BAY OF PLENTY
REGIONAL COUNCIL
TOI MOANA

5 September 2023

Whakatāne District Council
C/- Astrid Hutchinson
Private Bag 1002
Whakatāne 3158

Dear Madam,

Resource Consent Application RM23–0010 for comprehensive stormwater consent for existing stormwater discharges from the Whakatane Township and associated network structures located in the bed/bank of a river or stream, and/or the CMA – Request for Further Information pursuant to Section 92 of the Resource Management Act 1991 (RMA)

Following review of your application the Bay of Plenty Regional Council requests the further information in order to gain a full understanding of the proposal and/or its potential environmental effects as detailed below.

In order to better understand the potential effects of the proposal, the following information is required:

a) Policy BW P2 (Policy 99) of the Regional Natural Resources Plan (RNRP) requires existing activities in the beds of streams, rivers and lakes to comply with Table BW 2. Specifically, BW 2(b) requires such activities to not cause a breach of the Water Quality Classification of the receiving stream, river, or lake. Please provide an assessment against Table BW 2(b).
b) Section 9.4.10 of the application implies that the application can be granted in light of Section 107 of the RMA, however, this is not outlined clearly in Section 4 of the Hamill report. Please provide further assessment on Section 107 of the RMA and clearly outline whether, after reasonable mixing, the contaminant or water discharged is likely to give rise to all or any of the matters listed in 107(1)(c)-(g).
c) Section 7.6 of the application discusses Natural Hazards and identifies there are areas of risk within the stormwater network. It is noted that the management of the stormwater network in regard to natural hazards (with the exception of climate change) is not addressed in the Stormwater Catchment Management Plan (CMP). Please address these matters in the CMP, or if not, please provide an explanation of why these matters are not addressed in the CMP.
d) Please provide the existing expiry dates of the consents sought to be managed under this resource consent.

To understand the potential effects of the proposal on **ecological values and water quality**, the following information is required:

e) In relation to the report titled *Whakatane CSC Potential effects on ecology and water quality* (Hamill 2023):
    i. In Table 3.8 and 4.9, what does the "*" mean in relation to Sullivan Lake?
    ii. ANZECC and DGV are used together/interchangeably throughout the report, but they are separate guideline documents. ANZG (2018) is the most recent up to date guideline document, whereas ANZECC (2000) has been superseded. Please update the report to ensure the reference used throughout is to the ANZG (2018) document. If ANZECC (2000) still needs to be used within the report, please state

    that it has been superseded and outline the reasons why it is being used.
    iii. There is a spelling area on page 49, first set of bullets, last bullet point, last sentence "…*particularly important to collected…"*. Please change this to "collect".

f) In relation to the *Whakatane Comprehensive Stormwater Consent Monitoring Plan* (Hamill 2019 Draft),
    i. ANZECC and DGV are used interchangeably throughout the monitoring plan, but ANZECC and ANZG are different (but very similar in many triggers) documents. As mentioned above, ANZG (2018) is the most recent up to date guideline document, whereas ANZECC (2000) has been superseded. Please update the monitoring plan to ensure the reference used throughout is to the ANZG (2018) document. If ANZECC (2000) still needs to be used, please state that it has been superseded and outline the reasons why it is being used.
    ii. Table 1.4 consists of outdated data. The current sediment quality needs analysing.
    iii. Table 2.1 states an "annual" monitoring frequency, is this once a year? And is this for a baseline or rainfall event?
    iv. Section 2.3 discusses the proposed frequency of water quality sampling. The review of the draft ecological assessment noted:

    > *Other councils do four baselines in the four seasons and rainfall triggers as well. Compare to consent triggers for exceedances and use an adaptive management approach. E.g., TCC Comp consent requires an investigation (and mitigation) if baseline exceeds trigger at a site in consecutive seasons or a rainfall event is triggered in the same season at the same site in consecutive years. Would be good to include a table of survey sites for water quality monitoring. Could also include regular monitoring of the freshwater and marine receiving environments – with higher priority sites surveyed two yearly and less critical sites surveyed every five years.*

    This approach is still recommended as it will enable meaningful and comprehensive data collection and analysis.
    v. In section 2.4.3, paragraph 4 mentions excess water should be decanted. Does the sampler need more guidance, so the sediment sample isn't compromised/lost to some degree?
    vi. In section 2.5.2, paragraph 3 mentions there should be "*consideration given for [additional analyses] organic carbon and dry matter*" etc. Organic carbon and dry matter should be routinely surveyed in sediment samples.
    vii. In Table 3.2, Cd and Ni are faded out, why is this?

A technical review has been completed on the following documents included within the application:

- Comprehensive Stormwater Consent Assessment of Effects on the Environment January
- 2023 (AEE).
- Whakatāne Urban Stormwater Catchment Management Plan January 2023
- Whakatāne Urban Area Stormwater Catchment Description 2 August 2022
- Whakatāne Urban Stormwater Modelling 25 September 2020
- Stormwater Monitoring Plan March 2019

To better understand the application of these documents, the following information is required:

g) In their Climate Risk Assessment Guide, the Ministry for the Environment (MoE) recommends that Councils model an RCP of 8.5 to identify the most significant risk. Please model an RCP 8.5 1% 72-hour event (including in the Wainui te Whara).
h) Please model the current climate for scenarios C1-C6, and where any further modelling is proposed, please consult with BOPRC. In particular, please include the roof water from any structures in the modelling.
i) The zones identified in Table 5-6 (particularly those with 500mm or more ponding) of the Stormwater Modelling report, should be referenced in the Catchment Management Plan (CMP) to be investigated further and cross-referenced with any flooding reports along with carrying out a floor level survey.
j) Please provide a GIS map layer clearly showing existing consent discharge points and the corresponding catchment areas. This will be extremely helpful for future compliance.

k) In relation to the stormwater pump stations:
    i. What return period events for their respective catchments do the pumping rates correspond to?
    ii. How much formalised storage exists in the catchments /informal storage before floor levels are threatened?
    iii. How many Stormwater pumps have back-up generators or provision for non-electric pumping? Back up plans?
    iv. What kind of rain event can be catered for with gravity outfalls only, and for no pumps and no gravity outfalls?

l) The promotion of soakage is appropriate however the soakage rates given in Figure 4 of the CMP for different Whakatāne locations are a mix of wrong or extremely high. Although some of the quoted soakage rates may be possible under dry conditions for short durations, they are not appropriate for designing for soakage under saturated conditions and longer durations. These soakage rates should be reviewed and amended to reflect realistic soakage rates for longer duration storage/soakage mitigation for new builds.

m) Please comment on whether there will be a requirement for new builds to mitigate up to RCP 8.5, 1% 72-hour event, and if so, what will be the mechanism? (e.g., District Plan/ ECOP).

n) Please provide more comment around the 10% AEP current level of service of the pipe network system (current and future climate). Please address whether you think this level of service is feasible and whether a 20% AEP would be more realistic.

o) Please provide information on the condition of all the existing stormwater outlets, including photographs.

p) The soakage system around the Whakatane Pool is inundated in small events. Are there any plans for remediation or investigation?

Once we have received all information necessary to assess the effects of your proposal on the receiving environment, we will continue processing your application.

When and how should I respond?

In accordance with section 92A(1) of the Resource Management Act 1991 (RMA) you must respond to this request by **26 September 2023**. You may either:

- Provide the required information;
- Write to us stating that you will supply the required information, but require a longer period in which to do so; or
- Write to us stating that you refuse to provide the required information.

What happens if I do not respond or refuse to provide the information?

If you do not respond by **26 September 2023** or respond indicating your refusal to provide the requested information, then under section 92B(2) of the RMA we must continue to process your application but your application is likely to be notified (incurring extra costs) and/or declined. If we decline your application, you have the right of appeal (s120 RMA) to the Environment Court.

Please feel free to contact me regarding the requirements of this letter, on 07 927 5748.

Ngā mihi nui,

Bethany Bennie

(Consultant Planner)

15 November 2023

Bay of Plenty Regional Council
Quay Street
Whakatāne 3121
BY EMAIL
ATTN: Sean Grace
Email: sean.grace@boffamiskell.co.nz

Dear Sean

RE: RESOURCE CONSENT APPLICATION RM23–0010 FOR COMPREHENSIVE STORMWATER CONSENT FOR EXISTING STORMWATER DISCHARGES FROM THE WHAKATANE TOWNSHIP AND ASSOCIATED NETWORK STRUCTURES LOCATED IN THE BED/BANK OF A RIVER OR STREAM, AND/OR THE CMA – REQUEST FOR FURTHER INFORMATION PURSUANT TO SECTION 92 OF THE RESOURCE MANAGEMENT ACT 1991 (RMA)

Please find below responses to the request for further information dated 5 September 2023 in relation to resource consent application RM23-0010.

a) Policy BW P2 (Policy 99) of the Regional Natural Resources Plan (RNRP) requires existing activities in the beds of streams, rivers and lakes to comply with Table BW 2. Specifically, BW 2(b) requires such activities to not cause a breach of the Water Quality Classification of the receiving stream, river, or lake. Please provide an assessment against Table BW 2(b).

Clarification was received that the above question relates to policy DW P1, not BW P2. Please refer to the attached assessment provided by Keith Hamill of River Lake Limited.

b) Section 9.4.10 of the application implies that the application can be granted in light of Section 107 of the RMA, however, this is not outlined clearly in Section 4 of the Hamill report. Please provide further assessment on Section 107 of the RMA and clearly outline whether, after reasonable mixing, the contaminant or water discharged is likely to give rise to all or any of the matters listed in 107(1)(c)-(g).

Please refer to the attached assessment provided by Keith Hamill of River Lake Limited.

c) Section 7.6 of the application discusses Natural Hazards and identifies there are areas of risk within the stormwater network. It is noted that the management of the stormwater network in regard to natural hazards (with the exception of climate change) is not addressed in the Stormwater Catchment Management Plan (CMP). Please address these matters in the CMP, or if not, please provide an explanation of why these matters are not addressed in the CMP.

As noted in the resource consent application (page 119), the potential impact of natural hazards is considered when infrastructure is designed and installed. Future land use changes or developments need to account for these hazards via any consent or plan process.

Section 7.6 of the consent application notes “[s]uch scenarios [natural hazard events] are hard to predict and, should they occur, will be managed through the either ‘business as usual’ methods, or under the Civil Defence and Emergency Management framework.” The Council will respond as necessary in the event of any natural hazard that impacts on the stormwater network.

There is a high risk of landslides on the Whakatāne escarpment, as indicated on figure 1. It is not considered necessary to specifically address this risk in the CMP due to the small area of the stormwater network that could potentially be affected and the limited impact of any event.

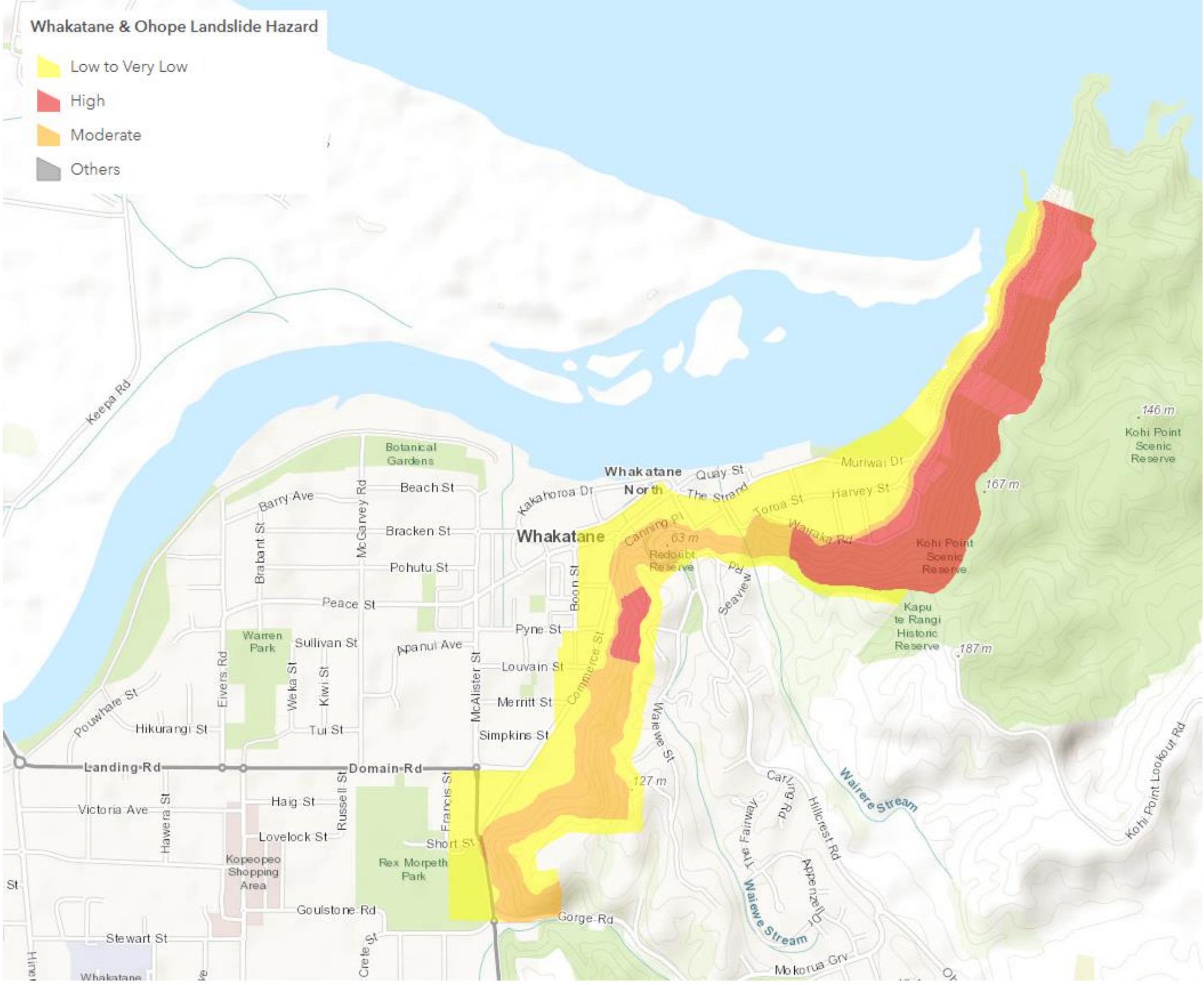


Figure 1: Whakatāne landslide risk (source: Landslide Risk Assessment Map)

d) ***Please provide the existing expiry dates of the consents sought to be managed under this resource consent.***

Consent number	Granted date	Expiry date
20183	6/03/1975	1/10/2026
20267	2/09/1976	1/10/2026
20319	1/09/1977	01/10/2026
21785-1	5/12/1985	1/10/2026
21785-2	5/12/1985	1/10/2026
24283	16/10/1995	31/08/2004
24801	4/12/1996	30/11/2011
60053	15/10/1998	31/10/2008
61841	10/12/2002	30/11/2022
62713	27/02/2005	30/06/2015
63352	26/10/2005	30/09/2030
65353	29/05/2008	30/04/2028
65604	1/06/2010	30/04/2045
67420	12/03/2013	28/02/2048
68057	4/08/2020	4/08/2040
RM20-0493-DC.01	30/10/2020	30/10/2023

e) ***In relation to the report titled Whakatane CSC Potential effects on ecology and water quality (Hamill 2023):***
   i. *In Table 3.8 and 4.9, what does the "*" mean in relation to Sullivan Lake?*
   ii. *ANZECC and DGV are used together/interchangeably throughout the report, but they are separate guideline documents. ANZG (2018) is the most recent up to date guideline document, whereas ANZECC (2000) has been superseded. Please update the report to ensure the reference used throughout is to the ANZG (2018) document. If ANZECC (2000) still needs to be used within the report, please state that it has been superseded and outline the reasons why it is being used.*
   iii. *There is a spelling area on page 49, first set of bullets, last bullet point, last sentence "…particularly important to collected…". Please change this to "collect".*

Please refer to the attached response provided by Keith Hamill of River Lake Limited.

f) ***In relation to the Whakatane Comprehensive Stormwater Consent Monitoring Plan (Hamill 2019 Draft)***
   i. *ANZECC and DGV are used interchangeably throughout the monitoring plan, but ANZECC and ANZG are different (but very similar in many triggers) documents.*
   As mentioned above, ANZG (2018) is the most recent up to date guideline document, whereas ANZECC (2000) has been superseded. Please update the monitoring plan to ensure the reference used throughout is to the ANZG (2018) document. If ANZECC (2000) still needs to be used, please state that it has been superseded and outline the reasons why it is being used.
   ii. *Table 1.4 consists of outdated data. The current sediment quality needs analysing.*
   As agreed, analysis of sediment will be required as a condition of consent.
   iii. *Table 2.1 states an "annual" monitoring frequency, is this once a year? And is this for a baseline or rainfall event?*
   iv. *Section 2.3 discusses the proposed frequency of water quality sampling. The review of the draft ecological assessment noted:*

   Other councils do four baselines in the four seasons and rainfall triggers as well. Compare to consent triggers for exceedances and use an adaptive management approach. E.g., TCC Comp consent requires an investigation (and mitigation) if baseline exceeds trigger at a site in consecutive seasons or a rainfall event is triggered in the same season at the same site in consecutive years. Would be good to include a table of survey sites for water quality monitoring. Could also include regular monitoring of the freshwater and marine receiving environments – with higher priority sites surveyed two yearly and less critical sites surveyed every five years.

   This approach is still recommended as it will enable meaningful and comprehensive data collection and analysis.
   v. *In section 2.4.3, paragraph 4 mentions excess water should be decanted. Does the sampler need more guidance, so the sediment sample isn't compromised/lost to some degree?*
   vi. *In section 2.5.2, paragraph 3 mentions there should be "consideration given for [additional analyses] organic carbon and dry matter" etc. Organic carbon and dry matter should be routinely surveyed in sediment samples.*
   vii. *In Table 3.2, Cd and Ni are faded out, why is this?*

Please refer to the attached response provided by Keith Hamill of River Lake Limited.

g) ***In their Climate Risk Assessment Guide, the Ministry for the Environment (MoE) recommends that Councils model an RCP of 8.5 to identify the most significant risk. Please model an RCP 8.5 1% 72-hour event (including in the Wainui te Whara).***

The Council uses the modelling information to assess flood risk. The RCP 6.0 climate change scenario was used as it is a mid-high range that the Council deems appropriate for assessing the existing system. Additional modelling using RCP 8.5 will be carried out on a case-by-case basis for greenfields development and for sensitivity testing or long-life infrastructure projects and policy decisions. The Council considers that the use of RCP 6.0 is appropriate for consenting purposes to demonstrate the flood risk from a 1% AEP event.

h) Please model the current climate for scenarios C1-C6, and where any further modelling is proposed, please consult with BOPRC. In particular, please include the roof water from any structures in the modelling.

No further modelling is proposed, except on a case-by-case basis as noted in the response to (g) above. Please refer to the Whakatāne Urban Stormwater Model Review by Tonkin and Taylor dated 26 May 2022, which considered the effects of roof water runoff on flood levels.

i) The zones identified in Table 5-6 (particularly those with 500mm or more ponding) of the Stormwater Modelling report, should be referenced in the Catchment Management Plan (CMP) to be investigated further and cross-referenced with any flooding reports along with carrying out a floor level survey.

Verification against known flood depths was included in the model build. The CMP includes the flood assessment maps from the modelling report. It is not considered necessary to include additional reference to the modelling report results in the CMP.

The attached stormwater investment framework is used by the Council to assess and prioritise stormwater projects.

j) Please provide a GIS map layer clearly showing existing consent discharge points and the corresponding catchment areas. This will be extremely helpful for future compliance.

The map of the Council’s stormwater network is publicly available on the Council’s website. The Council’s GIS mapping system does not identify specific discharge points by consent number.

k) In relation to the stormwater pump stations:

i. What return period events for their respective catchments do the pumping rates correspond to?

In most cases, the 10 year return is more than the pumping rate.

ii. How much formalised storage exists in the catchments /informal storage before floor levels are threatened?

This information is not available. Flood level information is available in the stormwater modelling report.

iii. How many Stormwater pumps have back-up generators or provision for nonelectric pumping? Back up plans?

The following stormwater pumpstations have provision for nonelectric pumping: McAlister Street (1301), Riverside Drive (1302), Barry Avenue (1303), St Josephs (1306), Amber Grove (1309), Gateway (1310), Karaka Lane (1313), Hub 1 (1315), Hub 2 (1316), Douglas Street (1319), Awatapu lagoon (1321), rose garden (1307), Awatapu reserve (1308), Hinemoa Street (1311), Karaka Lane (1304), and Marchignal Street (1314).

The following stormwater pumpstations do not have provision for nonelectric pumping: Halberg Crescent (1305), James Street (1312).

iv. *What kind of rain event can be catered for with gravity outfalls only, and for no pumps and no gravity outfalls?*

This information is not available. As noted on page 8 of the Whakatāne Urban Stormwater Modelling report, "[s]ome gravity outfalls with flap valves allow discharge to the Whakatāne River when levels are low, but many of the catchments have pump stations that discharge through the stopbank to artificially drain the catchments." One of the assumptions of the hydraulic model, as noted on page 47 of the report, was "[p]umps were assumed to be operational for the entire storm period and with discharge based on pump curves and estimated system losses."

l) The promotion of soakage is appropriate however the soakage rates given in Figure 4 of some of the quoted soakage rates may be possible under dry conditions for short durations, they are not appropriate for designing for soakage under saturated conditions and longer durations. These soakage rates should be reviewed and amended to reflect realistic soakage rates for longer duration storage/soakage mitigation for new builds.

The soakage rates were determined following a standard process. Site specific soakage tests will be required as deemed necessary for future development. The soakage rates reported are based on tests carried out in 2011 to categorise areas in Whakatāne that had good, moderate, or poor soakage rates. The tests were carried out in accordance with Section E1 of the NZ Building Code.

Please refer to the attached results of soakage tests carried out by MTEC Consultants in 2011.

m) Please comment on whether there will be a requirement for new builds to mitigate up to RCP 8.5, 1% 72-hour event, and if so, what will be the mechanism? (e.g., District Plan/ECOP).

This is not a current requirement for brownfield development. The mitigation requirement for new greenfield development will be determined on a case-by-case basis as part of consenting.

n) Please provide more comment around the 10% AEP current level of service of the pipe network system (current and future climate). Please address whether you think this level of service is feasible and whether a 20% AEP would be more realistic.

The Council's design standard is a 1 in 10 year AEP event. As the modelling shows, in many instances, this is not achieved in brownfield development. This design standard remains and is used for greenfield developments.

o) Please provide information on the condition of all the existing stormwater outlets, including photographs.

As agreed with Bay of Plenty Regional Council, this will be included as a condition of consent requiring a one off report within 12 months of the consent being granted.

p) ***The soakage system around the Whakatane Pool is inundated in small events. Are there any plans for remediation or investigation?***

From time to time, the soakage system around the Whakatāne Aquatic and Fitness Centre is overwhelmed, with relatively short lived, minor ponding as a result. There are no immediate plans to upgrade the stormwater system in this area but it will be considered as part of any future upgrade in this carpark.

Yours sincerely

A Hutchinson

Astrid Hutchinson
Project Planner

Attachments:

1. Whakatāne District Council stormwater investment framework
2. Soakage test results
3. Memo from Keith Hamill of River Lake Limited dated 7 November 2023
4. Revised Whakatane Comprehensive Stormwater Consent Monitoring Plan.

Whakatāne District Council stormwater investment framework

	INVESTMENT DRIVER								
CRITERIA	**Primary system has adequate capacity (inlets, pipes, channels, pumping stations)**	**Flood protection of habitable properties**	**Assets renewed or replaced when required**	**Resilience of the storm water system**	**Planning/Regulatory/Consenting needs are met**	**Preservation or enhancement of water quality and/or environmental parameters**	**Optimistic advantages (e.g. linking with roading project work)**	**Preservation of social and cultural values**	**Climate change**
Evaluation method (How to assess)	1D Modelling	1D/2D Modelling and RiskScape	CCTV	Risk assessment	Resource consents/Policy statements	Water quality/ecological results	Cost advantages are sought from integration with other projects	Feedback from community groups	Decisions are assessed against Council's seven Climate change principles
Evidence to invest (What are we testing?)	Components do not meet current or future (climate adjustments) needs	Habitable and commercial properties are at risk during the design 1% AEP flood	Age, condition, criticality	Risks (current and future) are unacceptable	Consent conditions are not met, or unlikely to be met in the future	Poor management of storm water that is not consistent with expectations of a well-designed modern storm water system	Advantages to invest early are compared with costs to upgrade at a later date	Sounds opportunities are available to meet community group aspirations	Components of the stormwater system are not compatible with effects based on likely climate change predictions
Target (What are we trying to achieve?)	Built infrastructure meets acceptable standards (e.g. Engineering Code of Practice)	Properties are protected from flooding for the 1% flood event but recognises that the level of investment needs to be affordable and satisfies economic scrutiny.	Assets are replaced/renewed in accordance with asset management best practice	Where practicable, the storm water systems is safe to fail, as opposed to fail safe	No non-compliances with resource consent conditions	Opportunities to improve storm water quality are identified and actioned as appropriate	Council maximises investment opportunities to take advantage of efficient infrastructure upgrades	Needs are satisfied and acted on as appropriate	Investments and decisions are required to ensure that the storm water system is future proofed to the effects of climate change
Community outcome (What benefit will the community realise?)	Frequent rain events is well managed. Nuisance ponding of storm water is avoided	A storm water system that aims to safeguard properties from flooding, considering economic constraints.	Asset deterioration is well managed so that assets are renewed at the right time and in the right places	The storm water system has in built resilience and safeguards in place to minimise the public's exposure should something not work as expected	Storm water systems operates under good environment controls.	Improved use of storm water as a resource that enhances aesthetic and amenity values.	Efficient use of stormwater funds	Community expectations are met	The systems is designed with effects of climate change in mind

Client:	Whakatane District Council		
Project Title:	Percolation Tests	***Page***	10
Site Address:	Marchignal Street Reserve	***No of Pages***	16
	Coastlands	***Test***	10 of 16
City:	Whakatane	***Date***	18/05/2011
File Number:	614914-M-E-S001	***By***	RGS

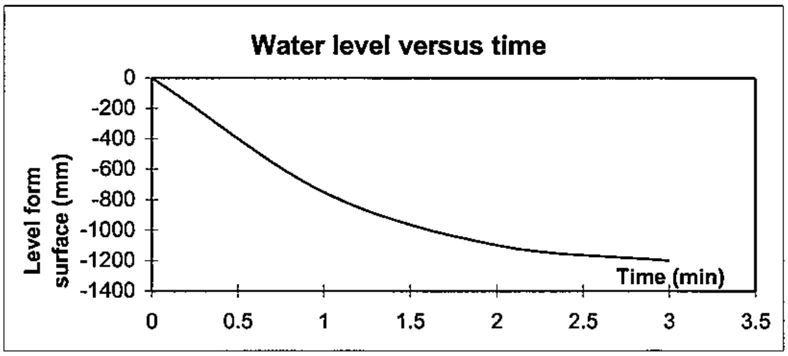
TGA REV 2 9/07/2010

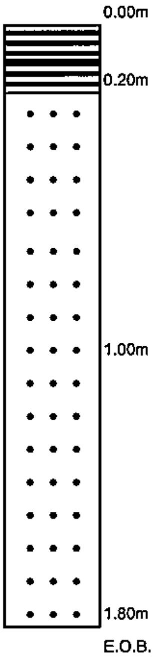
MTEC CONSULTANTS
Local People. Global Knowledge.

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
1	-750	-750
2	-350	-1100
3	-100	-1200





TOPSOIL, Silty **SAND**, very moist.

SAND medium, grey, uniformly graded, moist.

Becomes saturated, borehole collapsing.

Augered Hole depth (1)	1800	mm
Presoak hole depth (2)	1700	mm
End test hole depth (3)	1200	mm
Auger Diameter	100	mm
Water level drop	1200	mm
Av test depth (2+3)/2	1450	mm
Depth of topsoil	200	mm
Permeable Depth (av - top:	1250	mm
modified Hole Diameter	111	mm
Water Volume Lost	11.7	litres
Hole Surface Area	0.24	m^2
Total time of test	3	min

when time 0 to 3 min
permeable depth is 1250 to 50 mm
surface area is 0.24 m^2

Soakage rate **16.44 litres/m^2/min**

Notes: Moved locaton to low point in reserve.

Client: Whakatane District Council
Project Title: Percolation Tests
Site Address: Paterson Street Reserve
City: Whakatane
File Number: 614914-M-E-S001

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No of Pages 16
Test 11 of 16
Date 19/05/2011
By RGS

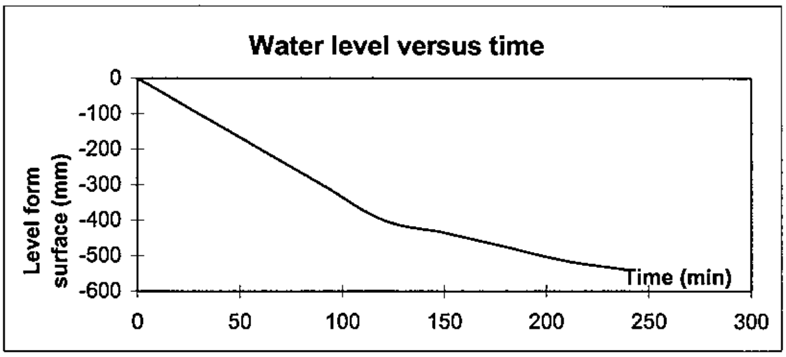
TGA REV 2 9/07/2010

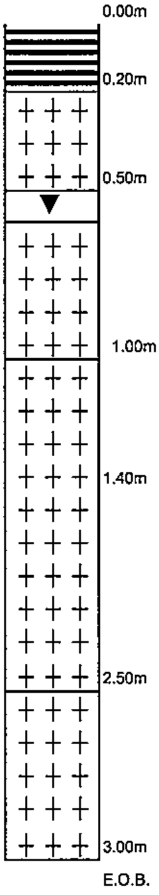
MTEC CONSULTANTS
Local People. Global Knowledge.

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
30	-100	-100
60	-100	-200
90	-100	-300
120	-100	-400
150	-35	-435
180	-40	-475
210	-40	-515
240	-25	-540





TOPSOIL, moist.

SILT, brown mottled grey & pale brown, plastic, very moist - wet.

Clayey **SILT**, pale brown mottled pale grey & pale brown, plastic, becomes saturated.

Clayey **SILT** pale brown streaked pale grey & dark orange, wet - saturated.

SILT, pale green, non plastic, wet - saturated.

Augered Hole depth (1)	3000	mm
Presoak hole depth (2)	650	mm
End test hole depth (3)	650	mm
Auger Diameter	100	mm
Water level drop	540	mm
Av test depth (2+3)/2	650	mm
Depth of topsoil	200	mm
Permeable Depth (av - top:	450	mm
modified Hole Diameter	215	mm
Water Volume Lost	19.6	litres
Hole Surface Area	0.19	m^2
Total time of test	240	min

when time 0 to 240 min
permeable depth is 450 to 0 mm
surface area is 0.19 m^2

Soakage rate **0.43 litres/m^2/min**

Notes:

Client:	Whakatane District Council		
Project Title:	Percolation Tests	***Page***	12
Site Address:	Farnworth Street Reserve	***No of Pages***	16
		Test	12 of 16
City:	Whakatane	***Date***	19/05/2011
File Number:	614914-M-E-S001	***By***	RGS

TGA REV 2 9/07/2010

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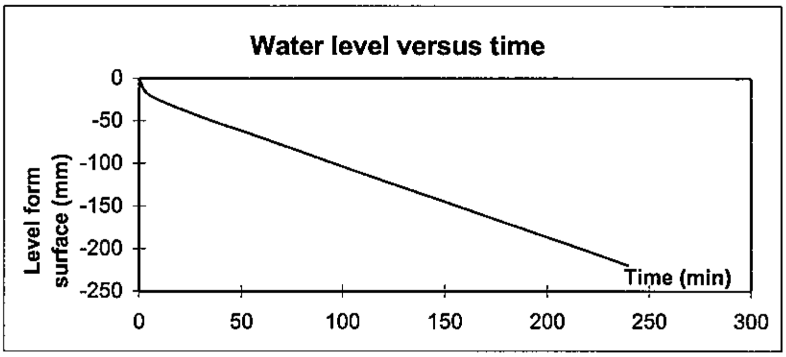
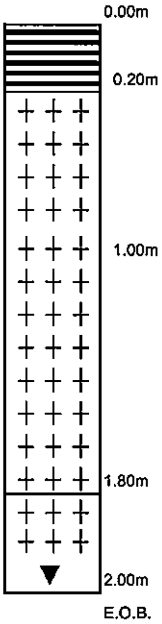
Local People. Global Knowledge.

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
5	-20	-20
30	-25	-45
60	-25	-70
90	-25	-95
120	-25	-120
150	-25	-145
180	-25	-170
210	-25	-195
240	-25	-220





TOPSOIL.

SILT, pale brown mottled pale grey & dark orange, non cohesive, slightly plastic,moist.

Becomes **SILT**, pale brown streaked pale grey & dark orange, non plastic, moist.

Becomes SILT brown streaked dark orange, slightly plastic, moist becomes very moist - wet.

SILT occasional medium sand, pale green, non plastic, saturated.

Ground water level.

Augered Hole depth (1)	2000	mm
Presoak hole depth (2)	2000	mm
End test hole depth (3)	2000	mm
Auger Diameter	100	mm
Water level drop	220	mm
Av test depth (2+3)/2	2000	mm
Depth of topsoil	200	mm
Permeable Depth (av - top:	1800	mm
modified Hole Diameter	100	mm
Water Volume Lost	1.7	litres
Hole Surface Area	0.54	m^2
Total time of test	240	min

when time	0	to	240	min
permeable depth is	1800	to	1580	mm
surface area is			0.54	m^2

Soakage rate **0.01 litres/m^2/min**

Notes: Water level drop at 23 hours 450mm, water level drop at 120 hours 730mm.

Client:	Whakatane District Council		
Project Title:	Percolation Tests	***Page***	13
Site Address:	Reserve Adjacent Pump Station	***No of Pages***	16
	Awatapu Drive Whakatane South	***Test***	13 of 16
City:	Whakatane	***Date***	19/05/2011
File Number:	614914-M-E-S001	***By***	RGS

TGA REV 2 9/07/2010

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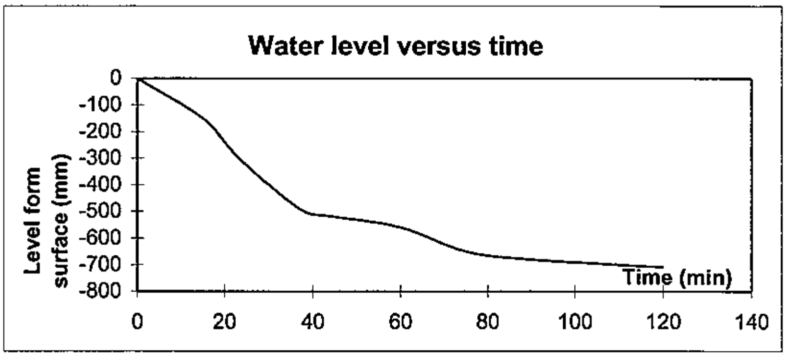
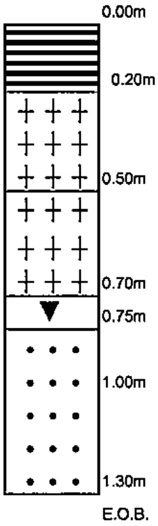
Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
15	-150	-150
22	-130	-280
30	-120	-400
38	-100	-500
45	-20	-520
60	-40	-560
75	-90	-650
90	-30	-680
120	-30	-710





TOPSOIL Sandy **SILT**.

Medium - fine Sandy **SILT**, brown, non plastic, very moist.

Medium - fine Sandy **SILT**, pale brown mottled dark orange & pale grey, non plastic - slightly plastic, very moist becomes saturated.

Ground water level.

Medium - fine Sand, brown mottled dark orange, saturated.

Borehole collapsing.

Augered Hole depth (1)	1300	mm
Presoak hole depth (2)	750	mm
End test hole depth (3)	750	mm
Auger Diameter	100	mm
Water level drop	710	mm
Av test depth (2+3)/2	750	mm
Depth of topsoil	200	mm
Permeable Depth (av - top:	550	mm
modified Hole Diameter	132	mm
Water Volume Lost	9.7	litres
Hole Surface Area	0.13	m^2
Total time of test	120	min

when time 0 to 120 min
permeable depth is 550 to 0 mm
surface area is 0.13 m^2

Soakage rate **0.63 litres/m^2/min**

Notes:

Client: Whakatane District Council
Project Title: Percolation Tests
Site Address: Fishermans Drive Reserve
Coastlands
City: Whakatane
File Number: 614914-M-E-S001

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No of Pages 16
Test 14 of 16
Date 20/05/2011
By RGS

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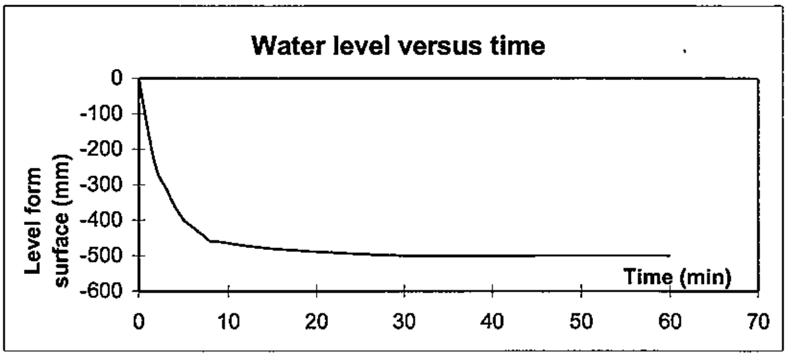
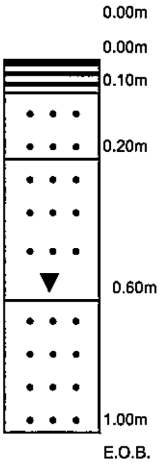
TGA REV 2 9/07/2010

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
1	-150	-150
2	-110	-260
3	-50	-310
4	-50	-360
5	-40	-400
6	-20	-420
7	-20	-440
8	-20	-460
9	0	-460
15	-20	-480
30	-20	-500
45	0	-500
60	0	-500





TOPSOIL, Silty **SAND**, moist.
SAND medium - fine, brown, poorly graded graded, moist.
SAND medium, grey, uniformly graded, becomes saturated.
Ground water level.
Borehole collapsing.

