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28 June 2016

The Senior Planner
Dunedin City Council
PO Box 5045
Dunedin

Attn: John Sule

Dear John

SUB-2015-78 & LUC2015-433
380 SOUTH ROAD, DUNEDIN

Please find the information provided below in support of the application for subdivision and land use consents for the site at 380 South Road which are currently under process by Dunedin City Council.

This letter provides three elements of further information, these being-

1. Expert evidence on matters of stormwater and foul sewage infrastructure, and
2. Applicant's comments on matters of earthworks, and
3. Applicant's comments on matters related to the Main South Railway.

Stormwater and Foul Sewage Infrastructure

The information provided below has been prepared as expert evidence by Mr Kurt Bowen of Paterson Pitts Group. Mr Bowen is qualified as a Registered Professional Surveyor and has in excess of 18 years' experience in working on land development projects within the Dunedin City region, many of which have involved detailed stormwater and foul sewage assessment.

<u>Stormwater Management</u>

The method of stormwater assessment that is appropriate to apply to this project is best explained in the following stages-

1. Assessment of permitted baseline discharge (also maximum allowable development discharge) – i.e. what level of stormwater discharge could be expected as of right. This must determine a fixed (i.e. non-dynamic) rate of discharge.
2. Assessment of the anticipated post-development discharges (if uncontrolled) for different duration rainfall events.
3. Assessment of the degree to which any post-development discharges exceed the permitted discharge, and the anticipated maximum volume of water that would result from these excesses being retained on-site.
4. Assessment of the practical ability for the project to store the anticipated maximum retention volume.

The above methodology is the usual approach that is taken to determining an appropriate means of achieving a sustainable stormwater solution. Effectively, this achieves an outcome whereby stormwater discharge is restricted to the permitted 'as of right' rate, and an appropriate level of on-site storage is provided to cater for rainfall events that produce stormwater flows in excess of that rate. Water which is stored on-site will be released for the retention facility into the public reticulation system at the permitted rate as the triggering rainfall event recedes.

In respect of the application property, the assessment of stormwater management in accordance with the above methodology occur as follows-

1. Assessment of Maximum Allowable Development Discharge:

   This assessment uses the standard stormwater flow equation of Q = 2.78 c i a, where 'Q' is litres per second, 'c' is the run-off coefficient, 'i' is the rainfall intensity and 'a' is the site area. Note-

   - c = 0.45 (adopted from Building Code: E1, Table 1, residential areas with impervious proportion less than 36%).
   - i = 65 mm/hr (adopted from DCC rainfall intensity report by David Stewart Dec 2006, Figure 2, 1:100 year rainfall event, 20 minute duration). The actual time of concentration for the application site is less than 20 minutes, however accepting 20 minutes (which is common practice for small sites) provides a more conservative outcome.
   - a = 0.1314 hectares.

   Applying the above equation, it can be determined that Q = 10.7 litres per second. Therefore, the permitted discharge rate, for a 1:100 year return event with a 20 minute duration, is 10.7 litres per second.

   However, if we consider the existing situation rather than the permitted baseline, and repeat the above equation using the existing site data, which replaces 'c' with 0.37 rather than 0.45, we find that Q = 8.8 litres per second. Therefore, the existing discharge rate, for a 1:100 year return event with a 20 minute duration, is 8.8 litres per second.

   In consideration of the permitted discharge rate of 10.7 l/s and the existing discharge rate of 8.8 l/s, our preference is to satisfy both of these determinations by establishing a maximum allowable discharge rate from the proposed development of **8.0 litres per second** (rounded down from 8.8 l/s to provide additional contingency).

2. Assessment of Uncontrolled Post-Development Discharges:

   This assessment is undertaken using the same equation as noted in 1 above, however I have made these calculations for a range of event durations in order to determine the nature of the stormwater run-off under different conditions. These calculations use different 'i' values for the various durations (all 'i' values are sourced

from the 2006 DCC rainfall intensity report). The 'c' values and 'a' values are also variable as these reflect the different levels of impermeability within the developed site. The 'c' values have been adopted form the Building Code: E1 as applicable to the various surface types. The 'c' and 'a' values used for this calculation are-

Surface Type	'c' value	'a' value
Roofs (inc. sheds)	0.90	0.0270
Paving	0.85	0.0569
Decks (gravel below)	0.50	0.0163
Greenspace	0.25	0.0312

Using the above parameters, we can determine that the post-development flows, if uncontrolled, will be as follows for 1:100 year return period events at the various durations shown-

Duration (minutes)	10	20	30	40	50	60	90	120
Intensity (1:100)	105	65	48	37	31	27	22	20
Post-Dev. Flows (l/s)	**25.9**	**16.0**	**11.8**	**9.1**	7.6	6.7	5.4	4.9

It is significant to note that the flows resulting from 10, 20, 30 and 40 minute 1:100 year event durations all exceed the maximum allowable discharge rate of 8.0 litres per second as established in 1 above. Therefore, these are the flows that the proposed development must address.

