Port of Hastings Development Project

Settlement Testing and TSS-Turbidity Relationships for Dredged Material Management Purposes

Port of Hastings Development Authority

March 2015
Final Working Draft (Revision 0)
8A0300

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In May 2016 the Special Minister of State asked Infrastructure Victoria to provide advice on the future capacity of Victoria's commercial ports. Specifically, the Minister has asked for advice on when the need for a second container port is likely to arise and which variables may alter this timeline. The Minister has also asked for advice on where a second container port would ideally be located and under what conditions, including the suitability of, and barriers to investing in, sites at the Port of Hastings and the Bay West location.

In undertaking this task, Infrastructure Victoria reviewed work that was completed as part of the Port of Hastings development project before it was cancelled in 2014. This document forms part of the initial work undertaken for the proposed port development at Hastings. Infrastructure Victoria considers that much of the previous Hastings work, although preliminary in nature, is relevant and suitable for informing a strategic assessment. Therefore, Infrastructure Victoria has made the reports previously commissioned for the development project part of the evidence base on which Infrastructure Victoria will use in providing the Minister with advice.

The opinions, conclusions and any recommendations in this document are based on conditions encountered and information reviewed at the date of preparation of the document and for the purposes of the Port of Hastings Development Project.

Infrastructure Victoria and its consultants have used the information contained in these reports as an input but have not wholly relied on all the information presented in these reports.

HASKONING AUSTRALIA
MARITIME & WATERWAYS

Level 14
56 Berry Street
NORTH SYDNEY NSW 2060
T: +61 (0) 2 8854 5000
F: +61 (0) 2 9929 0960
www.royalhaskoningdhv.com
ABN 66 153 656 252

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Drafted by	Patrick Lawless / Sam Balian
Checked by	Greg Britton
Date/initials check	26/3/15
Approved by	
Date/initials approval	

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CONTENTS

1 INTRODUCTION

1.1 Background

In 2012 the Victorian Government established the Port of Hastings Development Authority (the Authority) to fast track the development of a second container port at Hastings. The Authority is progressing staged planning of the Port of Hastings Development Project (the Project) from 2014 to 2018, culminating in a rigorous business case and full environmental and social impact assessment. It is envisaged that the container port will begin operations in the mid 2020s with a capacity of 3 million twenty-foot equivalent (TEU) per year, increasing to 9 million TEU by 2060.

1.2 Dredged Material Management

Port development will require a significant quantity of capital dredging to be undertaken. The management of dredged material is a key component of the port development as it will be one of main drivers for capital expenditure. Management of dredged material will also be a key consideration in the environmental impact assessment for the project.

A proportion of dredged material is proposed to be beneficially reused as fill within land reclamation. The management of this proportion of the dredged material falls within the scope of the Dredging and Reclamation Design work package. The remainder of the dredged material, considered either unsuitable for use as reclamation material or surplus to the volumetric requirements of reclamation, will be disposed of elsewhere. Management of this material falls within the scope of the Dredged Material Management (DMM) work package.

1.3 Objectives and Scope

1.3.1 Settlement Tests

Settlement tests provide information on the settling behaviour of the various types of sediments to be dredged. This information can be used in the design of disposal areas (underwater and onshore) and as input for the assessment of potential impacts relating to turbidity generated from dredging and disposal activities.

Settlement tests were undertaken on sediment/water mixtures prepared from samples of material obtained as part of the marine geotechnical program and seawater that is representative of that which would be entrained from dredging within Western Port.

Settlement tests were undertaken for several material types that would be encountered during proposed dredging operations, including:

- stiff-hard clays;
- silty/clayey sands;
- very soft silty clays (located close to shore); and,
- combination of clay and sand material that is representative of the undifferentiated interbedded sediment in the dredge footprint.

The test procedure and results for each settlement test are described herein.

1.3.2 TSS-Turbidity Tests

As part of the environmental management of major dredging projects, water quality limits relating to impacts on sensitive biological receptors are commonly specified in terms of Total Suspended Solids (TSS)[1]. In accordance with standard industry practice, compliance with these limits is typically assessed through real time turbidity[2] monitoring, as suspended solid concentrations are not as easily and quickly measured in the field.

A TSS-turbidity relationship is therefore used to convert water quality limits into turbidity values that can be readily measured in the field during the proposed works and thus used for compliance monitoring and triggers for management actions.

The relationship between TSS and turbidity is highly site-specific, being dependant on the physical, optical and geochemical properties of the sediment being disturbed. As such, testing is required to establish relationships between these properties for the various material types that would be encountered during proposed dredging operations. These relationships should be supplemented with field data where possible.

Sedimentation tests were therefore undertaken for each of the material types outlined above for the purposes of establishing TSS-turbidity relationships. These tests were undertaken based on recommendations outlined in the US Army Corps of Engineers guidelines "Improved Methods for Correlating Turbidity and Suspended Solids for Monitoring" (Thackston and Palmero, 2000).

The test procedures and results are described herein, including TSS-turbidity relationships for each material type.

[1] TSS is a measurement of mass per unit volume, usually specified in mg/L.

[2] Turbidity is an optical property of water, measured in nephelometric turbidity units (NTU).

2 REMNANT MATERIAL AVAILABLE FOR TESTING

2.1 Material Quantities and Source Locations

A marine geotechnical investigation was commissioned by the Authority to develop a geotechnical model of the areas of Western Port that are within the potential dredging and reclamation area footprints. This involved drilling of up to 110 boreholes using jack-up barges and sampling of material down each borehole for performance of physical tests for geotechnical characterisation and pilot level investigation of geochemical properties. These investigations are described in WorleyParsons (2014).

Following completion of these tests, the remnant sample material was placed into long-term storage in a shipping container located on the Patrick's site at Stony Point. Material for settlement and TSS-turbidity testing was derived from these remnant samples.

The sediment used for settlement and TSS-turbidity testing should be representative of the material that is proposed to be dredged. At the present time, there are two dredge footprints that are being considered for the project, as indicated in **Figure 1**. It is evident that a common swing basin area is occupied by both footprints. Borehole locations in the proposed dredge areas are also indicated on **Figure 1**.

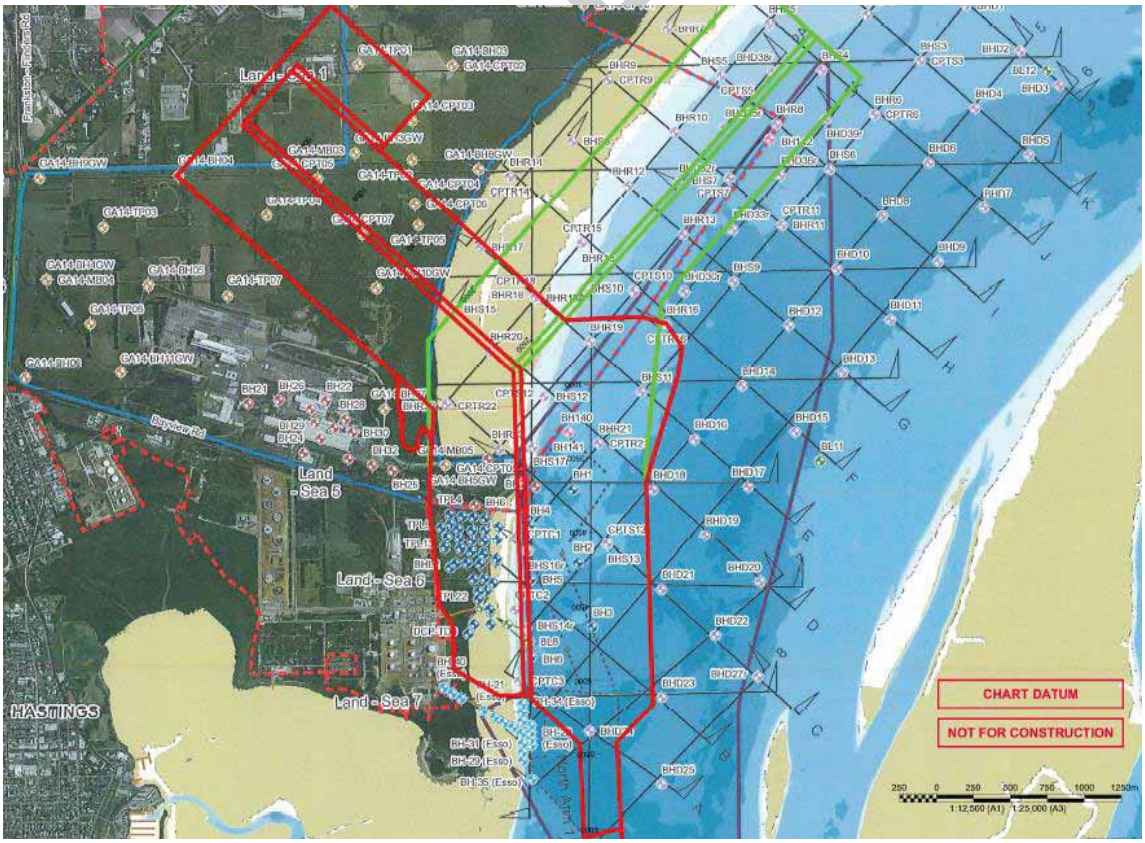


Figure 1: Borehole locations and proposed dredge footprints

Material for the settlement and TSS-turbidity testing described herein was derived exclusively from remnant samples that were collected inside the common area of the proposed dredge footprints. In addition, only those samples obtained from above a depth of -20 m CD were considered, as lower lying sediments are not likely to be dredged.

