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Nelson Mandela bay Municipality

CONTRACT No. B1198 B

CONCEPT AND VIABILITY REPORT SEAVIEW

PROJECT NAME:	**Seaview/Witteklip Alternative Sanitation Investigation**
AREA:	**NMBM**
PROVINCE:	**Eastern Cape**
DATE:	**05 May 2016**

Prepared By:

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Document Change History

Revision	Date	Changes	Approval
1	29/04/2016	Details of Tests and Recommendations - Seaview	

The Preliminary Design Report was:

Compiled by	:	S. Makhetha	Position	:	Director	Signature	: _____
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Approved by	:		Position	:		Signature	: _____

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Initials and Surname	Position	Method
Mtunzi Zinto	Client's Representative	Hard & Electronic

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1 TERMS OF REFERENCE

At a briefing held at the offices of the Nelson Mandela Bay Municipality on 6 August 2015, Makhetha Developmet Consultants (Makhetha) was requested to look at alternative Sanitation Proposals for Witteklip and Seaview in the Western side of the Municipality. The confirmation of the appointment to carry out the exercise was received on 15 September 2015.

The email confirming the appointment is attached as Annexure A.

The specific Terms of Reference for the project were to look at options for the provision of sanitation services in Witteklip as a result of problems encountered with the Environmental Authorisation for Construction of a Waste Water treatment plant. In a subsequent meeting with the Client it was clarified that the issue with Witteklip was the delay in obtaining the Environmental Authorisation as a result of community objections while the issue with Seaview was the problem of the prevalence of indigenous forests in the area and the subsequent problems with development of the area expressed by the Department of Forestry.

A full report comprising investigations and proposals for both areas has been compiled. This report is an extract from that report and it focuses on Seaview only.

2 LOCALITY

The Seaview area comprises a portion of Erf 238 (incorporating the informal settlement of New Rest), a subdivision of Erf 590 (incorporating the informal settlement of Zwelidinga), a subdivision of Erf 237 with portions of Farm 28/10 and 28/31 and the Land owned by Mr Steward Davidson shown in the locality plan (Annexure B)

A detailed introduction to the situation in Seaview is found in a report written by the Municipality's Rayno Madatt for the Executive Director of Human Settlements and the Chief Whip of Human Settlements. The report is entitled: Development of a Low Income Residential Area in the Seaview/Clarendon Marine Area. The details of the history have therefore not been repeated here and the mentioned report must be read in conjunction with this one.

The municipality has subsequently produced draft plans for all the above areas except for the land belonging to Mr Stewart Davidson. The average plot size shown in the draft plans is 260 m^2.

3 CURRENT STATUS/EXISTING SERVICES

Sanitation in the community of Zwelidinga mostly comprises home-built pit latrines, the majority of which are very unhealthy and physically unsafe. The community have dug these toilets due to lack of any other alternative services. Recently a few chemical toilets have been installed and are serviced by the municipality. Water is supplied through few standpipes located throughout the informal settlement. In New Rest, communal chemical toilets are provided and are serviced by a service provider appointed by the Municipality. Both communities have expressed dissatisfaction with this service.

In the developed area of Seaview, most of the sanitation service is provided through septic tanks built by property owners and a few conservancy tanks. They are serviced at cost to the owners by a service provider appointed by the Municipality.

4 SCOPE OF THIS REPORT

This report has been written in response to the requirement to separate the Seaview section of the Witteklip/Seaview Alternative sanitation feasibility report for the purpose of submission of a standalone EIA application for Seaview. It comprises excerpts from the main report and in many cases is a verbatim copy of that report. This report covers the various investigations done at Seaview, the various alternatives investigated and recommendations for the appropriate sanitation solutions for the area.

The scope of the report is therefore to discuss the viability of various options and ultimately come up with the best solution for Seaview.

5 DESIGN CRITERIA

The design criteria to be used in the project are summarised in the sections below and where applicable deviations from these criteria are highlighted.