Augered Hole depth (1)	1000	mm
Presoak hole depth (2)	600	mm
End test hole depth (3)	600	mm
Auger Diameter	100	mm
Water level drop	500	mm
Av test depth (2+3)/2	600	mm
Depth of topsoil	100	mm
Permeable Depth (av - top:	500	mm
modified Hole Diameter	129	mm
Water Volume Lost	6.5	litres
Hole Surface Area	0.11	m^2
Total time of test	60	min

when time 0 to 60 min
permeable depth is 500 to 0 mm
surface area is 0.11 m^2

Soakage rate **0.95 litres/m^2/min**

Notes:

Client: Whakatane District Council
Project Title: Percolation Tests
Site Address: Road Reserve Corner Olympic Drive & King Street
City: Whakatane
File Number: 614914-M-E-S001

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No of Pages 16
Test 15 of 16
Date 20/05/2011
By RGS

TGA REV 2 9/07/2010

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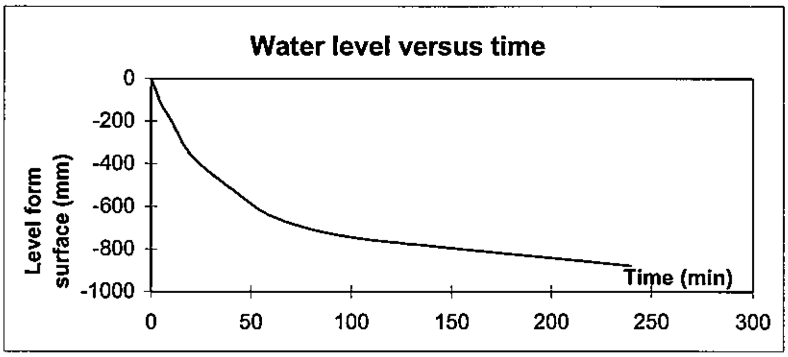
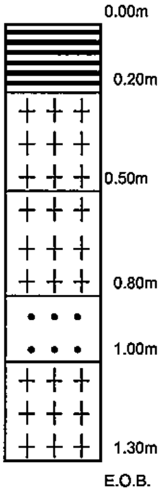
Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
2	-50	-50
4	-50	-100
6	-40	-140
10	-60	-200
18	-140	-340
28	-90	-430
42	-100	-530
57	-100	-630
77	-70	-700
97	-40	-740
120	-28	-768
150	-28	-796
180	-28	-824
210	-28	-852
240	-28	-880





TOPSOIL.

SILT minor medium - fine Sand, pale brown mottled dark brown, moist becomes very moist.

Medium - fine Sandy **SILT**, pale brown, slightly plastic, very moist becomes wet.

Medium - fine **SAND** with Silt, pale brown, poorly graded, saturated.

Medium - fine Sandy **SILT**, pale brown, slightly plastic, very moist becomes wet.

Becomes saturated, borehole collapsing.

Augered Hole depth (1)	1300	mm
Presoak hole depth (2)	1000	mm
End test hole depth (3)	1000	mm
Auger Diameter	100	mm
Water level drop	880	mm
Av test depth (2+3)/2	1000	mm
Depth of topsoil	200	mm
Permeable Depth (av - top:	800	mm
modified Hole Diameter	114	mm
Water Volume Lost	9.0	litres
Hole Surface Area	0.15	m^2
Total time of test	240	min

when time	0	to	240	min
permeable depth is	800	to	0	mm
surface area is			0.15	m^2

Soakage rate **0.24 litres/m^2/min**

Notes:

Client:	Whakatane District Council		
Project Title:	Percolation Tests	***Page***	16
Site Address:	Road Reserve Corner Valley Road	***No of Pages***	16
	& Arawa Road	***Test***	16 of 16
City:	Whakatane	***Date***	25/05/2011
File Number:	614914-M-E-S001	***By***	RGS

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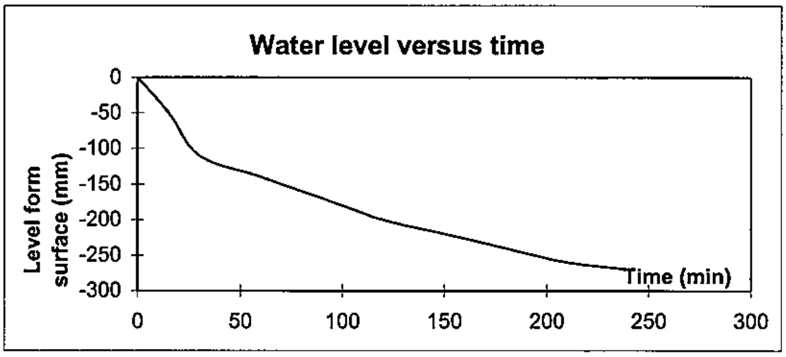
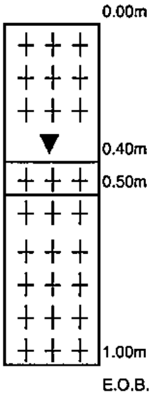
TGA REV 2 9/07/2010

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
15	-50	-50
30	-60	-110
60	-30	-140
100	-40	-180
120	-20	-200
150	-20	-220
180	-20	-240
210	-20	-260
240	-10	-270





Intermixed **TOPSOIL** & **SILT**, occasional subrounded medium gravel, slightly plastic very moist - wet.

Rising ground water level.

SILT minor medium - fine Sand pale grey streaked dark orange, very moist - wet.

Augered Hole depth (1)	1000	mm
Presoak hole depth (2)	400	mm
End test hole depth (3)	400	mm
Auger Diameter	100	mm
Water level drop	270	mm
Av test depth (2+3)/2	400	mm
Depth of topsoil	0	mm
Permeable Depth (av - top:	400	mm
modified Hole Diameter	158	mm
Water Volume Lost	5.3	litres
Hole Surface Area	0.15	m^2
Total time of test	240	min

when time	0	to	240 min
permeable depth is	400	to	130 mm
surface area is			0.15 m^2

Soakage rate **0.15 litres/m^2/min**

Notes: Rising ground water level initially ground water 800mm the finished at 400mm.
Moved location to low point on road reserve.

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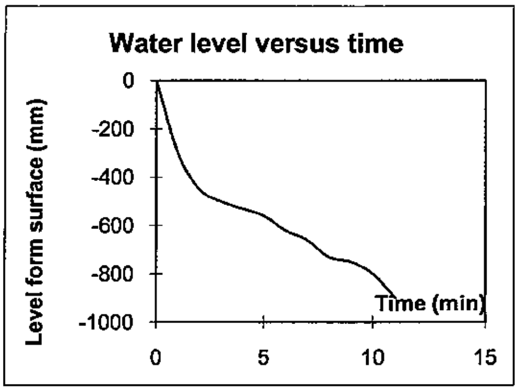
Percolation Test Results

Job Name:		**Date:**	17.11.05
Site Address:	156 A & B and 158 James Street, Whakatane	**By:**	M.C
Job Number:	126047		

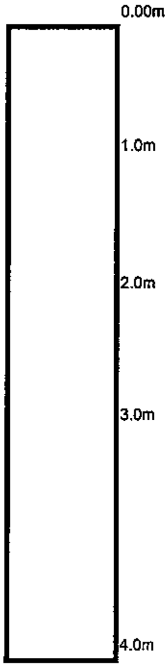
Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Test No. 2

Time (minutes)	Level Drop (mm)	Cumulative Level Drop (mm)
0	0	0
1	-300	-300
2	-150	-450
3	-50	-500
4	-30	-530
5	-30	-560
6	-60	-620
7	-40	-660
8	-70	-730
9	-20	-750
10	-50	-800
11	-100	-900



Bore Hole 2



No bore log recorded

Augered Hole depth (1)	1500	mm
Presoak hole depth (2)	950	mm
End test hole depth (3)	900	mm
Auger Diameter	100	mm
Water level drop	900	mm
Permeable Depth (2+3)/2	925	mm
modified Hole Diameter	127	mm
Water Volume Lost	11.5	litres
Hole Surface Area	0.20	m^2
Total time of test	11	min

when time 0 to 45 min

permeable depth is 925 to 25 mm

surface area is 0.20 m^2

Soakage rate **5.14 litres/m^2/min**

MTEC CONSULTANTS LTD

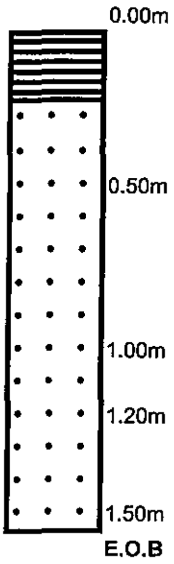
Borehole Log

Client :
Project : Proposed Residential Dwellings
Site Address: 156 - 158 James Street, Whakatane
File Number: 126047

Date: 13/03/2006
By: M.C

Notes: Depth of borehole begins at the existing ground level

Borehole 1

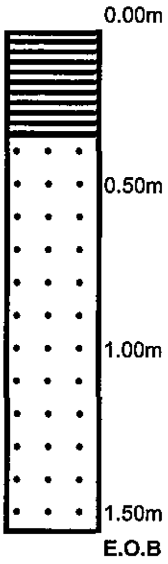


SANDY TOPSOIL

SAND,fine/medium, slightly moist, light brown.
After water got very sticky and wet

Water Table

Borehole 2



SANDY TOPSOIL

SAND,fine/medium, slightly moist, light brown.

MTEC CONSULTANTS LTD

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Percolation Test Results

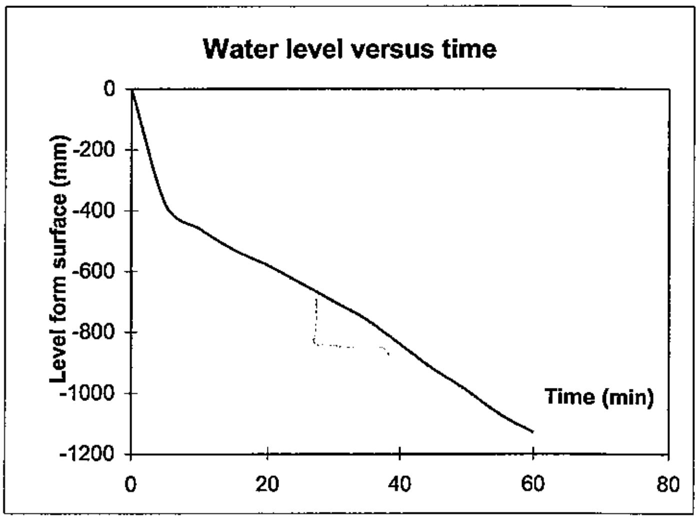
Job Name:
Site Address: 96 Domain Rd Whakatane
Job Number: 125458

Date: 7.9.05
By: MC

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Test No. 1

Time (minutes)	Level Drop (mm)	Cumulative Level Drop (mm)
0	0	0
5	-380	-380
10	-80	-460
15	-70	-530
20	-50	-580
25	-60	-640
30	-60	-700
35	-60	-760
40	-80	-840
45	-80	-920
50	-70	-990
55	-80	-1070
60	-60	-1130



Hole depth	1130	mm
Water level drop	1130	mm
Permeable Depth	1130	mm
Average Hole Diameter	115	mm
Water Volume Lost	11.7	litres
Average Surface Area	0.21	m^2
Total time of test	60	min

when time	0	to	60	min
permeable depth is	1130	to	0	mm
surface area is			0.21	m^2

Soakage rate **0.91 litres/m^2/min**

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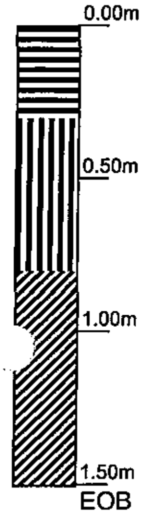
Borehole Log

Job Name:
Site Address: 96 DOMAIN RD
Job Number: 125458

Date: 7/09/2005
By: M.C

Notes: Depth of borehole begins at the existing ground level

BOREHOLE 1



SAND, rare silt , some gravel, frequent root hares
slightly moist

SAND, rare silt and minor organic content, dark brown/ black
slighly moist

SAND, brown, Slightly moist

MTEC CONSULTANTS LTD

Percolation Test Results

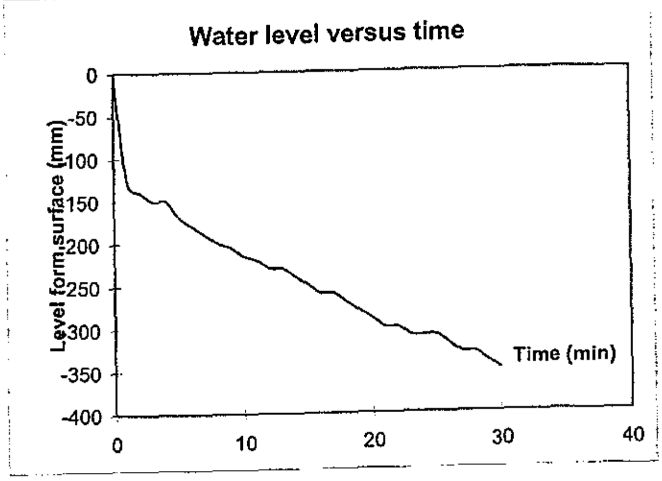
Date: 10.11.05
By: CJS

Job Name:
Site Address: 61 Pohutu Street, Whakatane
Job Number: 126055-W-E-S001

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Test No. 1

Time (minutes)	Level Drop (mm)	Cumulative Level Drop (mm)
0	0	0
1	-130	-130
2	-10	-140
3	-10	-150
4	0	-150
5	-20	-170
6	-10	-180
7	-10	-190
8	-10	-200
9	-5	-205
10	-10	-215
11	-5	-220
12	-10	-230
13	0	-230
14	-10	-240
15	-10	-250
16	-10	-260
17	0	-260
18	-10	-270
19	-10	-280
20	-10	-290
21	-10	-300
22	0	-300
23	-10	-310
24	0	-310
25	0	-310
26	-10	-320
27	-10	-330
28	0	-330
29	-10	-340
30	-10	-350



Hole depth	1300	mm
Water level drop	350	mm
Permeable Depth	1300	mm
Average Hole Diameter	100	mm
Water Volume Lost	2.7	litres
Average Surface Area	0.36	m^2
Total time of test	30	min

when time 0 to 30 min
permeable depth is 1300 to 950 mm
surface area is 0.36 m^2

Soakage rate **0.25 litres/m^2/min**

Client: Te Whare Wananga o Awanuiarangi
Project Title: Office Development - Ex Camelia Court Motel
Site Address: 11 Domain Road
City: Whakatane
File Number: 614738-M-E-S001

Page 2
No of Pages 2
Date 9/03/2011
By RGS

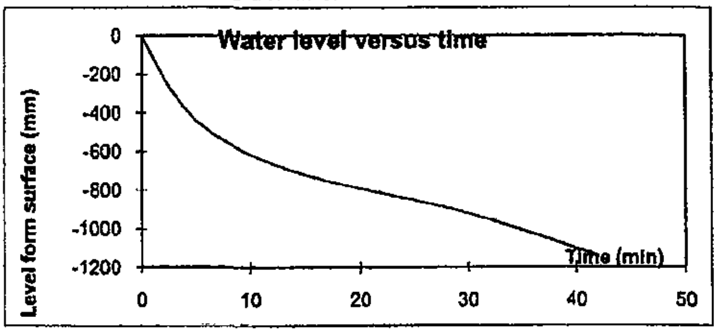
TGA REV 2 9/07/2010

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

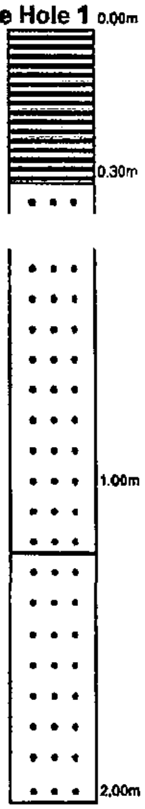
Test No. 1

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
3	-300	-300
7	-220	-520
15	-200	-720
30	-200	-920
42	-220	-1140



Augered Hole depth (1)	2000	mm
Presoak hole depth (2)	1700	mm
End test hole depth (3)	1650	mm
Auger Diameter	100	mm
Water level drop	1140	mm
Av test depth (2+3)/2	1675	mm
Depth of topsoil	300	mm
Permeable Depth (av - top:	1375	mm
modified Hole Diameter	109	mm
Water Volume Lost	10.7	litres
Hole Surface Area	0.29	m^2
Total time of test	42	min

Bore Hole 1



TOPSOIL

Silty medium - fine **SAND**, brown, poorly graded, moist.

Becomes less Silty.

Medium - fine **SAND**, pale grey mottled pale orange brown, poorly graded, very moist becomes wet.

Becomes wet.

E.O.B.

when time 0 to 42 min
permeable depth is 1375 to 235 mm
surface area is 0.29 m^2

Soakage rate **0.89 litres/m^2/min**

Client:		***Page***	2
Project Title:		***No of Pages***	4
Site Address:	Cnr Francis Street & Domain Road		
City:	Whakatane	***Date***	17/09/2010
File Number:	134007-M-E-S001	***By***	RGS/SMK

TGA REV 2 9/07/2010

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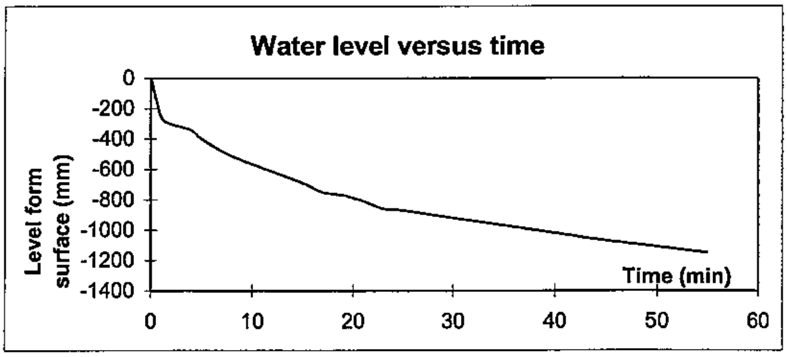
Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

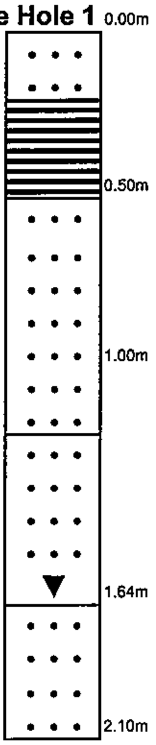
Test No. 1

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
1	-250	-250
2	-50	-300
4	-40	-340
5	-60	-400
7	-80	-480
9	-60	-540
11	-50	-590
13	-50	-640
15	-50	-690
17	-60	-750
19	-20	-770
21	-40	-810
23	-50	-860
25	-10	-870
30	-50	-920
35	-50	-970
40	-50	-1020
45	-50	-1070
55	-80	-1150



Augered Hole depth (1)	2100	mm
Presoak hole depth (2)	1350	mm
nd test hole depth (3)	1350	mm
Auger Diameter	100	mm
Water level drop	1150	mm
Av test depth (2+3)/2	1350	mm
Depth of topsoil	500	mm
Permeable Depth (av - top:	850	mm
modified Hole Diameter	125	mm
Water Volume Lost	14.0	litres
Hole Surface Area	0.18	m^2
Total time of test	55	min

Bore Hole 1



(FILL) TOPSOIL intermixed with pale brown Silt.

BURIED TOPSOIL Sandy **SILT** ranged Silty **SAND** fine - medium, greyish dark brown, poorly graded, moist.

Silty **SAND** fine - medium, brownish grey streaked dark orange & pale grey, poorly graded, moist - very moist.

SAND fine - medium, brownish pale grey streaked orange, poorly graded, very moist becomes saturated.

Ground Water Level

E.O.B.

when time	0	to	55	min
permeable depth is	850	to	0	mm
surface area is			0.18	m^2

Soakage rate **1.43 litres/m^2/min**

M TEC CONSULTANTS	SURVEYORS	JOB TITLE			PAGE	
	ENGINEERS	ADDRESS	24 Bracken Street			
	PLANNERS		Whakatane			
	ROTORUA TE PUKE OPOTIKI MT MAUNGANUI WHAKATANE	JOB No.	131806	DATE	18/03/2008	BY NB

Soakhole Capacity Spreadsheet

Flow Rate into soakhole =	1.40	l/s	
Soakge rate of soil =	2.40	l/m²/min	
Diameter of Hole =	0.900	m	
No Rings	3	Depth of Soak hole	1.35

Time	Water Depth start (m)	Surface area (wet) m²	Soakage rate (l/s)	Storage Rate (l/s)	Water Depth finish (m)
0	0	0.636	0.0254	1.3715	0.129
1	0.129	1.002	0.0401	1.3568	0.257
2	0.257	1.363	0.0545	1.3424	0.384
3	0.384	1.721	0.0689	1.3280	0.509
4	0.509	2.075	0.0830	1.3139	0.633
5	0.633	2.426	0.0970	1.2999	0.756
6	0.756	2.772	0.1109	1.2860	0.877
7	0.877	3.115	0.1246	1.2723	0.997
8	0.997	3.455	0.1382	1.2587	1.116
9	1.116	3.790	0.1516	1.2453	1.234
10	1.234	4.122	0.1649	1.2320	1.350

The above calculation shows that the average flowrate into the design soakhole that can be sustained without overflow is : 1.397 litres per second

The maximum area to be reticulated to each soakhole is therefore calculated as follows:

Rainfall Intensity (10% AEP 10min) =	16	mm/10min
Rainfall Intensity (10% AEP 10min) =	96	mm/hour
C Value for Paved / Roof Areas =	0.90	
C Value for Grassed Areas =	0.3	
Max Paved / Roof Area per soakhole =	**58**	m²
Max Grassed Area per soakhole =	**174**	m²

JOB TITLE	.			PAGE	
ADDRESS	16 Louvain Street				
	Whakatane				
JOB No.	130303	DATE	10/10/2008	BY	NB

Soakage Trench For Front Carpark Area

Use 900 wide x 600 deep soakage trench

Flow Rate into trench =	0.49	l/s
Soakge rate of soil =	2.50	l/m²/min ⇐
Trench Length =	1.0	m
Trench Width =	0.90	m
Trench Porous Depth =	0.60	m
Trench Void Ratio =	0.5	

Time	Water Depth start (m)	Surface area (wet) m²	Soakage rate (l/s)	Storage Rate (l/s)	Water Depth finish (m)
0	0	0.900	0.0375	0.4541	0.061
1	0.061	1.130	0.0471	0.4445	0.120
2	0.120	1.355	0.0565	0.4351	0.178
3	0.178	1.576	0.0657	0.4260	0.235
4	0.235	1.792	0.0747	0.4170	0.290
5	0.290	2.003	0.0835	0.4082	0.345
6	0.345	2.210	0.0921	0.3995	0.398
7	0.398	2.412	0.1005	0.3911	0.450
8	0.450	2.610	0.1088	0.3829	0.501
9	0.501	2.804	0.1168	0.3748	0.551
10	0.551	2.994	0.1248	0.3669	0.600

The above calculation shows that the average flowrate into the design soakhole that can be sustained without overflow is : 0.492 litres per second

The maximum area to be reticulated to each soakhole is therefore calculated as follows:

Rainfall Intensity (10% AEP 10min) =	16	mm/10min
Rainfall Intensity (10% AEP 10min) =	96	mm/hour
C Value for Paved / Roof Areas =	0.90	
C Value for Grassed Areas =	0.3	
Max Paved / Roof Area per soakhole =	**20**	m²
Max Grassed Area per soakhole =	**61**	m²
Carpark Area =	262	m²
Trench Length Required =	13	m

MTEC CONSULTANTS LTD

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Percolation Test Results

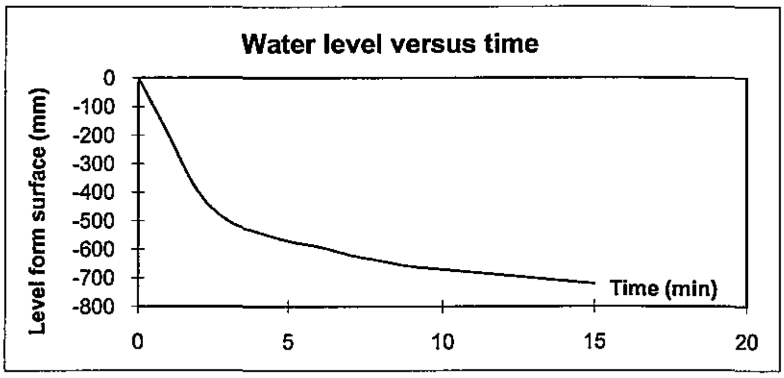
Client :
Project :
Site Address: 84 Thornton Rd, Whakatane
File Number: 128074-W-E-S001

Date: 12.10.06
By: MC

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Test No. 1

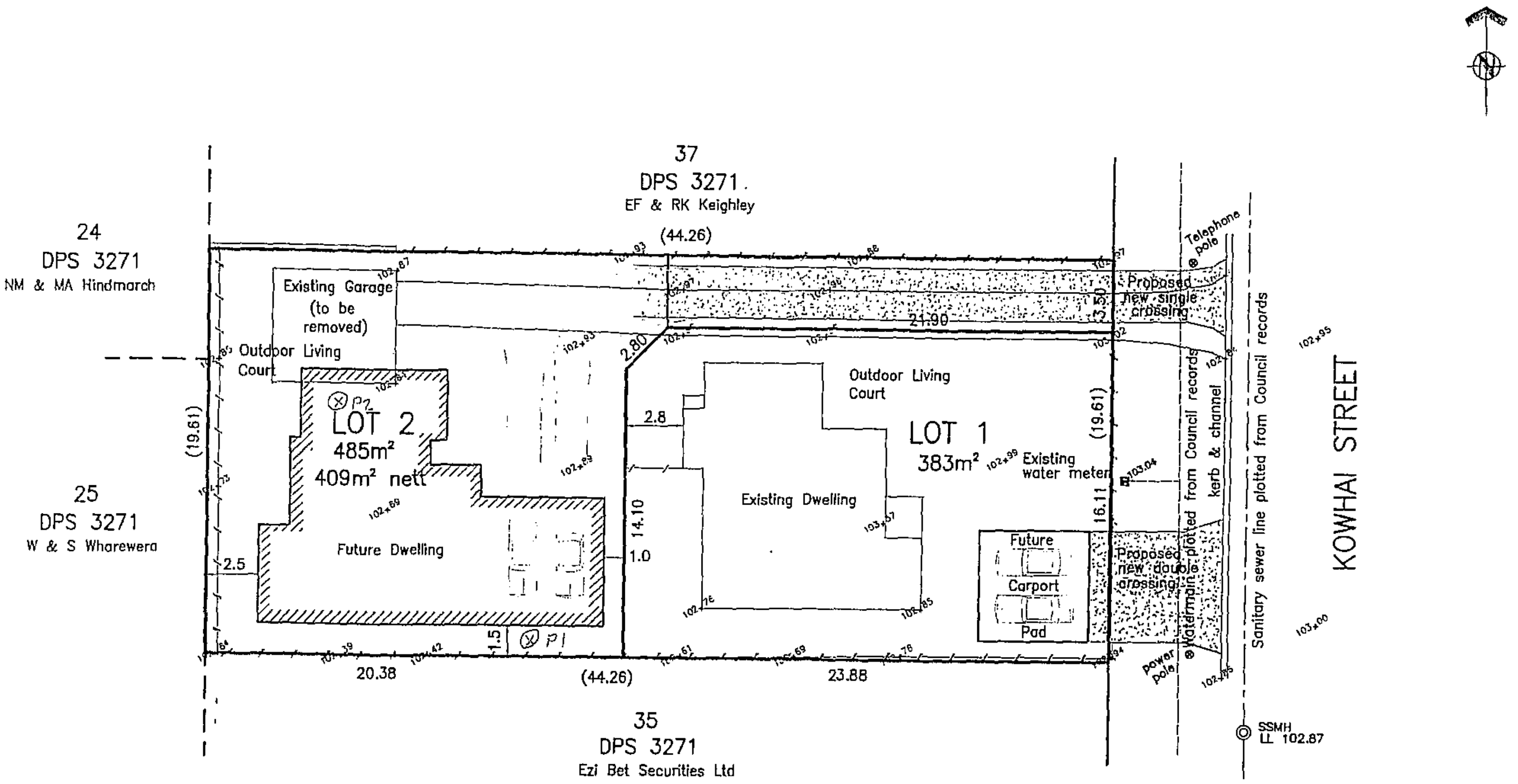
Time (minutes)	Level Drop (mm)	Cumulative Level Drop (mm)
0	0	0
1	-200	-200
2	-200	-400
3	-100	-500
4	-40	-540
5	-30	-570
6	-20	-590
7	-30	-620
8	-20	-640
9	-20	-660
10	-10	-670
11	-10	-680
12	-10	-690
13	-10	-700
14	-10	-710
15	-10	-720



Augered Hole depth (1)	900	mm
Presoak hole depth (2)	900	mm
End test hole depth (3)	900	mm
Auger Diameter	100	mm
Water level drop	720	mm
Av test depth (2+3)/2	900	mm
Depth of topsoil	300	mm
Permeable Depth (av - top:	600	mm
modified Hole Diameter	100	mm
Water Volume Lost	5.7	litres
Hole Surface Area	0.10	m^2
Total time of test	15	min

when time 0 to 15 min
permeable depth is 600 to 0 mm
surface area is 0.10 m^2

Soakage rate **3.69 litres/m^2/min**



NOTES;

1. Areas & measurements are approximate only and subject to survey.
2. Levels are in terms of Moturiki Datum
3. Total Area = 868m²
4. Comprised in CT SA 11B/27

REF	REVISIONS	BY	DATE

DESIGNED: DATE: SIGNED:
DRAWN: BWP DATE: 10/09 SIGNED:
CHECKED: DATE: SIGNED:
APPROVED: DATE: SIGNED:
PLOT BY: BWP
PLOT DATE: 30.10.09
SURVEY BY: BWP
SURVEY DATE: 10/09

ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND ACENZ
ISO 9001 QUALITY ASSURED

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HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
Ground Floor Shelby House 13 Louvain Street Whakatane Ph 07 308 5478 Fax 07 308 4907

PROJECT:
N KENNY & S SCHRODER
16 KOWHAI STREET
WHAKATANE

TITLE:
PROPOSED TWO LOT SUBDIVISION
OF LOT 36 DPS 3271

ISSUE STATUS: FINAL
PROJECT No: 1730-128945-01
SCALE: 1:200
A3
DRAWING No: 128945-SC01
REV A

File: WHAKATANE N:\1730\128945_A\CAD\128945-SC01.DWG

geolab
air, soil & water
laboratory services

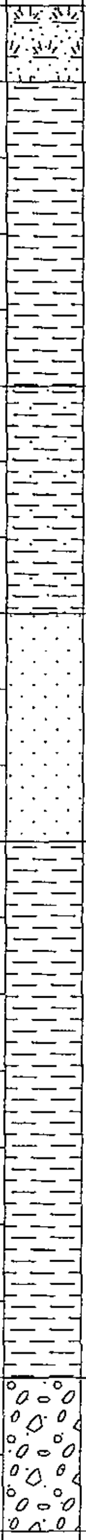
CLIENT:	N Kenny & S Schroder	BOREHOLE No: P1	
PROJECT:	New 2 Lot Subdivision, 16 Kowhai Street, Whakatane	Sheet 1 of 2	

Drill Type:	Hand Auger	Project No:	1730-128945-01	Logged By:	GR
Drilled By:	SW & SG	Coordinates:		Checked By:	
Date Started:	4/11/09	Ground Elevation:		Shear Vane No:	
Date Finished:	4/11/09	Water Level:			

GROUND WATER | DEPTH (m) | GRAPHIC LOG | SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering | DEPTH (m) | LABORATORY TESTS

NATURAL WATER CONTENT △
LIQUID LIMIT ✕
PLASTIC LIMIT ☐
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)



0.0

TOPSOIL

Light brown CLAY, low moisture.

0.5

Lighter colour, increasing sand content. Slightly more damp. Fine particulates.

SAND (fg-mg)

1.0

CLAY. Increasing moisture content and some organic content present.