It should also be noted that all remnant sample material that was collected from within the proposed north-south dredge footprint (and above -20 m CD) was retained for possible future settlement and TSS-turbidity testing.

Each of the remnant samples obtained for testing were sorted into distinct material types, based on material descriptions provided in the borehole logs (WorleyParsons, 2014). The following material types were identified:

- stiff-hard clays (**Plate 1**);
- silty/clayey sands (**Plate 2**); and,
- very soft silty clays (located close to shore) (**Plate 3**).

It is noted that classification of the above material types was based on particle size distribution and plasticity, in accordance with Appendix A of AS 1726-1993 (WorleyParsons, 2014). Classification tests were also carried out on all samples tested as part of this investigation. Laboratory reports for these tests are provided in **Appendix B**, and the results are summarised in **Section 6.1**.

It should be noted that the material used to represent the undifferentiated interbedded sediments in Western Port was a combination of the stiff-hard clay and silty/clayey sand material (refer **Section 2.2.4**).

Plate 1: Remnant samples available for testing – stiff-hard clays

Plate 2: Remnant samples available for testing – silty/clayey sands

Plate 3: Remnant samples available for testing – soft silty clays

The locations and masses of each sample obtained for testing are listed in **Appendix A**. The total available masses obtained for each material type are summarised in **Table 1**.

Table 1: Total sample masses for each material type

Material Type	Sample Mass (kg)
stiff-hard clay	18.9
silty/clayey sand	8.1
soft silty clay (inshore)	11.1

2.2 Sample Preparation

The remnant samples obtained for testing were combined and homogenised for each material type prior to testing, as described in the following sections.

2.2.1 Stiff-Hard Clays

Each of the stiff-hard clay samples were added to a mixing tray, and then manually worked into small clumps using trowels and other hand tools (**Plate 4**). Sub-samples of the mixed material were taken for moisture content and particle size distribution (PSD) analysis. Laboratory reports for these analyses are provided in **Appendix B**.

Plate 4: Initial working of stiff-hard clay samples into smaller clumps

Further working of the clay material was necessary to ensure that a slurry form of the sediment was available for settlement and TSS-turbidity testing[3]. The clay clumps were added to a cement mixer, and site water obtained from Western Port was gradually added to the mixer (**Plate 5**). The clay slurry was then transferred into buckets, and any remaining clumps of stiff clay were broken down using a power drill with mixer attachment (**Plate 6**).

[3] It is recognised that clumps of stiff clay would likely be present to some degree in the slurry mixtures created during proposed dredging operations. However, for the purposes of the testing undertaken herein, a completely broken down form of the clay material was considered to be appropriate.

Plate 5: Subsequent mixing of clay clumps and site water to create slurry

Plate 6: Final breakdown of clay clumps to create slurry

2.2.2 Silty/Clayey Sands

Each of the silty/clayey sand samples were combined, and then manually mixed using trowels and other hand tools (**Plate 7**). Unlike the clay material, no further breakdown of the silty/clayey sands was required prior to settlement and TSS-turbidity testing.

Sub-samples of the mixed material were taken for moisture content and PSD analysis. Laboratory reports for these analyses are provided in **Appendix B**.

Plate 7: Mixing of silty/clayey sand samples

2.2.3 Soft Silty Clays

Each of the inshore soft silty clay samples were combined on a mixing tray, and then manually mixed using trowels and other hand tools. Sub-samples of the mixed material were taken for moisture content and PSD analysis. Laboratory reports for these analyses are provided in **Appendix B**.

Due to the stiffness of some of the samples as a result of drying, further working of the material was necessary to ensure that a slurry form of the sediment was available for settlement and TSS-turbidity testing. The sediment was transferred into buckets along with site water obtained from Western Port, and the clay clumps were broken down using a power drill with mixer attachment (**Plate 8**).

Plate 8: Mixing of soft silty clay samples

2.2.4 'Representative' Sand/Clay Material

A 'representative' sand/clay mixture was used to undertake settlement and TSS-turbidity testing for the undifferentiated interbedded sediments that would typically be encountered during proposed dredging operations. This mixture was formed using a combination of the stiff/hard clay and silty/clayey sand materials described previously.

The 'representative' sand/clay mixture could not be formed until after completion of all testing for the stiff/hard clay and silty/clayey sand materials. At the end of these tests, the sediment materials were settled in a slurrified form at the base of each settling column (**Plate 9**). The clarified water in the upper portion of the columns was carefully decanted, and the remaining sediment mixture was transferred into a number of trays which were then placed inside a drying oven until the sediment was converted to a dry form.

Plate 9: Slurrified forms of sand and clay material at end of respective settlement tests

Following the drying process, the quantities of sediment available to form the 'representative' sand/clay mixture were:

- stiff/hard clay – 15.07 kg;
- silty/clayey sands – 6.50 kg.

The typical mixture of clay and sand material for sediments in the project area is around 65% (clay) and 35% (sand) by volume. The corresponding masses of clay and sand material required to form this mixture were determined based on the in-situ densities and moisture contents for the respective material types, as set out in **Table 2**.

Table 2: Mixture of sand and clay material required for testing of the undifferentiated interbedded sediments

Parameter	Clay	Sand	Comment
Density (in-situ) (t/m^3)	2.04	2.07	based on data in factual report
Moisture Content (in-situ)	22.5%	19.9%	based on data in factual report
Proportion (by volume)	65%	35%	required mix for testing
Volume (in-situ) m^3	0.65	0.35	for 1m^3 of material
Wet Mass (in-situ) t	1.32	0.73	for 1m^3 of material
Dry Mass (in-situ) t	1.08	0.61	for 1m^3 of material
Proportion (by dry mass)	64%	36%	
Available Mass (g)	15,070	6,500	
Mix for test (g)	11,595	6,500	
Total soil mass for test (g)	18,095		

The required masses of clay (11.6 kg) and sand (6.5 kg) were combined to form the 'representative' sand/clay mixture that was used to undertake settlement and TSS-turbidity testing for the undifferentiated interbedded sediments. Sub-samples of the mixed material were taken for PSD analysis. The laboratory report for this test is provided in **Appendix B**.

3 TEST PROCEDURES

3.1 Settlement Tests

The settlement tests were carried out within large settling columns (refer **Plate 10**) to minimise the 'wall effects' of the column sides on settling behaviour. Each settling column has a diameter of 200 mm and an overall height of 2000 mm.

Plate 10: Settling columns used for testing

Water properties such as salinity and turbidity can influence the settling behaviour of sediment. As such, it is preferred that the water used in settlement tests is sourced from the site where project activities are proposed (or a similar location). Clean seawater was therefore obtained from Western Port for use in the tests.

The settlement test procedure is based on the suggested method by Thackston and Palermo (2000) and is as follows:

1. Transfer the sediment material to a mass balance, removing any stones or rocks, until the required mass is obtained.
2. Fill the column with the amount of seawater required to provide the target slurry density of 30%[4].
3. Transfer the sediment material into the column.
4. Agitate the sediment/water mixture until a uniform slurry is visible inside the column (**Plate 11**).
5. Start the timer.
6. Record the height of all settlement layer(s) visibly present within the column. Settlement layers may include:

[4] The actual slurry densities achieved for each test were within 1% of the target density of 30%.

a. settled sediment at the bottom of the column;

b. interface between supernatant in upper portion of column and the adjacent mixed layer;

c. any other distinct settlement boundaries.