6 APPROACH TO THE ASSIGNMENT

Several visits were done to the Seaview area and extensive studies, both on existing information and proposed solutions were carried out. Technical visits to Projects in Stutterheim, Durban and Verulam we also undertaken to go and observe projects where alternative sanitation was used and to hear the user perceptions and satisfaction first hand.

The following alternatives in particular were analysed.

7 ANALYSIS OF ALTERNATIVES

A Full Water Borne Sanitation, VIP Toilets and Low Volume Flush Toilets with various methods of waste disposal and were analysed as follows:

7.1 Full Water Borne Sanitation

Advantages:

- Well known and well understood
- Very old and known technology
- Experience in installing and managing the system

Disadvantages:

- Requires sewerage reticulation – maintenance
- Flushes with 9 to 10 litres of water per flush (consumption)
- No infrastructure to connect to
- Needs full or package treatment plant – maintenance and operation
- Permission to build treatment plant already denied
- Remoteness will impact on maintenance and operations

7.2 VIP Toilets

Advantages:

- No water required
- Established and known technology
- Very low unit maintenance
- No EIA required

Disadvantages:

- Cannot normally be installed in the house
- Need extensive user education with repeated intervention
- Subject to abuse due to ease of "dumping" rubbish into the pit
- Difficult to de-sludge without appropriate equipment

7.3 Low Volume Flush Toilets

Advantages:

- Use less water than conventional sewerage to flush – 1.5 to 3 litres
- Can be installed in the house
- Designed to flush effectively whether from a cistern or pour
- Can be connected to communal septic tank or individual leach pits
- Tested extensively by WRC
- Tried and tested elsewhere from the 1980's (Two installed in the house in Lesotho since 1987 – still working well)
- No EIA required

Disadvantages:

- Relatively new technology in South Africa
- Need change of attitude and willingness to try new things
- Need shallow sewers if communal septic tanks are used
- Limited suppliers – competitive tendering limited

7.4 FURTHER INVESTIGATIONS

Geotechnical investigations were previously done for the piece of land known as Steward Davidson's land in preparation of the original plan that was developed for the land for high income housing and an old age home. These reports are in the custody of Urban Dynamics who did the planning and marketing of the proposed development for Mr Davidson. These geotechnical investigations, ldid not include soil percolation tests as they were focused on infrastructure development and not alternative sanitation. No investigations had been done for the other portions of the proposed development.

Labco was then engaged to perform soil percolation tests in the area. At the time of the tests, no layout plans were available for all the land parcels and tests were spread at

random thought-out the proposed areas and Mr Davidson's land. The results of the percolation tests are included in this report as Appendix 1.

Apart from one test pit piece of land referred to as Stewart Davidson's land, all percolation results exceed the minimum requirements for on-site percolation and hence individual soak pits will function well in the area.

8 RECOMMENDED ALTERNATIVES

As discussed earlier in this report, the current residents of Seaview are all on septic tanks with conventional toilets and many with baths in the houses. The waste water loading from the septic tanks to the ground if per-capita significantly higher than that which will be generated by the alternative sanitation system. We therefore recommend the use of the low volume flush toilet. The technical aspects and performance test results of the toilets as well as the leach pits, are discussed in detail below. The isolated case where percolation tests in Steward Davidson's land were unfavourable can be accommodated within a public open space or an institution.

In view of the fact that septic tanks are already the main method of waste water disposal in Seaview and with consideration of the percolation test results in Appendix 2, we recommend that the solution to be adopted in all the proposed areas of Seaview be low volume flush toilets flushing, with 2 litres of water per flush, to a leach pit located on the property. All pipework shall comprise 100 dia. pipes up to distances of 35 metres. Longer distances will be treated individually and designs based on slopes etc. be done. We also recommend that the minimum erf size be 250 m^2 to ensure adequate separation from individual leach pit.

