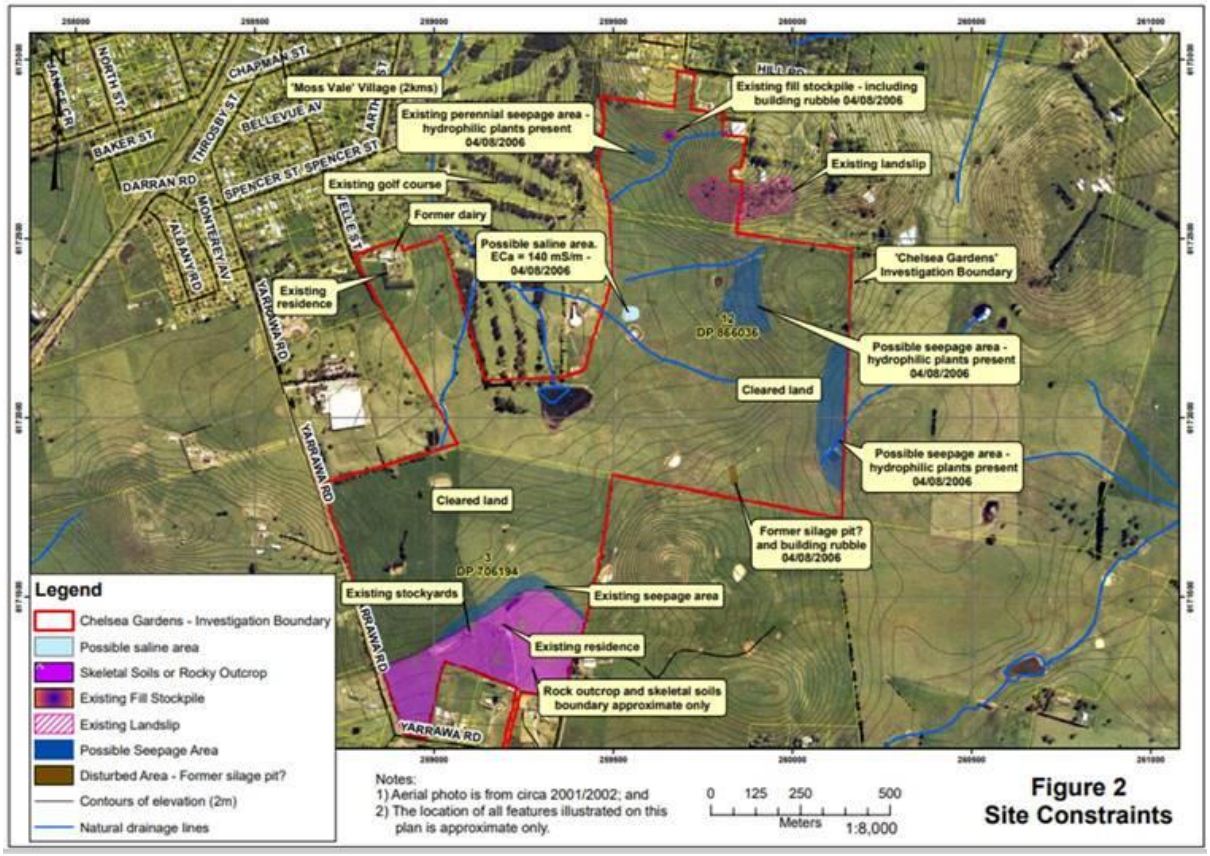
Design flows and capacity	LCA adopts a design basis that is not consistent with the sewerage servicing strategies (namely use of 180 L/EP/day versus 230 L/EP/day) which results in design flows that are ~22% lower. UWS calculated daily flows for Stage 1 to be ~140 kL/day.	The design wastewater flow rate has been calculated using Appendix C of the Water Supply Code (WSC) of Australia. Each equivalent person (EP) is given a design wastewater loading rate of 180 L/day. The difference in loading rates may be due to differences in assumed Water Efficiency Labelling and Standards (WELS) ratings applied at the time of document conception. We have written a condition in our report that minimum four-star water supply fixtures must be used in all new developments in this subdivision, which is considered to be equivalent to full water reduction fixtures. A wastewater loading rate of 230 L/EP/day is more likely to be consistent with houses with no to standard water reduction fixtures.
Site hydrology, hydrogeology and drainage	Whilst we agree that the subject soils are well suited to the irrigation of recycled water, the LCA outcomes for site hydrology and groundwater do not align with the previously completed Capability Assessment by Harvest Scientific Services (2006) which identified high groundwater value and the presence of both intermittent and perennial seeps. Two intermittent seeps were identified by Harvest within and immediately downslope of the proposed irrigation areas. When combined with the high irrigation rates (and high risk of increase deep drainage), there is potential for the proposal to increase the frequency size and duration of these seeps, potentially creating a pollutant export risk.	At the time of our assessment no groundwater seepages were noted during our site inspection. This suggests that if they are present, they are intermittent only, and the risk posed by those seeps would be largely mitigated by the proposed wet weather storage. SEEC did not note the presence of elevated groundwater tables (within 1m of natural ground level) during soil investigations. SEEC concurs with the assessment of high groundwater value and has applied a conservative approach to soil and hydraulic loading to reduce the risk of treated effluent impacting on any groundwater. SEEC notes that the proposal is for an interim wastewater treatment system (IWTS) while the upgrades to the Moss Vale sewerage treatment plant are undertaken. As the proposed IWTS and land application are not long term solutions they are considered to be an acceptable short term solution for this site. Further comments on the Harvest Scientific Services (2006) report have been made by Terry Hams of Beveridge Williams and are included below.
Water balance modelling and wet weather controls	The monthly water balance approach used in the LCA is designed for domestic and small commercial on-site wastewater management system design. It includes a number of assumptions and limitations that are not consistent with DEC (2004) or WICA requirements for sewage management. The calculations undertaken are essentially an assessment of the maximum volume of effluent that can be disposed on the site without saturating the soil. This is not beneficial reuse as defined in DEC (2004). Table 6 from SEEC (2020) proposes long-term (average annual) loading rates of 2.5mm/day. However, subtracting annual rainfall from annual evaporation would suggest an optimistic average annual loading rate of 0.8mm/day is required to meet	SEEC's hydraulic balance was adapted from recommendations given in Appendix 6 of Environment & Health Protection Guidelines: On-site Sewage Management for Single Households, 1998 (the Silver Book). The water balance (Nominated Area Method) in the Silver Book is calculated as follows: *Design Precipitation + Wastewater Applied = Evapotranspiration + Percolation.* The water balance in DEC (2004) is calculated as follows: *Precipitation + Effluent applied = Evapotranspiration + Percolation + Runoff.* DEC (2004) recommends setting run-off to zero thus both documents' calculations could be considered the same. The reviewer states that an optimistic annual loading rate of 0.8 mm/day could be applied, however this calculation has not included an allowance for the percolation of effluent through the soil. At Moss Vale, average evaporation is 1,232 mm/year, and median precipitation is 933.3 mm/year. Therefore the yearly water balance is 1,232 mm-933.3 mm = 298.7 mm. 298.7 mm divided by 365 days = 0.82 mm/day (approx.). The review is correct in stating that approximately 0.8 mm of effluent could be applied to achieve a satisfactory water balance. However as noted above, this model does not