7. Record the turbidity in the upper portion of the settling column (if feasible)[5]. The turbidity sensor was gently lowered into the settling column to minimise potential for re-agitation of the sediment/seawater mixture.
8. Take a photo of the settling column at each measurement time.
9. Repeat Steps 6 to 8 at desired time intervals. It is not necessary to maintain a precise or uniform interval, but a larger number of measurements were taken at first (say every few minutes) with an increasing interval (to say every few hours) as the tests progressed.
10. Continue test until settlement rates reduce to near zero.

Plate 11: Agitation of seawater/sediment mix to create uniform slurry (left: clay material; right: estuarine mud material)

[5] Turbidity measurements were undertaken using a Wetlab ECO-NTU sensor. The measurement range of the sensor used was 0-250 NTU, which is considered to be reasonable for the purposes of the settlement testing described herein. However, it should be noted that turbidity measurements could not be undertaken during the early stages of testing due to the typically high turbidity of the slurry mix (i.e., exceeding 250 NTU).

In addition, it should be noted that the Wetlab ECO-NTU sensor generally takes turbidity measurements within a 5 cm field of view. Each settlement test was typically characterised by an upper clarifying layer of supernatant overlying a denser mixed layer, and the turbidity of this mixed layer was very high (i.e., beyond the sensor's measurement range of 250 NTU). As such, the turbidity of the supernatant could generally not be measured until the thickness of this layer was at least 5 cm.

3.2 TSS-Turbidity Tests

The TSS-turbidity tests for each material type were undertaken following completion of the corresponding settlement test, i.e. for each material type, the same settling columns and material quantities were utilised in both the settlement and TSS-turbidity tests.

Thackston and Palmero (2000) recommended specific procedures to develop TSS-turbidity relationships for three distinct areas related to field monitoring:

1. Monitoring re-suspension of solids in the immediate vicinity of sediment disturbance, e.g. adjacent to dredge cutter heads. This test procedure is commonly referred to as the 'Dilution Test'.
2. Monitoring suspended solids in the effluent discharge from sedimentation ponds. This test procedure is commonly referred to as the 'Column Test'.
3. Monitoring suspended solids during open water dredged material placement. The 'Column Test' procedure is also recommended for this type of monitoring.

TSS-turbidity tests for the material types investigated involved both 'Dilution Tests' and 'Column Tests', as set out below.

3.2.1 Dilution Tests

Dilution tests were carried out for each material type. The testing methodology involved the following steps:

1. Fill a small (4 to 5 L) measuring cylinder with clean site water obtained from Western Port.
2. Re-agitate the sediment/water mixture inside the settling column until a uniform slurry is visible inside the column.
3. Transfer a small volume of the slurry into the measuring cylinder and mix until a uniform turbidity is evident.
4. Record the turbidity inside the measuring cylinder.
5. Collect a water sample for TSS analysis.
6. Replace the sample volume with clean site water to re-fill the measuring cylinder.
7. Repeat Steps 3 to 6, each time adding slightly more of the slurry mixture such that a progressively concentrated sediment/water mixture is realised inside the measuring cylinder. The objective is to collect a sufficient number of water samples that are characterised by a wide range of TSS and turbidity values such that a strong correlation between TSS and turbidity is developed.

It is noted that the 'Dilution Test' described in Thackston and Palmero (2000) involves collecting sub-samples in progressively *diluted* mixtures of sediment and site water, whereas the method described above involves sampling of progressively *concentrated* mixtures. However, this difference would not be expected to affect the overall results from the testing.

3.2.2 Column Tests

Column tests were undertaken for each material type (with the exception of the 'representative' sand/clay material). The testing procedure involved following steps:

1. Re-agitate the sediment/water mixture inside the settling column until a uniform slurry is visible inside the column.
2. As soon as the slurry has started to settle, take a water sample from just below the water surface (top of column) for TSS analysis. Measure turbidity at the sampling depth (if feasible)[6].
3. Repeat Steps 2 and 3 at desired time intervals for the turbidity and TSS determination. It is not necessary to maintain a precise or uniform interval for sampling, but a larger number of samples should be taken at first with an increasing interval as the test progresses. Samples should be taken until the TSS and turbidity have obviously dropped to low levels.

Water samples were analysed for TSS and turbidity by Eurofins (NATA accreditation number 1261) in accordance with the analysis methodologies described by APHA 2540D (TSS) and APHA 2130 (turbidity).

[6] As noted in **Section 3.1**, the Wetlab ECO-NTU sensor has a measurement range of 0-250 NTU, and generally takes turbidity measurements within a 5 cm field of view. As such, turbidity measurements below 250 NTU could not be undertaken until the thickness of the supernatant layer was at least 5 cm.

4 SETTLEMENT TEST RESULTS

4.1 Bulking Factors

4.1.1 Definition

The hydraulic dredging process (for both trailing suction hopper dredgers and cutter suction dredgers) disturbs and mixes large volumes of water into the soil being dredged. This results in the dredged material occupying a larger volume post dredging than the soil originally occupied in situ. This process is referred to as bulking, and is often characterised for a material by a parameter termed the bulking factor.

The bulking factor is defined as the ratio of the initial volume of material to the final volume of material after being dredged. For example, if 10,000 m^3 of material was dredged, placed in a containment area, allowed to settle out of suspension and occupied a total volume of 20,000 m^3 this material would have a bulking factor of 2. This can be represented by the following equation:

Equation 1 – Bulking Factor in terms of Volume

$$B = V_c/V_i$$

where:

$B = bulking\ factor \quad V_c = Volume\ in\ containment\ area \quad V_i = in\ situ\ volume$

Using simple phase diagrams it can be shown that the bulking factor can also be calculated as the ratio of the dry density of the in situ soil divided by the dry density of the material in the containment area. This can be represented by the following equation:

Equation 2 – Bulking Factor in terms of Dry Density

$$B = \gamma_{dry\ (i)}/\gamma_{dry\ (c)}$$

where:

$B = bulking\ factor \quad \gamma_{dry\ (c)} = containment\ area\ dry\ density \quad \gamma_{dry\ (i)} = in\ situ\ dry\ density$

4.1.2 Typical Behaviours

For hydraulic dredging, depending on the soils being dredged, the ratio of soil volume to the volume of water added during dredging is typically between 1:7 and 1:10. Therefore, the initial bulking factor prior to settlement of the soil from suspension in the added water can be quite high. The rate at which the soil settles out of suspension and hence the rate the bulking factor reduces is related mainly to the particle size of the soil. Coarse grained soils will fall out of suspension relatively quickly, while fine grained soils may take a long time to settle out of suspension.

4.1.3 Calculations for Bulking Factors from Settlement Tests

As discussed in **Section 2**, the samples available for testing were initially received in a disturbed state and were then further disturbed during the sample preparation process prior to testing. As a result, the sample density in the laboratory prior to settlement testing was unrepresentative of the in situ density. Hence a direct comparison of the initial sample

volume to the volume in the settlement tube (as presented in Equation 1) is not an accurate representation of the bulking factor.

The approach adopted herein was to compare the calculated dry density of the material in the settlement column to the average in situ dry density of the samples which comprised the material being tested. The in situ dry density was based on results from the laboratory analysis undertaken during the project marine geotechnical investigations (WorleyParsons, 2014).

Note: where dry density of the sample was not directly reported it has been calculated based on moisture content, and assuming the following: samples would have been fully saturated in situ; all moisture was retained during sampling, a water density of 1.025 t/m^3, and a particle density of 2.6 t/m^3 or actual density if tested.

4.2 Stiff-Hard Clays

The settlement test for the stiff-hard clay material commenced on 19/11/14 and concluded on 26/11/14 (duration of seven days). A time series plot of the heights of each settlement layer is provided in **Figure 2**. Several photographs of the settling column taken during the test are provided in **Plate 12**. Test sheets completed during the stiff-hard clay test are provided in **Appendix C**.

Overall, it is evident that the clay material settled very slowly during the test. A thin layer of sand/silt (around 15 mm) was deposited immediately following the commencement of testing, and this layer thickness did not increase thereafter. The upper portion of the settling column comprised a slowly increasing layer of supernatant water overlying a well-defined mixed layer.