Special modifications to the leach pit to accommodate grey water from the sink and the shower as well, will comprise dual pits as shown in Annexure D. This modification is deemed to be adequate due to the sandy nature of the soil and high percolation rates. The ground water levels that may be influenced by the proximity of the sea will have to be checked before design is finalised (Due to the high prevalence of septic tanks that work well in the area, this is considered only precautionary). Institutions will provided with low volume flush toilets connecting, depending on size of institution, to either a small septic tank discharging to a soak pit (Annexure E) or to conventional septic tank discharging to a French drain.

9 TECHNICAL DETAILS OF THE PROPOSED SOLUTION

9.1 Development of Volume Flush Toilets

Low Volume Flush Toilets in their current form are a relatively new technology in South Africa. As long ago as the late 1970's several models of low volume flush toilets were tried and tested at various locations. For example, the Ballam Water-Slot toilet flushing with 500ml to 1 litre of water was tested and installed at various border posts in South Africa.

Elsewhere in the world, during the International Drinking Water Supply and Sanitation Decade (1980 – 1990) trials of Low Volume Flush Toilets were being made and a successful model, among others was developed by Dr Robert Boccaro in Lesotho, with the assistance of a South African company and units manufactured then are still in use today in Lesotho and surrounding countries.

In 2009, the Water Research Commission embarked on a research to develop the most viable low volume flush toilet which will function in various conditions in South Africa. The

project, Number WRC K5 1087 – Development of Appropriate Low Volume Flush Toilet for SA, was awarded to Partners in Development (PID), based in KZN with collaboration from Envirosan for the physical development and testing of models. The design conditions imposed on the research teams were that, the replacement parts must be easily available, components must be standard, there must be a proper water seal and the toilets must be able to handle toilet paper and newspaper and must use low volume flush toilets to clear the pan of stools and wiping materials. Project WRC K8 1018 was launched to try the pour flush toilets in different areas of the Western Cape. Then Project WRC K5 2198 was launched to test the incorporation of a cistern for users who have piped house water supplies. Further projects were launched to evaluate and compare the sludge from pour flush and low volume cistern flush with those derived from other methods.

9.2 Technical Details

The toilet has a funnel shaped pedestal instead of the regular bowl shape of the standard flush toilet. There is no ring distributer for the flush water which is distributed by the shape of the pan. The 75mm diameter is angled at 45º. The toilet flushes effectively with 1 to 2 litres of water and sludge accumulation rates have been measured to be less than those of a VIP latrine. Otherwise the toilet looks the same to the user as a full flush toilet with no user perceived difference.

Figure 1 shows the pedestal of the low volume flush toilet.

Figure 1: Low Volume Flush Toilet Pedestal

The toilet was put through various tests including the Standard Maximum Performance Protocol Test (MaP) with the same requirements as a regular toilet. Replica faeces samples continuing 5 grams of soya part in a latex sleeks were used in the test and the toilet was able to flush 6 of them with the prescribed 20 squares of single ply toilet paper with 1 litre of water 100% times with a single flush. The samples used and the results are shown in figures 2 and 3 below.

Figure 2: 50 Gram Latex Covered Faeces Replicas

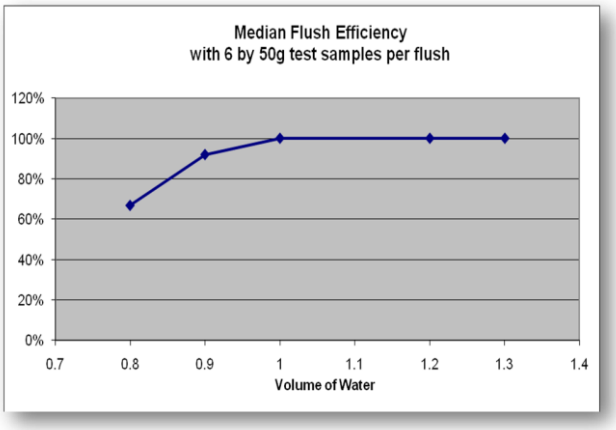

Figure 3: MaP Test results for Low Vol. Flush Toilets

Figures 4, 5, and 6 show different options for installation of the toilets either in the house, with or without a cistern or outside with or without cistern. Further details and user Survey results on the proposed toilets are obtainable from the Water Research Commission.