	plant water requirements. This does not account for the fact that Evapo-transpiration is typically 0.4-0.8 of pan evaporation.	include an allowance for the daily percolation of effluent through the soil. This value has been selected from AS/NZS1547:2012 based on soil field texture as determined during our onsite soil investigation. The reviewer is correct in stating that Evapo-transpiration (crop factor) is typically 0.4-0.8 of pan evaporation. This statement comes from Table 4.1 of DEC (2004) for pastures. SEEC have used crop factors of 0.6-0.8 in our monthly water balance, a practice considered acceptable by Wingecarribee Shire Council and WaterNSW for some time. If the regulator is concerned with the adopted crop factor the effluent management area could be conditioned to consist of Lucerne which has a higher crop factor than typical pastures.

Comments by Terry Hams, Beveridge Williams, 2022

At the time of writing this document SEEC had not been able to conduct a formal review of the Harvest Scientific Services (2006). A formal review had been conducted by Terry Hams of Beveridge Williams. The review is summarised below:

Groundwater Issues
The Peer Review, at page 20, states….
"…the LCA outcomes for site hydrology and groundwater do not align with the previously completed Capability Assessment by Harvest Scientific Services (2006) which identified high groundwater value and the presence of both intermittent and perennial seeps. Two intermittent seeps were identified by Harvest within and immediately downslope of the proposed irrigation areas."
Terry Hams
"*I have obtained a copy of the 2006 Harvest report from Council's DA Tracker site. This report refers to possible groundwater/salinity issues at page 7 and considers the issue of groundwater from pages 16 to 19 with the general findings depicted in Figure 2 which has been copied below.*



Copy of Figure 2 from Harvest Report 2006.

At Page 7, an area of seepage is reported as having been observed around the rock outcrop on the south-east portion of the site (currently planned for Stage 2). This area is identified in Figure 2 as being around the perimeter of the purple-coloured rock area and is distant from the proposed irrigation area in the east of the site.

Further, an existing perennial seepage area is noted as having been observed in the northern portion of the site. This area is located to the north of Shelly Road in Figure 2 and again distant from the proposed irrigation area.

At page 7, of the Harvest Report there is a comment that "rush plant species (Juncus sp) were observed sporadically over the major part of this site. This plant species indicates that the site is probably poorly drained (in places) and possibly intermittently saturates." There are two areas in Figure 2 which are adjacent to the proposed irrigation area where these plants were observed. It is noted that these areas are not identified as seepage areas, just areas with rush plants.