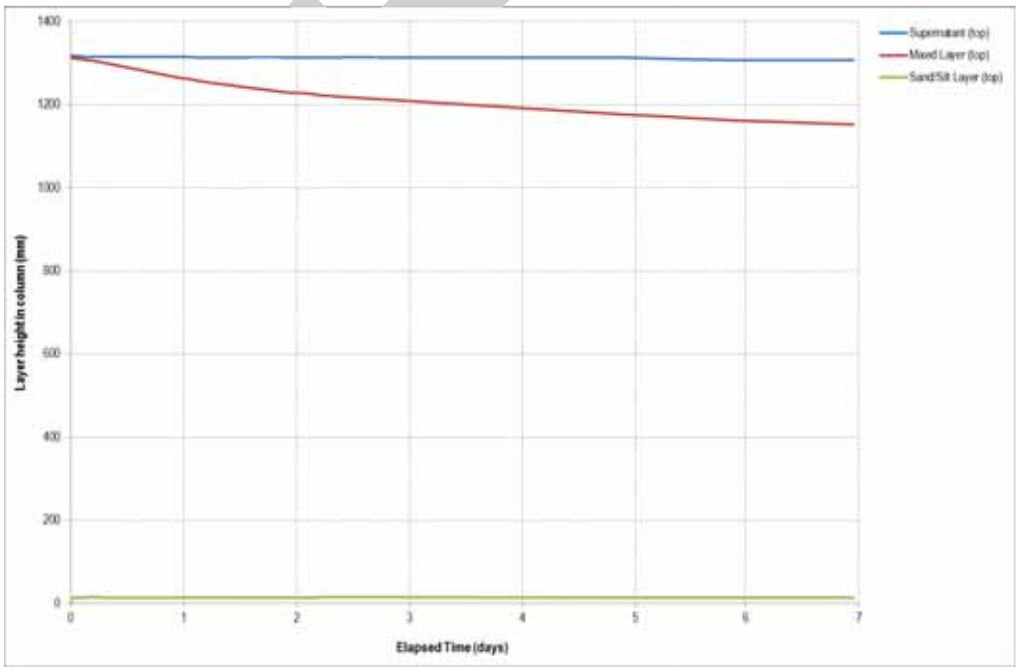


Figure 2: Settlement plot – stiff-hard clays

Plate 12: Selected photos showing settlement of stiff-hard clay material (time elapsed from start of test is noted on each photo)

The calculated bulking factor for the stiff-hard clay material was initially 3.9, and reduced slowly during the test. After one day of testing the bulking factor had reduced to 3.8 and was 3.4 at the completion of the test (seven days). These bulking factors were calculated based on an average in situ dry density of the sample of 1.6 t/m^3. A time series plot of the calculated bulking factors is presented in **Figure 14** (see **Section 6.1**).

A time series plot of turbidity in the upper portion of the settling column (i.e. the supernatant layer) is provided in **Figure 3** for the stiff-hard clay material. The thickness of the supernatant did not exceed 5 cm until around 22 hours after the commencement of testing, so it was not possible to take accurate turbidity measurements until this time[7]. All preceding turbidity measurements were therefore conservatively recorded as >250 NTU.

[7] As noted in **Section 3.1**, the Wetlab ECO-NTU sensor has a measurement range of 0-250 NTU, and generally takes turbidity measurements within a 5 cm field of view. As such, the turbidity of the supernatant could not be measured until the thickness of this layer was at least 5 cm. All turbidity measurements taken prior to this time were representative of the underlying mixed layer, which has very high turbidity beyond the measurement range of the sensor, i.e. greater than 250 NTU.

It is evident that turbidity levels in the supernatant decreased to around 10 NTU approximately 22 hours after the commencement of testing, and then gradually reduced to around 3 NTU after two days of testing.

It is noted that there was a single 'peak' measurement of 20 NTU recorded after 23 hours of testing, which was both preceded and followed by measurements of around 10 NTU. However, this slightly elevated measurement is not considered to be significant in terms of the overall settlement behaviour, i.e. the overriding observation from the results presented herein is that turbidity measurements progressively reduced throughout the test. It is possible that the single elevated measurement was due to minor disturbance of the interface between the upper supernatant and underlying slurry layers caused by the turbidity probe.

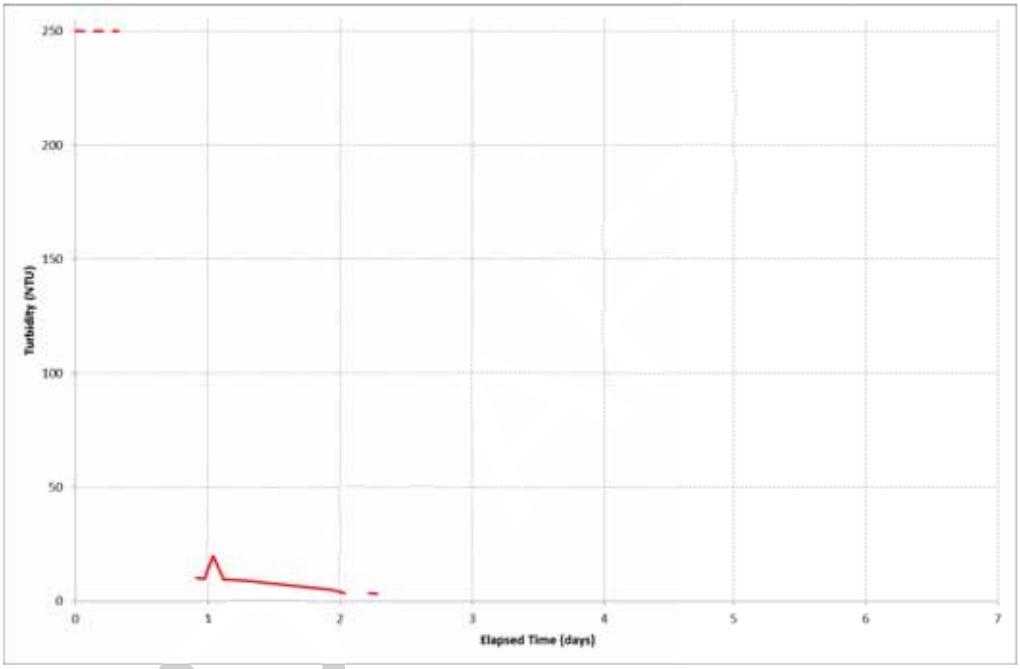


Figure 3: Turbidity vs time – stiff-hard clays

4.3 Silty/Clayey Sands

The settlement test for the silty/clayey sand material commenced on 19/11/14 and concluded on 26/11/14 (duration of seven days). A time series plot of the heights of each settlement layer is provided in **Figure 4**. Several photographs of the settling column taken during the test are provided in **Plate 13**. Test sheets completed during the silty/clayey sand test are provided in **Appendix D**.

A rapidly increasing sand/silt layer thickness was observed at the base of the settling column immediately following commencement of testing. Initially, this layer was well-defined (i.e. distinct in comparison to the adjacent mixed layer) and appeared to be predominantly comprised of sand and silt particles. The thickness of this layer was around 100 mm after the first five minutes of testing, and reached a maximum thickness of 160 mm after around two hours.

This sand/silt layer was subsequently overlaid with finer sediment (silt and clay) which was less distinct from the adjacent mixed layer. The combined thickness of the sand/silt/clay layer was 200 mm after around three hours, and 280 mm after around seven hours. The sand/silt/clay layer reached a maximum thickness of 290 mm approximately 24 hours after the commencement of testing, and did not increase during the remainder of the test.

A photograph showing the sand/silt layer taken around two days after the commencement of testing is provided in **Plate 14**. The well-defined sand layer is evident in the lower section of the settling column, which is overlaid by the less well-defined silt/clay material and adjacent mixed zone.