Figure 4: Outside LVFT With Cistern

Figure 5: In House LVFT with Cistern

Figure 6: Pour-Flush LVFT

10 DRAINAGE OPTIONS

Low Volume Flush Toilets can be drained to an on-site leach pit as indicated in Annexure D. The advantages of the system are that the pits are easy to construct, there is no sewerage system, and there will be longer desludging periods than septic tanks due to leaching. The disadvantages are that there will be many individual tanks to be handled at desludging time, the contents are dryer that those of septic tanks, and separate handling of **s**ullage is recommended unless the percolation rates are very high.

Figures 7 and 8 are the leach pits from toilets currently in use in KwaZulu Natal.

Figure 7: Leach Pit Construction

Figure 8: Active Leach Pit Contents

The toilets can also be connected to a sewerage system draining to either individual or communal septic tanks. Individual tanks would be very expensive and the sizes would be very small. This would lead to higher costs per capita. Communal Septic tanks have the following advantages:

- They are easy to service due to centralised location
- They are cheaper than individual soak pits
- They can also deal with sullage and their contents are easy to dislodge using conventional vacuum tankers.

11 CONCLUSION

In the Seaview area the solution shall comprise:

a) Low volume flush toilets flushing between 1 and 2 litres per flush
b) One shower and sink per dwelling (no bath)
c) 100mm on site drain to a dual leach pit
d) Lined and modified leach pit to accept both sewer and sullage.
e) Leach pits with small septic tanks for small institutions
f) Conventional septic tanks for large institutions.

We await further instruction from the Municipality on the detailed design of the solutions mentioned herein. We also hold ourselves available to clarify any matters contained herein.

ANNEXURE A: Letter of Appointment:

Seetella Makhetha

From: Mtunzi Zinto <mzinto@mandelametro.gov.za>
Sent: 14 September 2015 10:52 AM
To: Seetella Makhetha; Zoliswa Nyila
Subject: Re: Sea View/Witteklip Sanitation

Good Morning

This email serves as an instruction from NMBM to MDC to proceed with the planning and works for Witterklip / sea view sanitation project.

A presentation from MDC with regards the strategies, alternatives and recommendations to be implemented for these two areas is required. The date for this presentation, MDC will provide to the NMBM.

I hope all is in order.

Regards
mtunzi zinto
>>> "Seetella Makhetha" <seetella@makhetha.co.za> 08-19-2015 10:49 AM >>>
Dear Zoliswa,

We thank you for the discussion regarding the inclusion of Sea View and Witteklip in our alternative sanitation proposals.
We are still awaiting the written instruction from you to commence work on these projects. We have already visited the projects and are in a position to begin the required planning for the execution of the task.

Please expedite the issuing of the instruction so that we can proceed on the project urgently

I the meantime can we have access to the geotechnical reports, the layout plans and the topographic survey for Witteklip.