1.5

▽

Sandy GRAVEL

2.0

SOIL_KENNY.GPJ GEOLAB.GDT 10/11/09

HARRISON GRIERSON CONSULTANTS LTD HG

File No 1730-128945-01

PERCOLATION TEST RESULT SHEET

Date 4-Nov-09

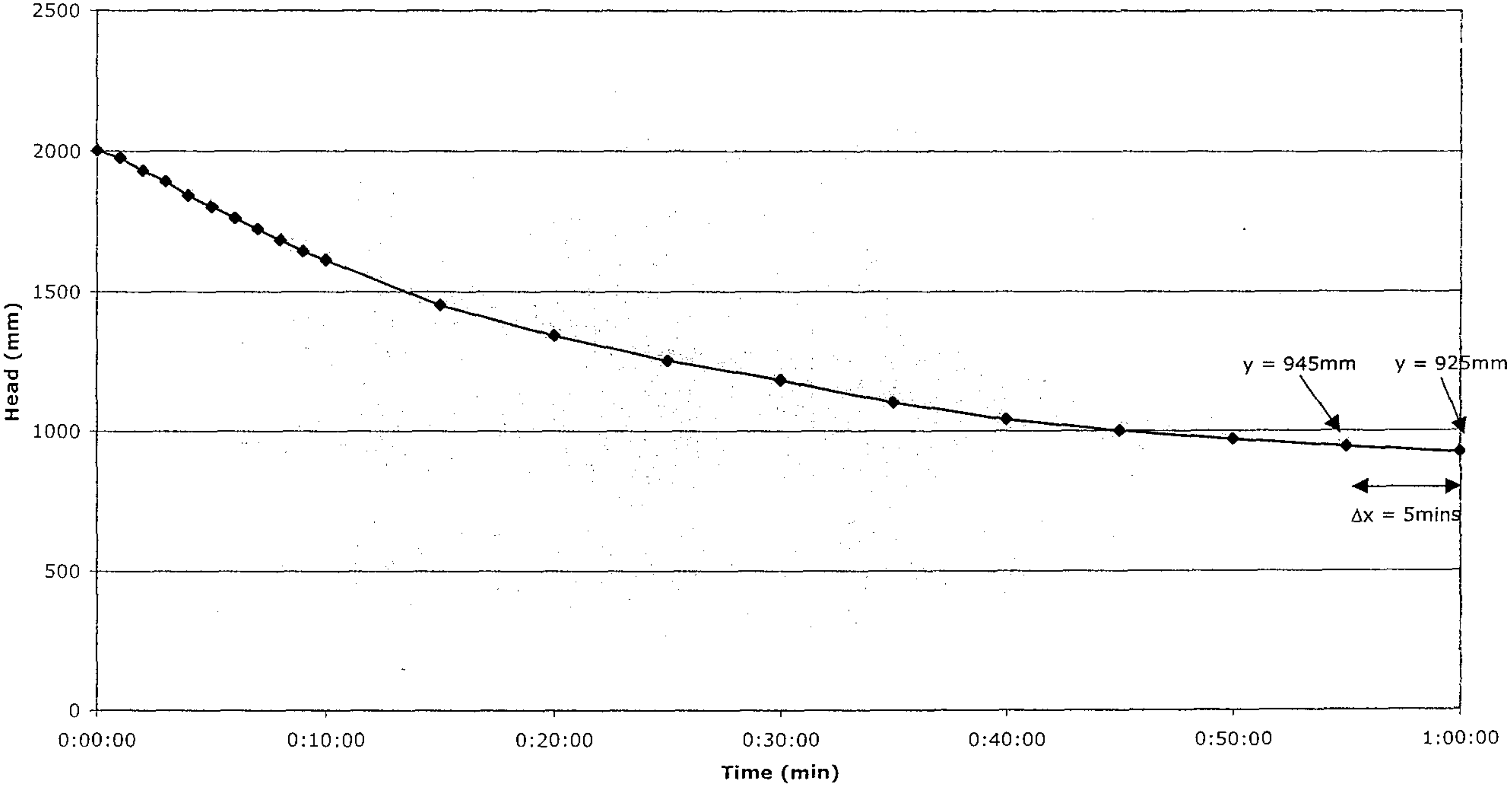
Project Name: 16 Kowhai Street, Whakatane

Initials SW/SG

Test No: 1 Depth of hole (mm): 2000 Diameter: 150mm

Actual time	Down to	Diff time	Drop in	Head	Perc rate		graphical information			
(hh:mm:ss)	WL (mm)	(min)	WL (mm)	(mm)	(mm/hr)	Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 1										
0:00:00	0			2000		2000				
0:01:00	25	1.0	25	1975	1500	1975	1500			
0:02:00	70	1.0	45	1930	2700	1930	2700			
0:03:00	110	1.0	40	1890	2400	1890	2400			
0:04:00	160	1.0	50	1840	3000	1840	3000			
0:05:00	200	1.0	40	1800	2400	1800	2400			
0:06:00	240	1.0	40	1760	2400	1760	2400			
0:07:00	280	1.0	40	1720	2400	1720	2400			
0:08:00	320	1.0	40	1680	2400	1680	2400			
0:09:00	360	1.0	40	1640	2400	1640	2400			
0:10:00	390	1.0	30	1610	1800	1610	1800			
0:15:00	550	5.0	160	1450	1920	1450	1920			
0:20:00	660	5.0	110	1340	1320	1340	1320			
0:25:00	750	5.0	90	1250	1080	1250	1080			
0:30:00	820	5.0	70	1180	840	1180	840			
0:35:00	900	5.0	80	1100	960	1100	960			
0:40:00	960	5.0	60	1040	720	1040	720			
0:45:00	1000	5.0	40	1000	480	1000	480			
0:50:00	1030	5.0	30	970	360	970	360			
0:55:00	1055	5.0	25	945	300	945	300			
1:00:00	1075	5.0	20	925	240	925	240			

16 Kowhai Street, Whakatane
Soak Hole Test 1
Head



geolab
air, soil & water
laboratory services

CLIENT: N Kenny & S Schroder

PROJECT: New 2 Lot Subdivision, 16 Kowhai Street, Whakatane

BOREHOLE No: P2

Sheet 1 of 2

Drill Type:	Hand Auger	Project No:	1730-128945-01	Logged By:	GR
Drilled By:	SW & SG	Coordinates:		Checked By:	
Date Started:	4/11/09	Ground Elevation:		Shear Vane No:	
Date Finished:	4/11/09	Water Level:			

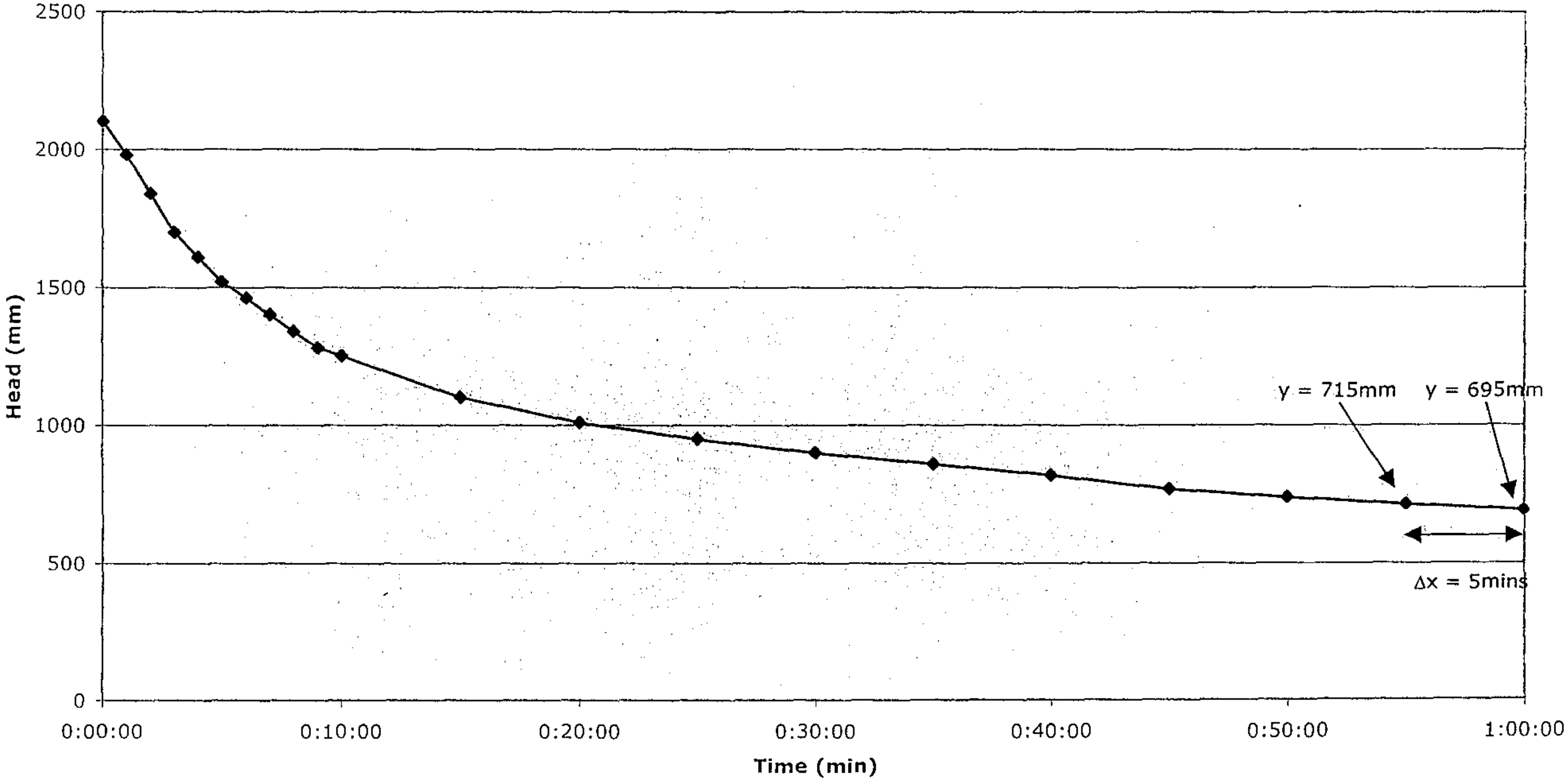
NATURAL WATER CONTENT △
LIQUID LIMIT ✕
PLASTIC LIMIT □
50 100 150 (%)

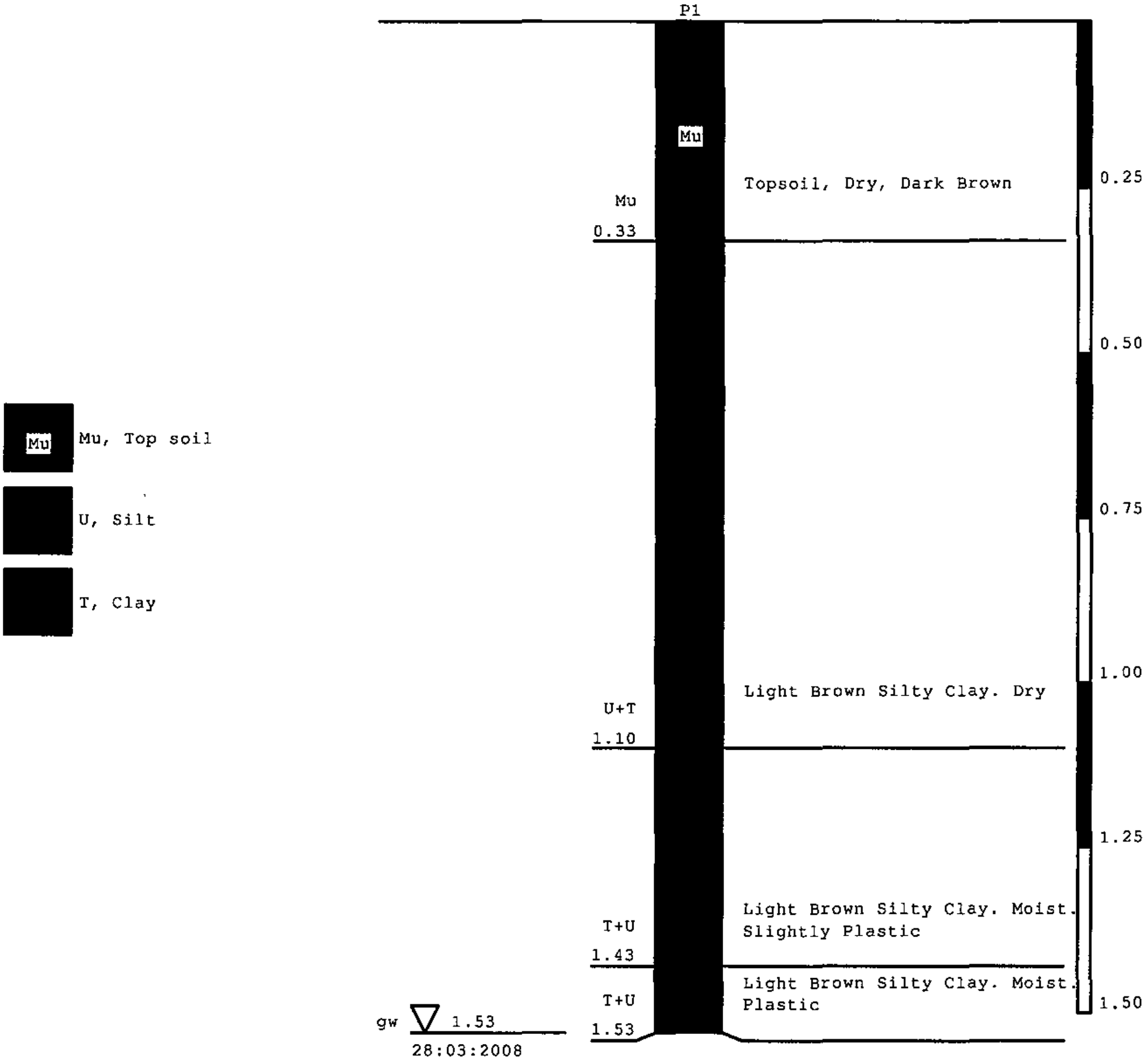
SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	DEPTH (m)	LABORATORY TESTS
	0.0		TOPSOIL.	0.0	
			Light brown CLAY, low moisture.		
	0.5		Lighter colour, increasing sand content. Slightly more damp. Fine particulates.	0.5	
	1.0		SAND (fg-mg).	1.0	
			CLAY. Increasing moisture content.		
	1.5			1.5	
			Wet brown-gray CLAY.		
	2.0			2.0	

HARRISON GRIERSON CONSULTANTS LTD								**HG**	File No	1730-128945-01
PERCOLATION TEST RESULT SHEET									Date	4-Nov-09
Project Name:	16 Kowhai Street, Whakatane								Initials	SW/SG
Test No:	2	Depth of hole (mm):		2100		Diameter:	150mm			
Actual time (hh:mm:ss)	Down to WL (mm)	Diff time (min)	Drop in WL (mm)	Head (mm)	Perc rate (mm/hr)	graphical information Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 1										
0:00:00	0			2100		2100				
0:01:00	120	1.0	120	1980	7200	1980	7200			
0:02:00	260	1.0	140	1840	8400	1840	8400			
0:03:00	400	1.0	140	1700	8400	1700	8400			
0:04:00	490	1.0	90	1610	5400	1610	5400			
0:05:00	580	1.0	90	1520	5400	1520	5400			
0:06:00	640	1.0	60	1460	3600	1460	3600			
0:07:00	700	1.0	60	1400	3600	1400	3600			
0:08:00	760	1.0	60	1340	3600	1340	3600			
0:09:00	820	1.0	60	1280	3600	1280	3600			
0:10:00	850	1.0	30	1250	1800	1250	1800			
0:15:00	1000	5.0	150	1100	1800	1100	1800			
0:20:00	1090	5.0	90	1010	1080	1010	1080			
0:25:00	1150	5.0	60	950	720	950	720			
0:30:00	1200	5.0	50	900	600	900	600			
0:35:00	1240	5.0	40	860	480	860	480			
0:40:00	1280	5.0	40	820	480	820	480			
0:45:00	1330	5.0	50	770	600	770	600			
0:50:00	1360	5.0	30	740	360	740	360			
0:55:00	1385	5.0	25	715	300	715	300			
1:00:00	1405	5.0	20	695	240	695	240			

16 Kowhai Street, Whakatane
Soak Hole Test 2
Head

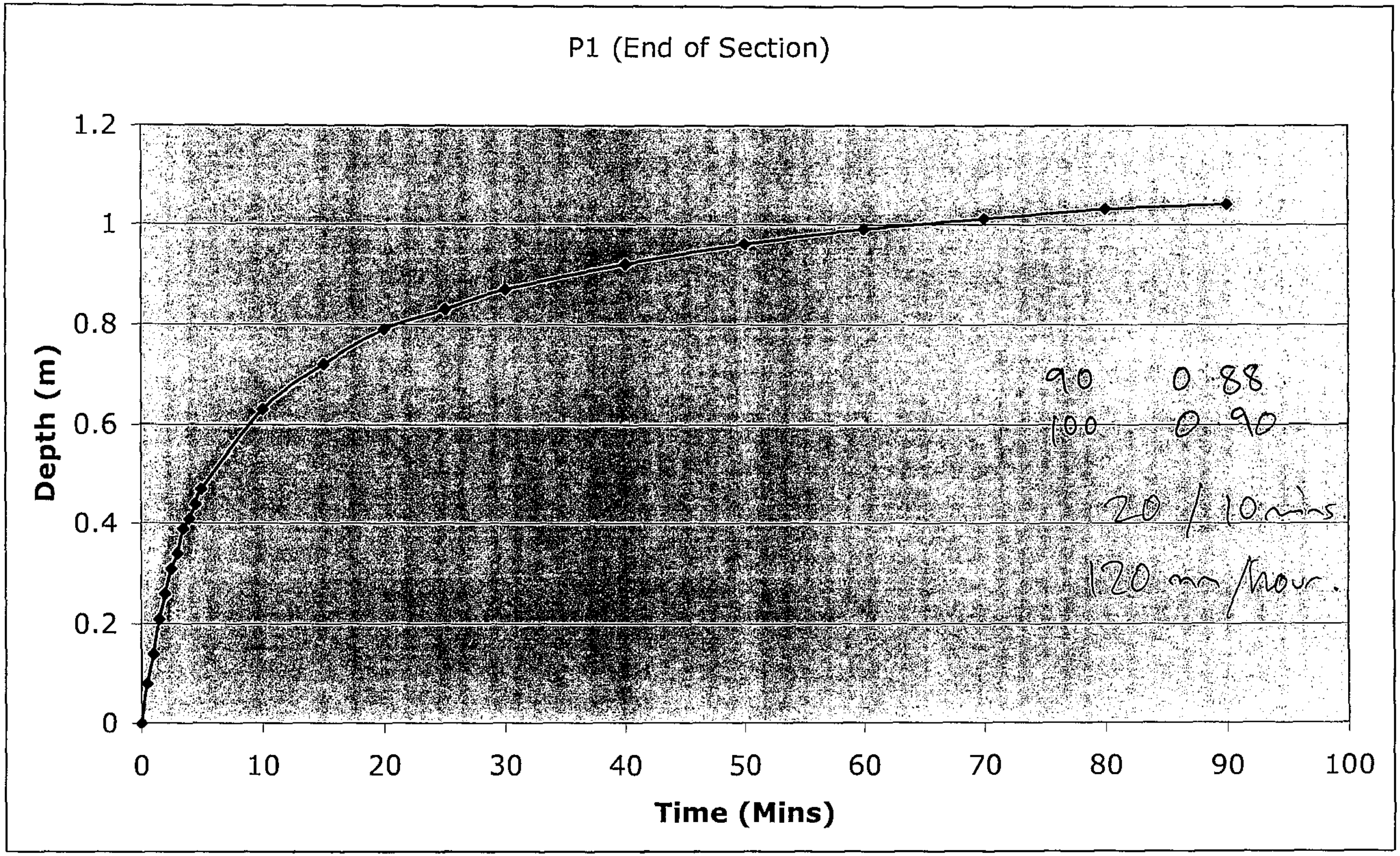




Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane, Bay of Plenty

Scale 1:10	Title: F K Developments Limited
File:	Date: Friday, 28 March 2008
Page No.:	Project: 21 Bridge Street, Whakatane

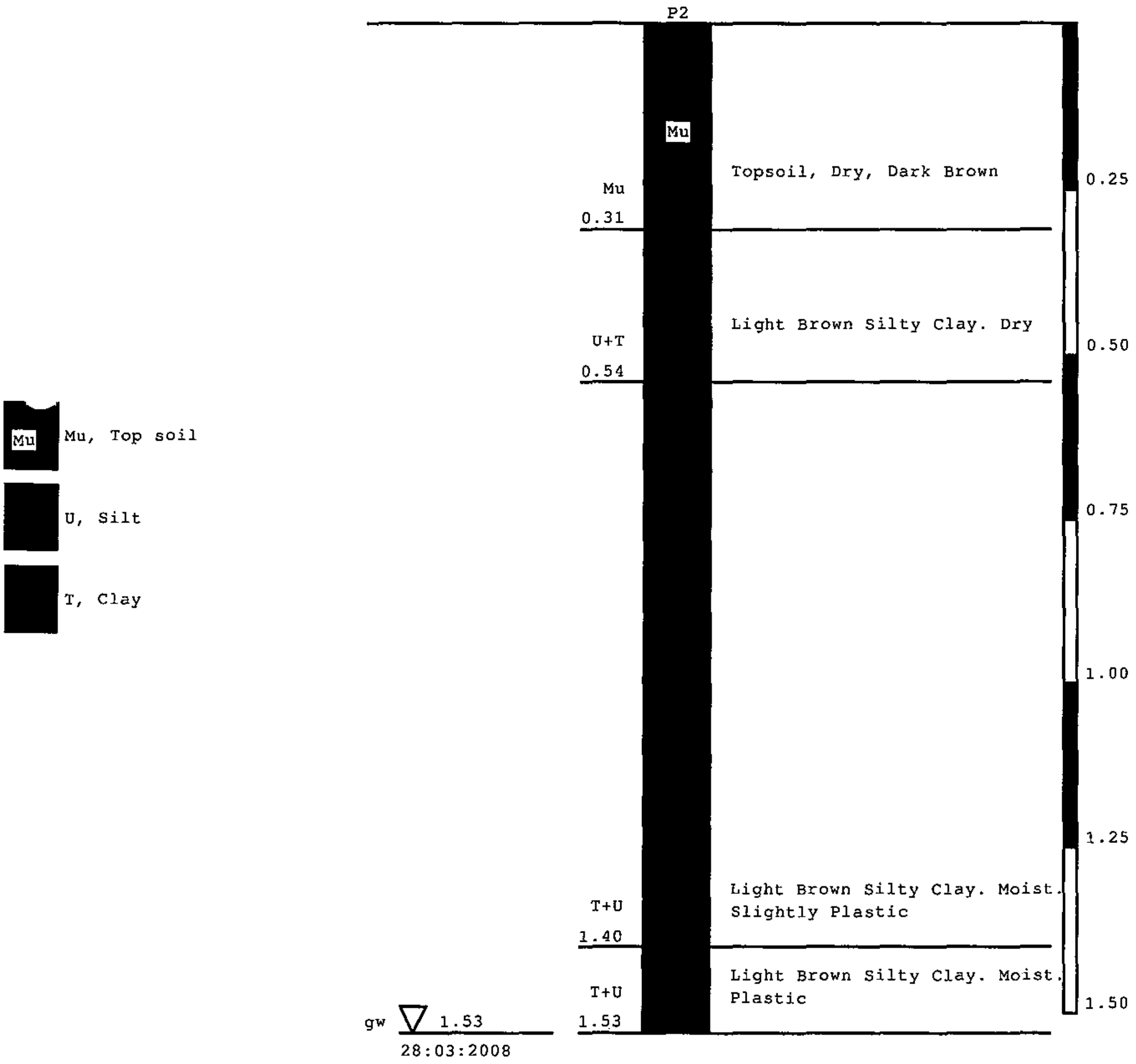
5501.



90 0.88
100 0.90

20 / 10 mins

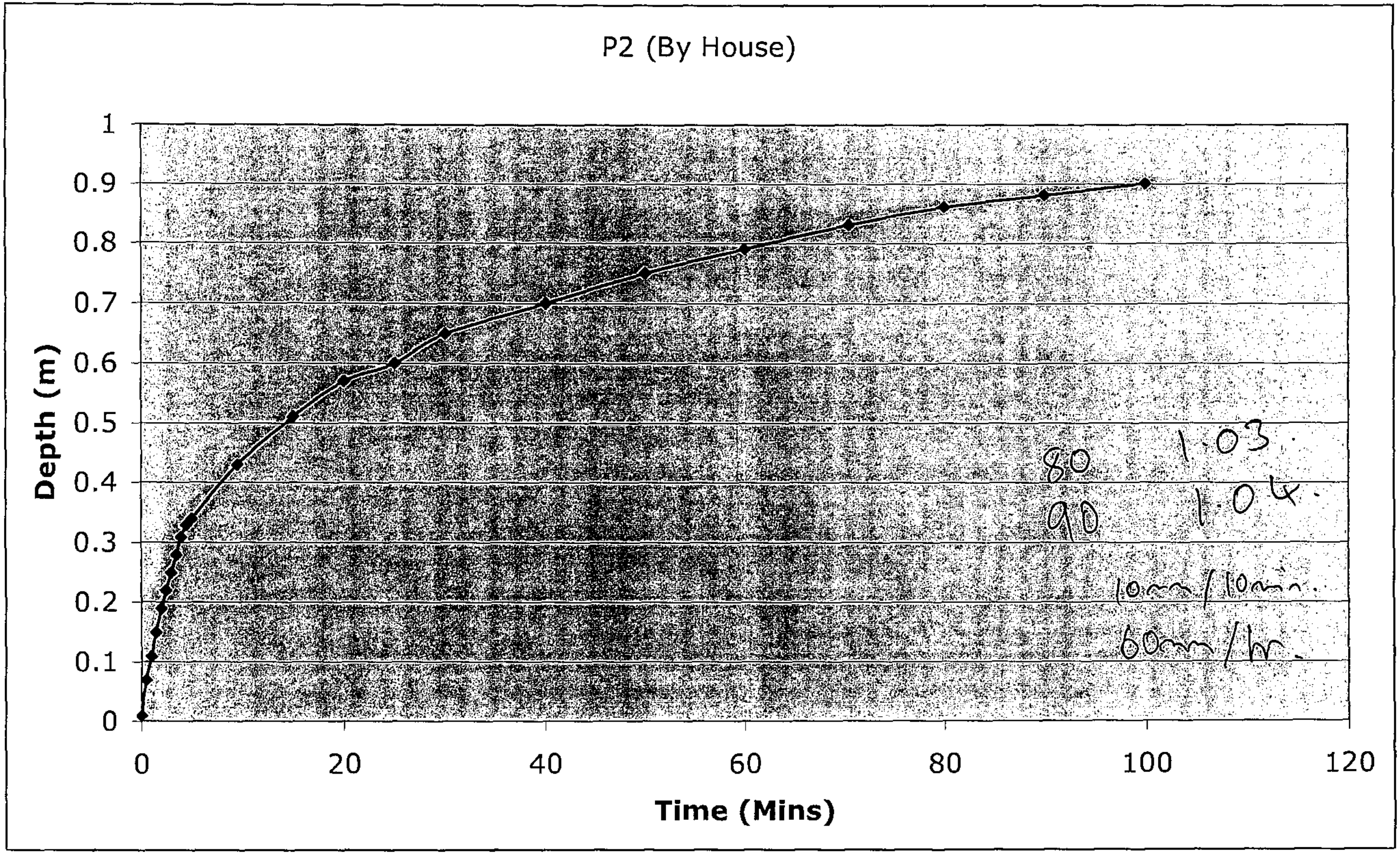
120 mm / hour.



Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane, Bay of Plenty

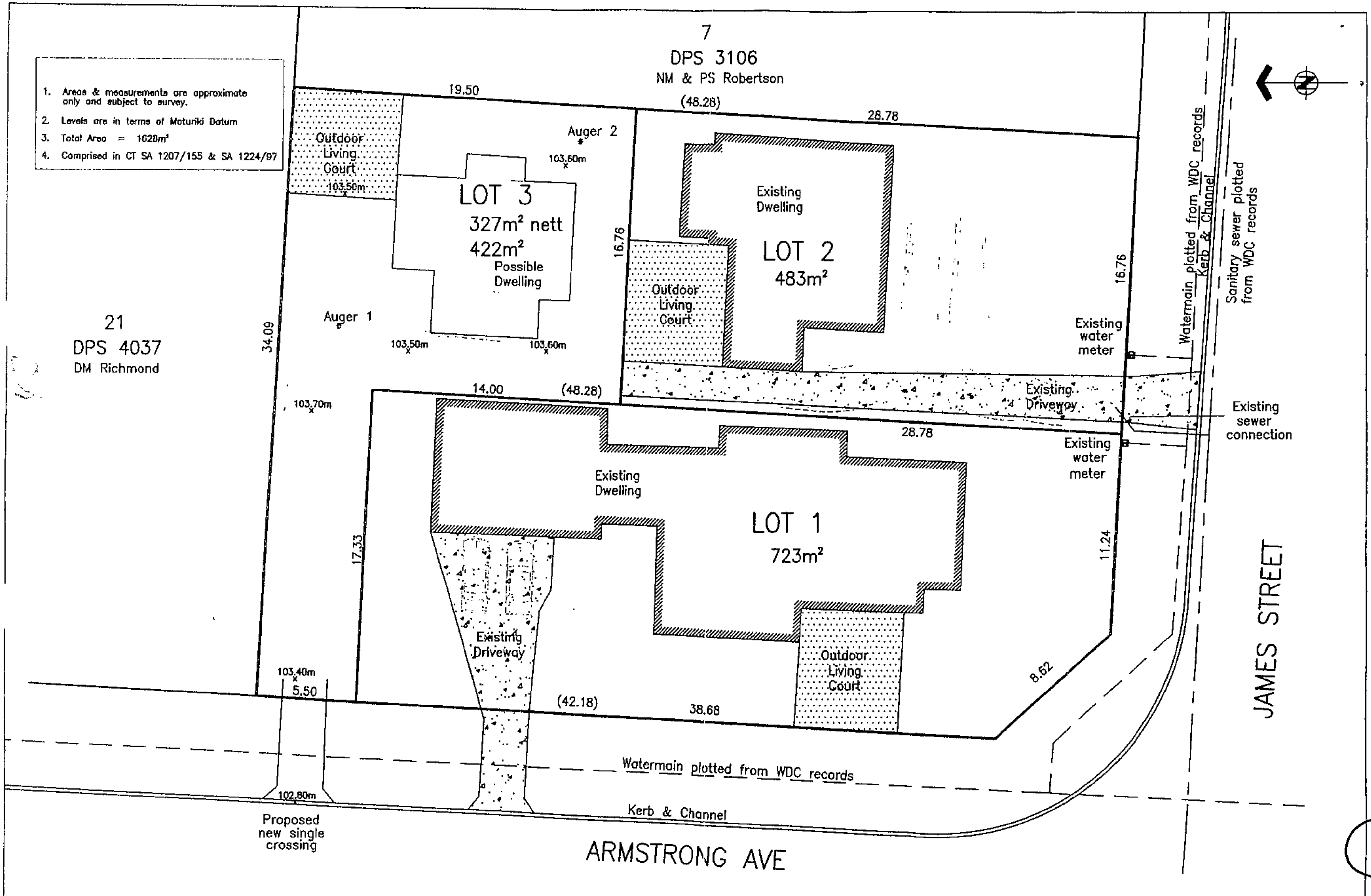
ale 1:10 | Title: F K Developments Limited
: | Date: Friday, 28 March 2008
ge No.: | Project: 21 Bridge Street, Whakatane

- Soak miss.
~ 10%



80 1.03.
90 1.04.

10mm/10min.
60mm/hr.



1. Areas & measurements are approximate only and subject to survey.
2. Levels are in terms of Moturiki Datum
3. Total Area = 1628m²
4. Comprised in CT SA 1207/155 & SA 1224/97

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				DESIGNED:	DATE:	SIGNED:	PLOT BY: SRW	
				DRAWN: SRW	DATE: 25/03/10	SIGNED:	PLOT DATE: 25/03/10	
D	WIDEN LOT 3 ACCESS	SRW	25/03/10	CHECKED: TPF	DATE: 25/03/10	SIGNED:	SURVEY BY:	
C	CHANGE LOT 3 TO A SINGLE GARAGE & ADD LEVELS	SRW	21/01/10					
B	MOVE LOT 3 DWELLING NORTH	SRW	15/01/10	APPROVED: SRW	DATE: 25/03/10	SIGNED:	SURVEY DATE:	
		BY	DATE					

ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND

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HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
Ground Floor Shelby House 23 Louvain Street Whakatane Ph 07 308 5478 Fax 07 308 4907

PROJECT:
HTM HOLDINGS LIMITED
112 & 114 JAMES S T
WHAKATANE

TITLE:
PROPOSED THREE LOT SUBDIVISION
OF LOTS 5 & 6 DPS 3106

ISSUE STATUS: FINAL
PROJECT No: 1730-129182-01
SCALES: 1:200
A3
DRAWING No: 129182-SC01
REV: D

File: WHAKATANE N:\1730\129182_A\CAD\DRAWING1.DWG

HARRISON GRIERSON CONSULTANTS LTD

HG

File No: 1730-129182-01

PERCOLATION TEST RESULT SHEET

Date: 3-Feb-10

Project Name: HTM Holdings Ltd

Location: 112 James St, Whakatane

Initials: SJG

Test No: 1

Depth of hole (mm): 1360

Diameter: 80mm

Actual time (hh:mm:ss)	Down to WL (mm)	Diff time (min)	Drop in WL (mm)	Head (mm)	Perc rate (mm/hr)		graphical information			
						Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 1										
0:00:00	0			1360		1360				
0:00:30	60	0.5	60	1300	7200	1300	7200			
0:01:00	90	0.5	30	1270	3600	1270	3600			
0:02:00	140	1.0	50	1220	3000	1220	3000			
0:03:00	180	1.0	40	1180	2400	1180	2400			
0:04:00	220	1.0	40	1140	2400	1140	2400			
0:05:00	260	1.0	40	1100	2400	1100	2400			
0:06:00	290	1.0	30	1070	1800	1070	1800			
0:07:00	300	1.0	10	1060	600	1060	600			
0:08:00	320	1.0	20	1040	1200	1040	1200			
0:09:00	340	1.0	20	1020	1200	1020	1200			
0:10:00	360	2.0	40	1000	1200	1000	1200			
0:15:00	430	5.0	70	930	840	930	840			
0:20:00	480	5.0	50	880	600	880	600			
0:30:00	530	10.0	50	830	300	830	300			
0:40:00	560	10.0	30	800	180	800	180			
1:00:00	580	20.0	20	780	60	780	60			
1:15:00	600	15.0	20	760	80	760	80			
1:35:00	610	20.0	10	750	30	750	30			
3:30:00	650	115.0	40	710	21	710	21			
Collapsed hole										

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geolab
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CLIENT: HTM Holdings Ltd

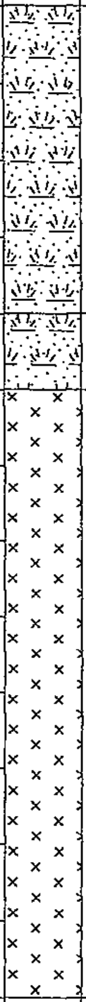
PROJECT: , 112 James Street, Whakatane

BOREHOLE No: HA1

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1730-129182-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	3/2/10	Ground Elevation:		Shear Vane No:	
Date Finished:	3/2/10	Water Level:			

NATURAL WATER CONTENT △
LIQUID LIMIT ✕
PLASTIC LIMIT ☐
50 100 150 (%)
SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	DEPTH (m)	LABORATORY TESTS
	0.0		Dark brown TOPSOIL.	0.0	
			TOPSOIL with colour lightening slightly.		
	0.5		Golden brown SILT.	0.5	
	1.0			1.0	
			Dry, golden SAND (fg to mg).		
	1.5			1.5	
	2.0			2.0	

SOIL HTM.GPJ GEOLAB.GDT 24/02/10

HARRISON GRIERSON CONSULTANTS LTD **HG** File No 1730-129182-01

PERCOLATION TEST RESULT SHEET Date 3-Feb-10

Project Name: HTM Holdings Ltd Location: 112 James St, Whakatane Initials SJG

Test No: 2 Depth of hole (mm): 1150 Diameter: 80mm

Actual time (hh:mm:ss)	Down to WL (mm)	Diff time (min)	Drop in WL (mm)	Head (mm)	Perc rate (mm/hr)	graphical information				
						Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 2										
0:00:00	0			1150		1150				
0:00:30	490	1.0	490	660	29400	660	29400			
0:01:00	540	0.5	50	610	6000	610	6000			
0:02:00	690	1.0	150	460	9000	460	9000			
0:03:00	790	1.0	100	360	6000	360	6000			
0:04:00	860	1.0	70	290	4200	290	4200			
0:05:00	910	1.0	50	240	3000	240	3000			
0:06:00	945	1.0	35	205	2100	205	2100			
0:07:00	970	1.0	25	180	1500	180	1500			
0:08:00	990	1.0	20	160	1200	160	1200			
0:09:00	1000	1.0	10	150	600	150	600			
0:10:00	1025	1.0	25	125	1500	125	1500			
0:11:00	0	REFILL	0	1150		1150				
0:11:30	470	0.5	470	680	56400	680	56400			
0:12:00	625	0.5	155	525	18600	525	18600			
0:13:00	770	1.0	145	380	8700	380	8700			
0:14:00	850	1.0	80	300	4800	300	4800			
0:15:00	900	1.0	50	250	3000	250	3000			
0:16:00	940	1.0	40	210	2400	210	2400			
0:17:00	960	1.0	20	190	1200	190	1200			
0:18:00	980	1.0	20	170	1200	170	1200			
0:19:00	1000	1.0	20	150	1200	150	1200			
0:20:00	1015	1.0	15	135	900	135	900			
0:21:00	1030	1.0	15	120	900	120	900			

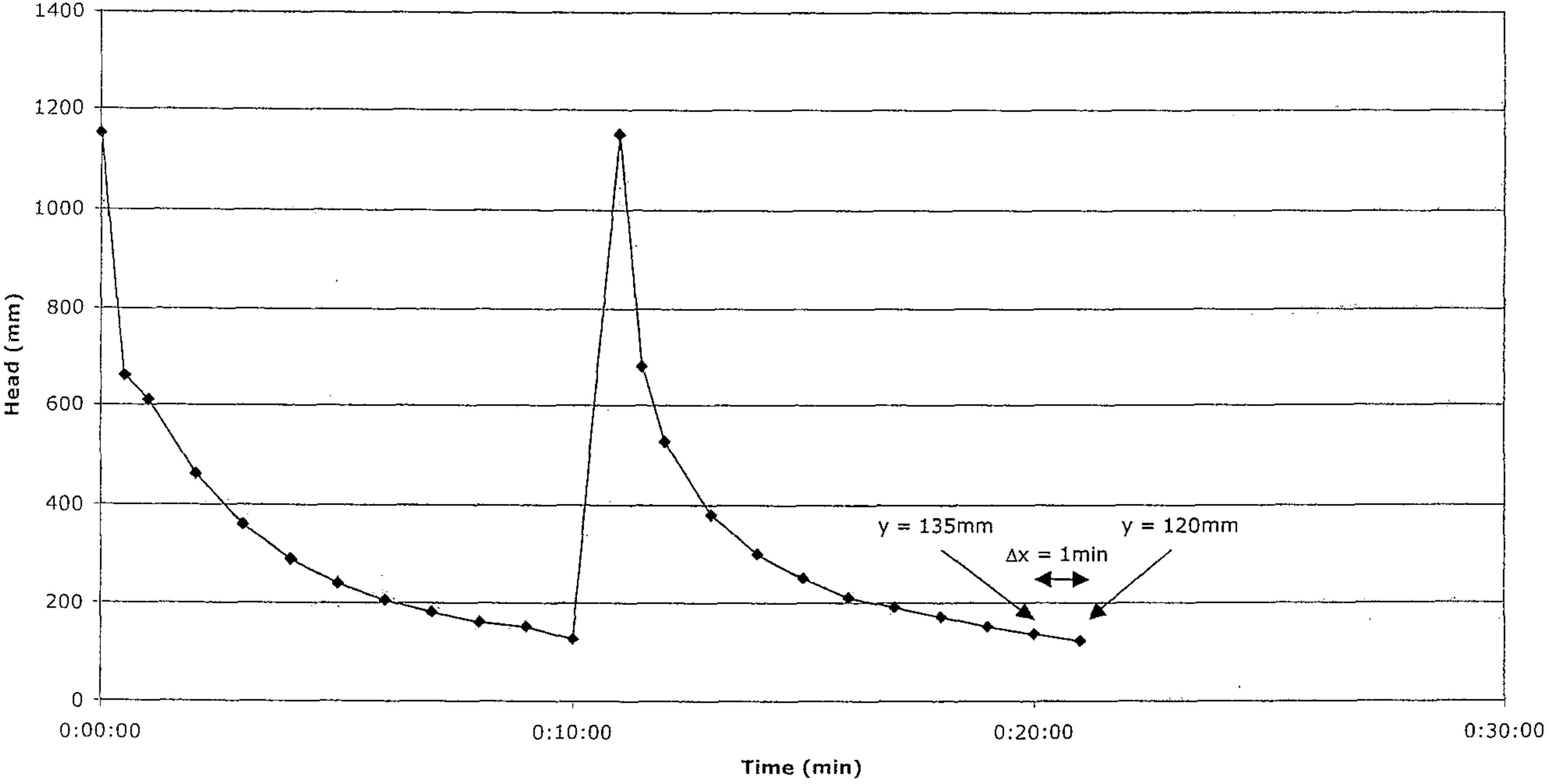
CLIENT:	HTM Holdings Ltd	BOREHOLE No: HA2
PROJECT:	, 112 James Street, Whakatane	Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1730-129182-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	3/2/10	Ground Elevation:		Shear Vane No:	
Date Finished:	3/2/10	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT ☐ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ⊙ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
	0.0		Medium to dark brown TOPSOIL.	0.0		
			TOPSOIL. Colour slightly lighter. Dry.			
	0.5		Light coloured fine grained sandy SILT.	0.5		
			Course grained SAND. Gold colour, dry.			
			Course grained SAND. Slightly lighter colour, and slightly larger particle size.			
	1.0			1.0		
	1.5			1.5		
	2.0			2.0		

SOIL HTM.GPJ GEOLAB.GDT 24/02/10

112 James Street, Whakatane
Soak Hole Test 2
Head



geolab
air, soil & water
laboratory services

CLIENT: River Quays Ltd
PROJECT: , 139 James Street, Whakatane

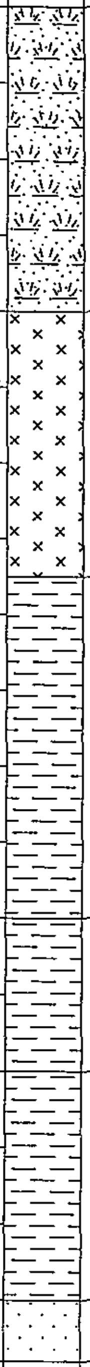
BOREHOLE No: HA1
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1730-129349-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	11/2/10	Ground Elevation:		Shear Vane No:	
Date Finished:	11/2/10	Water Level:			

GROUND WATER | DEPTH (m) | GRAPHIC LOG | SOIL DESCRIPTION
MAIN\minor components, strength, colour structure, weathering | DEPTH (m) | LABORATORY TESTS

NATURAL WATER CONTENT △
LIQUID LIMIT ✕
PLASTIC LIMIT ☐
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)



Medium brown TOPSOIL.