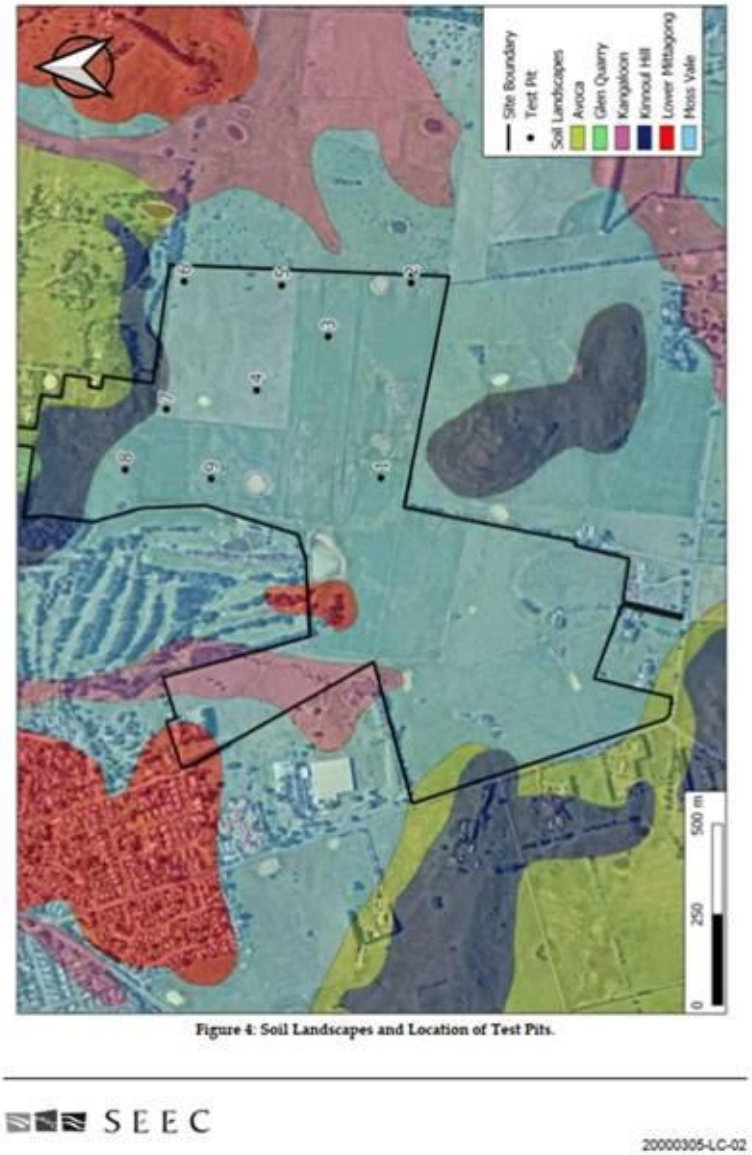
At Pages 16-19, The Harvest Report discusses the issue of Groundwater. The first part of the discussion is general in nature only. A number of bores are identified in the area. The two closest are located just to the south of the property with water levels being noted as between 17m and 24m from the surface.

At page 20, the Harvest Report confirms that "During field investigations on the 4th of August, 2006, two main areas of seepage were observed on this property (Figure 2). The first

of these was located in the northern portion of the CGDS in the steep area near hill road and the second occurs in the southern portion of this CGDS at the base of the syenite/microsyenite plateau." Both of these areas are identified in Figure 2 and are both distant from the proposed irrigation zone.

The remainder of the discussion on groundwater in the Harvest Report considers the impact of the development on ground water and so is not relevant to the current issues identified in the peer review.

The Land Capability Assessment (LCA) completed by SEEC in October 2020 was based on 9 test pits with the test pits being spread across the proposed irrigation site as indicated in Figure 4 of the LCA (copied below).



Copy of Figure 4 from SEEC LCA.

It is noted that SEEC Test pits 2 and 5 are located in the eastern blue area marked in the Harvest Figure 2 as a "possible seepage area" and that SEEC Test pits 4 and 7 are in the

other blue area marked in the Harvest Figure 2 as "possible seepage area" located to the immediate west of the proposed irrigation area.

These SEEC test pits were excavated to a depth of at least 1m and no sign of saturation or seepage was noted. The soils were generally classified as being "moderately well drained".

In conclusion, I have reviewed the 2006 Harvest Scientific Services report and the SEEC land Capability Assessment against the comments in the DWA Peer Review and cannot find any evidence to support the findings of the peer review. The Peer Review states that the Harvest Report found high ground water values but there are no such references in the Harvest Report in the area of the proposed irrigation area. The Peer review infers that the Harvest Report found perennial and intermittent groundwater seeps in the vicinity of the proposed irrigation area but the only seepage areas identified in the Harvest Report are located well to the north and south of the proposed Irrigation area which will not be impacted upon or impact on the proposed irrigation area. The Peer Review states that "Two intermittent seeps were identified by Harvest within and immediately downslope of the proposed irrigation areas." This is factually incorrect. The two areas immediately downslope of the proposed irrigation area were identified in the Harvest Report as "possible seepage areas" based on the vegetation observed on site only. Subsequent test pit data obtained by SEEC did not identify any saturation issues with the soils in these areas."

If you would like to discuss any aspect of the above, please feel free to contact me on 02 4862 1633 or 0432 218 315 or cbromhead@seec.com.au

Yours faithfully,

Ciaran Bromhead
Environmental specialist, SEEC

ABN 97 155 426