3. Assessment of Storage Volumes to be Retained:

This is a relatively simple calculation to undertake. Essentially we take the uncontrolled post-development flows from 2 above, and subtract from these the maximum allowable discharge rate from 1 above (this is the water which would be being discharged by the system at the same time as excess water was being stored), and multiply the resulting rates by the duration of the rainfall event (converted to seconds). The table below shows these calculations-

Post Dev. Flows (l/s)	25.9	16.0	11.8	9.1	7.6	6.7	5.4	4.9
Less Allowable	8	8	8	8	8	8	8	8
Retained Flows (l/s)	17.9	8.0	3.8	1.1	*-0.4*	*-1.3*	*-2.6*	*-3.1*
Duration (s)	600	1200	1800	2400	3000	3600	5400	7200
Retained Vol. (litres)	10740	9600	6840	2640	*0*	*0*	*0*	*0*
Retained Vol. (m3)	**10.7**	9.6	6.8	2.6	*0*	*0*	*0*	*0*

Note that the values in italics are below 0, meaning that no retention will occur in during events of these durations.

Of the above calculations, I have determined that the maximum volume of storage, across all forms of rainfall event at a 1:100 year return period, is 10.7m3, which occurs at the 10 minutes (600 second) rainfall event. If the applicant therefore

satisfies a retention volume of **10.7m3**, I am able to confidently state that all the full range of 1:100 years rainfall events will be satisfied.

4. Practical Ability for Development Site to Achieve Required Retention:

   A volume of 10.7m3, as determined in 3 above, is not particularly difficult to achieve. For instance, a common solution would be the installation of an underground chamber made up of 1.8m diameter circular manhole sections. This chamber would only need to be **4.21m** long to achieve the necessary storage volume. There is easily sufficient space within the development site to accommodate a chamber of this size.

   The chamber itself will need to be designed with a restrictive outlet at its base, constraining the normal discharge to the determined 8.0 litres per second. An emergency outflow would be installed at its soffit to enable directly overflow in the instance of a rainfall event that exceeds the 1:100 design capacity (as per normal practice).

The above assessment provides robust evaluation of the requirements for stormwater management and retention as part of the proposed development. Given that the detailed design of the development is still evolving, the applicant wishes to maintain flexibility over how the required 10.7m3 of stormwater storage is provided, rather than being locked into the chamber example provided above, it would seem entirely reasonable for a condition of consent to be installed stating:

> *"The consent holder shall prepare a stormwater management plan detailing the nature of the stormwater retention facilities to be installed on-site. This plan will include a retention volume of 10.7m3. This plan shall be submitted to Council's Water and Waste Services Department for approval prior to construction of the proposed units."*

In regard to several residual stormwater matters, being firstly stormwater management during the construction period and secondly, the mention of a 12 hour retention storage in one of the Council department memo's, I comment below.

The matter of stormwater management during construction processes is one that can easily be dealt with by way of consent conditions. It is relatively common practice for Council to install a condition of consent that the consent holder submit for approval prior to construction processes starting an 'erosion and sediment control management plan'. Such a plan is specifically designed to ensure that stormwater discharges for the site are properly controlled and monitored. It is sensible that this plan is prepared closer to the time of construction, rather than at the resource consent application stage, as the method and timing of construction processes, which are often not precisely known at the resource consent stage, will influence the nature of the management plan.

The matter of the 12 hours of retention storage in the Council department memo is somewhat erroneous. For this to be meaningful the specification must also include reference to a permitted level of discharge from the site so that a storage volume can be

determined. Using the more refined methodology described above it is possible to determine precisely the volume of on-site retention that is required to satisfy the full range of 1:100 year event scenarios. In this sense, the time period related to the storage is not relevant – as long as the maximum allowable discharge rate is not exceeded and as long as there is capacity installed to satisfy the calculated maximum volume of storage, then the downstream effects cannot be any greater than either the permitted bassline situation or the existing situation.