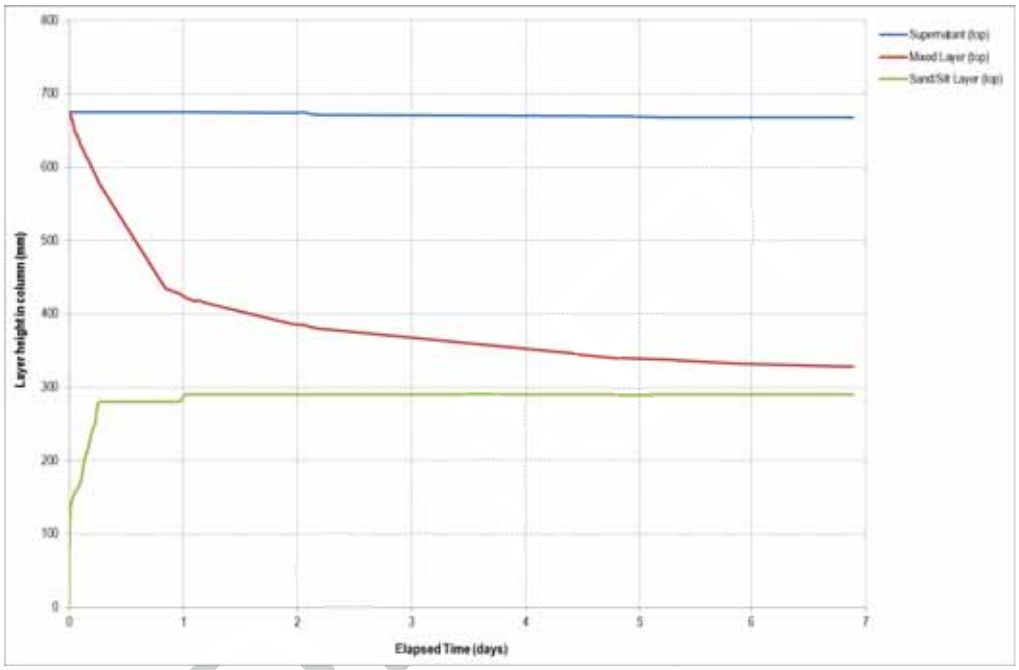


Figure 4: Settlement plot – silty/clayey sands

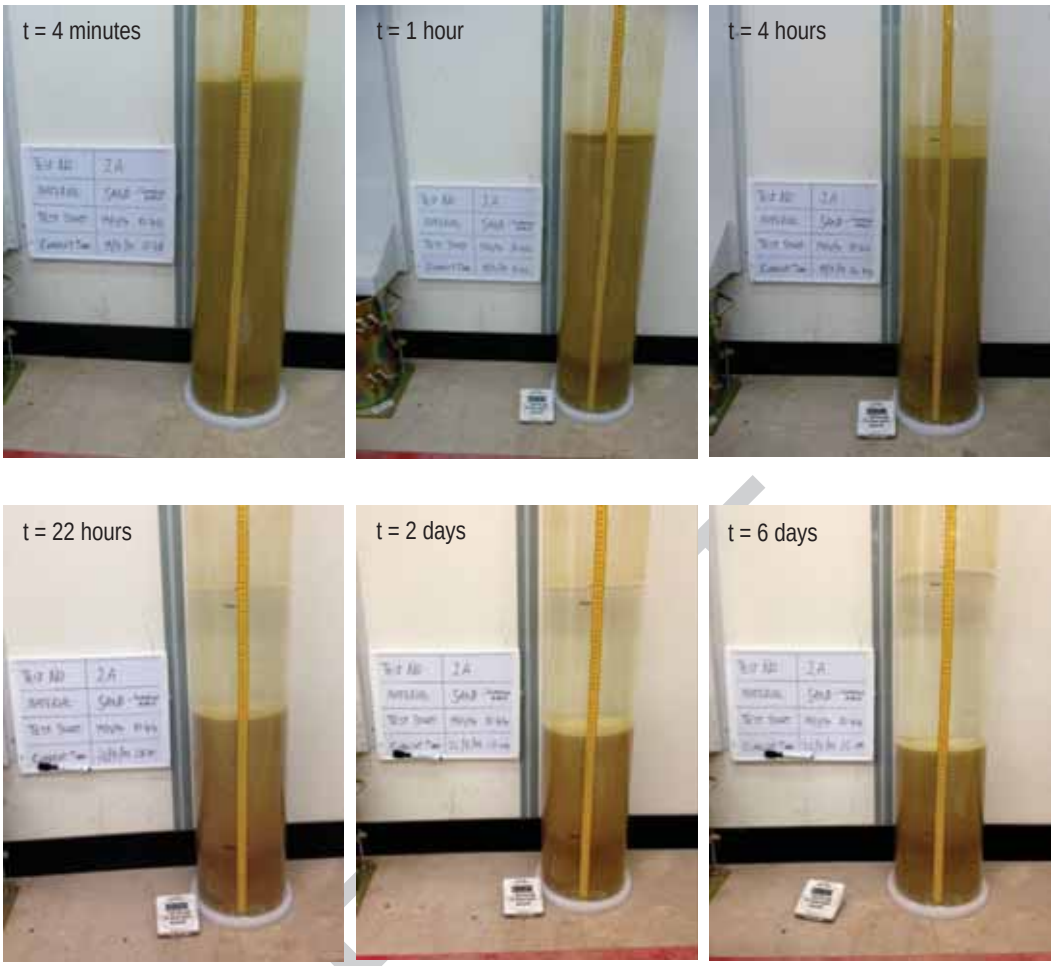


Plate 13: Selected photos showing settlement of silty/clayey sand material (time elapsed from start of test is noted on each photo)

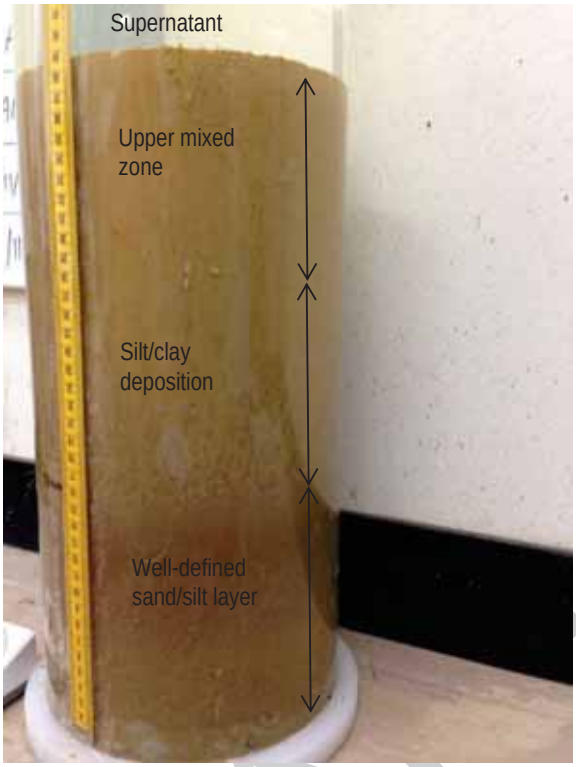


Plate 14: Settlement layers evident in silty/clayey sand material (approximately two days after commencement of test)

The calculated bulking factor for the silty/clayey sand material was initially 4.2, which then reduced to 2.6 after one day of testing, and was 2.0 at the completion of the test (seven days). These bulking factors were calculated based on an average in situ dry density of the sample of 1.6 t/m^3. A time series plot of the calculated bulking factors is presented in **Figure 14** (see **Section 6.1**).

A time series plot of turbidity in the upper portion of the settling column (i.e. the supernatant layer) is provided in **Figure 5** for the silty/clayey sand material. The thickness of the supernatant did not exceed 5 cm until around 2.5 hours after the commencement of testing, so it was not possible to take accurate turbidity measurements until this time[8]. All preceding turbidity measurements were therefore conservatively recorded as >250 NTU.

It is evident that turbidity levels in the supernatant decreased to around 50 NTU approximately 5 hours after the commencement of testing, while turbidity levels of around 30 NTU were recorded after approximately 7 hours. Turbidity levels subsequently decreased to around 10 NTU approximately 24 hours after the commencement of testing, and then gradually reduced to below 5 NTU after around five days of testing.

[8] As noted in **Section 3.1**, the Wetlab ECO-NTU sensor has a measurement range of 0-250 NTU, and generally takes turbidity measurements within a 5 cm field of view. As such, the turbidity of the supernatant could not be measured until the thickness of this layer was at least 5 cm. All turbidity measurements taken prior to this time were representative of the underlying mixed layer, which has very high turbidity beyond the measurement range of the sensor, i.e. greater than 250 NTU.