Yours faithfully

Seetella N Makhetha Pr. Eng., Pr. CPM, FSAICE, FWISA, Aff. MASCE,
Director

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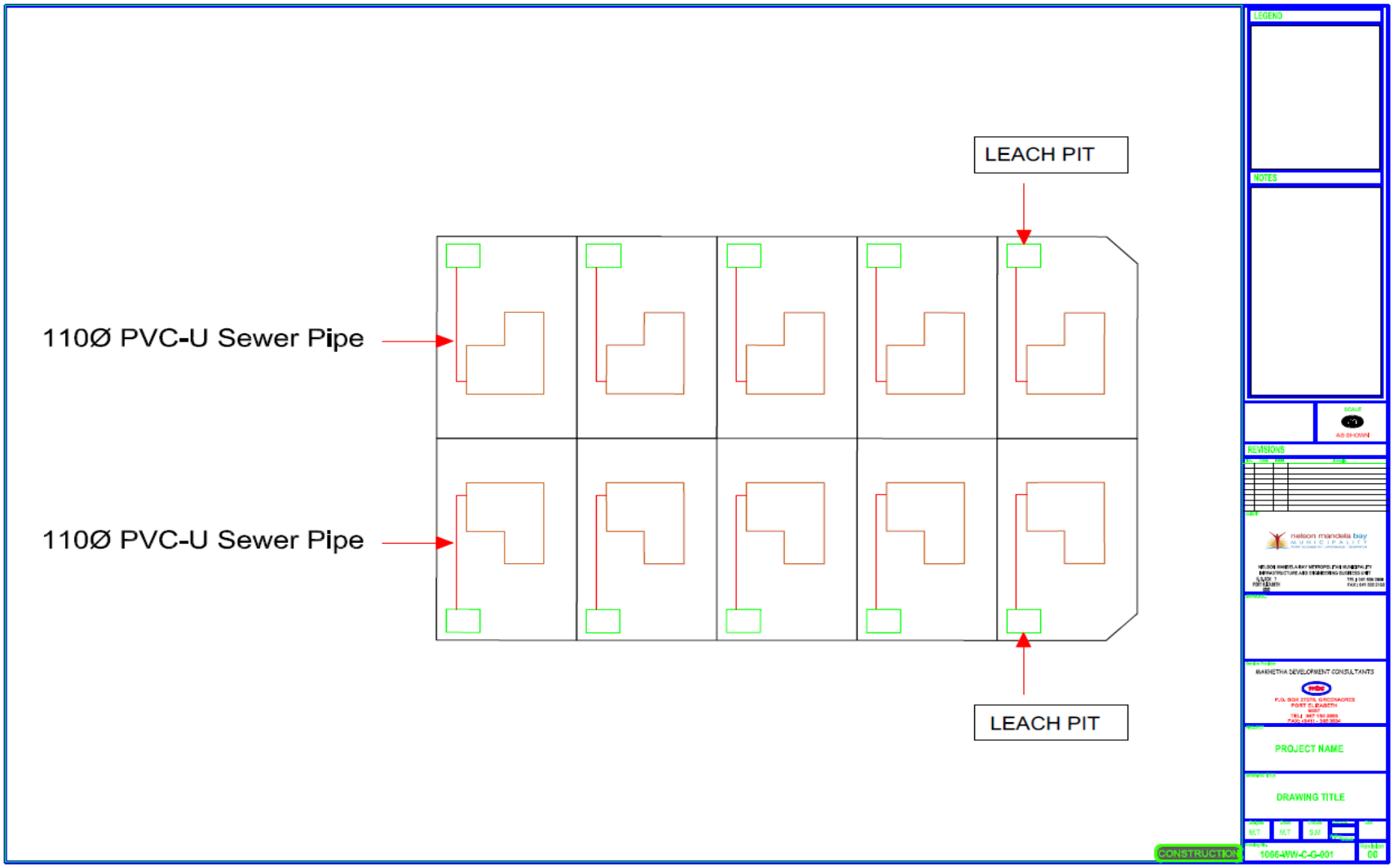
ANNEXURE B: Seaview Locality Plan:

ANNEXURE C: Schematic layout of LVFTs connected to leach pits.