Light brown SILT.

CLAY, with some sand.

Increasing moisture content.

Grey CLAY. Moist.

Coarse white/grey SAND.

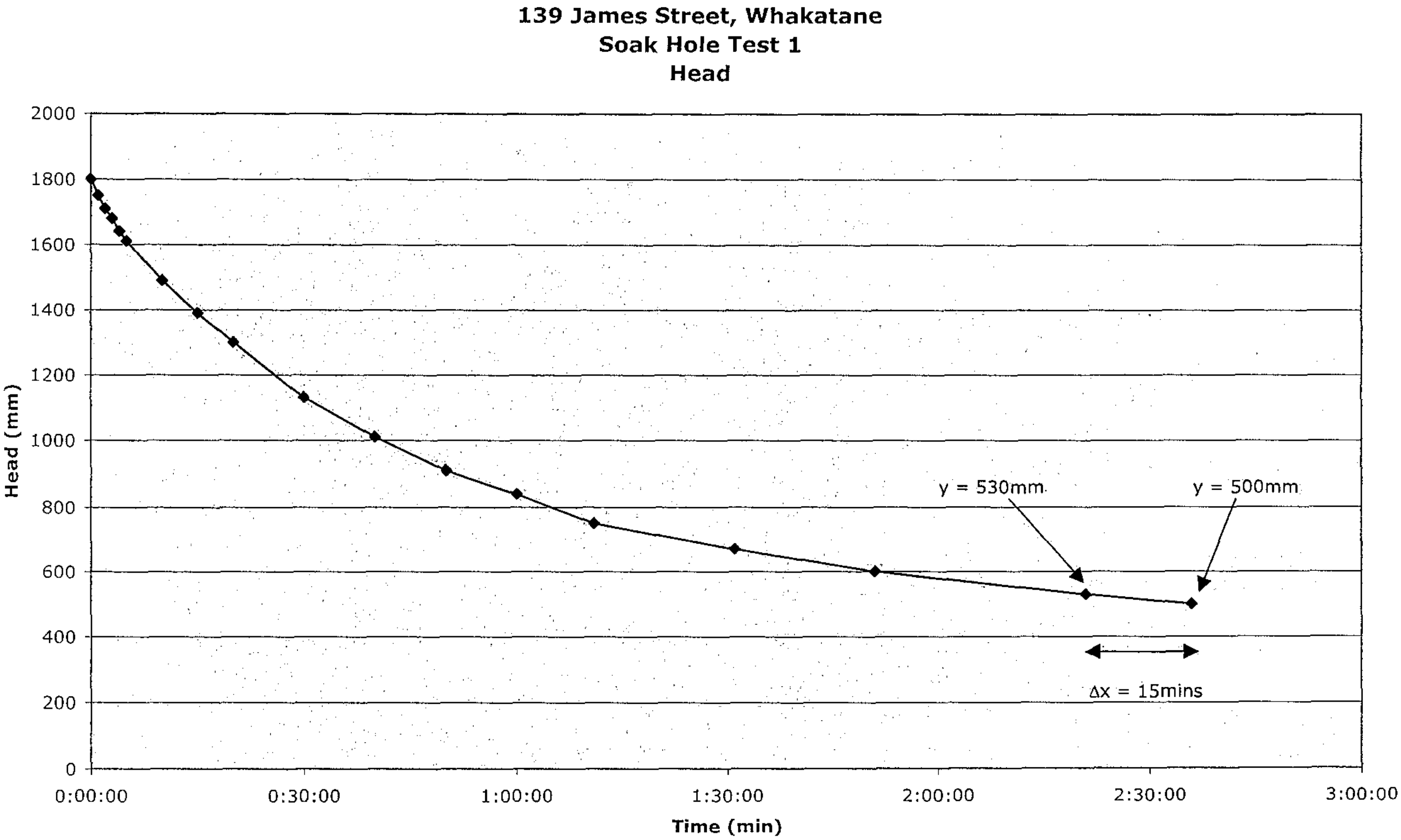
SOIL RQ.GPJ GEOLAB.GDT 25/02/10

HARRISON GRIERSON CONSULTANTS LTD HG

PERCOLATION TEST RESULT SHEET

Project Name:	River Quays Ltd	Location:	139 James Street, Whakatane
Test No:	1	Depth of hole (mm):	1800
Diameter:	80mm		
File No	1730-129349-01	Date	11-Feb-10
Initials	SJG		

Actual time	Down to	Diff time	Drop in	Head	Perc rate		graphical information			
(hh:mm:ss)	WL (mm)	(min)	WL (mm)	(mm)	(mm/hr)	Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 1										
0:00:00	0			1800		1800				
0:01:00	50	1.0	50	1750	3000	1750	3000			
0:02:00	90	1.0	40	1710	2400	1710	2400			
0:03:00	120	1.0	30	1680	1800	1680	1800			
0:04:00	160	1.0	40	1640	2400	1640	2400			
0:05:00	190	1.0	30	1610	1800	1610	1800			
0:10:00	310	5.0	120	1490	1440	1490	1440			
0:15:00	410	5.0	100	1390	1200	1390	1200			
0:20:00	500	5.0	90	1300	1080	1300	1080			
0:30:00	670	10.0	170	1130	1020	1130	1020			
0:40:00	790	10.0	120	1010	720	1010	720			
0:50:00	890	20.0	220	910	660	910	660			
1:00:00	960	10.0	70	840	420	840	420			
1:11:00	1050	11.0	90	750	491	750	491			
1:31:00	1130	20.0	80	670	240	670	240			
1:51:00	1200	20.0	70	600	210	600	210			
2:21:00	1270	30.0	70	530	140	530	140			
2:36:00	1300	15.0	30	500	120	500	120			


139 James Street, Whakatane
Soak Hole Test 1
Head
Head (mm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0:00:00
0:30:00
1:00:00
1:30:00
2:00:00
2:30:00
3:00:00
Time (min)
y = 530mm
y = 500mm
Δx = 15mins

geolab
air, soil & water
laboratory services

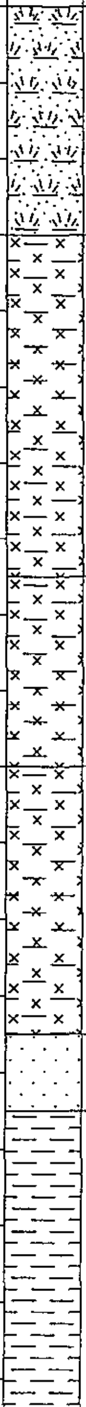
CLIENT:	River Quays Ltd
PROJECT:	, 139 James Street, Whakatane

BOREHOLE No: HA2

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1730-129349-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	11/2/10	Ground Elevation:		Shear Vane No:	
Date Finished:	11/2/10	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ⊙ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
	0.0		Medium brown, crumbly TOPSOIL.	0.0		
			Crumbly, light brown Clayey SILT.			
	0.5			0.5		
			Golden Clayey SILT.			
	1.0		Increasing clay content and increasing moisture.	1.0		
			White SAND (fg).			
	1.5		Moist, sticky, light brown CLAY.	1.5		
			Wet CLAY.			
	2.0			2.0		



SOIL RQ.GPJ GEOLAB.GDT 25/02/10

HARRISON GRIERSON CONSULTANTS LTD **HG**

File No 1730-129349-01

PERCOLATION TEST RESULT SHEET

Date 11-Feb-10

Project Name: River Quays Ltd

Location: 139 James Street, Whakatane

Initials SJG

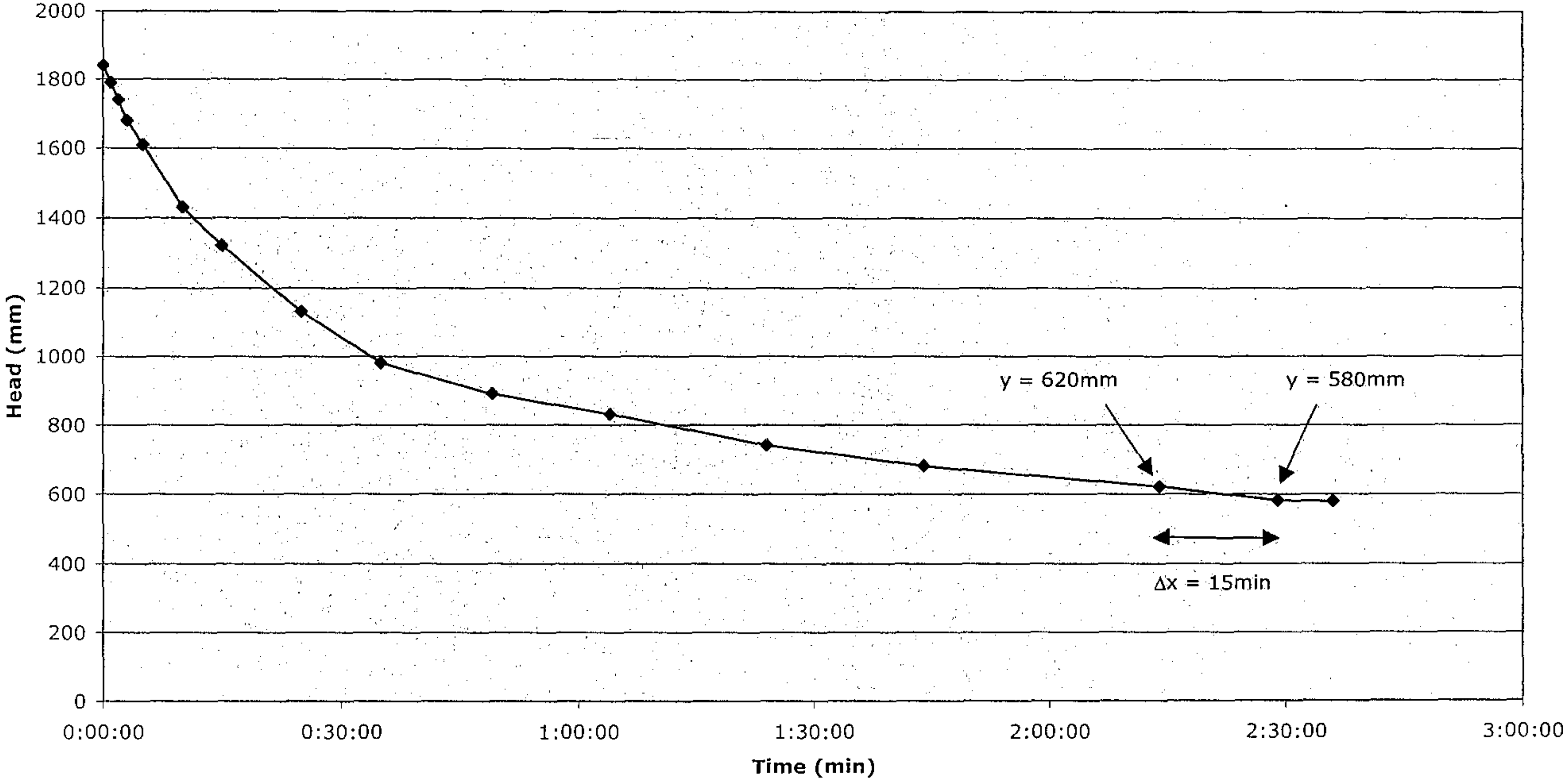
Test No: 2

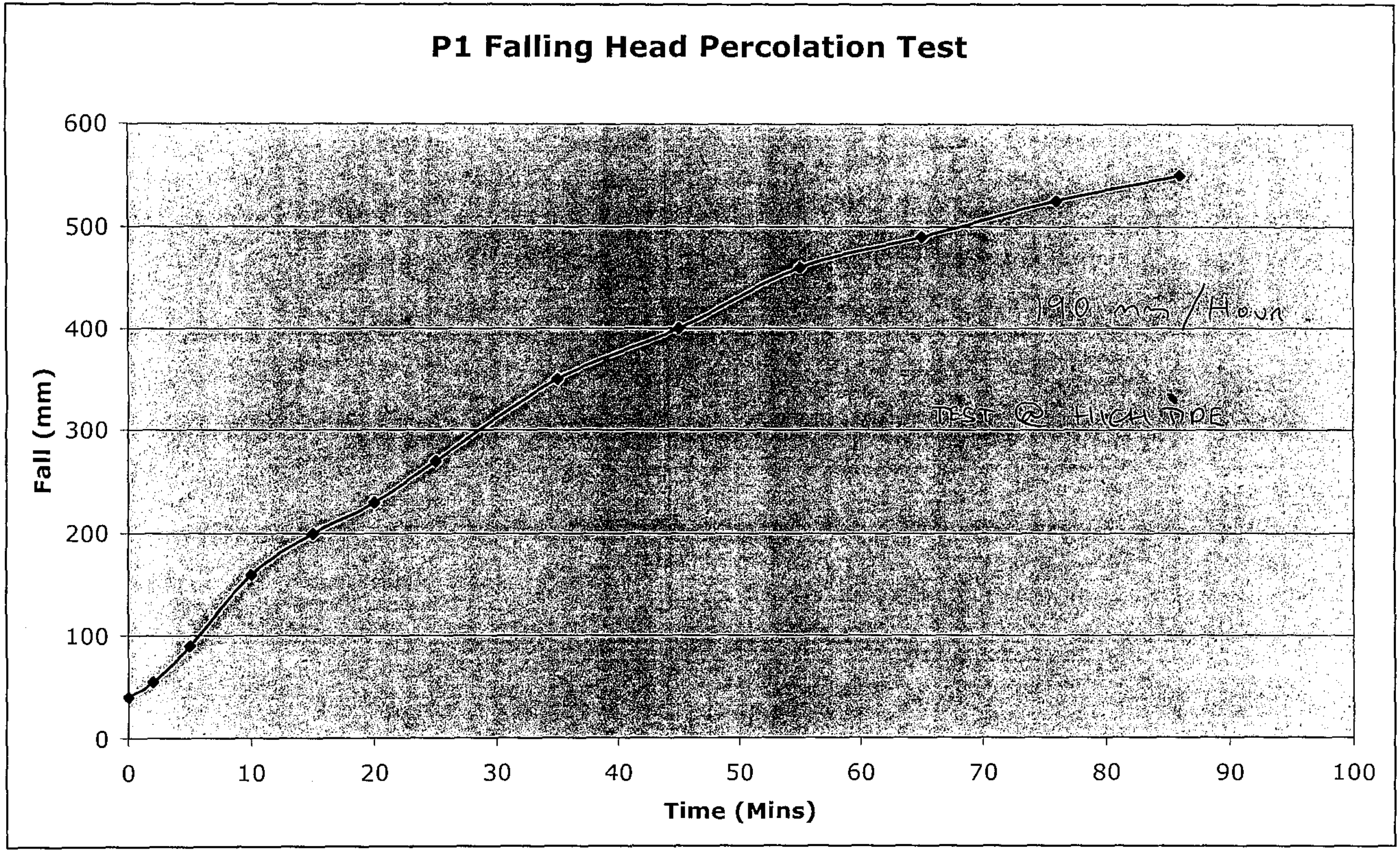
Depth of hole (mm): 1840

Diameter: 80mm

Actual time	Down to	Diff time	Drop in	Head	Perc rate	graphical information				
(hh:mm:ss)	WL (mm)	(min)	WL (mm)	(mm)	(mm/hr)	Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 2										
0:00:00	0			1840		1840				
0:01:00	50	1.0	50	1790	3000	1790	3000			
0:02:00	100	1.0	50	1740	3000	1740	3000			
0:03:00	160	1.0	60	1680	3600	1680	3600			
0:05:00	230	2.0	70	1610	2100	1610	2100			
0:10:00	410	5.0	180	1430	2160	1430	2160			
0:15:00	520	5.0	110	1320	1320	1320	1320			
0:25:00	710	10.0	190	1130	1140	1130	1140			
0:35:00	860	10.0	150	980	900	980	900			
0:49:00	950	14.0	90	890	386	890	386			
1:04:00	1010	15.0	60	830	240	830	240			
1:24:00	1100	20.0	90	740	270	740	270			
1:44:00	1160	20.0	60	680	180	680	180			
2:14:00	1220	30.0	60	620	120	620	120			
2:29:00	1260	15.0	40	580	160	580	160			
2:36:00	1261	7.0	1	579	9	579	9			

139 James Street, Whakatane
Soak Hole Test 2
Head

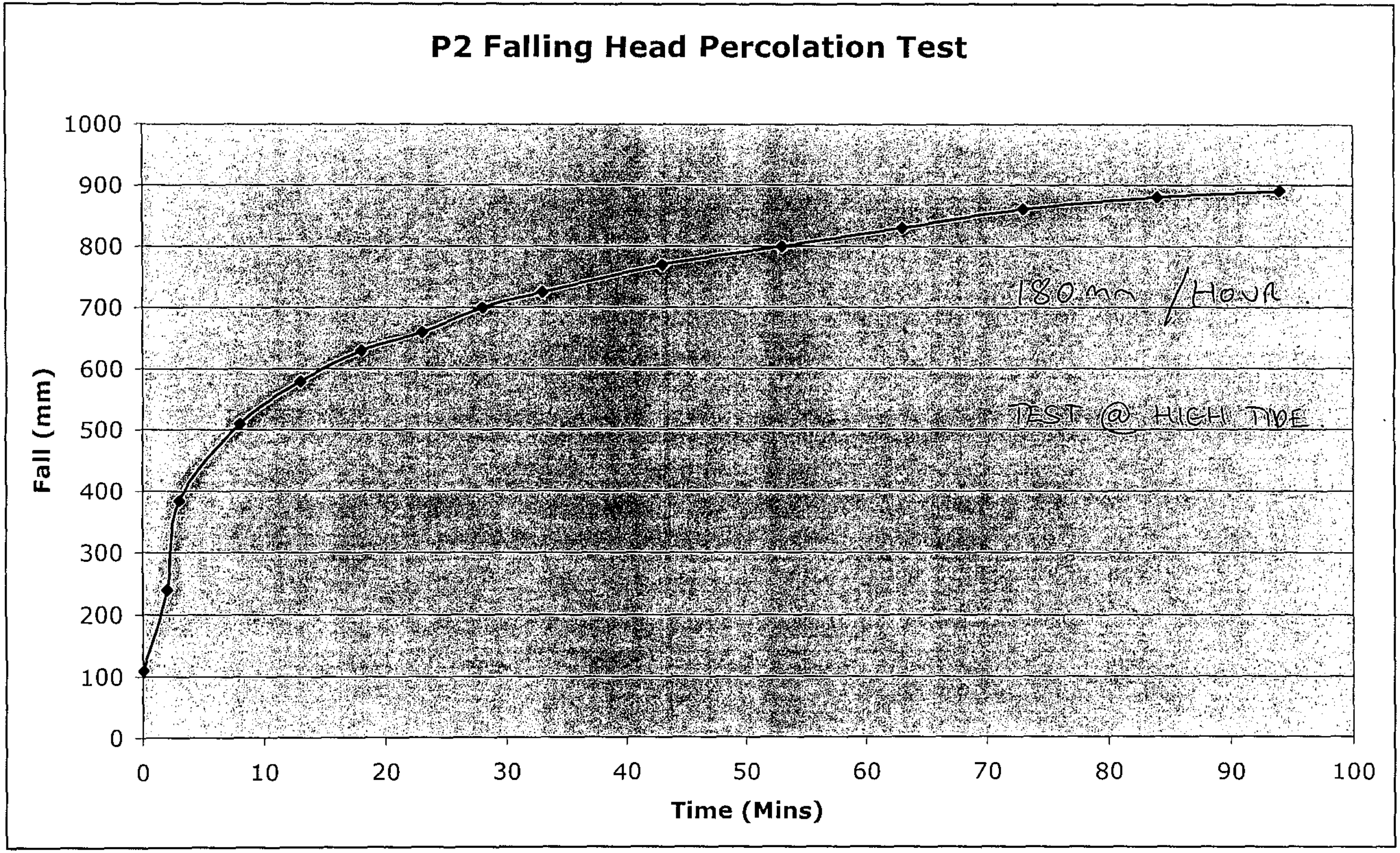




P1 Falling Head Percolation Test

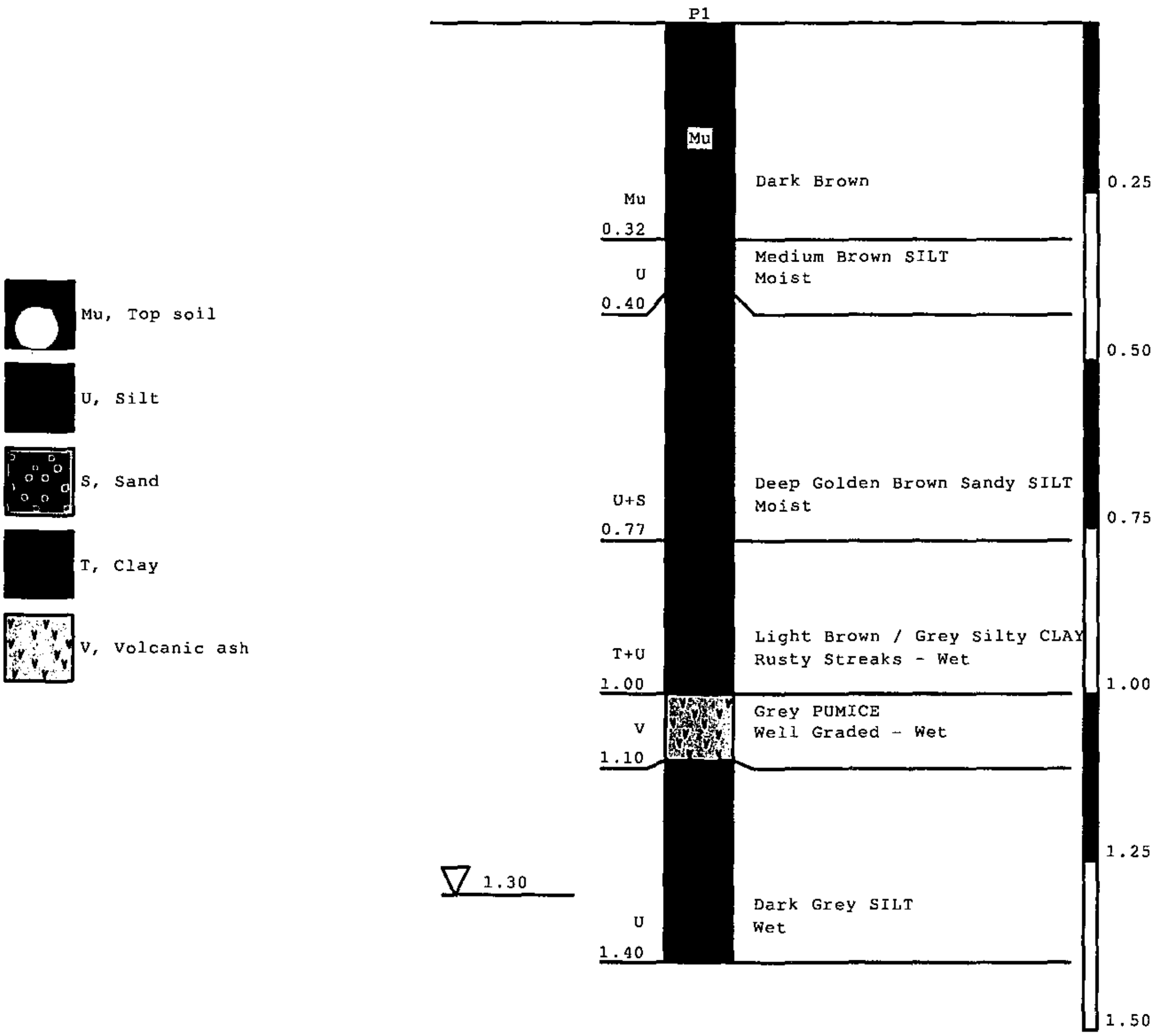
190 mm/Hour

TEST @ HIGH SIDE


P2 Falling Head Percolation Test

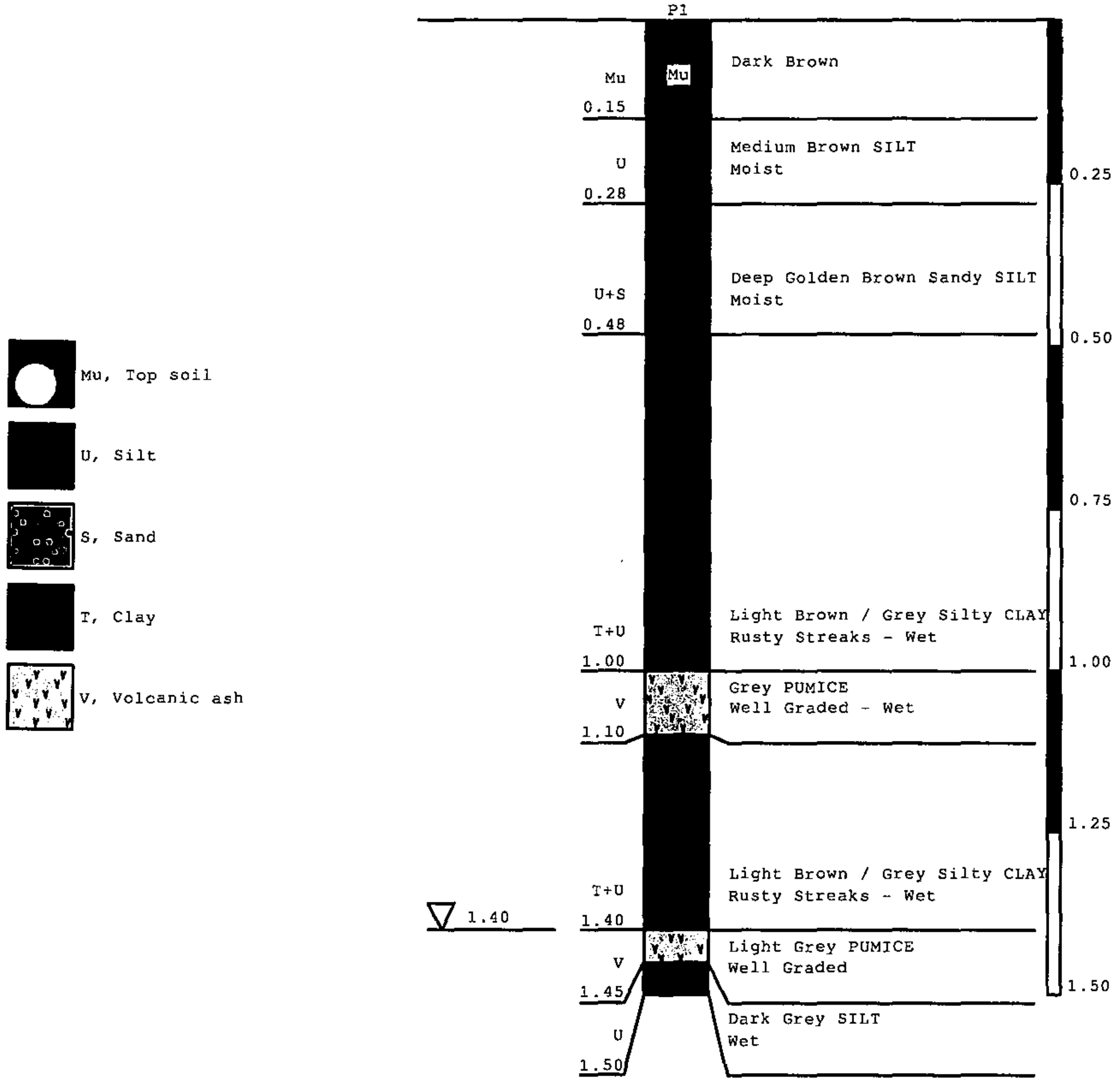
180mm /HOUR.

TEST @ HIGH TIDE.



Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane. Tel. 07 3085478 Fax 07 3084907

cale 1:10	Title: 92 Eivers Road, Whakatane
ile:	Date: Wednesday, 4 March 2009
age No.:	Project: Falling Head Percolation Tests



Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane. Tel. 07 3085478 Fax 07 3084907

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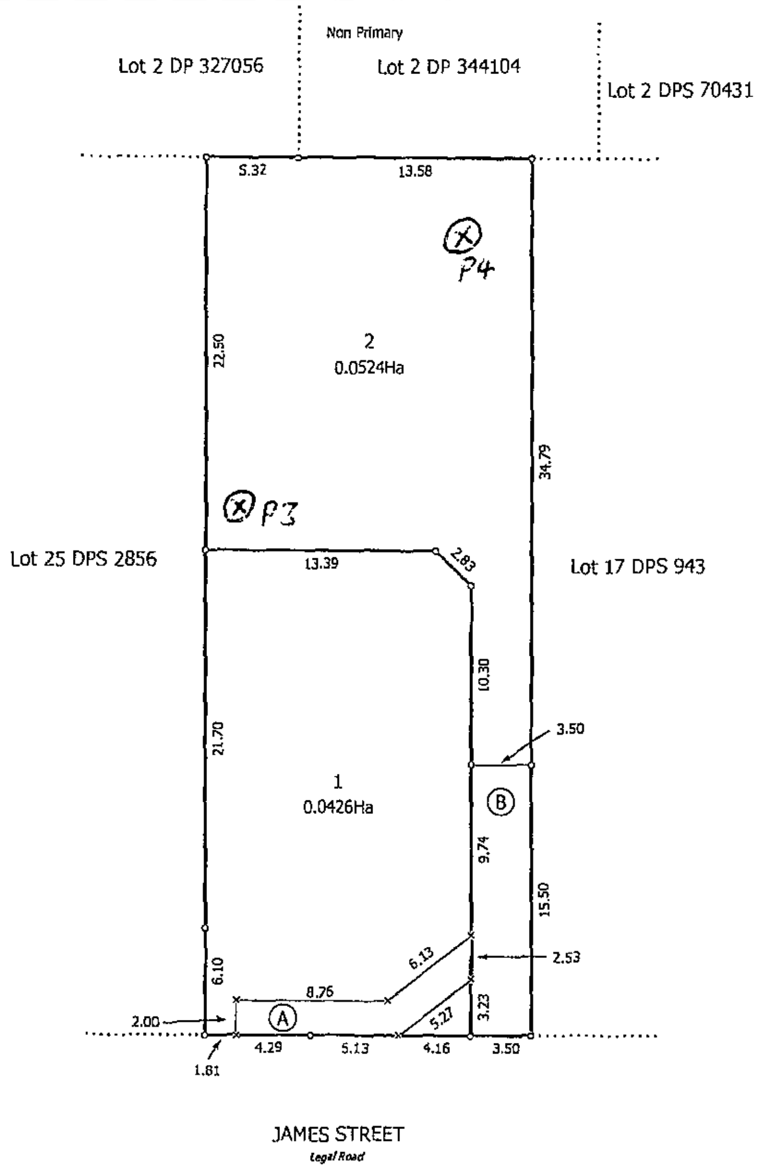
ile:	Date: Wednesday, 4 March 2009
age No.:	Project: Falling Head Percolation Tests



LOCATION OF BORE HOLES
& PERCOLATION TESTS

T 1/1

Land District: South Auckland

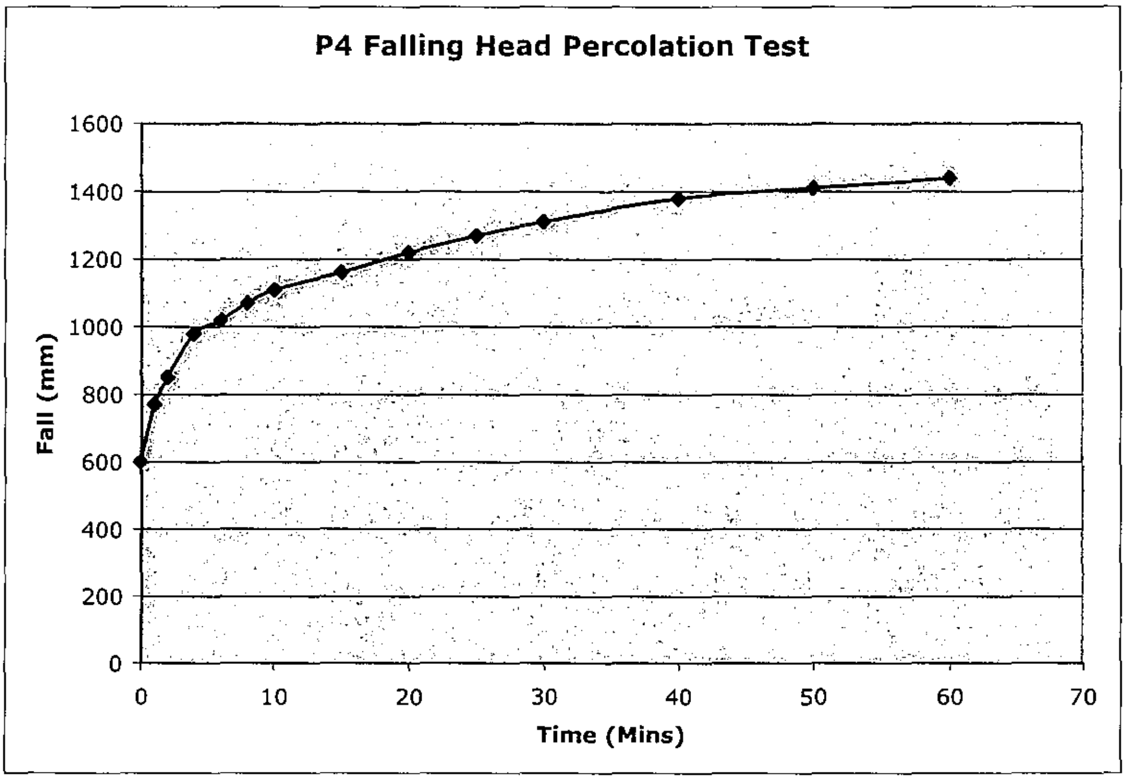
Digitally Generated Plan
Generated on: 16/06/2009 10:39am Page 3 of 3

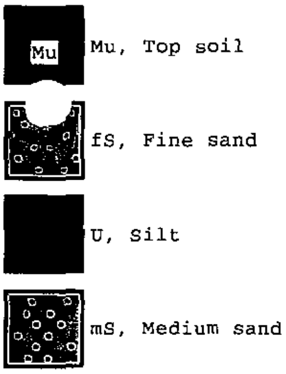
Lots 1 & 2 being a subdivision of Lot 16 DPS 943 & Lot 27 DPS 2856

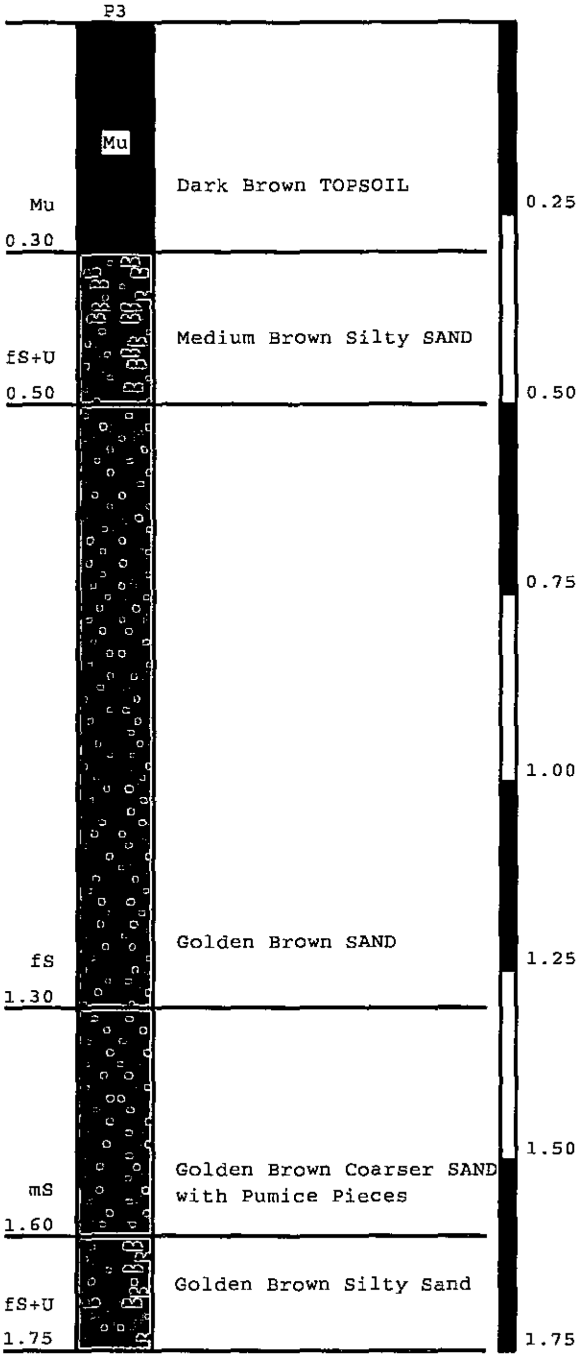
Surveyor: Scott Robert Blake Williamson
Firm: Harrison Grierson Consultants Ltd (Au