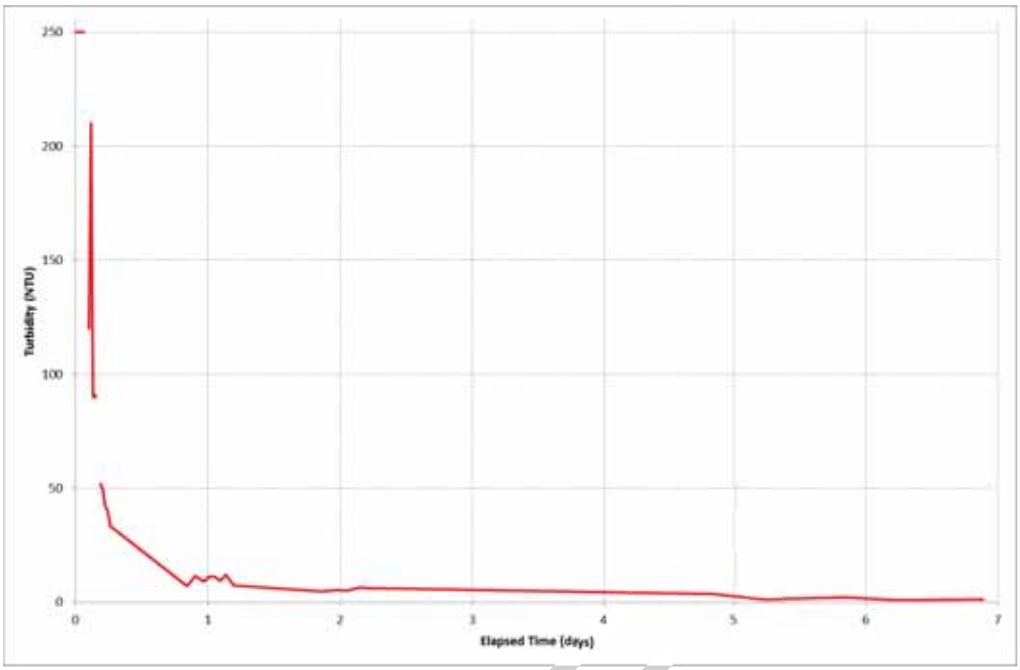


Figure 5: Turbidity vs time – silty/clayey sands

4.4 Soft Silty Clays

The settlement test for the soft silty clay (inshore) material commenced on 15/12/14 and concluded on 22/12/14 (duration of seven days). A time series plot of the heights of each settlement layer is provided in **Figure 6**. Several photographs of the settling column taken during the test are provided in **Plate 15**. Test sheets completed during the soft silty clay test are provided in **Appendix E**.

A 25 mm layer of sand/silt was deposited immediately following the commencement of testing, which increased to a thickness of around 165 mm after around one hour, with negligible change observed thereafter. The upper portion of the settling column comprised a slowly increasing layer of supernatant water overlying a well-defined mixed layer.

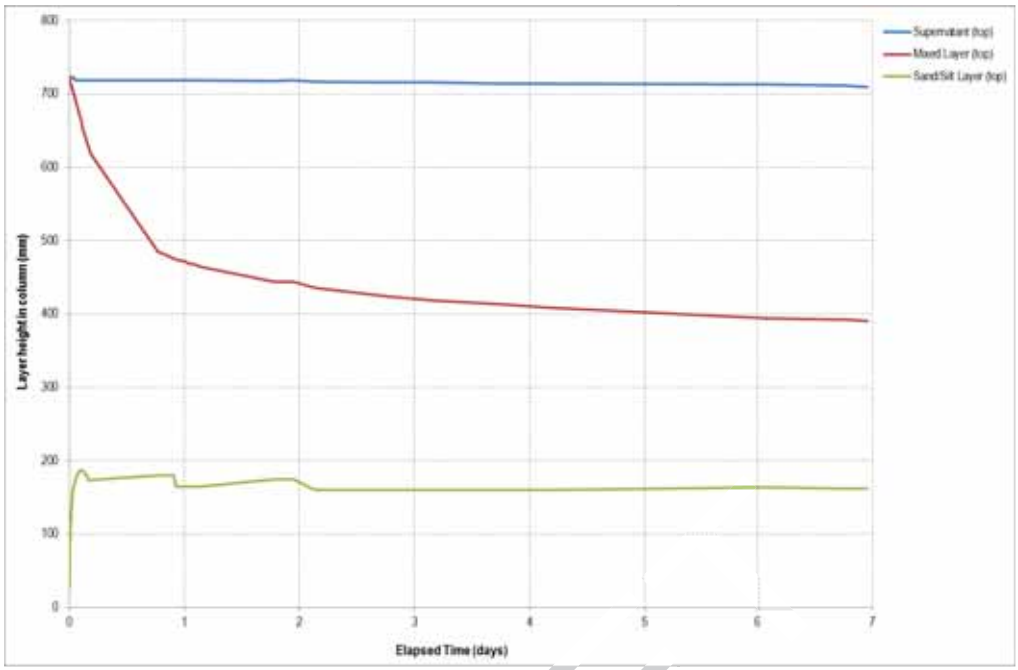


Figure 6: Settlement plot – soft silty clays (inshore)

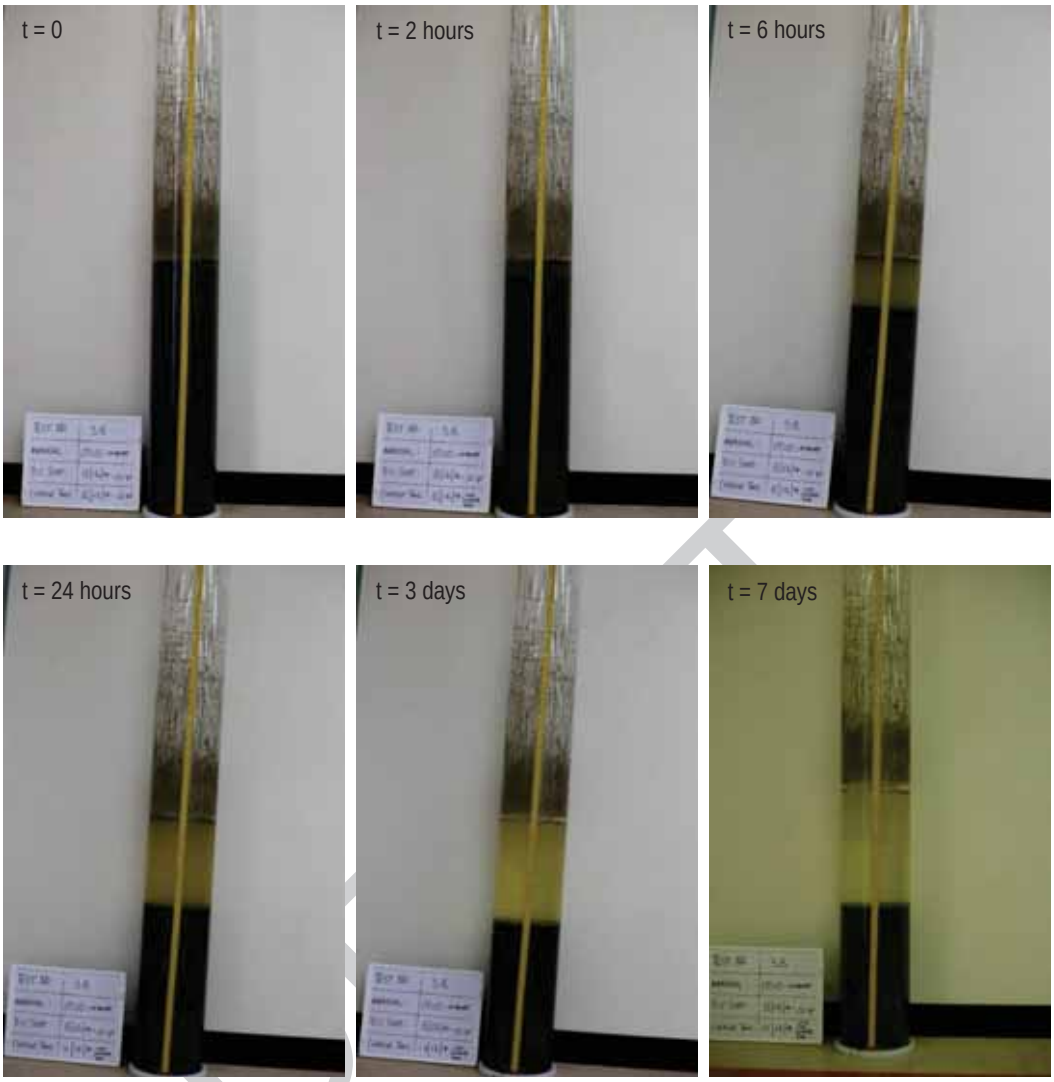


Plate 15: Selected photos showing settlement of soft silty clay material (time elapsed from start of test is noted on each photo)

The calculated bulking factor for the soft silty clay material was initially 3.4, which then reduced to 2.2 after one day of testing, and was 1.9 at the completion of the test (seven days). These bulking factors were calculated based on an average in situ dry density of the sample of 1.3 t/m^3. A time series plot of the calculated bulking factors is presented in **Figure 14** (see **Section 6.1**).