In reference to paragraph 73 of the planner's report, which compares the 12 hour storage suggested by Council Water and waste staff with the 20 minute design event duration applied by the applicant, I note that these two elements are not intrinsically comparable and the result is that the last sentence of the report which states *"The applicant is proposing considerably less storage than has been identified as being required by Council staff"* is incorrect. The two elements are different attempts at providing an appropriate outcome to stormwater management, although the applicant's method is by far the more refined and complete technique.

Paragraph 74 makes reference to the allocation of hard stand and soft stand elements. The planner is correct in this statement, and I agree that the proportions of the different areas have changed slightly as a result of other modifications to the proposal. The assessment above takes into account the modified proposal and is correct at the date of this evidence.

Foul Sewage Management

The figure below shows the nature of the existing public foul sewage network in the vicinity of the application site.

This network comprises a 300mm dia sewer aligned reasonably close to the site's southern boundary, and the 450mm dia and 225mm dia sewers aligned together on the opposite side of South Road.

The staff comments from Council's Water and Waste Services department, in relation to the proposed foul sewage reticulation, make two recommendations. Firstly, the comments state that the holding tank, if installed on-site to support sustainable foul sewage discharge, should be designed with a holding period of 24 hours (rather than the 4 hours noted in the application document). Secondly, the comments suggest a preference for the new drainage connection to discharge into the existing 225mm dia foul sewer on the opposite side of South Road due to the existing network being already significantly surcharged.

What is unclear in these comments is whether the options suggested are an either/or scenario (i.e. either connect to the closer main and include a 24 hour period of on-site storage, or connection to the farthest main without needing on-site storage), or whether both requirements are required in tandem.

The applicant did undertake several pre-application meetings with Council Water and Waste departments, and the information conveyed in those meetings supported an either/or situation. Clarification around this would be appreciated at the hearing.