Digital Title Plan
LT 419728
Approved on: 16/06/2009

BENBOW - 164 JAMES STREET 28/07/09

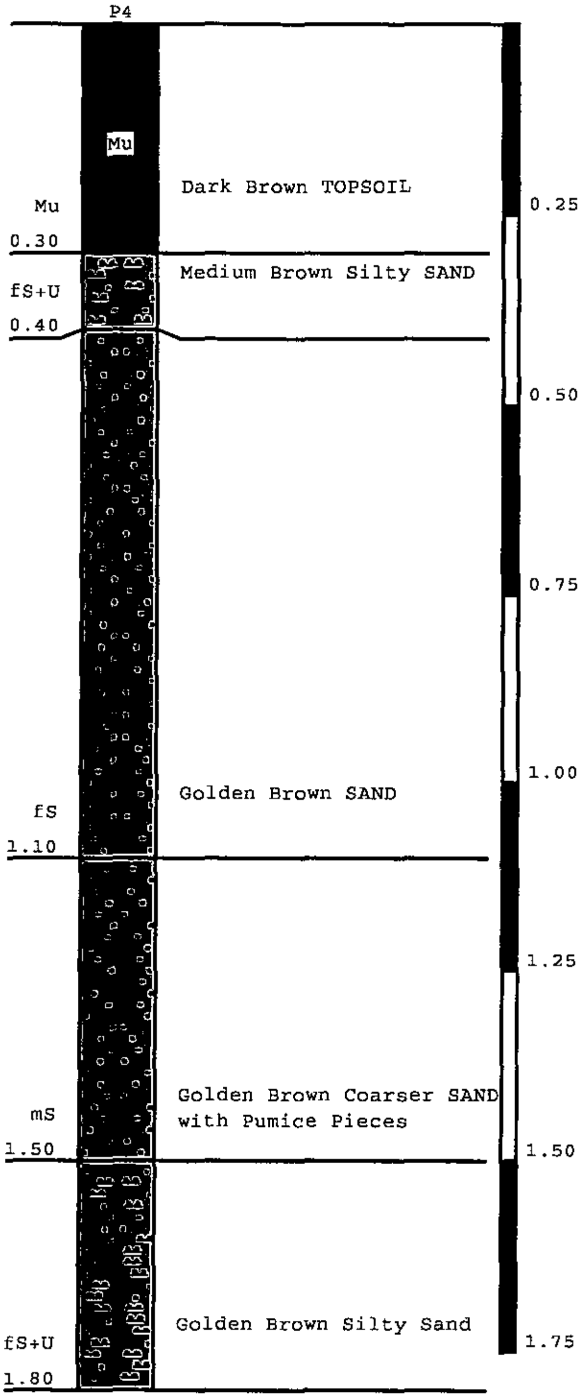






Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane. Tel. 07 3085478 Fax 07 3084907

cale 1:10	Title: Mike Benbow
ile:	Date: Tuesday, 9 June 2009
age No.:	Project: 164 James Street, Whakatane



■ Mu, Top soil

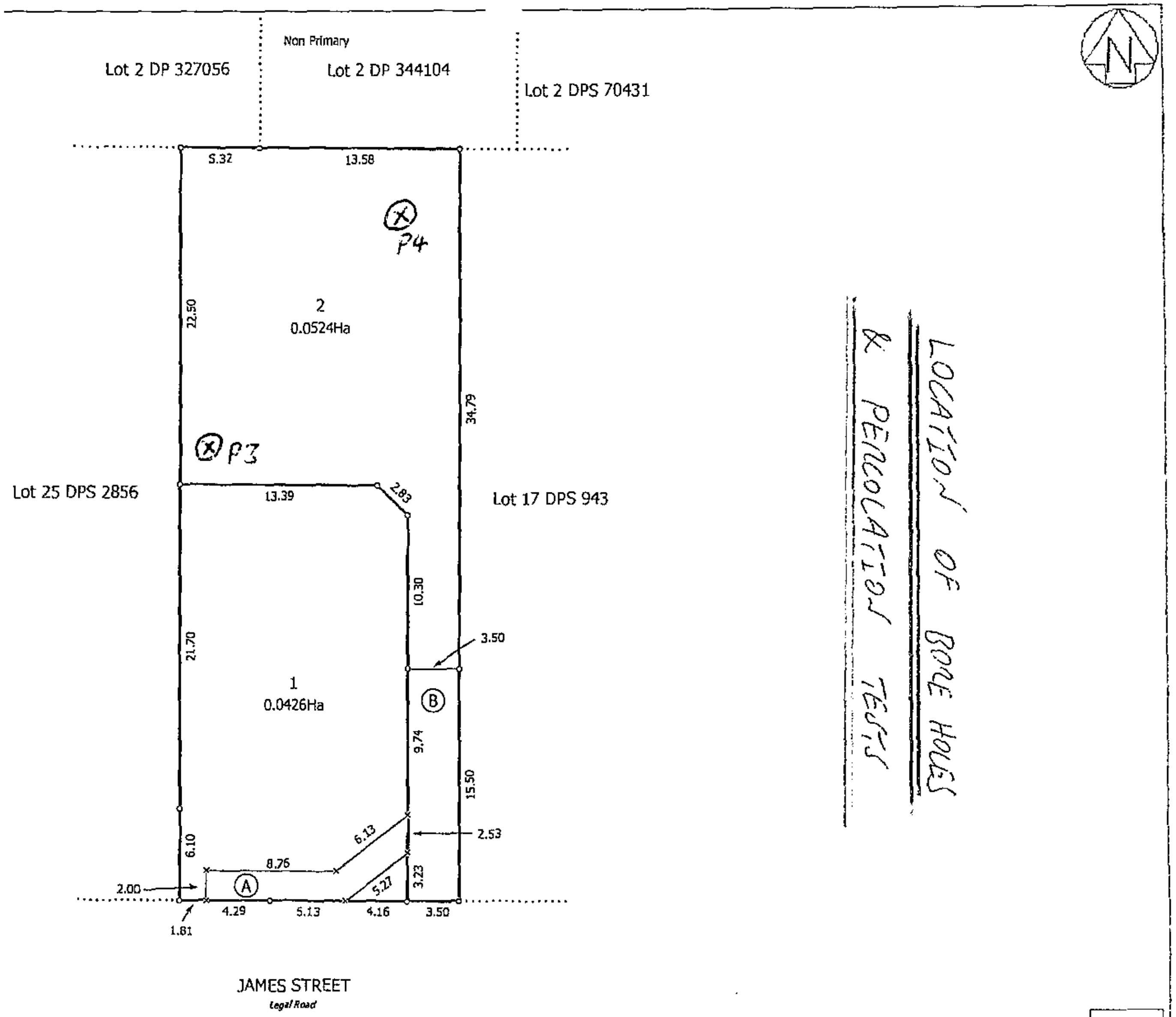
▨ fS, Fine sand

■ U, Silt

▨ mS, Medium sand

Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane. Tel. 07 3085478 Fax 07 3084907

Scale 1:10	Title: Mike Benbow
File:	Date: Tuesday, 9 June 2009
Page No.:	Project: 164 James Street, Whakatane



T1/1

Land District: South Auckland

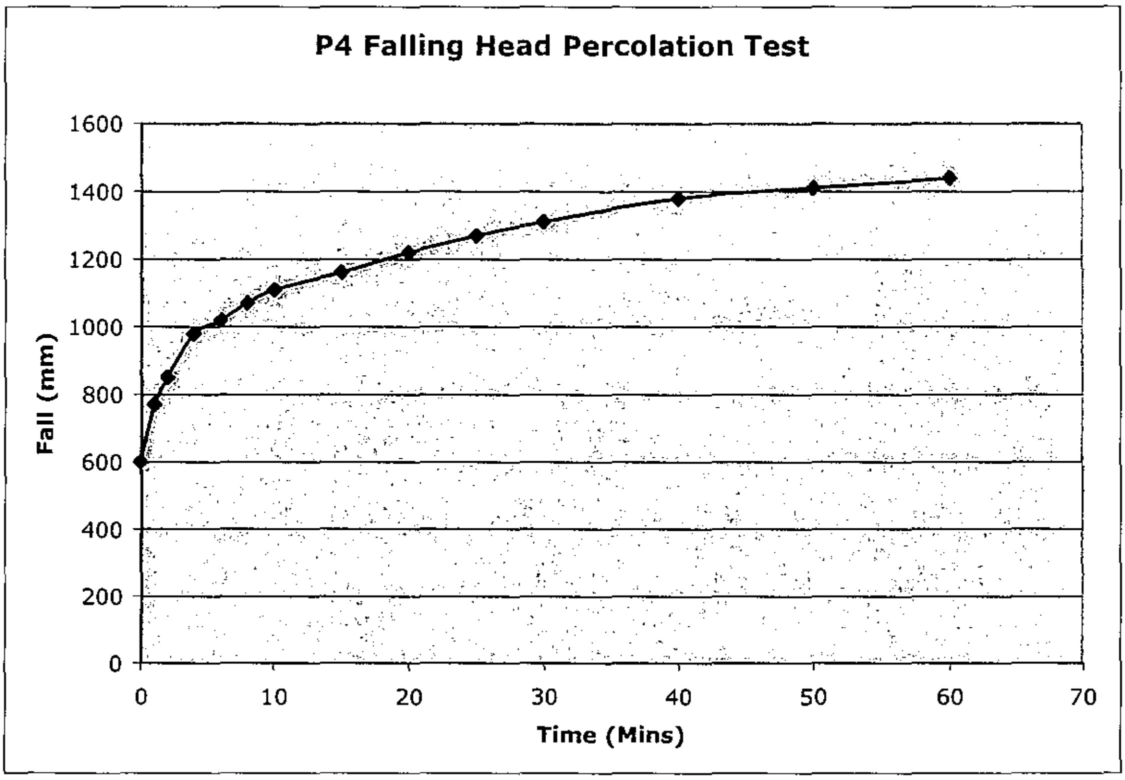
Digitally Generated Plan
Generated on: 16/06/2009 10:39am Page 3 of 3

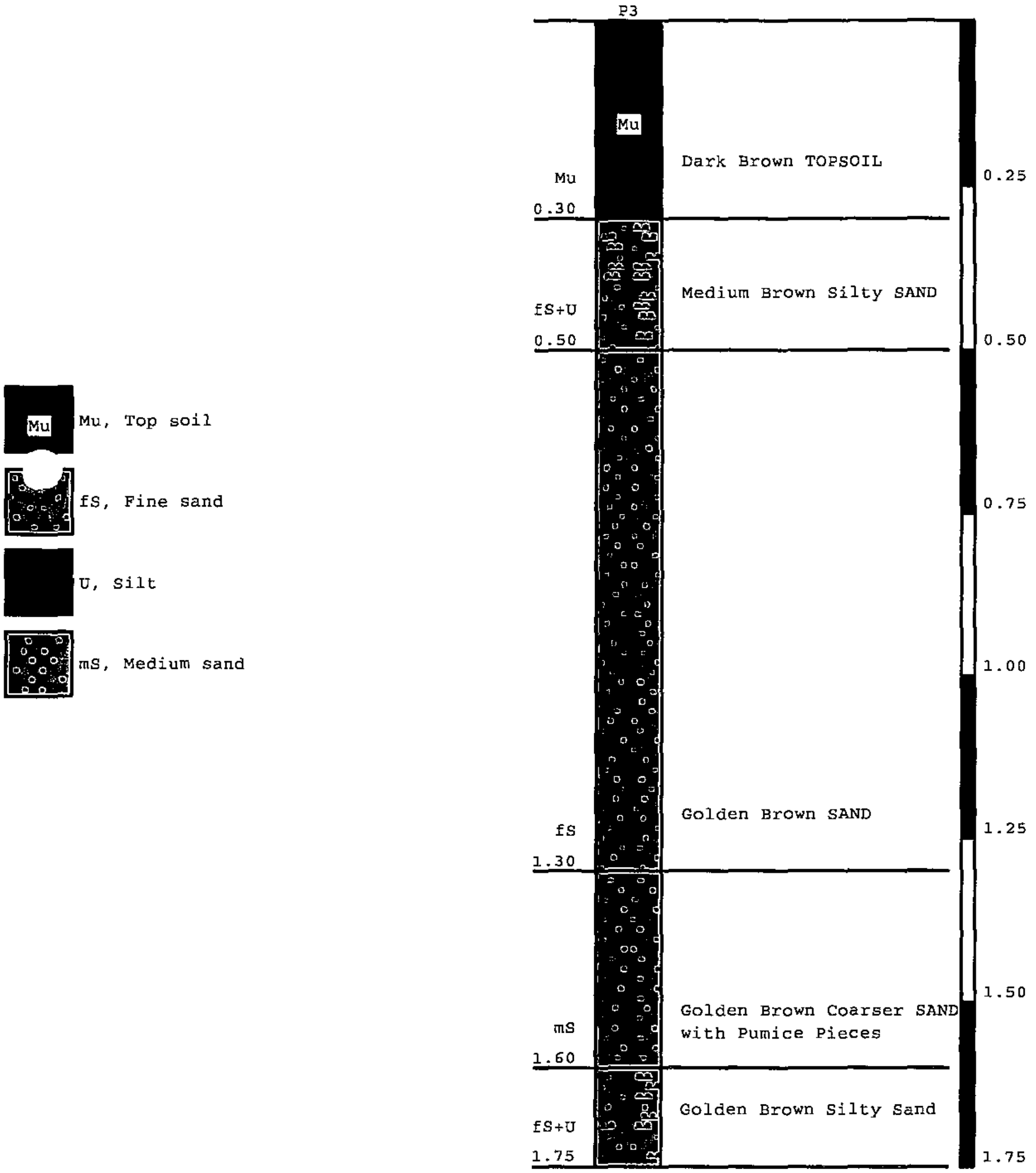
Lots 1 & 2 being a subdivision of Lot 16 DPS 943 & Lot 27 DPS 2856

Surveyor: Scott Robert Blake Williamson
Firm: Harrison Grierson Consultants Ltd (Au

Digital Title Plan
LT 419728
Approved on: 16/06/2009

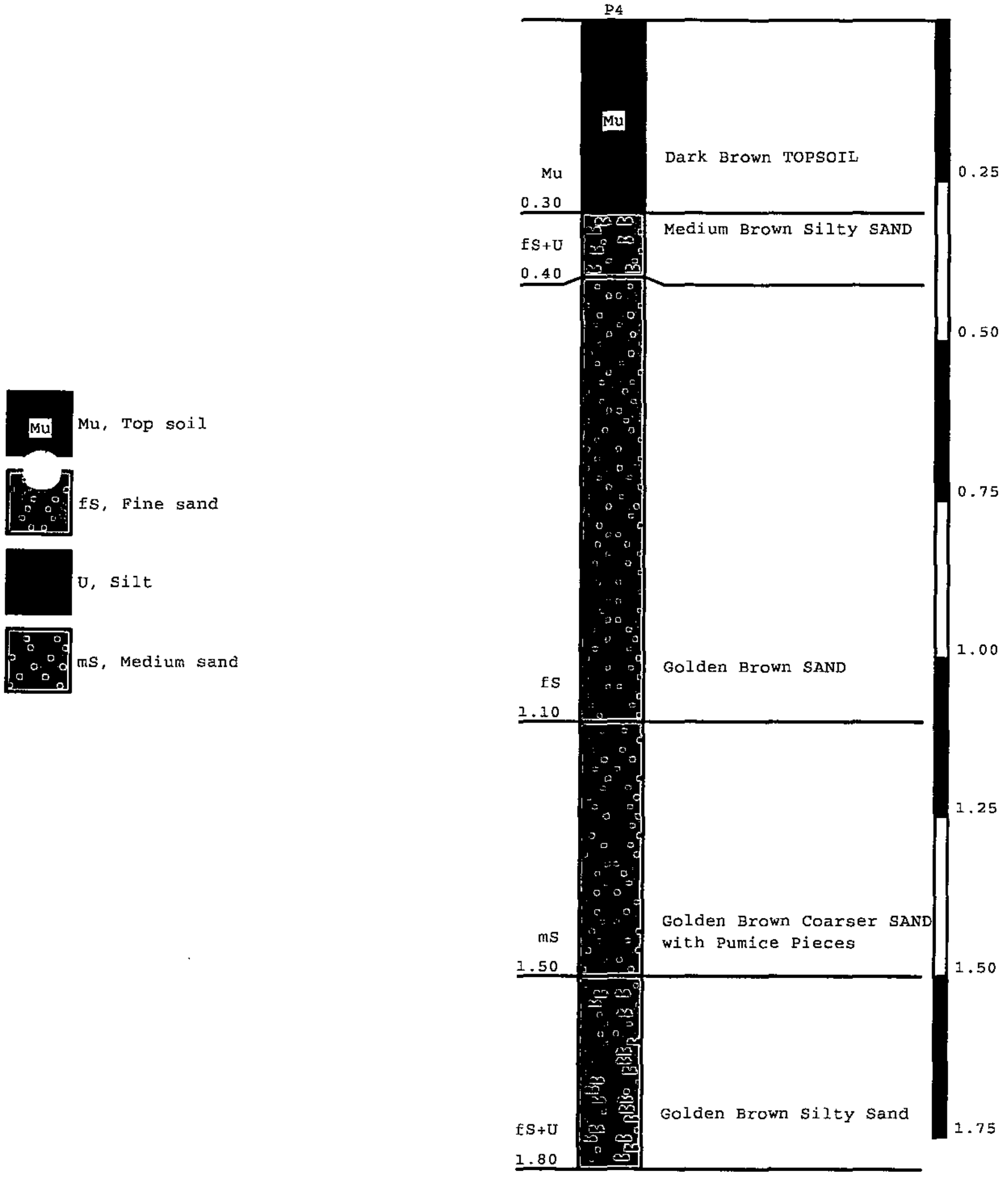
BENBOW - 164 JAMES STREET 28/07/09





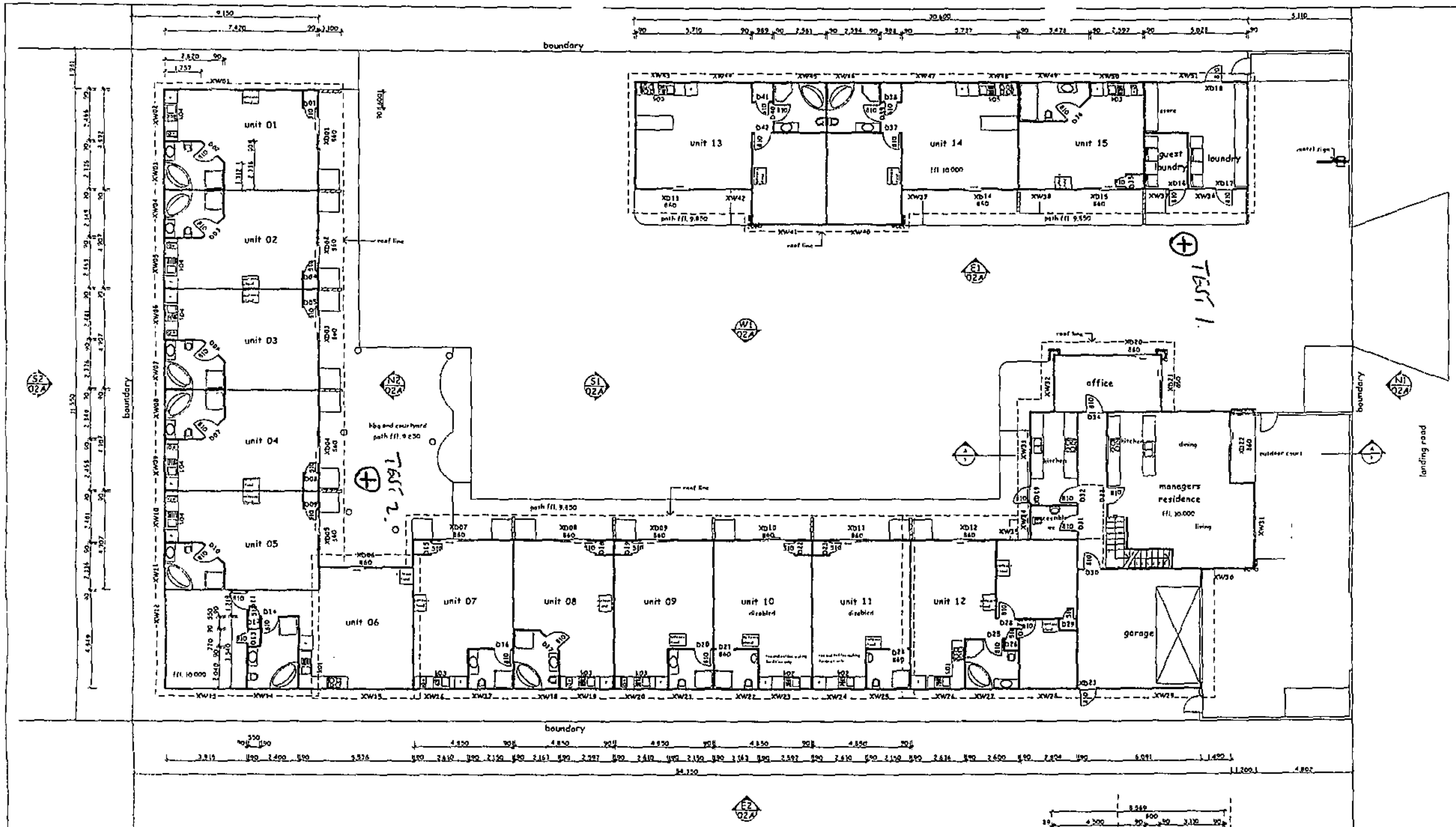
Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane. Tel. 07 3085478 Fax 07 3084907

cale 1:10	Title: Mike Benbow
ile:	Date: Tuesday, 9 June 2009
age No.:	Project: 164 James Street, Whakatane

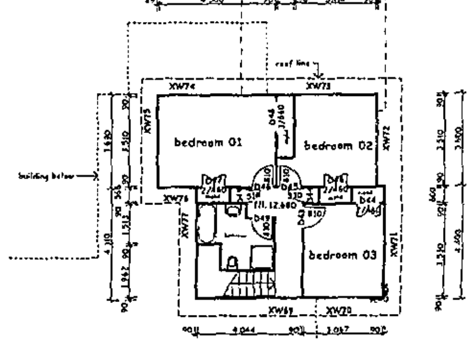


Harrison Grierson Consultants Limited
22 Louvain Street, Whakatane. Tel. 07 3085478 Fax 07 3084907

Scale 1:10	Title: Mike Benbow
File:	Date: Tuesday, 9 June 2009
Page No.:	Project: 164 James Street, Whakatane



proposed ground floor 1
scale 1:100



proposed first floor
scale 1:100

floor layout plan legend

═	fence
▬	timber frame walls 90 x 45 MSG8 H1.2 studs at max. 600 ctrs with nogs at max. 800 ctrs
▬	noise control timber frame walls spec No GBTA 45a 2 layers 13mm gib 90 x 45 MSG8 H1.2 studs at max 600 ctrs with nogs at max 800 ctrs pink batts silencer insulation gib rail 2 layers 13mm gib STC 55
▨	timber frame privacy walls 140 x 45 MSG8 H3.1 studs at max. 600 ctrs with nogs at max. 800 ctrs
▨	classic stone, NZ mountain slate feature wall

issue	date	description
4	31.11.10	building consent & tender

carling

Client
#Client

Project
THE GOOD MOTEL

Drawing Title
PROPOSED FLOOR PLAN

Job No	3262	Scale	as noted @ A1
		Date	31.11.10
Sheet No	01A 1 of 3	Drawn	DG
		Checked	

Do not scale this drawing
Contractor to verify all dimensions on site
Any discrepancies between the documents and the layout shown shall be referred to the architect for clarification
THESE DRAWINGS ARE TO REMAIN THE COPYRIGHT OF CARLING ARCHITECTS LTD

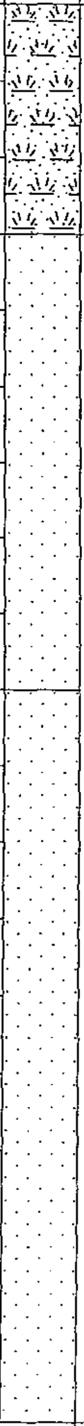
31

geolab
air, soil & water
laboratory services

CLIENT:	Jason Good	BOREHOLE No: BH1
PROJECT:	New Motel Development, 37-39 Landing Road, Whakatane	Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1720-130067-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	9/11/10	Ground Elevation:		Shear Vane No:	
Date Finished:	9/11/10	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT ☐ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ⊙ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
	0.0		Light coloured, dusty, hard TOPSOIL	0.0		
			Orange/brown, dry uniform graded (fg) SAND			
	0.5			0.5		
			Light brown, dry, uniform graded SAND. Particle size slightly increased.			
	1.0			1.0		
	1.5			1.5		
	2.0			2.0		



SOIL GOOD.GPJ GEOLAB.GDT 16/11/10

HARRISON GRIERSON CONSULTANTS LTD

HG

File No 1720-130067-01

PERCOLATION TEST RESULT SHEET

Date 16-Feb-10

Project Name: Good Motel

Location: 37-39 Landing Road

Initials SJG

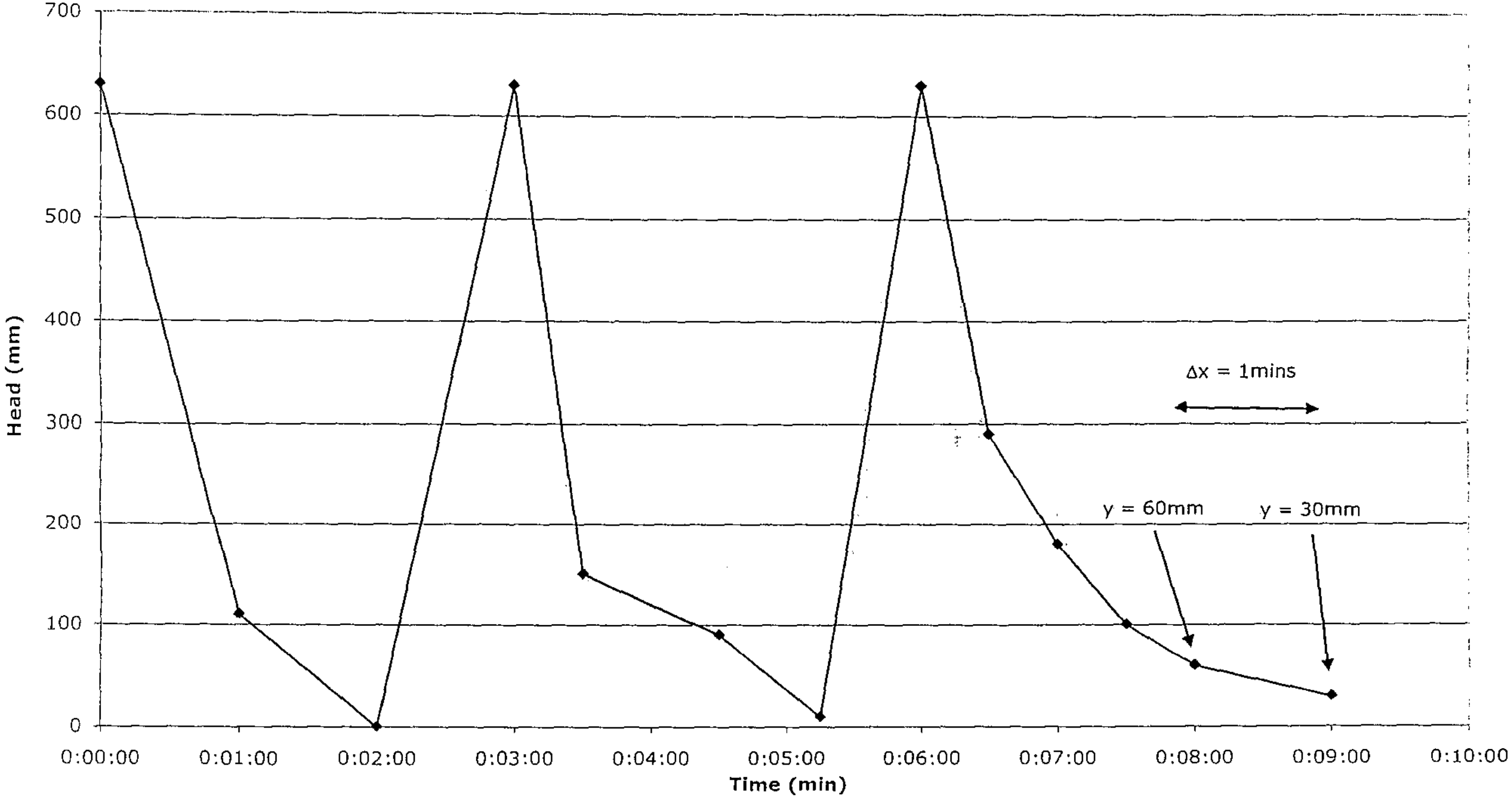
Test No: 1

Depth of hole (mm): 630

Diameter: 80mm

Actual time	Down to	Diff time	Drop in	Head	Perc rate		graphical information			
(hh:mm:ss)	WL (mm)	(min)	WL (mm)	(mm)	(mm/hr)	Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 1										
0:00:00	0			630		630				
0:01:00	520	1.0	520	110	31200	110	31200			
0:02:00	630	1.0	110	0	6600	0	6600			
0:03:00	0	REFILL	0	630		630				
0:03:30	480	0.5	480	150	57600	150	57600			
0:04:30	540	1.0	60	90	3600	90	3600			
0:05:15	620	0.8	80	10	6400	10	6400			
0:06:00	0	REFILL	0	630		630				
0:06:30	340	0.5	340	290	40800	290	40800			
0:07:00	450	0.5	110	180	13200	180	13200			
0:07:30	530	0.5	80	100	9600	100	9600			
0:08:00	570	0.5	40	60	4800	60	4800			
0:09:00	600	1.0	30	30	1800	30	1800			

37-39 Landing Road, Whakatane
Soak Hole Test 1
Head



geolab
air, soil & water
laboratory services

CLIENT: Jason Good

PROJECT: New Motel Development, 37-39 Landing Road, Whakatane

BOREHOLE No: BH2

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1720-130067-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	9/11/10	Ground Elevation:		Shear Vane No:	
Date Finished:	9/11/10	Water Level:			

NATURAL WATER CONTENT △
LIQUID LIMIT ✕
PLASTIC LIMIT ☐
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	DEPTH (m)	LABORATORY TESTS
	0.0		TOPSOIL.	0.0	
	0.5		Light coloured, silty TOPSOIL.	0.5	
			Red, dry, uniform graded (fg) SAND.		
			Dark red, slightly moist, uniform graded (fg) SAND.		
	1.0			1.0	
			Light coloured, dry, uniform graded (fg) SAND.		
	1.5			1.5	
	2.0			2.0	

SOIL GOOD.GPJ GEOLAB.GDT 16/11/10

HARRISON GRIERSON CONSULTANTS LTD

HG

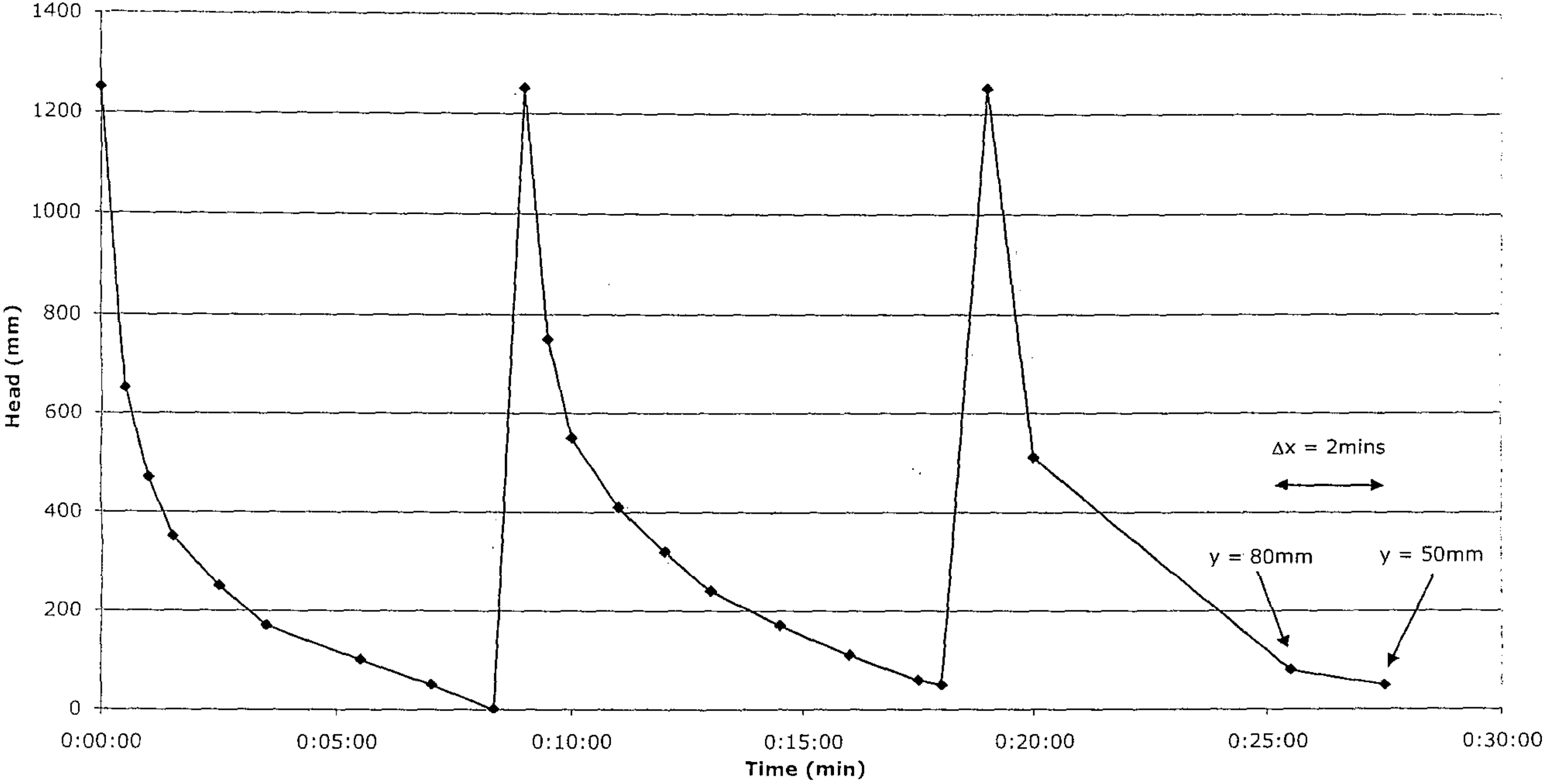
File No 1720-130067-01
Date 16-Feb-10
Initials SJG

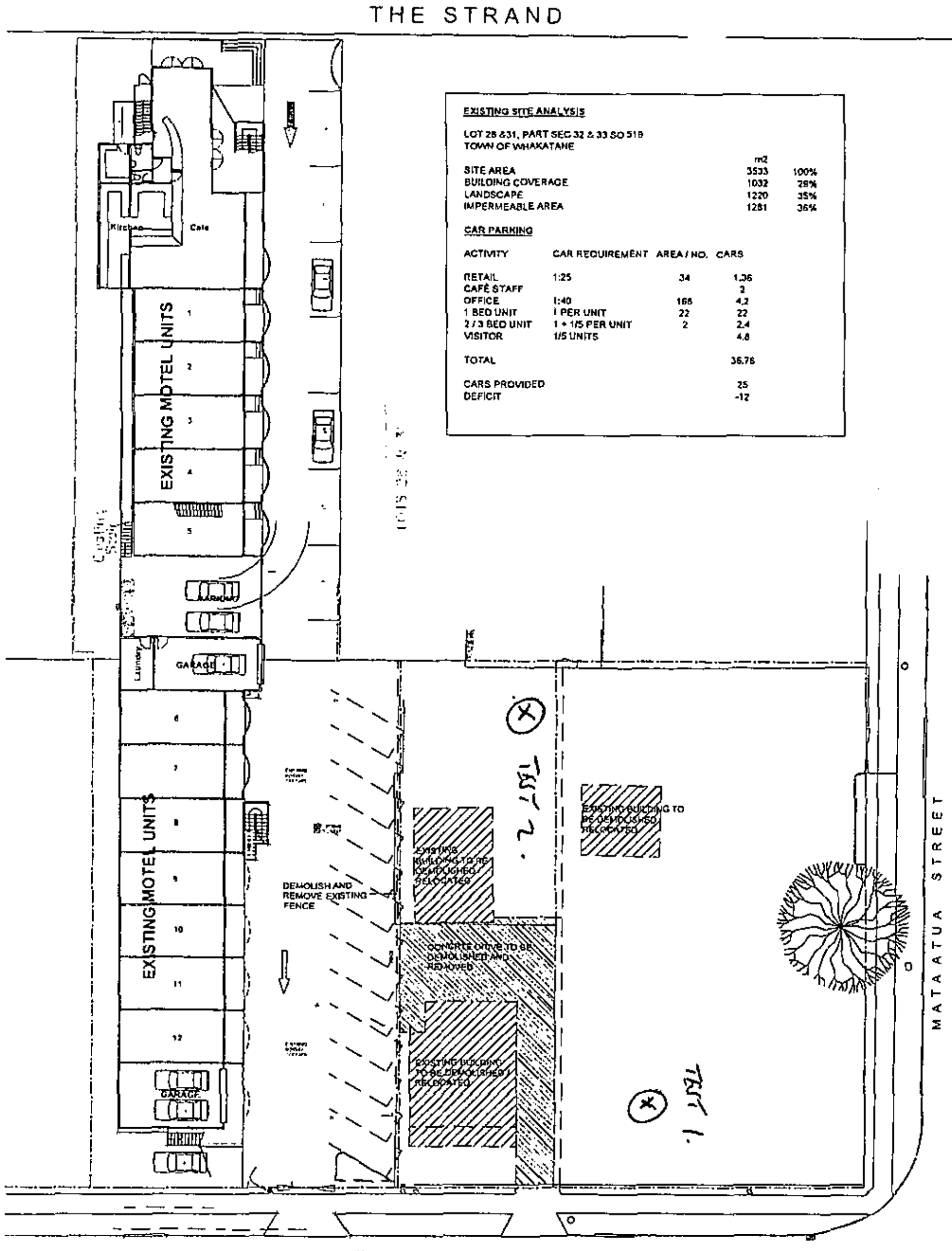
PERCOLATION TEST RESULT SHEET

Project Name: Good Motel
Location: 37-39 Landing Road
Test No: 2
Depth of hole (mm): 1250
Diameter: 80mm