A time series plot of turbidity in the upper portion of the settling column (i.e. the supernatant layer) is provided in **Figure 7** for the soft silty clay material.

It is evident that turbidity levels in the supernatant decreased to around 60 NTU approximately 19 hours after the commencement of testing, while turbidity levels of around 18 NTU were recorded after approximately 23 hours.

Turbidity levels subsequently increased to around 43 NTU over the following two hours (i.e. until approximately 25 hours after the commencement of testing), and then gradually reduced throughout the remainder of the test. Turbidity levels decreased to around 15 NTU approximately two days after the commencement of testing, and then gradually reduced to below 4 NTU after around four days of testing.

The brief increase in turbidity values observed after 23 hours of testing is not considered to be significant in terms of the overall settlement behaviour, i.e. the overriding observation from the results presented herein is that turbidity measurements progressively reduced throughout the test. It is possible that the elevated measurements were related to minor disturbance of the interface between the upper supernatant and underlying slurry layers caused by the turbidity probe.

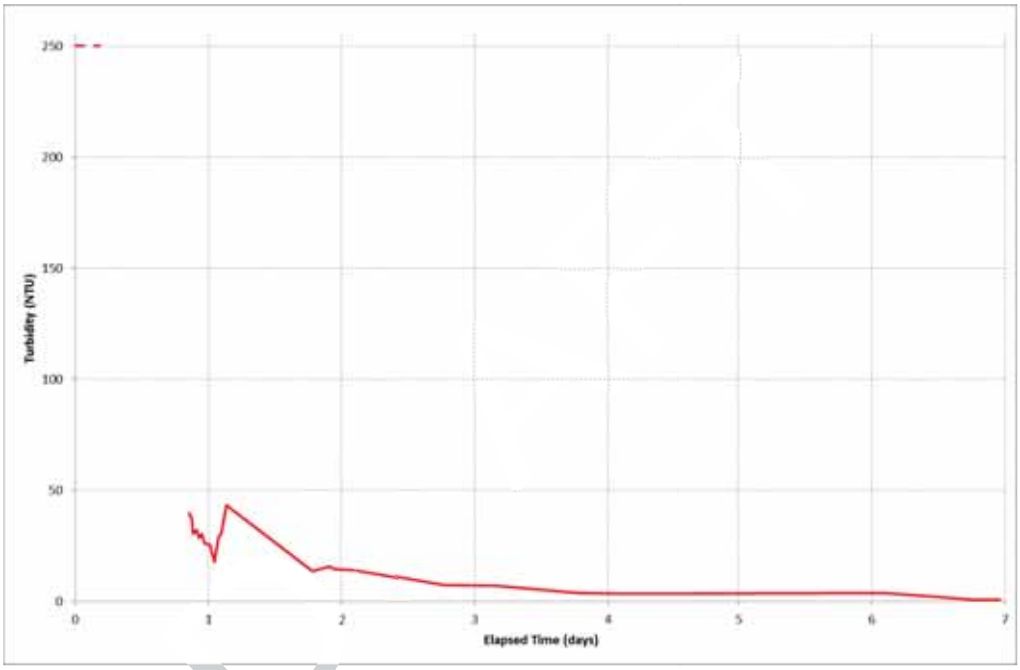


Figure 7: Turbidity vs time – soft silty clay

4.5 'Representative' Sand/Clay Material

The settlement test for the sand/clay material that is representative of the undifferentiated interbedded sediments of Western Port commenced on 8/12/14 and concluded on 16/12/14 (duration of eight days). A time series plot of the heights of each settlement layer is provided in **Figure 8**. Several photographs of the settling column taken during the test are provided in **Plate 16**. Test sheets completed during the 'representative' sand/clay test are provided in **Appendix F**.

A 25 mm layer of sand/silt was deposited immediately following the commencement of testing, which increased to a thickness of around 285 mm after around three hours, with negligible change observed thereafter. The upper portion of the settling column comprised a slowly increasing layer of supernatant water overlying a well-defined mixed layer.