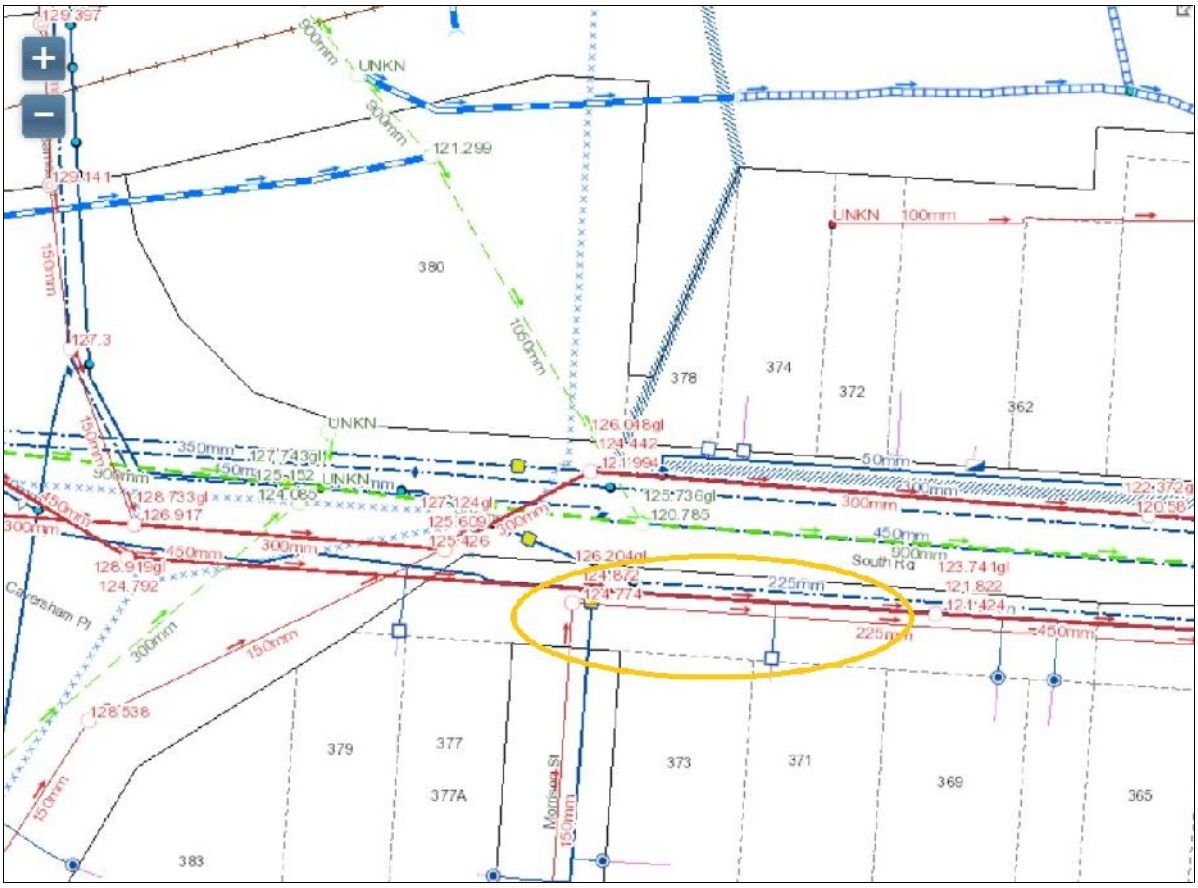

Fig 1: Foul Sewer Map - The gold oval highlights the 225mm line referred to by Council staff

Let us consider each of the requirements described in the comments by Council's Water and Waste Services department.

The first requirement is for the applicant to provide a holding period of 24 hours for foul sewage management. The original application suggested that a 4 hour period would produce a volume of 1,000 to 3,000 litres.

An appropriate means of calculating the anticipate volume of foul effluent storage is to use the method outlined in the Dunedin City Code of Subdivision and Development, paragraph 5.3.5.1, where this relates to residential flows. For the purposes of these calculations it is appropriate to adopt the wet weather peaking factor of 3 (in preference to using the dry weather peaking factor of 2). It is also appropriate to adjust the projected persons per dwelling in this paragraph from 3.5 to 2.5 on the basis that the proposed units are limited to small three-bedroom units only. The base effluent generation of 270 litres per person per day is suitable for these calculations.

For a 4 hour storage period we can determine a storage volume of 1,688 litres (270 (litres per person per day) x 3 (peaking factor) x 2.5 (persons per dwelling) x 5 (number of dwellings) x 4/24 (storage period factor) = 1,688 litres). This volume fits within the range suggested in the original application.

For a 24 hour period we can determine a storage volume of 10,125 litres (the same calculation as above but without the 4/24 storage period factor).

Either of these volumes can be feasibly contained on-site. For instance, the greater of the two storage volumes, i.e. 10,125 litres, would be accommodated within an underground chamber made up of 1.8m diameter circular manhole sections installed to a length of 3.98m. There is sufficient open space within the proposed development to enable a chamber of this nature to be installed.

The second suggestion is for the new drainage connection to discharge into the existing 225mm dia foul sewer on the opposite side of South Road. Staff of Council's Water and Waste Services department note that such a connection would involve a number of crossings with other existing infrastructure, which is correct (the various alignments of existing infrastructure can be seen in the above figure). The new connection will need to be carefully designed to avoid any conflicts with other items of public infrastructure within the South Road corridor. While this might appear to be challenging on first looks, it is not expected to be fundamentally difficult. The depth of the existing foul sewer at the manhole at Morrison Street (1.43m) and the moderate slope of the 225mm dia pipe as it runs east along South Road (approximately 1:15) affords a high degree of flexibility in terms of the design of a new connection to satisfy this request. While some additional real-world information is likely to need to be collected to aid the design of this connection (a sub-surface radar scan, or similar, might be required) we are highly confident that a successful design is indeed achievable.

The applicant's preference is to install an on-site storage tank of the required capacity, and to discharge into the closest of the three existing sewers (i.e. the 300mm dia sewer). However, the alternative option, of discharging to the 225mm dia sewer on the opposite side of South Road, is also very likely to be achievable, and similarly, if the two options together were to prove necessary this is expected to be feasible from a physical engineering perspective. Under any of these scenarios, the provision suitable foul sewage discharge can be appropriately implemented.

As noted above, it would be helpful to have the matter foul sewage drainage further discussed at the hearing. Clarification will be needed from Council staff in regard to whether an appropriate solution can be achieve by either one of the noted options, or whether both are required together. It would also be helpful to undertake further discussion around the required holding period (i.e. 4 hours versus 24 hours) and the implications on the existing foul network as a result of implementation at each of these levels.

Earthworks

The scale of the anticipated earthworks is shown on the cross-section plans supplied with the application. While the Applicant is not seeking earthworks consent at this time, these cross-sections usefully describe the level foe artworks that is generally likely to occur, and this enables the present application to be properly considered.