Actual time (hh:mm:ss)	Down to WL (mm)	Diff time (min)	Drop in WL (mm)	Head (mm)	Perc rate (mm/hr)		graphical information			
						Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 2										
0:00:00	0			1250		1250				
0:00:30	600	1.0	600	650	36000	650	36000			
0:01:00	780	0.5	180	470	21600	470	21600			
0:01:30	900	0.5	120	350	14400	350	14400			
0:02:30	1000	1.0	100	250	6000	250	6000			
0:03:30	1080	1.0	80	170	4800	170	4800			
0:05:30	1150	2.0	70	100	2100	100	2100			
0:07:00	1200	1.5	50	50	2000	50	2000			
0:08:20	1250	1.3	50	0	2250	0	2250			
0:09:00	0	REFILL	0	1250		1250				
0:09:30	500	0.5	500	750	60000	750	60000			
0:10:00	700	0.5	200	550	24000	550	24000			
0:11:00	840	1.0	140	410	8400	410	8400			
0:12:00	930	1.0	90	320	5400	320	5400			
0:13:00	1010	1.0	80	240	4800	240	4800			
0:14:30	1080	1.5	70	170	2800	170	2800			
0:16:00	1140	1.5	60	110	2400	110	2400			
0:17:30	1190	1.5	50	60	2000	60	2000			
0:18:00	1200	0.5	10	50	1200	50	1200			
0:19:00	0	REFILL	0	1250		1250				
0:20:00	740	1.0	740	510	44400	510	44400			
0:25:30	1170	5.5	430	80	4691	80	4691			
0:27:30	1200	2.0	30	50	900	50	900			

37-39 Landing Road, Whakatane
Soak Hole Test 2
Head





EXISTING SITE ANALYSIS

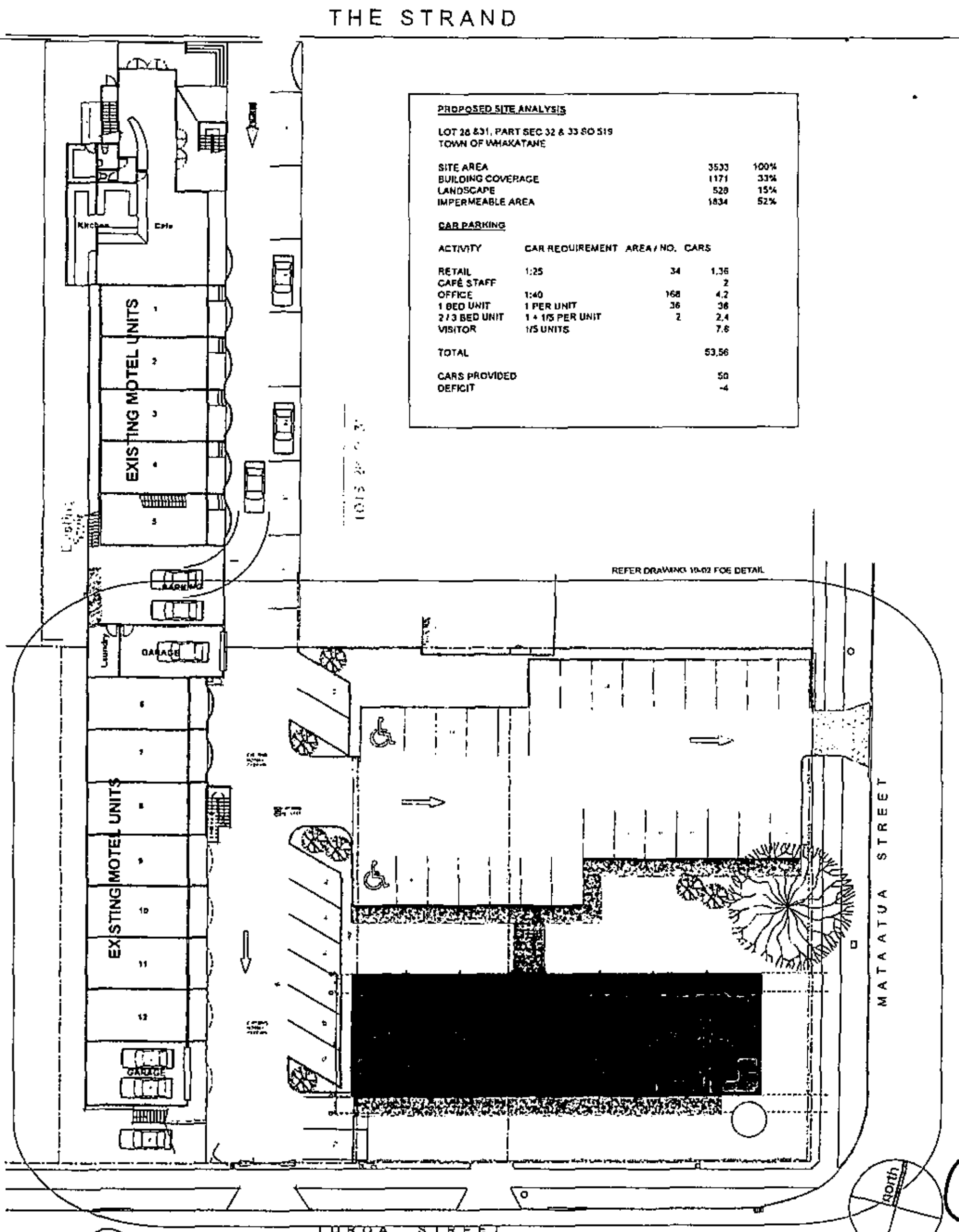
LOT 28 &31, PART SEC 32 & 33 SO 518
TOWN OF WHAKATANE

	m2	
SITE AREA	3533	100%
BUILDING COVERAGE	1032	28%
LANDSCAPE	1220	35%
IMPERMEABLE AREA	1281	36%

CAR PARKING

ACTIVITY	CAR REQUIREMENT	AREA / NO.	CARS
RETAIL	1:25	34	1.36
CAFÉ STAFF			2
OFFICE	1:40	168	4,2
1 BED UNIT	1 PER UNIT	22	22
2 / 3 BED UNIT	1 + 1/5 PER UNIT	2	2.4
VISITOR	1/5 UNITS		4.8
TOTAL			36.76
CARS PROVIDED			25
DEFICIT			-12

01 EXISTING SITE PLAN
SCALE 1:200



PROPOSED SITE ANALYSIS

LOT 28 &31, PART SEC 32 & 33 SO 519
TOWN OF WHAKATANE

SITE AREA	3533	100%
BUILDING COVERAGE	1171	33%
LANDSCAPE	528	15%
IMPERMEABLE AREA	1834	52%

CAR PARKING

ACTIVITY	CAR REQUIREMENT	AREA / NO.	CARS
RETAIL	1:25	34	1,36
CAFÉ STAFF			2
OFFICE	1:40	168	4,2
1 BED UNIT	1 PER UNIT	36	36
2 / 3 BED UNIT	1 + 1/5 PER UNIT	2	2,4
VISITOR	1/5 UNITS		7.6
TOTAL			53,56
CARS PROVIDED			50
DEFICIT			-4

01 PROPOSED SITE PLAN
SCALE 1:200

32

BROWN DAY GROUP
ARCHITECTS
BROWN DAY SOMERFORD WRACK

General Notes:
These drawings shall be read in conjunction with all Engineering and other consultants drawings and specifications and with other written instructions as may be issued during the course of the contract.
All discrepancies shall be referred to the Architect before proceeding with the work.
All dimensions shall be verified by the contractor before construction and fabrication is commenced.

Workmanship and materials are to be in accordance with the relevant current NZS codes, NZBD and amendments and local statutory authorities, except where exceeded by the contract documents.

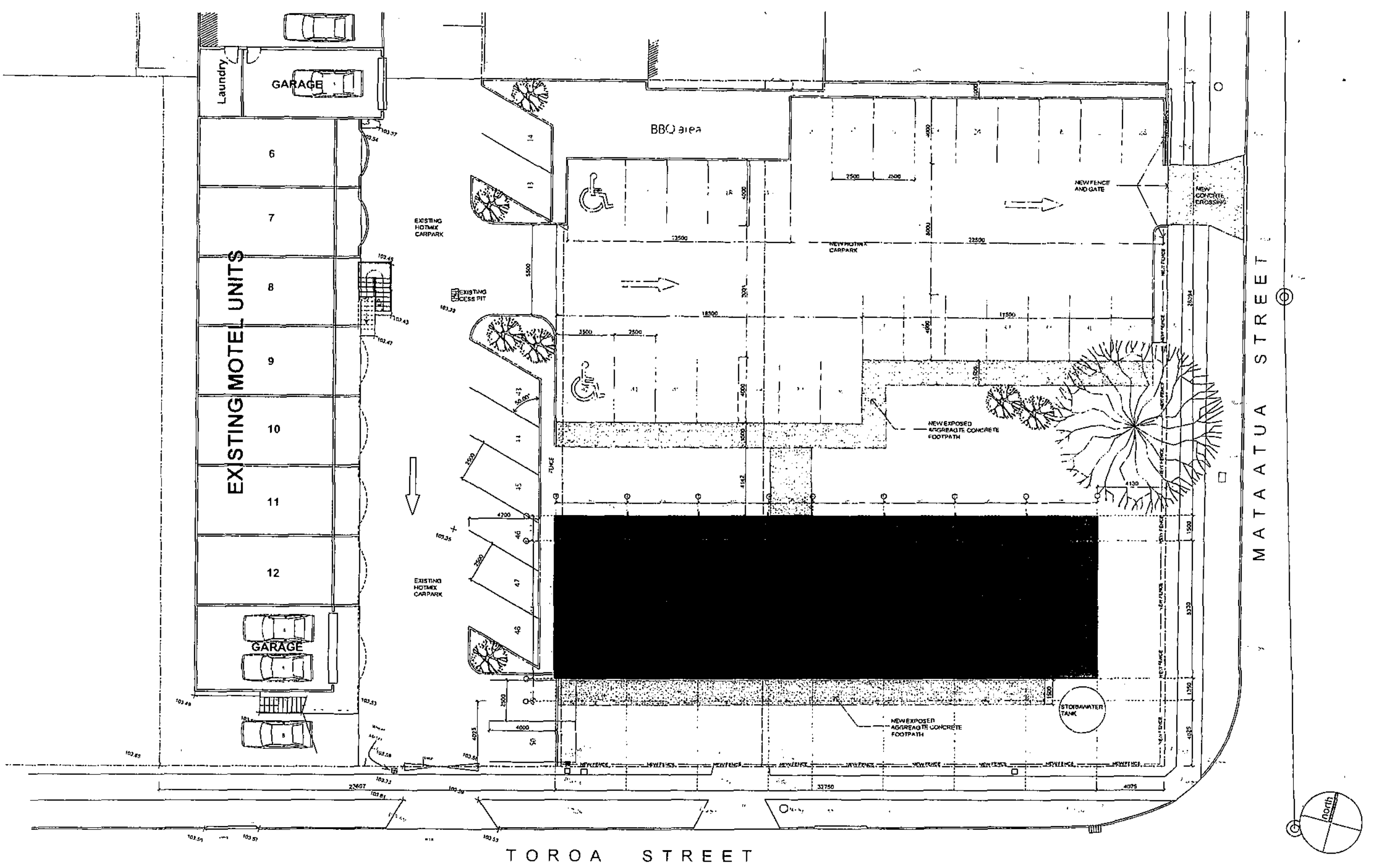
Revisions:
Rev: Date: Notes:

Client:
RENDEZVOUS MOTEL

Project:
MOTEL DEVELOPMENT
12 & 14 TOROA STREET,
WHAKATANE

Drawing Title:
SITE PLAN

Design:	Drawn: JM		
Job No: 1647	Checked: MB		
Plot Date: Plot Date	Scale (A1): 1:200	Drawing No: 10-01	Rev:
Date: Date	Scale (A3): 1:400		
File Location: X:\DWG\1647-Rendevous Motel\Cad-dwg\motel 90 2.vwx			



[redacted]

BROWN DAY GROUP
ARCHITECTS
BROWN DAY SOMERFORD WRACK

General Notes:
These drawings shall be read in conjunction with all Engineering and other consultants drawings and specifications and with other written instructions as may be issued during the course of the contract.
All discrepancies shall be referred to the Architect before proceeding with the work.
All dimensions shall be verified by the contractor before construction and fabrication is commenced.

Workmanship and materials are to be in accordance with the relevant current NZS codes, NZBC and amendments and local statutory authorities, except where exceeded by the contract documents.

Revisions:
Rev: Date: Notes:

Client:
RENDEZVOUS MOTEL

Project:
MOTEL DEVELOPMENT

12 & 14 TOROA STREET,
WHAKATANE

Drawing Title:
DETAILED SITE PLAN

Design:
Drawn: JH
Job No: 1547
Checked: MB
Plot Date: Plot Date
Scale (A1): 1:100
Date: Date
Scale (A3): 1:200
Drawing No.: 10-02
Rev:
File Location: X:\DWG\1647-Rendevous Motel\Cad-dwg\motel 90 2.vwx

geolab
air, soil & water
laboratory services

CLIENT: P&J Tait

PROJECT: White Island Motel Extension, 12-14 Toroa Street, Whakatane

BOREHOLE No: BH1

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1720-129342-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	13/12/10	Ground Elevation:		Shear Vane No:	
Date Finished:	13/12/10	Water Level:			

GROUND WATER | DEPTH (m) | GRAPHIC LOG | SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering | DEPTH (m) | NATURAL WATER CONTENT △ LIQUID LIMIT × PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ⊙ r POCKET PENETROMETER ○ p 50 100 150 (kPa) | LABORATORY TESTS

0.0

Light brown, dry, sandy TOPSOIL.

Light brown, dry SAND, with pumice interspersed.

0.5

Sand lighter colour and more course. Pumice still present.

1.0

Sand colour light grey.

Sand more golden colour. Pumice content reducing.

1.5

Sand now red/brown colour. Pumice still present.

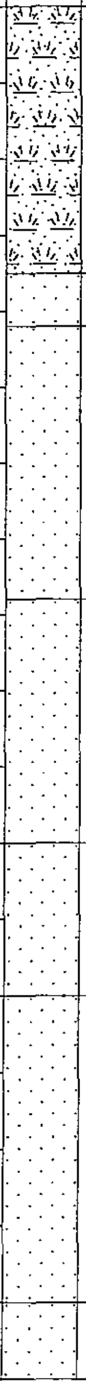
2.0

geolab
air, soil & water
laboratory services

CLIENT: P&J Tait		BOREHOLE No: BH2
PROJECT: White Island Motel Extension, 12-14 Toroa Street, Whakatane		Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	1720-129342-01	Logged By:	GPR
Drilled By:	SJG	Coordinates:		Checked By:	
Date Started:	13/12/10	Ground Elevation:		Shear Vane No:	
Date Finished:	13/12/10	Water Level:			

GROUND WATER | DEPTH (m) | GRAPHIC LOG | SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering | DEPTH (m) | NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT ☐ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ⊙ r POCKET PENETROMETER ○ p 50 100 150 (kPa) | LABORATORY TESTS



0.0

Light brown, dry, sandy TOPSOIL.

Light brown, dry SAND, with pumice interspersed.

Golden brown, dry, uniform graded SAND (mg) with pumice interspersed throughout.

0.5

Colour change to a mix of red and white/grey sand.

1.0

Sand now white and more course.

Change in colour to red/brown.

1.5

Change in colour to grey.

2.0

SOIL TAIT.GPJ GEOLAB.GDT 14/12/10

HARRISON GRIERSON CONSULTANTS LTD

HG

File No 1720-129342-01

PERCOLATION TEST RESULT SHEET

Date 13-Dec-10

Project Name: White Island Motel

Location: 12-14 Toroa Street

Initials SJG

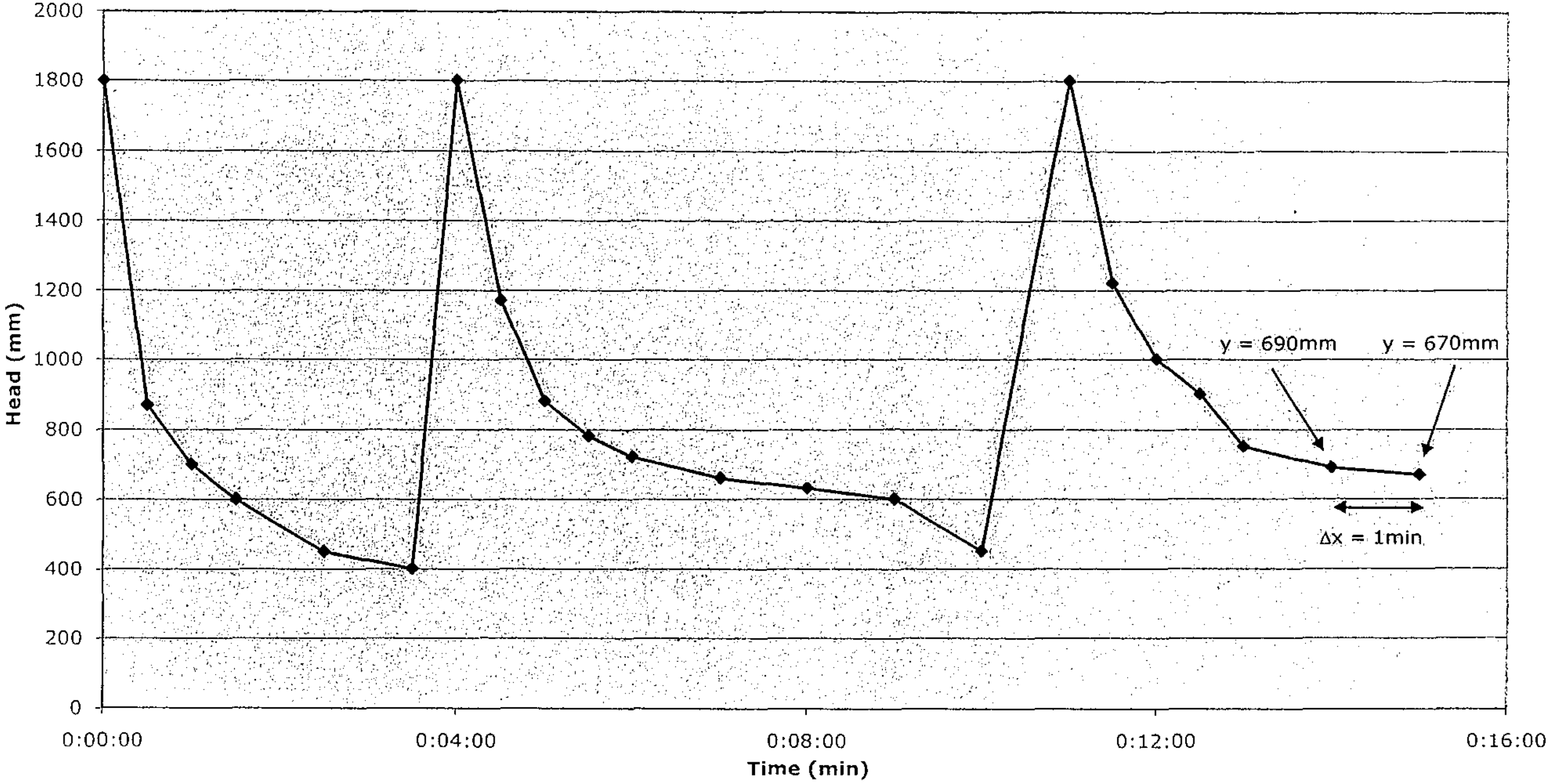
Test No: 2

Depth of hole (mm): 1800

Diameter: 80mm

Actual time	Down to	Diff time	Drop in	Head	Perc rate		graphical information			
(hh:mm:ss)	WL (mm)	(min)	WL (mm)	(mm)	(mm/hr)	Head	Y1 (Perc)	Y2	Y3	Y4
Soak Hole 2										
0:00:00	0			1800		1800				
0:00:30	930	1.0	930	870	55800	870	55800			
0:01:00	1100	0.5	170	700	20400	700	20400			
0:01:30	1200	0.5	100	600	12000	600	12000			
0:02:30	1350	1.0	150	450	9000	450	9000			
0:03:30	1400	1.0	50	400	3000	400	3000			
0:04:00	0	REFILL	0	1800		1800				
0:04:30	630	0.5	630	1170	75600	1170	75600			
0:05:00	920	0.5	290	880	34800	880	34800			
0:05:30	1020	0.5	100	780	12000	780	12000			
0:06:00	1080	0.5	60	720	7200	720	7200			
0:07:00	1140	1.0	60	660	3600	660	3600			
0:08:00	1170	1.0	30	630	1800	630	1800			
0:09:00	1200	1.0	30	600	1800	600	1800			
0:10:00	1350	1.0	150	450	9000	450	9000			
0:11:00	0	REFILL	0	1800		1800				
0:11:30	580	0.5	580	1220	69600	1220	69600			
0:12:00	800	0.5	220	1000	26400	1000	26400			
0:12:30	900	0.5	100	900	12000	900	12000			
0:13:00	1050	0.5	150	750	18000	750	18000			
0:14:00	1110	1.0	60	690	3600	690	3600			
0:15:00	1130	1.0	20	670	1200	670	1200			

12-14 Toroa Street, Whakatane
Soak Hole Test 2
Head



Client:	Whakatane District Council		
Project Title:	Percolation Tests	***Page***	17
Site Address:	Boundy Of No 39 & 43 Bunyan Road Coastlands	***No of Pages***	19
		Test	17 of 19
City:	Whakatane	***Date***	15/06/2011
File Number:	614914-M-E-S001	***By***	RGS

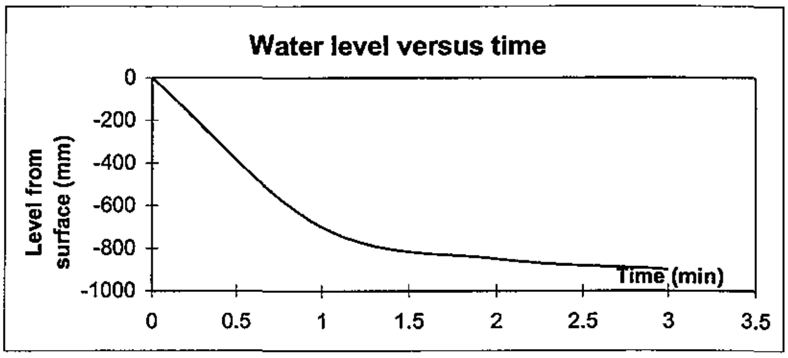
MTEC CONSULTANTS
Local People. Global Knowledge.

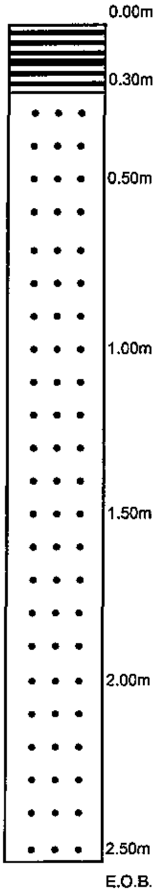
TGA REV 2 9/07/2010

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
1	-700	-700
2	-150	-850
3	-50	-900





TOPSOIL, Silty **SAND**, very moist.

SAND medium, brown, uniformly graded, very moist - wet.

Becomes brownish grey very moist - wet.

Very moist - wet.

Augered Hole depth (1)	2500	mm
Presoak hole depth (2)	2000	mm
End test hole depth (3)	900	mm
Auger Diameter	100	mm
Water level drop	900	mm
Av test depth (2+3)/2	1450	mm
Depth of topsoil	300	mm
Permeable Depth (av - top:	1150	mm
modified Hole Diameter	131	mm
Water Volume Lost	12.2	litres
Hole Surface Area	0.30	m^2
Total time of test	3	min

when time	0	to	3	min
permeable depth is	1150	to	250	mm
surface area is			0.30	m^2

Soakage rate **13.44 litres/m^2/min**

Notes: Location on boundry between two properties at the lowest ground level possible. Borehole collapsed to 900mm during test.

Client:	Whakatane District Council		
Project Title:	Percolation Tests	***Page***	18
Site Address:	Piripai Rise Coastlands	***No of Pages***	19
		Test	18 of 19
City:	Whakatane	***Date***	15/06/2011
File Number:	614914-M-E-S001	***By***	RGS

TGA REV 2 9/07/2010

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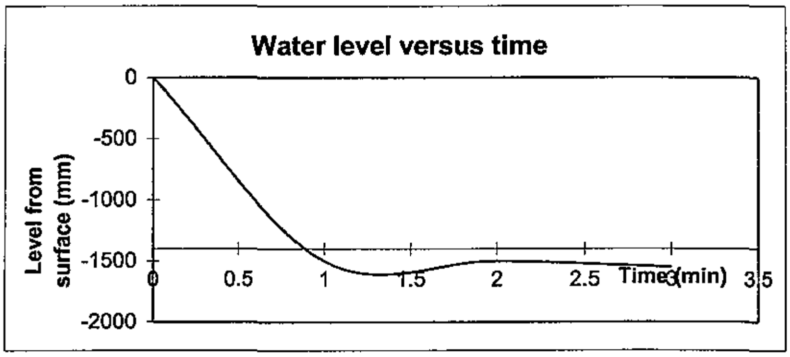
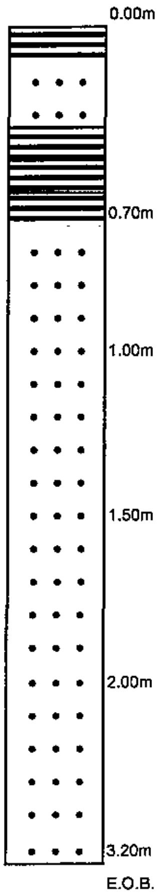
Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
1	-1500	-1500
2	0	-1500
3	-50	-1550





TOPSOIL, Silty **SAND**, very moist.
Becomes **SAND** medium, brownish grey, very moist.

TOPSOIL, Silty **SAND**, very moist.

SAND medium, greyish brown, uniformly graded, very moist - wet.

Becomes brownish grey.

Very moist - wet.

Augered Hole depth (1)	3200	mm
Presoak hole depth (2)	3000	mm
End test hole depth (3)	1550	mm
Auger Diameter	100	mm
Water level drop	1550	mm
Av test depth (2+3)/2	2275	mm
Depth of topsoil	500	mm
Permeable Depth (av - top:	1775	mm
modified Hole Diameter	119	mm
Water Volume Lost	17.1	litres
Hole Surface Area	0.38	m^2
Total time of test	3	min

when time	0	to	3	min
permeable depth is	1775	to	225	mm
surface area is			0.38	m^2

Soakage rate **14.88 litres/m^2/min**

Notes: Moved location to lowest possible ground level at base of slope in road reserve.
Borehole collapsed to 1550mm during test.

Client: Whakatane District Council
Project Title: Percolation Tests
Site Address: Alpha Avenue Reserve Coastlands
City: Whakatane
File Number: 614914-M-E-S001

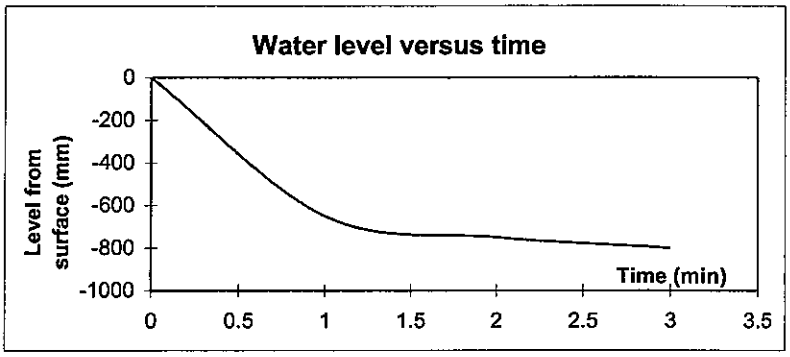
Page 19
No of Pages 19
Test 19 of 19
Date 15/06/2011
By RGS

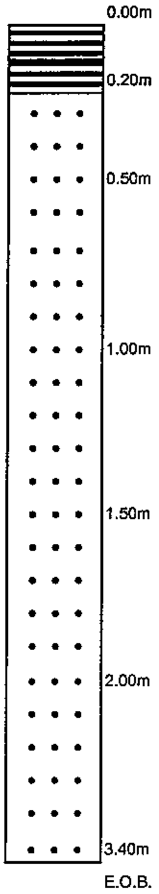
TGA REV 2 9/07/2010

Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
1	-650	-650
2	-100	-750
3	-50	-800





TOPSOIL, SILT minor Sand occasional subrounded fine - medium gravel, very moist.
SAND medium, brownish grey, uniformly graded, very moist - wet.

Becomes wet.

Augered Hole depth (1)	3400	mm
Presoak hole depth (2)	3200	mm
End test hole depth (3)	800	mm
Auger Diameter	100	mm
Water level drop	800	mm
Av test depth (2+3)/2	2000	mm
Depth of topsoil	300	mm
Permeable Depth (av - top:	1700	mm
modified Hole Diameter	130	mm
Water Volume Lost	10.7	litres
Hole Surface Area	0.55	m^2
Total time of test	3	min

when time 0 to 3 min
permeable depth is 1700 to 900 mm
surface area is 0.55 m^2

Soakage rate **6.52 litres/m^2/min**

Notes:

Borehole collapsed to 800m during test.

Client:	Versatile Buildings Ltd		
Project Title:	19a Salonika Street	***Page***	
		No of Pages	
Site Address:			
City:	Whakatane	***Date***	28/09/2011
File Number:	134945-m-e-s002	***By***	FW/ TS

TGA REV 2 9/07/2010

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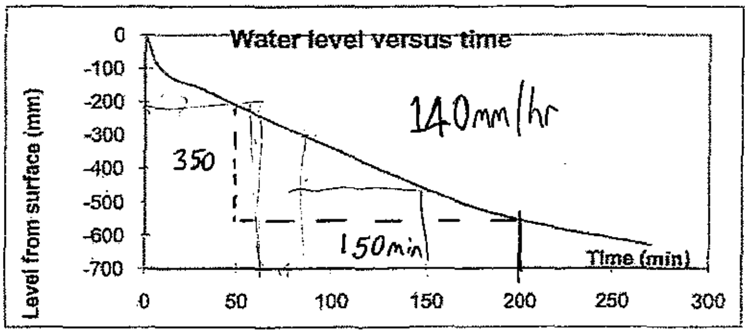
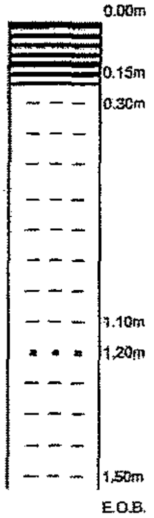
Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
5	-75	-75
11	-40	-115
16	-19	-134
23	-13	-147
30	-13	-160
90	-155	-315
180	-209	-524
270	-106	-630



Location - TEST 1



Imported broket road aggregrate

Brown **Clay** with rubble / stones / rubbish intermixed

WATER TABLE AT 900mm

Brown medium sized pumice

mottled Brown **Clay**

Ground Water Level approximately 1600mm.

Augered Hole depth (1)	1500	mm
Presoak hole depth (2)	1500	mm
End test hole depth (3)	1500	mm
Auger Diameter	170	mm
Water level drop	630	mm
Av test depth (2+3)/2	1500	mm
Depth of topsoil	1100	mm
Permeable Depth (av - top:	400	mm
modified Hole Diameter	170	mm
Water Volume Lost	14.3	litres
Hole Surface Area	0,13	m^2
Total time of test	270	min

when time	0	to	270	min
permeable depth is	400	to	0	mm
surface area is			0.13	m^2

Soakage rate **0.41 litres/m^2/min**

0.2ℓ m^2

134945-M-E-S002 - Percolation Testing .xls/11/10/2011

Client: Versatile Buildings Ltd
Project Title: 19a Salonika Street
Page
No of Pages
Site Address:
City: Whakatane
Date 28/09/2011
File Number: 134945-m-e-s002
By FW/ TS

TGA REV 2 9/07/2010

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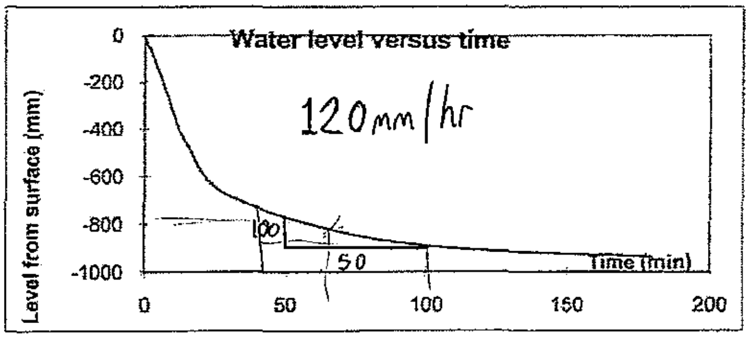
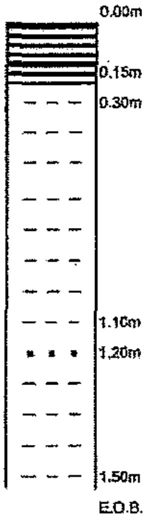
Stormwater Disposal - Percolation Test Results

Notes: Tests carried out in accordance with Section E1 of the NZ Building Code

Time (minutes)	Level Drop (mm)	Cumulative (mm)
0	0	0
1	-40	-40
2	-20	-60
3	-33	-93
5	-59	-152
6	-28	-180
7	-43	-223
8	-29	-252
10	-75	-327
15	-138	-465
30	-215	-680
90	-197	-877
180	-58	-935



Location - Test 2



Imported broket road aggregrate

Brown Clay with rubble / stones / rubbish intermixed

WATER TABLE AT 900mm

Brown medium sized pumice

mottled Brown Clay

Ground Water Level approximately 1600mm.

Augered Hole depth (1)	1500	mm
Presoak hole depth (2)	1500	mm
End test hole depth (3)	1500	mm
Auger Diameter	170	mm
Water level drop	935	mm
Av test depth (2+3)/2	1500	mm
Depth of topsoil	1100	mm
Permeable Depth (av - top:	400	mm
modified Hole Diameter	170	mm
Water Volume Lost	21.2	litres
Hole Surface Area	0.13	m^2
Total time of test	180	min

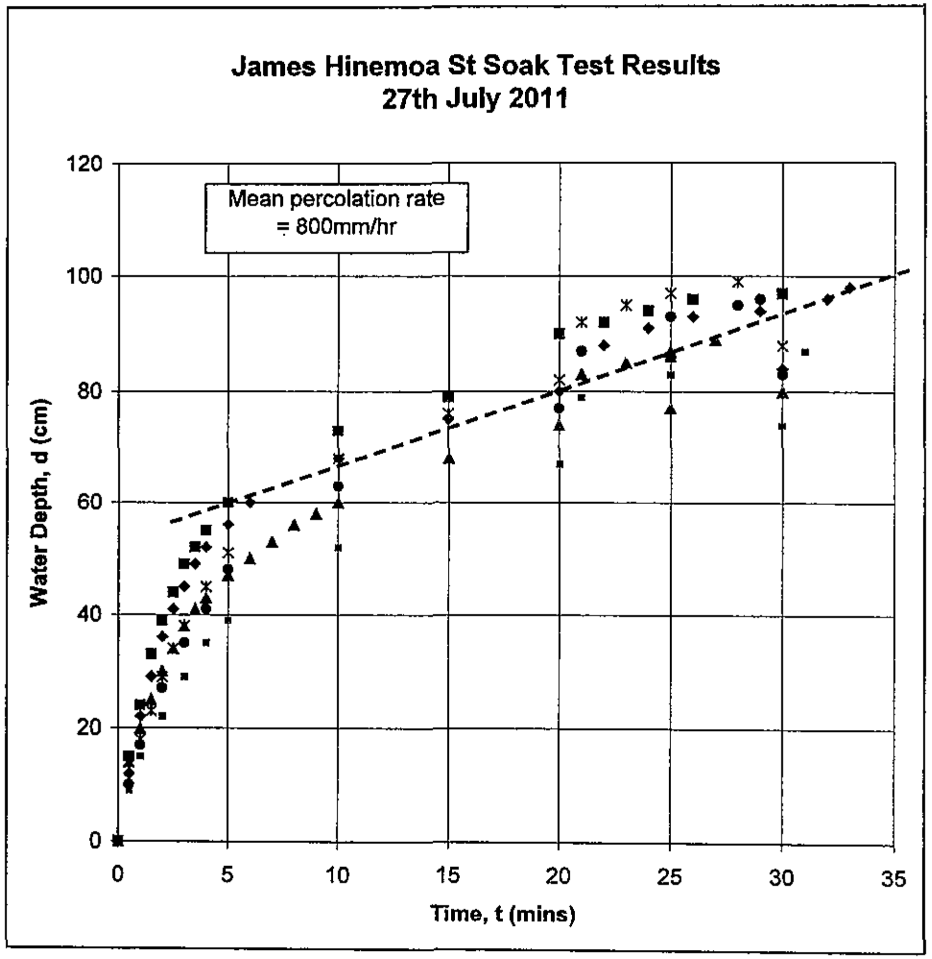
when time 0 to 180 min
permeable depth is 400 to 0 mm
surface area is 0.13 m^2

Soakage rate **0.91 litres/m^2/min**

James, 52 Hinemoa St, Whakatane
Soak Tests 27th July 2011
Falling Head

Readings after 35 minutes discarded.

time (mins)	H1 T1 WL (cm)	H1 T2 WL (cm)	H2 T1 WL (cm)	H2 T2 WL (cm)	H3 T1 WL (cm)	H3 T2 WL (cm)
0	0	0	0	0	0	0
0.5	12	15	14	9	11	10
1	22	24	20	15	18	17
1.5	29	33	25		23	
2	36	39	30	22	29	27
2.5	41	44	34		34	
3	45	49	38	29	38	35
3.5	49	52	41			
4	52	55	43	35	45	41
5	56	60	47	39	51	48
6	60		50			
7			53			
8			56			
9			58			
10	68	73	60	52	68	63
15	75	79	68		76	
20	80		74	67	82	77
25		86	77			
30	84		80	74	88	83
35		90				
40	88		83	79	92	87
45		92				
50	91		85		95	
55		94				
60	93		87	83	97	93
65		96				
68			89			
70	94				99	95
74						96
75		97				
80	96			87		
83	98					



River Lake

River Lake Ltd
13 Louvain Street, Whakatāne
New Zealand
m. +64 27 308 7224
www.riverlake.co.nz

TO	Astrid Hutchinson
COPY	
FROM	Keith Hamill
DATE	7 November 2023
FILE	
SUBJECT	**Whakatāne Comprehensive Stormwater consent application: Response to Section 92 request for further information**

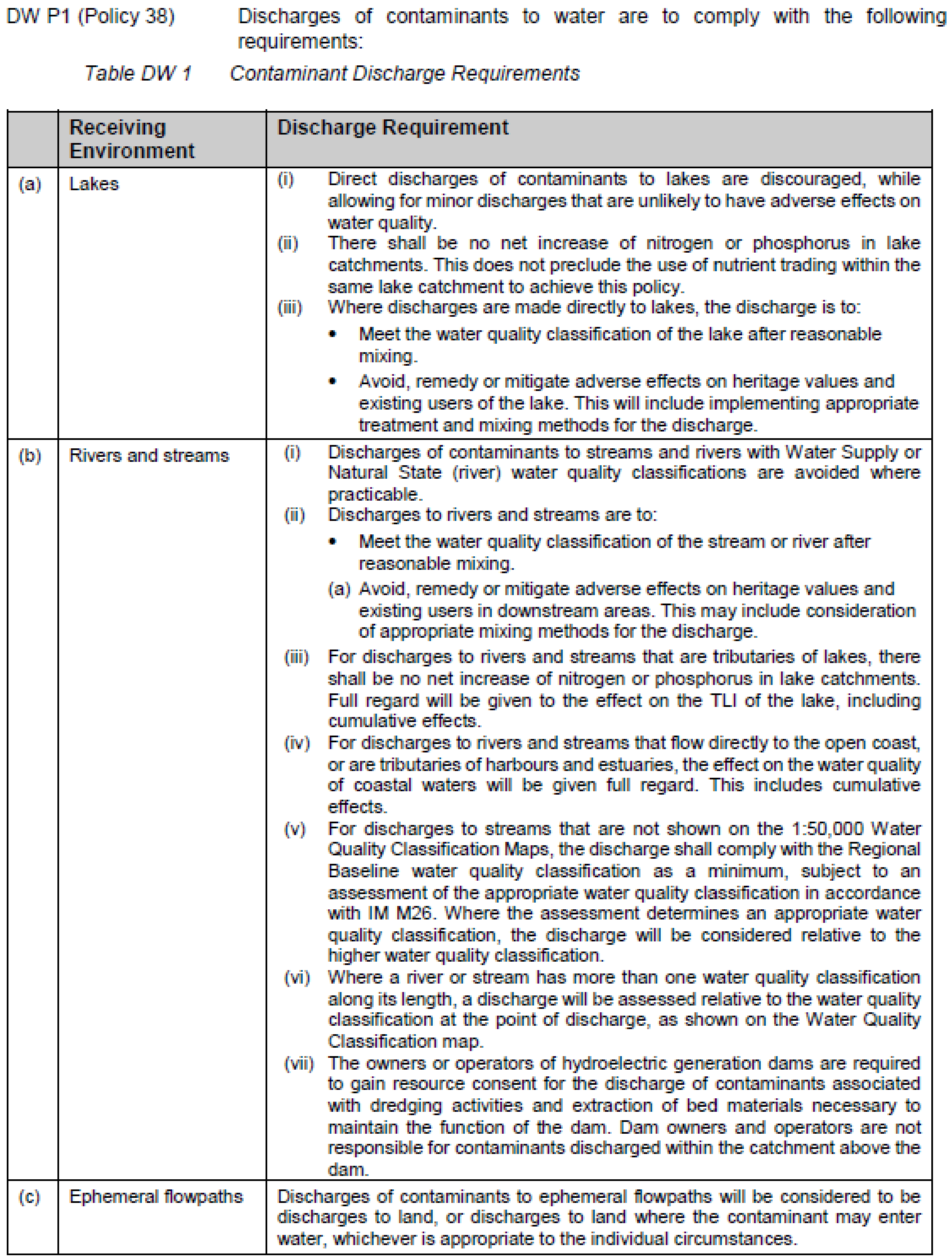
Bay of Plenty Regional Council (BOPRC) has requested further information relating to the comprehensive stormwater consent application lodged by Whakatāne District Council on 16 January 2023. This memo provides a response to some of the questions raised.