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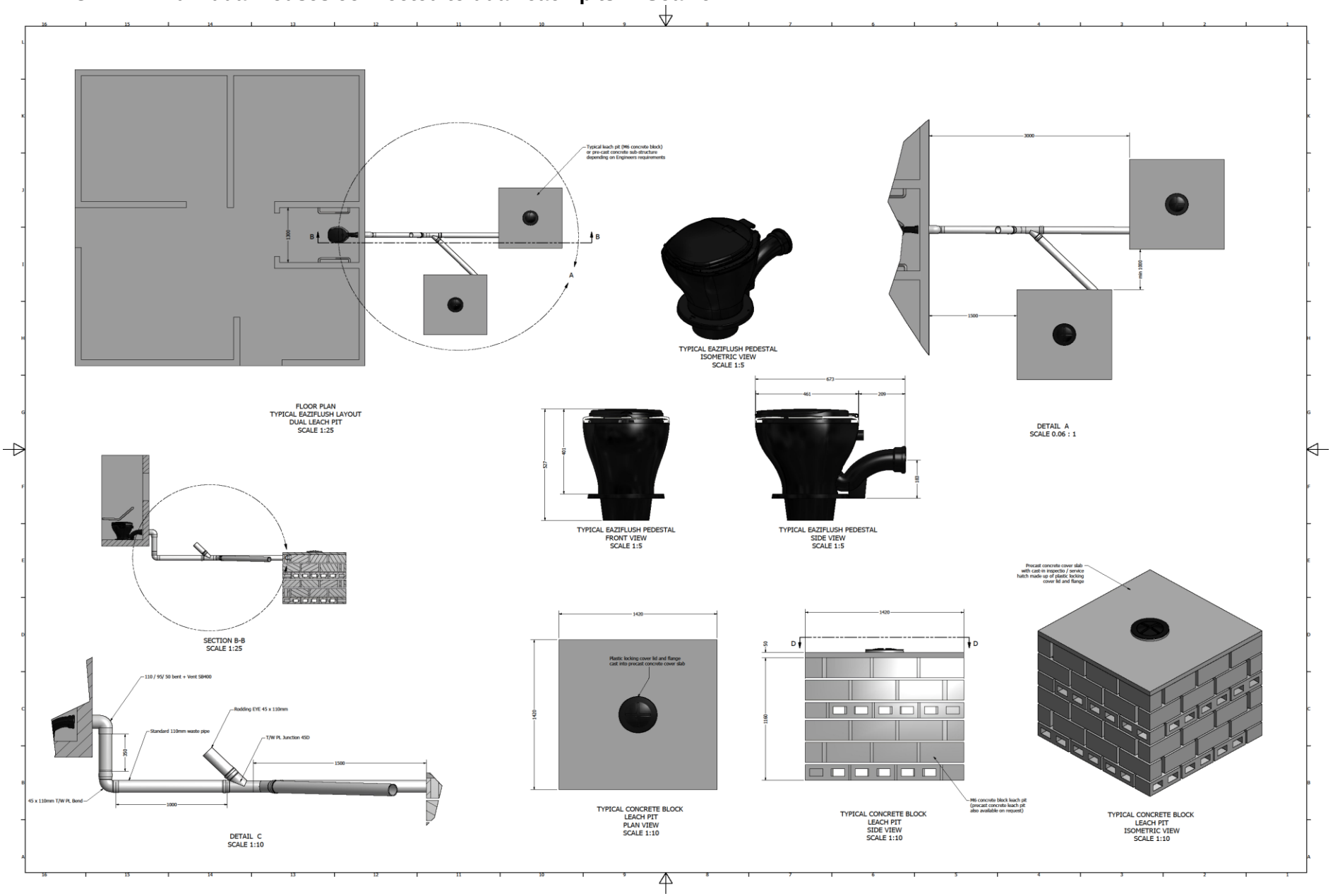
ANNEXURE D: Individual houses connected to dual leach pits in Seaview.