In terms of the volume and extent of the likely earthworks, this information can be understood for the supplied plans. If the Applicant was to apply for earthworks consent it is possible that the only piece of additional information needed would be an Erosion and Sediment Control management Plan (ESCMP). The ESCMP described how stormwater issues will be managed during the period in which earthworks construction is occurring.

The reason that an earthworks consent has not been sought at this time is because the content of the ESCMP will be influenced by a number of factors that have yet to be determined, including-

- Final shape and level of the proposed units, and
- Intended method of unit foundation construction, and
- Intended length of earthworks construction period, and
- Intended season in which the earthworks construction will occur.

This information is not likely to be sufficiently well known until the detailed architectural plans have been submitted to Dunedin City Council for building consent.

However, the consideration of an earthworks consent application is not expected to in any sense fundamentally obstruct the proposed development. Dealing with earthworks processes, and the effects that arise from these, is generally simply a matter of appropriate engineering solutions. There are a variety of mechanical options for addressing ESCMP matters, inc. on-site detention, silt fencing, directional trenching, and others, and the appropriate solution for any particular site could involve a combination of these. A full and proper solution will certainly be available in one form or another.

In this case, a better outcome will be achieved through the Applicant seeking earthworks consent once the nature of the anticipated earthworks processes are has been more comprehensively determined.

Main South Railway

The Applicant has reviewed the submission by KiwiRail and the related comments contained in the planners report.

In respect of mechanical ventilation, the Applicant has received some professional advice on how a suitable level of ventilation might be achieved as part of this development. This advice recommends that compliance with the standard AS1668.2 (indoor air quality) will be satisfactory.

To comply with AS1668.2 the following input air and extraction rates apply.

- Bedrooms: 7.5l/s or 15l/s minimum
- Living Area: 7.5l/s per person
- WC: 10l/s continuous extraction.
- Bathroom: 10l/s continuous extraction.

With this in mind, the Applicant is prepared to modify the proposed development to include the proposition of achieving ventilation compliance with the AS1668.2 standard.

In respect of planting along the KiwiRail boundary, the Applicant is prepared to modify the proposed development to remove all suggested planting from the KiwiRail land. Instead, all development planting, for mitigation, amenity and landscaping purposes, will be wholly contained within the development site. This will avoid the possibility of future maintenance access issues.

In respect of a fence along the KiwiRail boundary, the Applicant agrees that this is a sensible idea for safety reasons. The Applicant is prepared to modify the proposed development to include a suitable safety fence along the northern boundary of the application site. Where the Applicant has proposed a retaining wall on the KiwiRail boundary, this new fence will be able to be installed on top of the wall.

The submitter has also raised concerns at possible access into the KiwiRail corridor during construction processes. The Applicant has spoken to a retaining wall / fencing contractors who has advised that these facilities are able to be constructed without requiring any construction vehicles to enter onto KiwiRail land (these will all be operated from within the application land). There may be a need for a single person to enter KiwiRail land on foot to assist with fixing the new posts in place, however with the proper safety controls in place this is not anticipated to present a hazard to either the contractor undertaking the installation or to the submitter.

The Applicant is optimistic that the solutions offered above will mitigate the majority of the submitter's concerns, particularly when these solutions are combined with a reverse sensitivity agreement being registered on the new titles.

Lastly, in regard to development of the subject site, it is relevant to keep in mind that the Applicant could as-of-right build two residential units on this land without any consultation with neighbours or controls requiring specific forms of construction. The outcome of the proposed development will achieve the establishment of 5 new units that will be built to a higher standard than would otherwise be required (even though this might not be to the full standard that some submitters seek), and this should be taken into account during the Committee's deliberations.

Conclusion

The Applicant has provided evidence above to resolve the stormwater and foul sewage concerns raised in the planners report.

The Applicant has put forward good reason for deferring the earthworks consent application to a later process.

The Applicant has offered to modify the proposed activity to address what are considered to be the principal concerns contained in the KiwiRail submission.

With this information provided, the Applicant believes that the majority of the relevant effects addressed in the planners report are able to be satisfactorily resolved. As a result of this, the Applicant considers that the adverse environmental effects of the proposed development will be less than minor and that the Committee is able to fully consider the application.

Yours faithfully
PATERSON PITTS GROUP

Kurt Bowen
Registered Professional Surveyor