QUESTION

Please provide an assessment against RNRP policy DW P1 (see below), particularly regarding whether or not the limits outlined in the policy are met.

Table: Whakatāne urban area stream classifications

Stream name	RNRP Schedule 9 water quality classification
Awatapu Lagoon	Unspecified Water bodies
Sullivan Lake	Unspecified Water bodies
Hinemoa Stream (Landing Road)	Regional Base Line
Various unnamed streams	Natural State
Wainui te Whara Stream	Regional Base Line
Waiewe Stream	Regional Base Line
Wairere Stream	Regional Base Line, Aquatic Ecosystem (d/s Falls)
Whakatāne River	Contact Recreational (u/s bridge)
Kōpeōpeō Canal	Drain Water Quality
Orini Canal	Modified watercourse with ecological values



DW P1 (Policy 38) Discharges of contaminants to water are to comply with the following requirements:

Table DW 1 Contaminant Discharge Requirements

	Receiving Environment	Discharge Requirement
(a)	Lakes	(i) Direct discharges of contaminants to lakes are discouraged, while allowing for minor discharges that are unlikely to have adverse effects on water quality. (ii) There shall be no net increase of nitrogen or phosphorus in lake catchments. This does not preclude the use of nutrient trading within the same lake catchment to achieve this policy. (iii) Where discharges are made directly to lakes, the discharge is to: • Meet the water quality classification of the lake after reasonable mixing. • Avoid, remedy or mitigate adverse effects on heritage values and existing users of the lake. This will include implementing appropriate treatment and mixing methods for the discharge.
(b)	Rivers and streams	(i) Discharges of contaminants to streams and rivers with Water Supply or Natural State (river) water quality classifications are avoided where practicable. (ii) Discharges to rivers and streams are to: • Meet the water quality classification of the stream or river after reasonable mixing. (a) Avoid, remedy or mitigate adverse effects on heritage values and existing users in downstream areas. This may include consideration of appropriate mixing methods for the discharge. (iii) For discharges to rivers and streams that are tributaries of lakes, there shall be no net increase of nitrogen or phosphorus in lake catchments. Full regard will be given to the effect on the TLI of the lake, including cumulative effects. (iv) For discharges to rivers and streams that flow directly to the open coast, or are tributaries of harbours and estuaries, the effect on the water quality of coastal waters will be given full regard. This includes cumulative effects. (v) For discharges to streams that are not shown on the 1:50,000 Water Quality Classification Maps, the discharge shall comply with the Regional Baseline water quality classification as a minimum, subject to an assessment of the appropriate water quality classification in accordance with IM M26. Where the assessment determines an appropriate water quality classification, the discharge will be considered relative to the higher water quality classification. (vi) Where a river or stream has more than one water quality classification along its length, a discharge will be assessed relative to the water quality classification at the point of discharge, as shown on the Water Quality Classification map. (vii) The owners or operators of hydroelectric generation dams are required to gain resource consent for the discharge of contaminants associated with dredging activities and extraction of bed materials necessary to maintain the function of the dam. Dam owners and operators are not responsible for contaminants discharged within the catchment above the dam.
(c)	Ephemeral flowpaths	Discharges of contaminants to ephemeral flowpaths will be considered to be discharges to land, or discharges to land where the contaminant may enter water, whichever is appropriate to the individual circumstances.

RESPONSE

Below is a brief technical assessment of the likely compliance of different waterbodies with standards and criteria set in Schedule 9 of the RNRP. The background information supporting this assessment is available in Hamill (2022).

Awatapu Lagoon and Sullivan Lake are "*unspecified water bodies*" and as such have no standards set in Schedule 9. They are, arguably, classed as artificial waterbodies rather than natural lakes. If this is the case, they may fall outside the requirements of both the National Policy Statement for Freshwater Management 2020 and policy DW P1.

Hinemoa Stream is the remanent channel of the Wainui Te Whara prior to its diversion directly to what is now Awatapu Lagoon. Much of the channel shown on the BOPRC planning maps is culverted under residential land. The open channel starts at James Street and its catchment is 100% urban residential, the lower section of the stream is tidal and has a saline influence. Almost all of the catchment's water is stormwater plus some unknown amount of groundwater seepage into the stormwater pipes. This makes it very difficult to apply the criteria set in Schedule 9 for Regional Baseline waterbodies or to ascertain what would constitute a 'reasonable mixing zone'. The current state of Hinemoa Stream is poor (see section 3.6 of Hamill (2022)). Past water quality measures have recorded low dissolved oxygen (56% saturation) and median *E.coli* bacteria of 635 cfu/100mL.

Wainui Te Whara Stream is classified as Regional Baseline. Urban stormwater is a small fraction of the catchment (<5%). There are no direct measurements upstream and downstream of individual culverts to assess stormwater discharges against standards in Schedule 9.[1] There has been monitoring of the Wainui Te Whara Stream at Valley Road and Hinemoa Street that gives a comparison of changes in water quality and ecology that occur as the stream travels through the main urban area of Whakatāne, this gives an indication of cumulative effects of discharges in combination with changes in stream habitat, morphology and gradient. There is a general pattern of declining water quality in the Wainui Te Whara Stream between Valley Road and Hinemoa Street, but key variables such as dissolved oxygen and *E.coli* bacteria are within Schedule 9 standards. DGT sampling in 2020 found dissolved Zn elevated above DGVs at King Street (Table 4.7), suggesting a possible contaminant source to the stream at this time. However, generally we expect the stormwater, after reasonable mixing, to comply with Schedule 9 standards.

Waiewe Stream is classified as Regional Baseline. Urban stormwater is a small fraction of the overall catchment (<5%) and presents a low risk to the stream. Sediment monitoring has found Zn to be slightly elevated but still within ANZG DGV values. We expect the stormwater, after reasonable mixing, to generally comply with Schedule 9 standards.

Wairere Stream is classified as Regional Baseline. Urban stormwater is a very small fraction of the overall catchment (<4%) and presents a low risk to the stream. Metals in sediment were low and within ANZG DGVs. The median for four spot samples of *E.coli* bacteria below the waterfall in 2009 was 700 cfu/100ml - which exceeds the microbiological bathing guidelines, but this is likely to be mainly due to runoff from rural land in the catchment. We expect the stormwater, after reasonable mixing, to generally comply with Schedule 9 standards.

The Whakatāne River is classified as Contact Recreation. Urban stormwater is a very small fraction of the overall catchment (<1%). Metals in fine sediment are within ANZEC DGVs and similar upstream and downstream of the town, but there may possibly be small scale localised effects close to stormwater outlets. The lower river (at the Landing Road bridge) does not meet microbial water quality guidelines for swimming (graded "poor"), this is mostly caused by high *E.coli* concentrations coming from upstream during rain events. The median *E.coli* concentration is about 105 cfu/100mL. Baseflow sampling results indicated lower concentrations of *E.coli* downstream of most stormwater outlets compared to upstream (Table 4.4) but the differences

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[1] The hospital carpark stormwater outlet has stormwater monitoring but only for some metals.

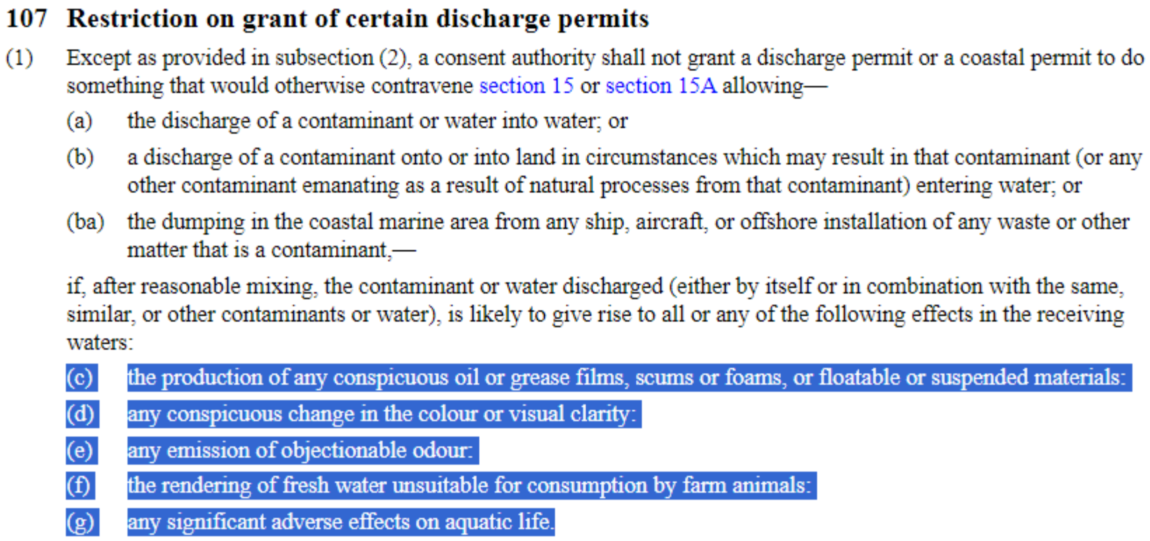
are small. This may reflect more dilution from sea water at the downstream sites. We expect the stormwater, after reasonable mixing, to generally comply with Schedule 9 standards.

Kōpeōpeō Canal is classified as Drain Water Quality. Urban stormwater is a small fraction of the catchment. Monitoring has found some indication of elevated Zn in stormwater from Gateway Drive, however it is likely that the Zn concentration would have complied with the DGVs after reasonable mixing in the Kōpeōpeō Canal considering the small relative size of the urban catchment (<0.6%) and current state of the canal. We expect the stormwater, after reasonable mixing, to generally comply with Schedule 9 standards.

Orini Canal is classified as Modified watercourse with ecological values. Urban stormwater is a small fraction of the catchment. The stormwater monitoring has found low concentrations of Zn, Cu, Pb and dioxins – and all within guidelines. The stormwater also has very low concentrations of nitrogen. There is no reason to expect that the stormwater is not complying with all Schedule 9 standards.

QUESTION:

Section 9.4.10 of the application implies that the application can be granted in light of Section 107 of the RMA, however, this is not outlined clearly in Section 4 of the Hamill report. Please provide further assessment on Section 107 of the RMA and clearly outline whether, after reasonable mixing, the contaminant or water discharged is likely to give rise to all or any of the matters listed in 107(1)(c)-(g).



107 Restriction on grant of certain discharge permits

(1) Except as provided in subsection (2), a consent authority shall not grant a discharge permit or a coastal permit to do something that would otherwise contravene section 15 or section 15A allowing—

- (a) the discharge of a contaminant or water into water; or
- (b) a discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or
- (ba) the dumping in the coastal marine area from any ship, aircraft, or offshore installation of any waste or other matter that is a contaminant,—

if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

- (c) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:
- (d) any conspicuous change in the colour or visual clarity:
- (e) any emission of objectionable odour:
- (f) the rendering of fresh water unsuitable for consumption by farm animals:
- (g) any significant adverse effects on aquatic life.

RESPONSE

Based on the information available and described in Hamill (2022) it is unlikely that, after reasonable mixing, Whakatāne stormwater will give rise to the effects listed in Sec. 107 c to g.

Staff undertaking stormwater monitoring reported in Opus-WSP (2019) did not observe any of the effects listed in 107 d to e (i.e. relating to conspicuous oils, foams, change in colour or clarity or objectionable odour) (James Gladwin pers. comm. 2023). During wide scale rain events the Whakatāne River is typically more turbid than the stormwater discharges and it is common to observe turbid water from the river entering Awatapu Lagoon and Apanui Canal.

Section 4.3.4 of Hamill (2022) describes that *E. coli* bacteria concentrations can be high during storm events but that faecal source tracking identified the source as wildfowl and possible ruminants. It is unlikely that the Whakatāne stormwater would render freshwater receiving environments unsuitable for consumption by farm animals. The waterways that might possibly be used by farm animals are the Whakatāne River, Wairere Stream, upper Wainui Te Whara Stream and Orini Canal. In all these waterways the effects of Whakatāne stormwater was assessed as negligible or low (Table 4.7 of Hamill 2022).

Similarly, it is unlikely that the Whakatāne stormwater will have significant adverse effects on aquatic life in natural receiving waters. However, as described in Table 4.7 and 4.9 (of Hamill 2022), stormwater may result in “moderate-High” or “High” magnitude of effects on water quality in Apanui Canal, Hinemoa Stream and the Amber Grove drains because almost all of the catchments for these waterways is urban. However, using the Ecological Impact Assessment framework (EcIA) approach (Table 4.9), the overall ecological effect on these waterways is assessed as “low” because of their highly degraded and artificial nature.

QUESTION

In relation to the report titled Whakatane CSC Potential effects on ecology and water quality (Hamill 2023):

i. In Table 3.8 and 4.9, what does the "*" mean in relation to Sullivan Lake?

ii. ANZECC and DGV are used together/interchangeably throughout the report, but they are separate guideline documents. ANZG (2018) is the most recent up to date guideline document, whereas ANZECC (2000) has been superseded. Please update the report to ensure the reference used throughout is to the ANZG (2018) document. If ANZECC (2000) still needs to be used within the report, please state that it has been superseded and outline the reasons why it is being used.

iii. There is a spelling error on page 49, first set of bullets, last bullet point, last sentence "…particularly important to collected…". Please change this to "collect".

RESPONSE

i. In Table 3.8 and 4.9 the "*" in relation to Sullivan Lake refers to a footnote that read *"* = The amenity values of Sullivan Lake are likely 'Moderate', and would improve with better water quality*."

ii. Hamill (2022) makes reference to both ANZECC (2000) and ANZG (2018). ANZECC (2000) is relevant because it is referenced in current plans (e.g. BOP Regional Natural Resources Plan, Schedule 9 (water quality classification and criteria), and previous reports). ANZG (2018) is an updated version of ANZECC (2000), so is more contemporary. For most variables being referenced, the ANZG (2018) DGV equates to the ANZECC (2000) 95 percentile value.

iii. The typographical error on page 49 is noted, thank you.

QUESTION

In relation to the Whakatane Comprehensive Stormwater Consent Monitoring Plan (Hamill 2019 Draft)

i. ANZECC and DGV are used interchangeably throughout the monitoring plan, but ANZECC and ANZG are different (but very similar in many triggers) documents. As mentioned above, ANZG (2018) is the most recent up to date guideline document, whereas ANZECC (2000) has been superseded. Please update the monitoring plan to ensure the reference used throughout is to the ANZG (2018) document. If ANZECC (2000) still needs to be used, please state that it has been superseded and outline the reasons why it is being used.

ii. Table 2.1 states an “annual” monitoring frequency, is this once a year? And is this for a baseline or rainfall event?

iii. Section 2.3 discusses the proposed frequency of water quality sampling. The review of the draft ecological assessment noted: “Other councils do four baselines in the four seasons and rainfall triggers as well. Compare to consent triggers for exceedances and use an adaptive management approach. E.g., TCC Comp consent requires an investigation (and mitigation) if baseline exceeds trigger at a site in consecutive seasons or a rainfall event is triggered in the same season at the same site in consecutive years. Would be good to include a table of survey sites for water quality monitoring. Could also include regular monitoring of the freshwater and marine receiving environments – with higher priority sites surveyed two yearly and less critical sites surveyed every five years.” This approach is still recommended as it will enable meaningful and comprehensive data collection and analysis.

iv. In section 2.4.3, paragraph 4 mentions excess water should be decanted. Does the sampler need more guidance, so the sediment sample isn’t compromised/lost to some degree?

v. In section 2.5.2, paragraph 3 mentions there should be “consideration given for [additional analyses] organic carbon and dry matter” etc. Organic carbon and dry matter should be routinely surveyed in sediment samples.

vi. In Table 3.2, Cd and Ni are faded out, why is this?

RESPONSE

i. ANZECC (2000) vs. ANZG (2018). Noted. Please see response to this same question given above.

ii. Table 2.1 specifies annual sampling (i.e. one a year) of stormwater grab-samples, DGT integrated sampling, and sediment samples. Stormwater grab samples are to be collected during the first flush of a rain event as described in section 2.3.1.

iii. There are many ways to undertake stormwater monitoring. Stormwater is highly variable both between rain events and within the same rain event. The approach proposed for Whakatāne District Council includes sampling of stormwater when it is usually at its worst (i.e. first flush) and the proposed use of DGT to provide time integrated sampling of metals – incorporating rain-events and baseflow between events. In addition, priority waterways are proposed to be monitored for sediment and with DGTs – both of which are time integrative.

iv. Section 2.4.3 decanting of excess water. We have added the words. "*Any loss of sediment shall be minimised*." However, in practice losing a small amount of resuspendable sediment has negligible effect on the results. What does make a noticeable difference to sediment results is the depth to which sediment is sampled.

v. Section 2.5.2, paragraph 3. Organic carbon and dry matter helps with interpretation of sediment data, but it is not critical for a strict comparison with ANZG (2018) DGVs. Nevertheless, we have modified this to be a requirement rather than an option.

vi. In Table 3.2, Cd and Ni are faded out because they are not proposed to be sampled. They have been deleted from the table to avoid confusion.

RIVER LAKE

Whakatane Comprehensive Stormwater Consent Monitoring Plan: DRAFT

Prepared for:

Whakatāne District Council

Whakatane Comprehensive Stormwater Consent Monitoring Plan

Prepared by:

K. D. Hamill

Prepared for:

Whakatāne District Council

Reviewed by: ……………………………….

Released by: ……………………………….

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Date: 28 August 2019
Status: DRAFT
Reference: wk-1053

Contents

1 Introduction

1.1 Background

Whakatāne District Council (WDC) is seeking a Comprehensive Stormwater Consent (CSC) to authorise stormwater discharges from Whakatāne, Coastlands and the Hub.

This Draft Stormwater Monitoring Plan has been prepared to support the Stormwater Catchment Management Plan and resource consent process. It is intended that this Draft Stormwater Monitoring Plan is finalised by a suitably qualified person after resource consents are obtained.

The purpose of stormwater monitoring proposed in this plan is to confirm the quality of stormwater being discharged, assess its potential effects on the receiving environment and test compliance against the CSC.

1.2 Whakatāne stormwater network

The Whakatāne Urban Stormwater Catchment includes the Whakatāne Township and central business district (CBD), the coastal development of Coastlands/Piripai and the commercial and industrial areas of the Hub and Gateway Drive (Figure 1.1).

There are three main Stormwater Zones: Apanui (256 ha), Hinemoa (202 ha) and Whakatāne South (256 ha) and six smaller Stormwater Zones: Whitehorse/Melville/Wainui Te Whara (153 ha), Awatapu (45 ha), Mātaatua/Muriwai/Wairaka (59 ha); Coastlands (124 ha); Gateway Drive/the Hub (103 ha), and Wairere (306 ha including rural catchment).

For the purpose of the CSC application, the Whakatāne Urban Stormwater Catchment incorporates all the residential and commercial land in Whakatāne that drains indirectly or directly to the Whakatāne River. Natural waterbodies that receive stormwater discharges are as follows (with the number of stormwater discharge locations in brackets): Whakatāne River (19 downstream of Landing Road Bridge, 23 upstream of Landing Road Bridge), Wainui Te Whara Stream (11), Wairere Stream (2), Waiewe Stream, Awatapu Lagoon (19), Sullivan Lake and Kopeopeo Canal (1).

Natural and modified tributaries that enter the Whakatāne River within the urban boundaries of Whakatāne, include from downstream to upstream[1]: Wairere Stream, Waiewe Stream (McAlister Street pump station/gravity flapgate), Orini Canal and Kopeopeo Canal (TL), Hinemoa Street drain, Te Rahu Canal (TL), Wainui Te Whara Stream via Awatapu Lagoon, Waioho Stream (TL) and several unnamed tributaries near the southern urban boundary.

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[1] TL = enters the Whakatāne River from the True Left side.

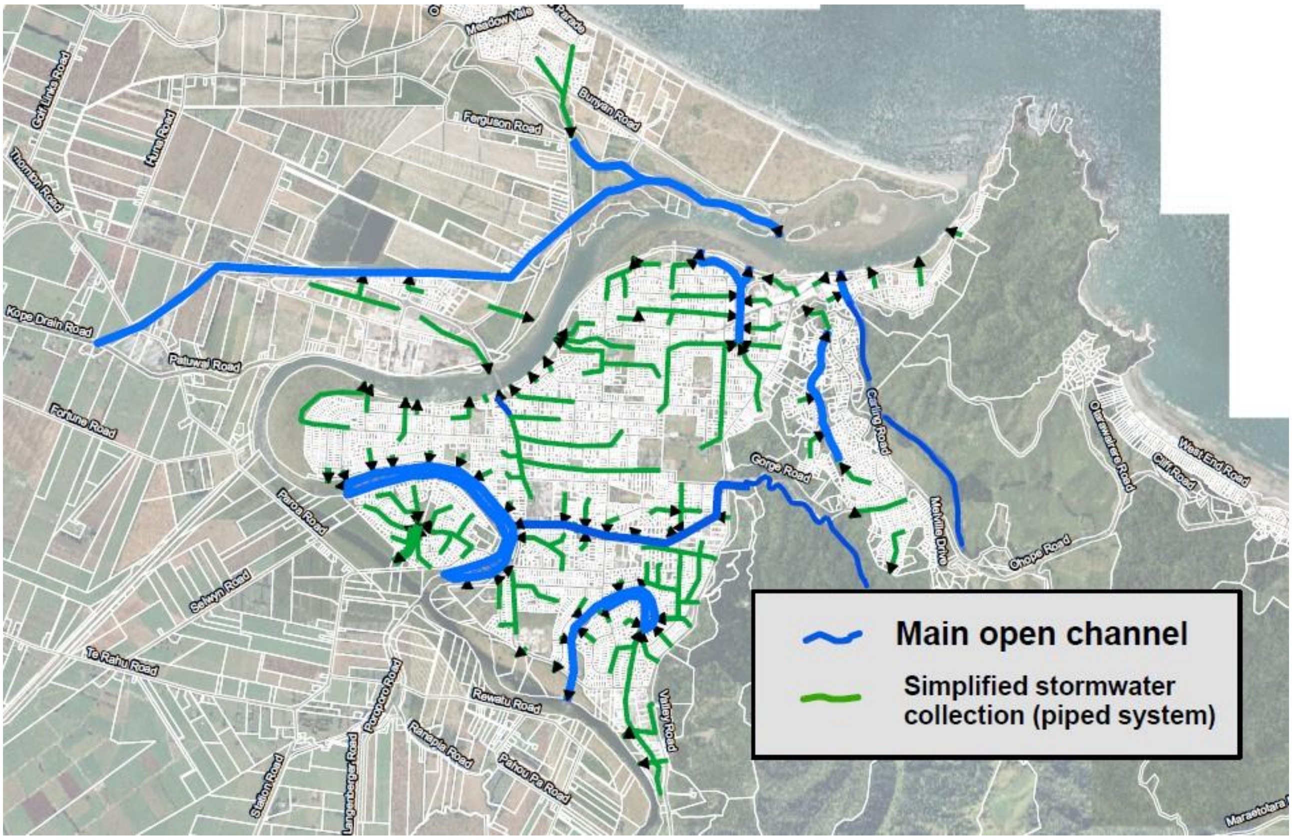

Figure 2.1: Whakatāne stormwater network showing simplified stormwater collection system and open waterways

1.3 Streams and the receiving environment

Ecological values of the stream receiving environment have been assessed in reports by Hamill (2015), Opus (2016), and Opus (2017). A summary of the ecological values of each of the receiving waters is provided below.

Whakatāne River has important ecological, recreational and cultural values. The salt marsh in the lower estuary provides important habitat for fish and birds. The lower section, downstream from Landing Road bridge, is considered in regional plans to be part of the coastal marine area. Daily water levels in this section of river are greatly affected by tidal fluctuations.

Wainui Te Whara Stream originates in the hill country around Mokourua, flows through the town and into Awatapu lagoon from which it enters the Whakatāne River via a fish friendly flap gate. It supports a range of native fish species.

Awatapu Lagoon is a man-made ox-bow lake that was isolated from the Whakatāne River as part of flood protection works in the 1970s. It is 7.7 ha in size and on average 1.7 m deep with a maximum depth of 4.3 m. Water quality in the lagoon improves closer to the outlet where it is tidally connected to the Whakatāne River; overall the nutrient water quality is poor with frequent algae blooms and the presence of nuisance aquatic macrophytes such as parrots feather and hornwort. Awatapu Lagoon nevertheless provides valuable habitat for fish and birds.

Sullivan Lake is a shallow nutrient rich lake. Water quality is poor (classed as hypertrophic) and there are frequent nuisance algae blooms. It is valued as a habitat for waterfowl.

Wairere Stream drains farmland east of Hillcrest and receives only a small amount of urban stormwater.

Waiewe Stream has about 1 km of open stream channel along Waiewe Street, is piped down Hillcrest Road, flows as a waterfall and open stream beside the Hillcrest steps and is piped under the Strand to discharge near the paru flax drying area and connect with the Apanui canal and McAlister Street pump station/gravity flapgate. Peak stormwater flows in this catchment are attenuated by a series of four small dams located in Waiewe Reserve

Apanui canal enters the Whakatāne River via a gravity flap gate and pump stations at McAlister Street and in the Whakatāne rose gardens. It has a completely urban catchment. There is about 1 km of open channel downstream of Pyne Street. Waiewe Stream connects with Apanui canal at the downstream end via the paru flax dying wetland and ponding area. The lower end (downstream of the strand) of Apanui canal is tidal due to the fish friendly flap gate (FFG) and this results in better water quality at the downstream end. Overall the water quality, habitat and ecological values of Apanui canal are poor, but it does support abundant shortfin eel (Opus 2017).

Hinemoa Street drain enters the Whakatāne River upstream of Landing Road bridge, via a gravity flap gate and pump station. It has a completely urban catchment and only about 360m of open channel. Overall, the water quality, habitat and ecological values of Hinemoa Street drain are poor. Shortfin eel and galaxiid species are present but in low abundance (Opus 2017).

1.4 Stormwater consent monitoring

WDC has the following resource consents for discharges of stormwater in Whakatāne that require monitoring:

- The Hub to Kopeopeo Canal (consent 63352)
- The Hub stormwater to Whakatāne River (consent 62713)
- Keepa Road pump station to Whakatāne River (consent 65604)
- Keepa Road settling pond to Orini Canal (RM20-0493, formerly resource consent 66383).

Monitoring requirements at these sites are summarised in Table 1.1 and the summary results are in Table 1.2. Numerical limits in the current consents are set for TSS (<150 mg/L), TPH (<15 mg/L) and pH (between pH 6 and 9).

Table 1.1: Summary of stormwater monitoring requirements on current stormwater consents for Whakatāne.

Consent	Location	Variables	Type	Frequency	Limits
63352	The Hub to Kopeopeo Canal	TSS, PAH, COD	Four samples at 10 minuite intervals per event	4 times per year	TSS
62713	The Hub to Whakatāne River PS	TSS, PAH, COD	Four samples at 10 minuite intervals per event	Quarterly	TSS
62713	The Hub Board Mill SW manhole	TSS, TPH	First flush	Annual	TSS, TPH
65604	Hub2 PS to Whakatāne River	TSS, TPH, pH	First flush (first 30 min)	4 times per year/ 2 times per year	TSS, TPH
66383	Keepa Rd ponds to Orini Canal	TSS, TPH, pH, Dioxin, TP, TN, Pb, Zn, Cu	First flush (first 30 min)	2 per year	TSS, TPH, pH

Note: Conditions also require compliance with criteria in the RMA Sec 107.

Table 1.2: Summary results of Whakatāne stormwater consent monitoring (dataset for Keepa Road was missing data for 2017 and 2018). Some lab results had unusually high detection limits of total metals.

Site	Statistic	n	pH	TSS	TPH	Dioxin WHO TEQ upper (pg/L)	PAH (mg/L)	COD (mg/L)	TP (mg/L)	TN (mg/L)	Total Lead	Total Zinc	Total Copper
Guideline				**150**	**15**	**30**					**0.012**	**0.043**	**0.008**
Keepa Rd to Oreni, 66383	Median	6	6.6	6.3	0.7	4.69			0.0885	0.49	0.0009	0.006	0.0021
Keepa Rd to Oreni, 66383	Max.	6	6.8	11	0.7	6.93			0.22	1.09	<0.0011	<0.021	<0.053
Hub to Kopeopeo Canal, 63352	Median	18		28			<0.00004	34					
Hub to Kopeopeo Canal, 63352	Max.	18		91			0.00047	200					
Hub to Whak. PS, 62713	Median	28		33.5			0.000018	25					
Hub to Whak. PS, 62713	Max.	28		179			<0.01	230					

Guidelines: TSS in discharge of <150 mg/L (BOPRC). TPH <15 mg/L (MfE Environmental Guidelines for Water Discharges from Petroleum Industry Sites in NZ). Dioxin < 30 pg I-TEQ /L (USEPA). Total metal guidelines are ANZECC trigger for 80% protection in marine waters.

1.5 Stormwater investigations

Tozer (2016) developed a monitoring programme for Whakatāne stormwater, which consisted of eight sampling locations to reflect a range of land use types across the catchment. The following samples were collected:

- Water samples were collected from 17 sites on four occasions during baseflow conditions. This included sampling from the Whakatāne River, Wainui Te Whara Stream, Wairere Stream, Hinemoa Stream, Apanui canal, Awatapu lagoon outlet, Sullivan Lake outlet and six stormwater outlets (Amber Grove, Coastlands, Gateway Drive, Sullivan Lake inlet, Te Tahi Street, and the Hub).
- Water samples were collected from four sites on four occasions during rain events.
- Sediment samples were collected from eight sites on two occasions. This included sampling from the Whakatāne River (three sites), Wainui Te Whara Stream (two sites), Wairere Stream, Apanui canal and the Amber Grove stormwater.

The sampling results were reported in WSP Opus (2019) (Table 1.3 and Table 1.4). The key results were:

- *E. coli* bacteria concentrations were high during storm events. Faecal source tracking of samples from Amber Grove, Apanui canal and Te Tahi Street found that the bacteria were not from a human source, instead the results indicated a wildfowl source and, at some sites, a possible ruminant source.
- Baseflow *E. coli* bacteria were above recreational bathing guidelines at Sullivan Lake and Hinemoa Stream.
- Total cadmium and mercury were within ANZG Default Guideline Values (DGV)[2] at all sites.
- Median total copper exceeded the ANZECC 80% protection level in baseflow stormwater discharges from Coastlands, Gateway Drive, and also at Amber Grove, Apanui canal and Te Tahi Street during rain events. In natural water bodies, total copper exceeded that 90% protection limit at Hinemoa Street, Wainui Te Whara and in the lower Whakatāne River.
- Median total zinc exceeded the ANZECC 80% protection level in baseflow stormwater discharges from Gateway Drive, and also at Amber Grove, Apanui canal and Te Tahi Street during rain events. The median zinc concentration at Gateway Drive was very high compared to other sites. In natural water bodies, total zinc exceeded that 90% species protection limit at Hinemoa Street and Apanui Stream.
- Median total chromium (III and IV) was within ANZECC 80% protection level at all sites (baseflow and rain event monitoring). In natural waterbodies total chromium was within the ANZECC 90% protection level at all sites. Note that chromium exceeded the ANZECC 95% protection trigger at all sites in part because the trigger level was lower than the laboratory detection limit.
- Median total lead was within the ANZG DGV at all sites during baseflow conditions. However, the ANZECC 90% protection level was exceeded in stormwater from Te Tahi Street during rain events. pH was consistently within the trigger range.
- There were five (marginal) exceedances of the BOPRC 150 mg/L TSS trigger level. In the Wainui Te Whara Stream this was associated with dredging work occurring in the stream at the time.
- All hydrocarbons were below laboratory detection limits.
- Sediment from Apanui canal had Cu, Pb and Zn above the ANZG DGV and Zn above the ANZG DV-high. Sediment from Amber Grove had Zn above the ANZG DGV (Table 1.4).
- High concentrations of total copper or zinc were often associated with high concentrations of suspended solids.
- In general, the highest concentration of total metals in baseflow stormwater was from Gateway Drive.

Key recommendations from WSP Opus (2019) included:

- Maintain *E. coli* monitoring at recreational sites on a quarterly basis. Undertake one-off faecal source tracking for Sullivan Lake and Hinemoa Stream.
- Maintain monitoring of copper, chromium, lead and zinc, TSS, pH, NH4-N, nitrate, TPH on a quarterly basis. Less frequent monitoring might be appropriate for Wainui Te Whara upstream and Wairere Stream.
- Continue sediment sampling for copper, lead and zinc and consider additional inclusion of chromium, cadmium and organic carbon.
- Investigate the possible reasons for relatively high copper and zinc at Gateway Drive stormwater and high copper at Coastlands.
- Apply the ANZECC 90% protection trigger for water quality in natural water receiving environments.

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[2] ANZG (2018) is an update of ANZCC (2000). ANZECC (2000) is referenced in the BOP Regional Natural Resources Plan, Schedule 9. For metal contaminants, the ANZG DGVs are the same as the ANZECC (2000) 95 percentile values. For sediments the ANZG (2018) is the same as the ANZECC DV low.

Note that this monitoring programme has refined some of these recommendations to incorporate more recent methods, focus on stormwater effects, link to actions and integrate with existing monitoring programmes.

Table 1.3: Median water quality from baseflow and rain-event sampling by WSP Opus (2019). Shaded cells indicated exceedance of ANZECC guideline values as follows: >95% protection = blue, >90% protection = green, >80% protection = yellow. Site names in bold are natural waterbodies.