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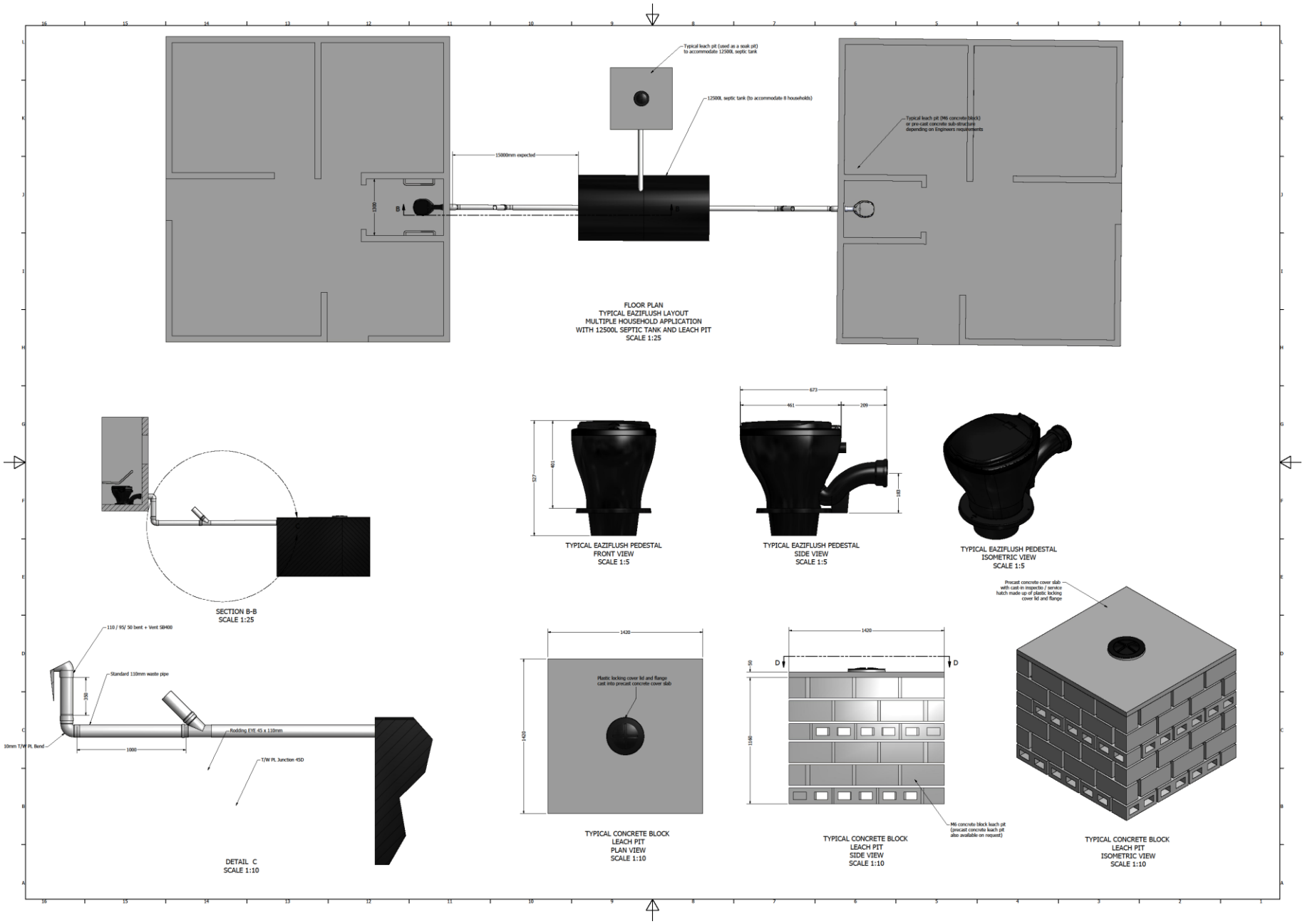
ANNEXURE E: Leach pit with septic tank for institutions in Seaview.



APPENDIX 1: Soil Percolation Test Results for Seaview