Site Name	**Count**	**Flow**	**TSS (g/m3)**	**Total Cadmium (g/m3)**	**Total Chromium (g/m3)**	**Total Copper (g/m3)**	**Total Lead (g/m3)**	**Total Mercury (g/m3)**	**Total Zinc (g/m3)**	**NH4-N (g/m3)**	**Nitrate-N (g/m3)**	***E. coli* cfu/100ml**
Amber Grove	4	Base	13	0.000053	0.00063	0.00075	0.00055	0.00008	0.01165	0.18	0.12	34
Apanui Canal	4	Base	5.5	0.000053	0.00058	0.000795	0.0003	0.00008	0.0186	0.27	0.21	27
Awatapu Outlet	4	Base	19	0.000053	0.00055	0.00124	0.0007	0.00008	0.0032	0.06	0.21	95
Coastlands	4	Base	4	0.000053	0.000635	0.0037	0.00067	0.00008	0.0063	0.03	0.01	60
Gateway Drive	4	Base	17.5	0.000053	0.00214	0.0043	0.00123	0.00008	0.3435	0.07	0.30	55
Hinemoa Stream	4	Base	3	0.000053	0.00053	0.00235	0.00065	0.00008	0.0465	0.21	1.08	685
Sullivan Lake Inlet	4	Base	13	0.000053	0.000825	0.00145	0.00065	0.00008	0.01455	0.05	0.23	780
Sullivan Lake Outlet	4	Base	10.5	0.000053	0.00053	0.001325	0.0006	0.00008	0.01105	0.010	0.05	225
Te Tahi Street	4	Base	3	0.000053	0.00053	0.00086	0.00026	0.00008	0.0166	0.04	0.30	40
The Hub	3	Base	33	0.00011	0.0011	0.0011	0.00021	0.00008	0.0094	0.12	0.15	10
Wairere Stream	4	Base	3	0.000053	0.00053	0.00053	0.00011	0.00008	0.0015	0.014	0.59	210
Wainui Te Whara Downstream	4	Base	59	0.000053	0.001345	0.001835	0.00177	0.00008	0.0069	0.014	0.40	75
Wainui Te Whara Upstream	4	Base	3	0.000053	0.00053	0.00053	0.00012	0.00008	0.0011	0.010	0.41	52
Whakatane River Downstream	4	Base	12.5	0.00021	0.0019	0.0019	0.0011	0.00008	0.0049	0.021	0.20	50
Whakatane River Bridge	4	Base	17.5	0.0000815	0.0011	0.0011	0.00077	0.00008	0.00325	0.020	0.20	55
Whakatane River Midway	4	Base	52	0.000053	0.00104	0.001515	0.00109	0.00008	0.00475	0.012	0.21	54.5
Whakatane River Upstream	4	Base	17	0.000053	0.00053	0.000595	0.00023	0.00008	0.00135	0.010	0.19	40.5
Amber Grove	4	Rain	17.5	0.000053	0.001545	0.0031	0.00355	0.00008	0.1095	0.07	0.14	3100
Apanui Canal	4	Rain	23	0.0000815	0.00244	0.01015	0.0054	0.00008	0.1435	0.07	0.09	3100
Te Tahi Street	4	Rain	83	0.000138	0.0079	0.0119	0.0084	0.00008	0.307	0.01	0.09	2850
Wainui Te Whara Downstream	3	Rain	17	0.000053	0.00077	0.00153	0.00074	0.00008	0.0127	0.01	0.09	500

Table 1.4: Sediment results from WSP Opus (2019) [3]

Date	**Site**	**Sediment fraction**	**Total Copper (mg/kg dw)**	**Total Lead (mg/kg dw)**	**Total Zinc (mg/kg dw)**
10/08/16	Amber Grove	<2mm	27	37	**350**
20/11/17	Amber Grove	<63µm	22	23	177
10/08/16	Apanui Canal	<2mm	42	**62**	**400**
20/11/17	Apanui Canal	<63µm	**121**	**181**	**1180**
20/11/17	Waiewe Stream	<63µm	15.2	25	164
20/11/17	Wairere Stream	<63µm	6.4	9.5	47
20/11/17	Wainui Te Whara Downstream	<63µm	10.2	12.3	76
10/08/16	Whakatāne River Downstream	<2mm	16.3	12	62
20/11/17	Whakatāne River Downstream	<63µm	15.1	9.9	61
10/08/16	Whakatāne River Midway	<2mm	11.6	8.3	44
20/11/17	Whakatāne River Midway	<63µm	16.2	11.5	63
10/08/16	Whakatāne River Upstream	<2mm	7.6	4.7	29
20/11/17	Whakatāne River Upstream	<63µm	15.7	10.3	60

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[3] Bolded values are above the ANZG Default Guideline Value (DGV) of copper 65 mg/kg, lead of 50 mg/kg and zinc of 200 mg/kg

2 Monitoring programme

2.1 Introduction

The monitoring proposed in this draft Stormwater Monitoring Plan focuses on collecting stormwater samples, sediment samples and passive DGT samples (diffusive gradient in thin film) of dissolved metal. These are compared to guideline trigger value to determine whether additional management action is required.

2.2 Sites

The locations of proposed sample sites are listed in Table 2.1. The sampling focuses on key waterbodies (Whakatāne River, Wainui Te Whara/Awatapu, Sullivan Lake, Apanui canal), areas with higher risk of stormwater contamination (i.e. the industrial zone near Te Tahi Street and commercial area/CBD draining to Apanui canal), and existing stormwater monitoring.

Apanui canal is classified as an artificial waterway and Hinemoa Stream is classified as a stream, but in practice both waterways have very similar characteristics. Both have almost 100% urban stormwater catchment, both are highly modified, have a tidal influence and support shortfin eel.

Table 2.1: Sample sites proposed for ongoing monitoring

ID	Site	Water type	Land use	Sample type	Frequency
Whakatāne South 11	Te Tahi Street	Stormwater	Industrial	Stormwater, DGT	annual
	Te Tahi Street to Sullivan Lake	Stormwater	Industrial	DGT	annual
	Keepa Road to Orini Canal (consent RM20-0493)	Stormwater	Residential	Stormwater	annual
	Gateway Dr to Kopeopeo Canal	Stormwater	Industrial/ Commercial	Stormwater, DGT	annual
	Hub to Kopeopeo Canal (consent 63352)	Stormwater	Industrial/ Commercial	Stormwater	annual
	Hub to Whakatāne River PS (consent 62713)	Stormwater	Industrial/ Commercial	Stormwater	annual
Apanui 2	Apanui canal	Stormwater	Commercial /CBD	Sediment, DGT	annual
	Hinemoa Stream	River	Residential	Sediment, DGT	annual
	Wainui Te Whara before Awatapu Lagoon	River	Residential	Sediment, DGT	annual
	Whakatāne River Upstream	River	Rural	Sediment	annual
	Whakatāne River Downstream McAlister St	River	Rural/urban	Sediment	annual

Note: the site Te Tahi Street to Sullivan Lake has not previously been sampled.

2.3 Timing and Frequency

2.3.1 Stormwater

Stormwater will be sampled at least annually during the first flush of a rain event. The samples shall be representative of the stormwater from the outlet and, where practicable, shall be collected within the first 30 minutes of a rain-event.

Stormwater quality can vary considerably during a rain-event, but generally the highest concentrations occur during a first flush and on a rising flow. Capturing the first flush of a rain event can be challenging and consideration will be given to using passive automatic sampling devices to collect samples at set water level(s) on the rising flow. The practicality of deploying these types of devices depends on the characteristics of individual stormwater outlets.

A long-term integrated sample of stormwater and baseflow events shall be collected using Diffusive Gradient in Thin-film (DGTs) devices (see below). DGTs (or equivalent) shall be deployed annually for a minimum three-week period during the summer/autumn (1 November to 30 May). The deployment period should include at least one /stormwater discharge event.

2.3.2 Sediment in rivers

A single, bulked, sediment sample shall be collected annually.

2.4 Methods

2.4.1 Stormwater grab samples

Samples shall be collected as grab samples from the stormwater drains or outlets. Samples shall be collected by a suitably experienced person. Gloves shall be worn to minimise the risk of sample contamination and to protect the field personnel. The grab sample collection method is described in Appendix B.

If samples are collected using a passive, automatic sampling device, then the devices shall be checked after each significant rain-event to ensure samples are collected from the devices within 24 hours of the event.

The sample shall be chilled, stored in a cool dark chill-bin and sent to the laboratory for analysis. Extra care should be taken of samples for analysis of faecal coliform bacteria. It is critical that these are stored in a cool, dark place and they should arrive at the laboratory for analysis within 24 hours of collection.

2.4.2 DGT sampling devices

DGT devices provide a cost-effective way to measure time-weighted average concentrations of dissolved metals in water. DGTs can be used for measuring concentrations of many metals including Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn. They provide results comparable to bioavailable dissolved metal fraction. DGT measures all solution species that are labile (available to biota). They do not measure metals that are incorporated inside mineral particles and are therefore inert or unreactive.

DGTs can be deployed for long periods of time to capture average concentrations over the period. The longer the deployment times, the more metal accumulates and the lower the detection limits. The maximum concentration that can be measured depends on the capacity of the resin.

When deploying DGTs in receiving waters it is appropriate to compare the results with chronic guideline values (e.g. ANZECC guidelines). Procedures for deploying DGTs are described in Appendix B.

2.4.3 Sediment

Samples shall be collected by a suitably trained person. Gloves shall be worn to minimise the risk of sample contamination and to protect the field personnel.

The samples shall be collected from an area of fine sediment deposition in a pool or a run.

The sediment samples shall be collected from the **top 2 cm** of sediment only. Samples shall be collected from a known area using a sediment corer or plastic scoop. A minimum of six cores shall be collected and bulked into a single sample to obtain a sediment volume of about 800 mL. The cores shall be collected over an area covering at least 1 m^2.

After the sample has been placed in the sample container, any excess free water shall be decanted. Any loss of sediment shall be minimised.

Samples shall be transported in a cool chilli-bin, chilled to 4°C and remain chilled during transport to the laboratory. Samples shall be transported to the laboratory promptly, in accordance with maximum holding times for relevant variables being tested. If sediment samples cannot be sent to the laboratory within 24 hours then they should be frozen.

The area of sediment sampled shall be recorded.

2.5 Variables to analyse

2.5.1 Water and stormwater

The water samples shall be analysed for: total suspended solids (TSS), hardness, chromium (Cr), copper (Cu), zinc (Zn), and lead (Pb). Note that hardness is important for assessing the bioavailability of metals in water samples (particularly Cr, Cu, Zn, and Pb). Water with more saline influence tend to be harder. Hardness may be removed from the analysis suite if a relatively consistent concentration is found after a minimum of six samples from a particular site.

Where DGTs are deployed they shall be analysed for Chromium (Cr), copper (Cu) and zinc (Zn). [4]

At the time of sample collection field observations shall be made of any films of hydrocarbon on the water. Also, records shall be made of:

- the date and time of sampling.

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[4] WSP OPUS (2018) found that variables were more likely to exceed guideline values in Whakatāne stormwater.

- amount of rain that fell in the previous 1 hour.
- amount of rain that fell in the previous 24 hours.
- conditions at the time of sampling.

The sample analysis shall be carried out by an IANZ accredited laboratory.

Some past and current stormwater discharge consents have included analyse of Total Petroleum Hydrocarbons (TPH) (Consent 66383) or Polycyclic Aromatic Hydrocarbons (PAH) (Consent 63352). TPH is general indicator of the level of contamination by a broad range of hydrocarbon compounds. MfE (1998) set guidelines for the maximum level of TPH allowable in stormwater averaged over an event as 15 mg/L. PAH are a class of semi-Volatile Organic Compounds (VOC). It is not proposed to regularly test stormwater for these variables on a regular basis because TPH and PAH are strongly associated with sediment particles, are typically low in urban stormwater (Kennedy et al. 2016), and have been confirmed in past consent monitoring as being very low of Whakatāne stormwater.

The current consent for the Keepa Road stormwater pond discharge to Orini Canal (Consent 66383) includes analysis for dioxins. The rational was, presumably, because the stormwater ponds is near a site known to be contaminated with dioxins from past dumping of wood waste. We proposed to continue to monitor dioxins from the stormwater for consistency with past monitoring, but note that dioxins from stormwater is considered a low risk because past monitoring has shown the dioxin concentration in the stormwater to be low, dioxins are strongly associated with sediment and the potential source of dioxins is from the capped contaminated site rather than the urban stormwater.

2.5.2 Sediment

The sediment samples shall be analysed for the following variables: total chromium (Cr), total copper (Cu), total lead (Pb), total zinc (Zn) and Polycyclic Aromatic Hydrocarbons (PAHs).

Sample analysis shall be carried out on the fraction of sediment less than 63 microns by an IANZ accredited laboratory. Prior to analysis the sediment samples shall be sieved through a 63 micron filter to remove coarse sands and gravels.

The following additional variables shall be analysed to help with interpretation: organic carbon, dry matter (g/100g), density (g/mL) and wet weight (g). Analysis of dry matter is to allow a conversion from wet weight to dry weight and analysis of density is to convert to sample volume and allow a retrospection confirmation of average depth actually sampled.

2.6 Health and Safety

Samples shall be collected in accordance with Whakatāne District Council Health and Safety procedures, including contact procedures and incident reporting. Contractors undertaking Monitoring shall submit a Health and Safety plan for review by WDC prior to undertaking works.

Potential hazards shall be identified for each regular sample site and contractors undertaking sampling are provided with a copy of the sampling locations and know hazards and risk assessment. Any additional hazards identified during sampling should be recorded, actions taken to remedy these if required and the risk assessment updated accordingly.

Site specific risks may change due to factors such as time of day and weather conditions. Those undertaking sampling should take appropriate actions to address risks presented for sampling alone, night time sampling, or sampling in adverse weather conditions.

If samples cannot be collected safely than an alternative site (e.g. further upstream), alternative timing (during low flows) or an alternative method should be investigated in consultation with the Project manager.

3 Reporting and Triggers

3.1 Triggers

Water quality guidelines have been set to trigger a response based on the monitoring results. The trigger values based on the DGVs indicate a level to trigger further analysis and monitoring to determine whether aquatic ecosystems are adequately protected. They are a prompt to investigate in more detail, rather than a standard that has to be met.

The triggers are based on the guideline values from ANZECC (2000)[5], ANZG (2018), USEPA (2006) and BOPRC. Response trigger values have been tailored to reflect whether the sample is from a stormwater discharge or a natural waterway, the quality of the receiving environment and the type of sample as follows:

- For baseflow monitoring (i.e. outside of flood events) of streams and rivers the triggers have been set at the 80% protection level and the 95% protection level depending on the state of the waterbody. These triggers apply to the results from DGT devices in natural waters because the devices integrate results over the whole period of deployment (Table 3.1).
- Rain event monitoring of natural waters is not currently proposed, but if it were to occur the recommended trigger for metals would be the relevant USEPA Criteria Maximum Concentration (CMC) which protects against acute effects. Acute toxicity criteria are used as triggers for intermittent stormwater discharges because the events are generally of very short duration and have considerable dilution with the receiving environment (Table 3.1).
- For stormwater discharges during baseflow conditions, i.e. results of long-term deployment of DGT devices, the triggers have been set at ten times the relevant ANZECC guideline for the receiving water, on the assumption of there being at least ten times dilution. This is an arbitrary but likely conservative assumption for the small stormwater systems under consideration.
- For stormwater discharges during rain-events, the triggers are set at 10 times the USEPA acute CMC value. A response trigger value of 150 mg/L total suspend solids is also applied to stormwater monitoring results based on BOPRC guidelines. This trigger excludes extreme rain events greater than the 10% AEP.

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[5] ANZG (2018) is an update of ANZCC (2000). ANZECC (2000) is referenced in the BOP Regional Natural Resources Plan, Schedule 9. For metal contaminants, the ANZG DGVs are the same as the ANZECC (2000) 95 percentile values. For sediments the ANZG (2018) is the same as the ANZECC DV low.

- For sediment samples from natural systems after reasonable mixing (e.g. Whakatāne River) the trigger is set as the Default Guideline Value (DGV) from ANZG (2018).
- For sediment samples from stormwater systems (e.g. Apanui canal) the trigger is set as the DGV-high from ANZG (2018) (Table 3.2). The GV-high has typically been used as the trigger in previous BOPRC Comprehensive Stormwater Consents (CSC).

The response trigger level for each monitoring site and sample type is shown in Table 3.3 (water quality) and Table 3.4 (sediment).

Table 3.1: Water quality trigger values for receiving water environments from ANZECC (2000) and USEPA (2006). Discharge values based on the US-EPA acute (CMC) assuming a hardness of 30 g/m^3.

Trigger values	**Freshwater (µg/L)**			**Marine water (µg/L)**			**Freshwater**
Metals	ANZECC Protection Level			ANZECC Protection Level			**US-EPA acute**
	95%	90%	80%	95%	90%	80%	CMC
Chromium (CrVI)	1	6	40	4.4	20	85	16
Copper	1.4	1.8	2.5	1.3	3	8	4.3
Lead	3.4	5.6	9.4	4.4	6.6	12	17
Zinc	8	15	31	15	23	43	42

Notes

- *Water trigger values for dissolved metals Cr, Cu, Pb, Zn, and Cd are based on the US-EPA acute (CMC) assuming a hardness of 30 g/m^3. The triggers should be adjusted for actual water hardness (USEPA 2006).*
- *Chromium (IV) is considerably more toxic than Cr (III), the trigger value provided relates to chromium (III) and so is conservative if total chromium is analysed.*

Table 3.2: Sediment trigger values receiving environments (ANZG 2018). Applicable to fine sediment fraction (<63um) and PAH normalised to 1% organic carbon within the limits of 0.2 to 10%.

Variable	**DGV (mg/kg dry wt)**	**GV-high (mg/kg dry wt)**
Total chromium	80	370
Total copper	65	270
Total lead	50	220
Total zinc	200	410
Polycyclic Aromatic Hydrocarbons (PAHs)	10	50

Table 3.2: Water quality trigger values for each monitoring site and sample type.

Site		**Cr (µg/L)**	**Cu (µg/L)**	**Pb (µg/L)**	**Zn (µg/L)**	**TSS (mg/L)**	**Trigger rational**
Stormwater							
Te Tahi St (WHK south11)	Stormwater	160	43	170	420	150	10x USEPA CMC
Te Tahi St (WHK south11)	DGT	10	14	34	80	150	10x ANZECC 95% level
Te Tahi St to Sullivan Lake	DGT	60	18	56	150	150	10x ANZECC 90% level
Keepa Rd to Orini Canal (Consent 66383)	Stormwater	160	43	170	420	150	10x USEPA CMC
Gateway Dr to Kopeopeo Canal	Stormwater	160	43	170	420	150	10x USEPA CMC
Gateway Dr to Kopeopeo Canal	DGT	60	18	56	150	150	10x ANZECC 90% level
Hub to Kopeopeo Canal (Consent 63352)	Stormwater	160	43	170	420	150	10x USEPA CMC
Hub to Whakatāne Rv PS (Consent 62713)	Stormwater	160	43	170	420	150	10x USEPA CMC
Streams/rivers							
Apanui Canal	DGT	40	2.5	9.4	31	na	ANZECC 80% level
Hinemoa Stream	DGT	40	2.5	9.4	31	na	ANZECC 80% level
Wainui Te Whara before Awatapu Lagoon	DGT	1	1.4	3.4	8	na	ANZECC 95% level

Table 3.2: Sediment trigger values for each monitoring site and sample type.

Site	**Cr (mg/kg)**	**Cu (mg/kg)**	**Pb (mg/kg)**	**Zn (mg/kg)**	**PAH (mg/kg)**	**Trigger rational**
Apanui Canal	370	270	220	410	50	ANZG GV-High
Hinemoa Stream	80	65	50	200	10	ANZG GDV
Wainui Te Whara before Awatapu Lagoon	80	65	50	200	10	ANZG GDV
Whakatāne River Upstream	80	65	50	200	10	ANZG GDV
Whakatāne River Downstream McAlister St	80	65	50	200	10	ANZG GDV

3.2 Response if triggers are exceeded

If the sampling of either stormwater or sediment has results that exceed the trigger levels[6] then the permit holder shall initiate the actions set out in the Stormwater Management Plan.

In the event that the results of either stormwater or sediment samples exceed the trigger values then the permit holder shall initiate the actions set out in the Stormwater Management Plan. These actions shall include:

- Notification of BOPRC Consent Compliance officer.

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[6] Triggers to apply at any time except where the 10% Annual Exceedance Probability (AEP) design event is exceeded.

- Investigating potential causes of the exceedance. This may include undertaking contaminant source investigations to identify the source of contaminants.
- If the contamination is likely to be derived from the stormwater network, then initiating appropriate corrective actions to reduce the source of contaminants. These actions may include:
    - Reducing loads at source.
    - Reviewing district plan provisions.
- Re-testing of the discharge following implementation of the corrective actions.
- Reporting the result of any additional monitoring or contaminant source investigation to BOPRC Consent Compliance officer.

3.3 Reporting

3.3.1 Annual reporting

The result of stormwater and sediment sampling shall be reported to the Consents Compliance officer, Bay of Plenty Regional Council annually (or as required by the CSC consent). The report shall include:

- The location of sample site.
- The date and time of sampling or DGT deployment period.
- Rainfall in the 1-hour and 24-hour period prior to water sampling.
- Daily rainfall during DGT deployment period.
- Area of sediment sampled and depth sampled, size of corer and number of replicate cores. The actual depth sampled shall be check by using a calculation that divides wet weight by sediment density, and divides this by the sample area.
- Results of sample analysis.
- A comparison of the results with ANZECC guideline trigger values, ISQG-high, ISQG-low, and triggers set in the consent.
- An assessment of the quality of discharges and implications of the discharges on the receiving environment.

3.3.2 Six yearly review and reporting

The appropriateness of the stormwater monitoring programme shall be reviewed at least every six years[7] and sent to the Consents Compliance Manager, Bay of Plenty Regional Council. The review shall include:

- A summary of all previous stormwater monitoring data for the sites.
- A summary of any past exceedances and actions taken.
- Assessment of whether any trends or patterns are apparent.
- An assessment of the effectiveness of the monitoring method and recommendations for any changes to the monitoring methods, variables or sites.
- An assessment of the appropriateness of trigger values whether they need to be revised.
- An assessment of any at risk catchments and recommendations regarding potential mitigation or revision of the Catchment Management Plan.

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[7] Six year reviews corresponds with the LTP process with the first review in 2024.

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Appendix 1: Stormwater discharge locations

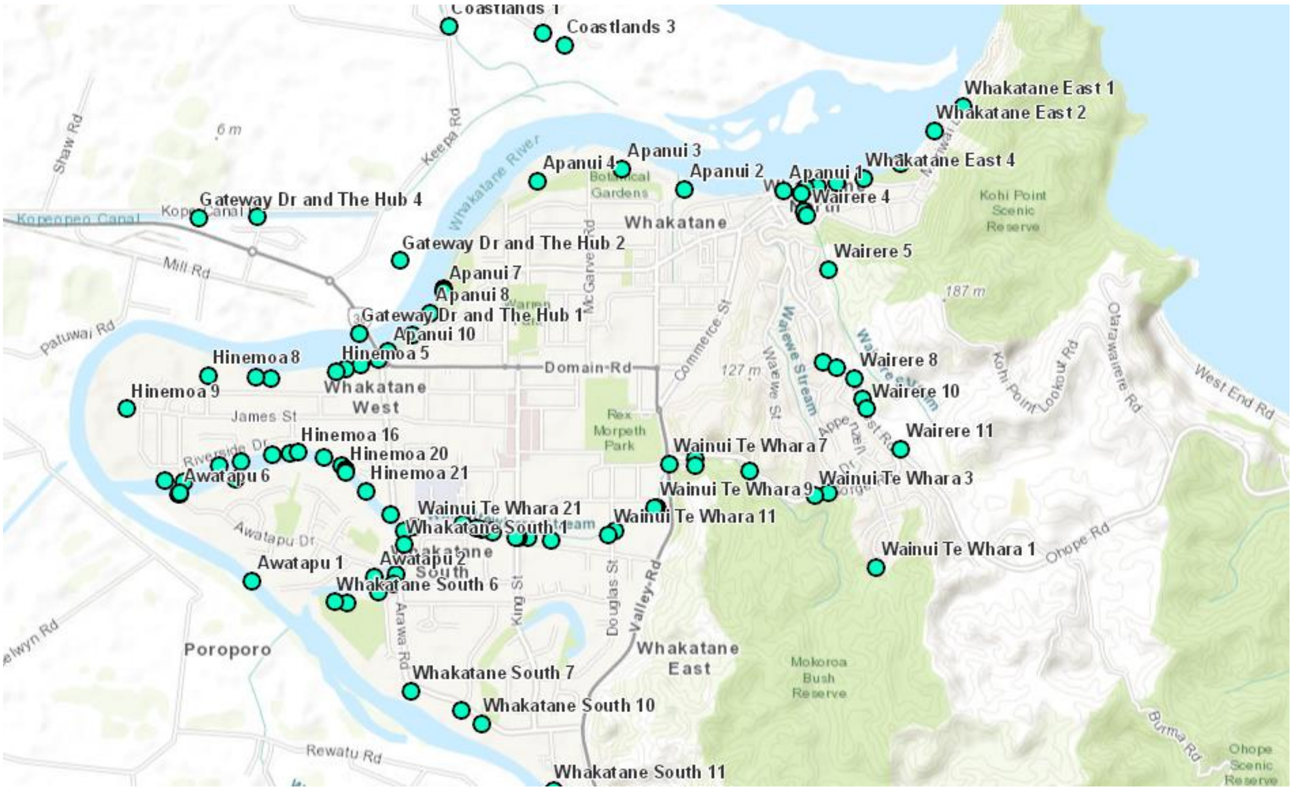

Figure 1: Whakatāne stormwater discharge locations

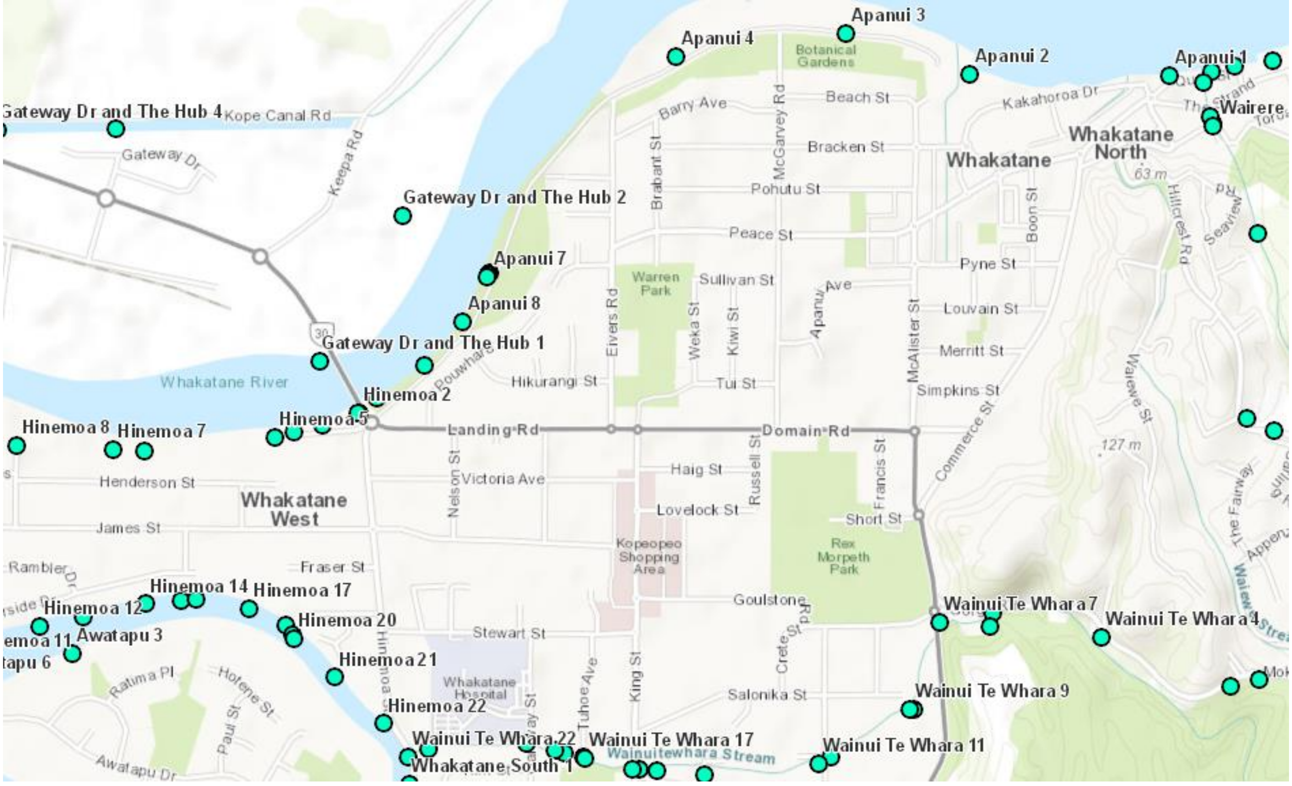

Figure 2: Whakatāne stormwater discharge locations, north.

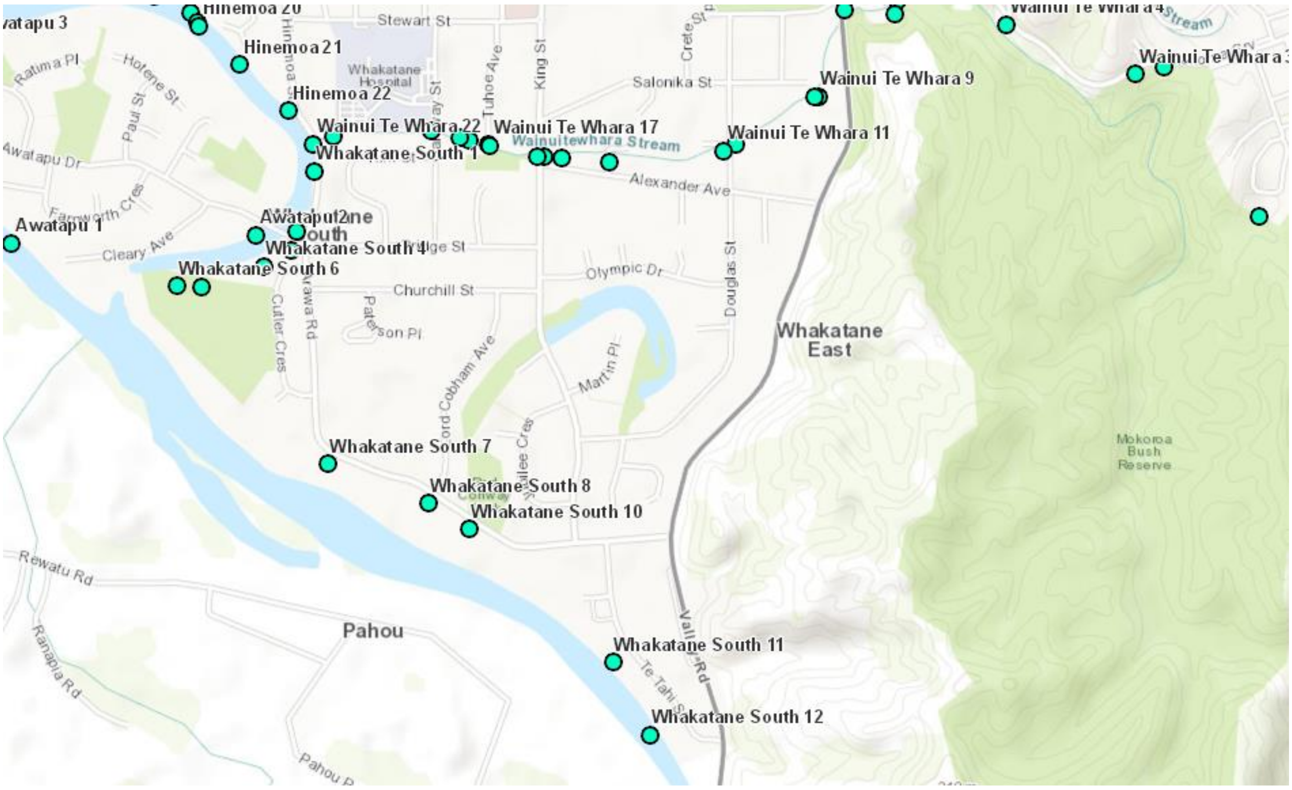

Figure 3: Whakatāne stormwater discharge locations, south.

Appendix 2: Monitoring location site details

Sample site:

Sub-catchment:

Site description and access:

Grid reference:

Hazards:

Water depth: **Tidal influence:**

Monitoring type:

Monitoring Frequency:

Photo

Sample site:

Sub-catchment:

Site description and access:

Grid reference:

Hazards:

Water depth: **Tidal influence:**

Monitoring type:

Monitoring Frequency:

Photo

Sample site:

Sub-catchment:

Site description and access:

Grid reference:

Hazards:

Water depth: **Tidal influence:**

Monitoring type:

Monitoring Frequency:

Photo

Sample site:

Sub-catchment:

Site description and access:

Grid reference:

Hazards:

Water depth: **Tidal influence:**

Monitoring type:

Monitoring Frequency:

Photo

Sample site:

Sub-catchment:

Site description and access:

Grid reference:

Hazards:

Water depth: **Tidal influence:**

Monitoring type:

Monitoring Frequency:

Photo

Appendix 3: Field sampling methods

Water quality grab samples

Sample containers shall remain unopened until time of sampling. Lids shall be placed upright, and the inside of the bottle, including the lid, should not be touched to avoid the potential for contamination.

Samples shall be collected directly into the prescribed container. Sample containers should NOT be rinsed to ensure any preservatives (e.g. for metal analysis) are not washed out.

Surface water samples shall be collected from about 5cm below the water surface, utilising a suitable device able to recover samples from a designated depth and prevent ingress of surface water. Samples containing preservatives shall be filled to maximum capacity, those not containing preservatives filled to overflowing. Sampling for analysis of TPH shall comprise a sweep across the water surface.

Care is needed to avoid potential contamination of the sample during sample collection. Sample containers shall be held at the base, and the bottle neck plunged downward below the surface. The bottle shall be turned until the neck points slightly upward and the mouth is directed toward the current. If there is no current, a current is artificially created by pushing the bottle forward horizontally in a direction away from the hand. Care shall be taken to avoid contact or disturbance of the bank or stream bed as this may cause fouling of the water and sample.

If more than one sample is to be collected from the same watercourse (e.g. open drain, stream), sampling shall commence at the location furthest downstream, and work upstream in turn.

Samples shall be transported in a cool chilli-bin, chilled to 4°C and remain chilled during transport to the laboratory. Samples shall be transported to the laboratory promptly, in accordance with maximum holding times for relevant variables being tested.

Passive Samplers (DGTs, diffusive gradient in thin film)

Procedures from DGT Research (www.dgtresearch.com/guides-to-using-dgt/)

Handling

- Store DGT units in a refrigerator prior to use and within a plastic bag. Ensure they remain in a moist environment.
- Do not remove from the sealed plastic bag until immediately (minutes) prior to deployment.
- Only get hold of the DGT unit with clean hands.
- Do not touch the white filter at the face of the unit and do not let it come into contact with anything else.

Deployment

- Having placed the DGT unit in its holder or attached it to any deployment device through the hole on the unit using any fishing line, deploy the unit immediately (minutes).

- Ensure the unit is deployed in flowing (or moving) water, but avoid excessive turbulence, particularly bubbles.
- Ensure that the white face of the DGT unit is fully immersed during the deployment period.
- Provide an accurate record to the nearest minute of the deployment time and the temperature of the water during the deployment time. If the variation is within + 2oC a mean (or start and end temperature) will suffice. If the variation is greater, ideally the mean temperature should be obtained from an integrated record of temperature (data logger or chart recorder).

Retrieval

- On retrieval of the holder remove the DGT unit immediately (minutes), taking care not to touch the face filter.
- Rinse the DGT unit with a wash bottle stream of distilled/deionised water and shake off obvious surface water (do not dry it).
- Place in the clean plastic bag provided and seal with minimum air space. Mark on the bag. Store it in a refrigerator.

Appendix 4: Further trigger value explanation

Sediment

Filtering sediments according to particle size has an important effect on the metal concentration. The ANZG (2018) recommends applying the revised default guideline values for toxicants in sediment' to the <63 um sediment fraction.

Previously, the ANZECC (2000) guidelines applied to whole sediment fractions but particles >2mm (e.g. gravels) are usually not a source of bioavailable contaminants. The silt/clay fraction (<63 um) is more likely to absorb heavy metal contaminants. Because of this it is common to normalise contaminant analysis on the basis of the clay/silt fraction. Sieving is usually undertaken to remove unrepresentative particles greater than 1-2 mm in size (e.g. rocks, shells) that might distort the analyses. However, monitoring programmes differ as to whether they focus on the <2mm fraction, <500 micron fraction or the less than 63 micron fraction. BOPRC coastal estuarine surveys are based on the <500um sediment fraction (Park 2009).

ANZG (2018), in the 'revised default guideline values for toxicants in sediment', specifies a default guideline value (DGV) and a Guideline Value – High (GV-high). The GV-high represents the median value of the effects ranking while the DGV is based on a no-observed-effects level (NOEL). As such, GV-high could be considered as more likely to be associated with biological effects than the DGV but the extent of that impact is not necessarily known.

Thus, the GV-high is recommended for use as an indicator of potential high-level toxicity problems, and the DGV is recommended as a guideline value to ensure protection of ecosystems. If a DGV is exceeded than a multiple lines-of-evidence approach is recommended to better assess the risk to a sediment ecosystem.

Table xx: ANZG (2018) default guideline values for sediment quality. Applicable to fine sediment fraction (<63um) and normalised to 1% OC within the limits of 0.2 to 10%.

Type of toxicant	Toxicant	DGV	GV-high
Metals (mg/kg dry weight)a	Antimony	2	25
	Cadmium	1.5	10
	Chromium	80	370
	Copper	65	270
	Lead	50	220
	Mercury	0.15	1
	Nickel	21	52
	Silver	1	4
	Zinc	200	410

Stormwater

Regional water quality classification standards and criteria reference ANZECC water quality guidelines (2000) for assessing potential adverse effects on aquatic life. ANZECC guidelines are based around continuous, long-term (chronic) exposure conditions, as opposed to the intermittent, relatively short-term (acute) exposure conditions associated with storm events. Because stormwater events are intermittent, the use of chronic guidelines values for assessing the potential for stormwater toxicants on aquatic life will tend to be overly conservative (i.e. too cautious). This may result in implementing contaminant mitigation measures that are unnecessary from an effects basis.

The US EPA water quality criteria for toxicants provide guideline concentrations for both chronic and acute exposure events (US EPA 2002). Chronic and acute guideline concentrations are referred to as criterion continuous concentrations (CCC) and criterion maximum concentrations (CMC), respectively. The CMC provides a better indication of acute effects and are appropriate to compare with short term declines in water quality during stormwater events; while the CCC (or the ANZECC guideline values) provide a better indication of chronic effects and are appropriate to compare with average or baseline monitoring results.