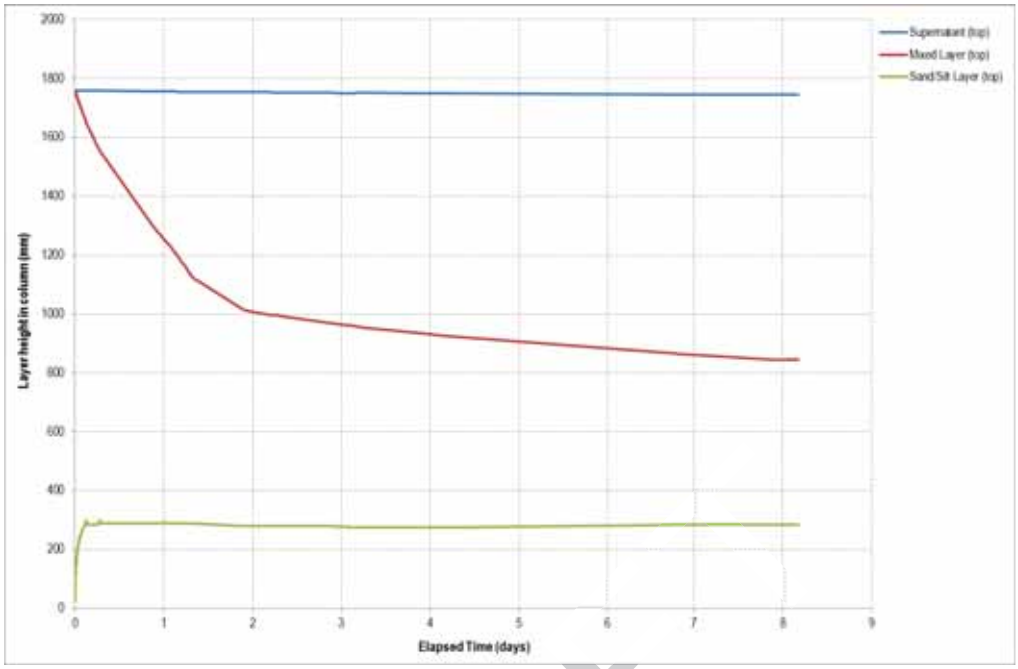


Figure 8: Settlement plot – 'representative' sand/clay material

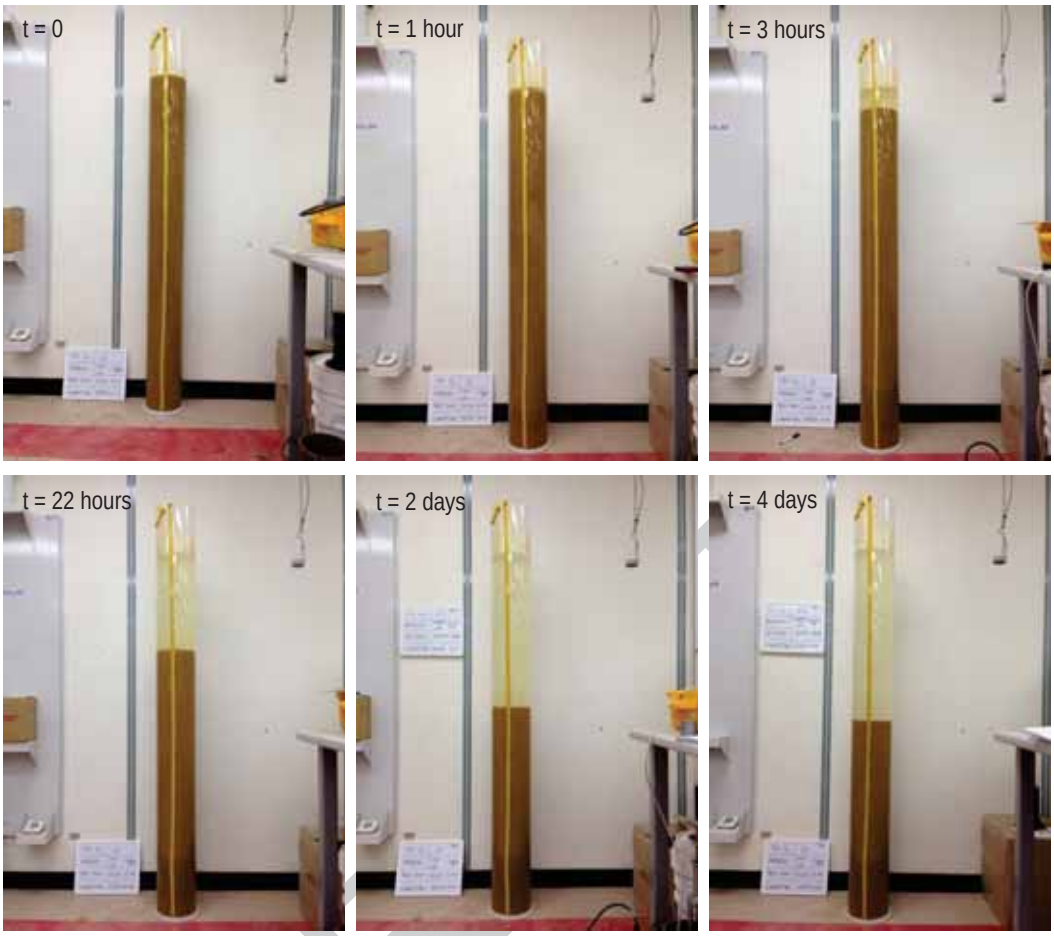


Plate 16: Selected photos showing settlement of 'representative' sand/clay material (time elapsed from start of test is noted on each photo)

The calculated bulking factor for the 'representative' sand/clay material was initially 4.4, which then reduced to 3.2 after one day of testing, and was 2.1 at the completion of the test (eight days). These bulking factors were calculated based on an average in situ dry density of the sample of 1.7 t/m^3. A time series plot of the calculated bulking factors is presented in **Figure 14** (see **Section 6.1**).

A time series plot of turbidity in the upper portion of the settling column (i.e. the supernatant layer) is provided in **Figure 9** for the 'representative' sand/clay material. The thickness of the supernatant did not exceed 5 cm until around one hour after the commencement of testing, so it was not possible to take accurate turbidity measurements until this time[9]. All preceding turbidity measurements were therefore conservatively recorded as >250 NTU.

[9] As noted in **Section 3.1**, the Wetlab ECO-NTU sensor has a measurement range of 0-250 NTU, and generally takes turbidity measurements within a 5 cm field of view. As such, the turbidity of the supernatant could not be measured until the thickness of this layer was at least 5 cm. All turbidity measurements taken prior to this time were representative of the underlying mixed layer, which has very high turbidity beyond the measurement range of the sensor, i.e. greater than 250 NTU.

It is evident that turbidity levels in the supernatant decreased to around 100 NTU approximately one hour after the commencement of testing, while turbidity levels of around 30 NTU were recorded after approximately two hours. Turbidity levels subsequently decreased to a NTU approximately 24 hours after the commencement of testing, and then gradually reduced to below 5 NTU after around three days of testing.

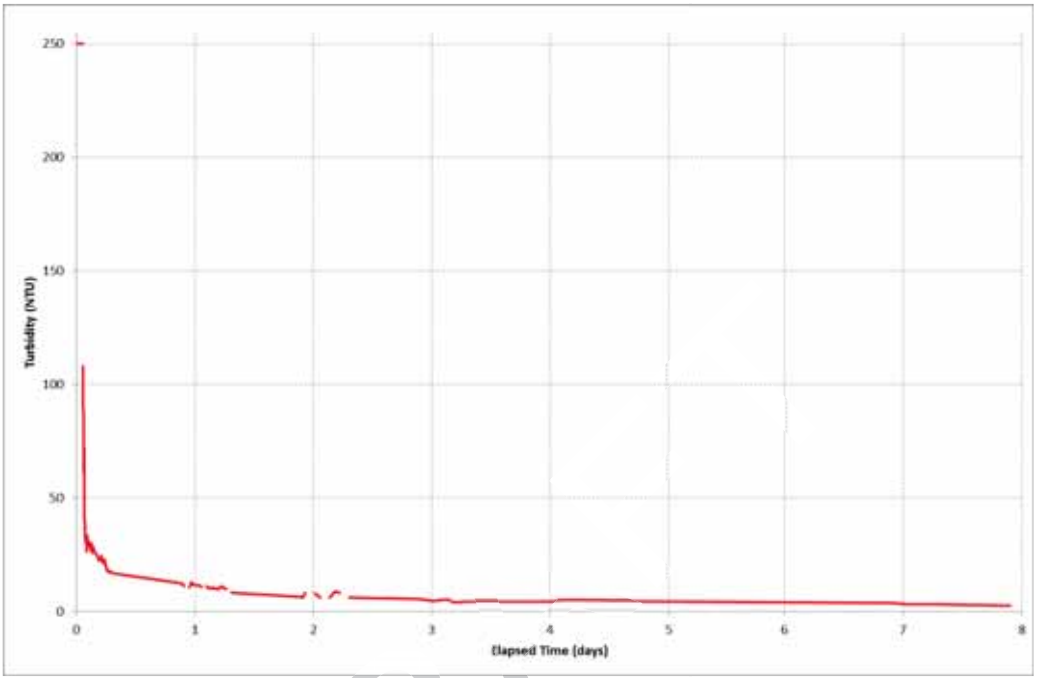


Figure 9: Turbidity vs time – 'representative' sand/clay material

5 TSS-TURBIDITY TEST RESULTS

5.1 Stiff-Hard Clays

TSS-turbidity testing for stiff-hard clays comprised both a Column Test and Dilution Test, which were undertaken on 26/11/14 and 2/12/14 (respectively). Certificates of Analysis provided by Eurofins for the TSS and turbidity analyses undertaken for samples collected during both tests are provided in **Appendix G**. Test sheets completed during the TSS-turbidity tests for the stiff-hard clay material are provided in **Appendix H**, which includes turbidity measurements undertaken during testing for each sample.

It is noted that 15 of the 18 samples collected during the Column Test were characterised by very high TSS concentrations ranging between 5,000 mg/L and 240,000 mg/L (Sample IDs CB1 to CB15, see **Appendix G**). It should be noted that the water quality limit for proposed dredging works would likely be specified in terms of a much lower TSS concentration, e.g. 50 mg/L. Therefore, the TSS-turbidity relationship should focus on a range of TSS values with a generally similar magnitude, say zero to several hundred mg/L. Including significantly higher TSS values may skew the TSS-turbidity relationship which could result in the establishment of an inaccurate turbidity limit for compliance monitoring.

As such, results for Sample IDs CB1 to CB15 have not been included in the TSS-turbidity relationship for stiff-hard clays. A plot of TSS versus turbidity for all other data collected during testing (i.e. both the Column Test and Dilution Test results) is provided in **Figure 10**. This dataset is plotted with a linear line of best fit which has an R^2 value of 0.78[10].

It should be noted that the turbidity data presented in this plot (and the plots for all other material types, refer **Sections 5.2** to **5.4**) are from the following sources for each test type:

- for samples collected during the Dilution Tests, the plotted turbidity data are the measurements taken during testing, rather than the laboratory results[11];
- for samples collected during the Column Tests, the plotted turbidity data are the laboratory results, rather than the measurements taken during testing[12].

[10] The R^2 value, also known as the coefficient of determination, is a measure of how close the plotted data are to the fitted regression line, i.e. the line of best fit. An R^2 value of 1 indicates that the regression line perfectly fits the data.

[11] Turbidity measurements taken during the Dilution Tests were carried out in a water volume of 4 to 5 L, while the laboratory measurements were undertaken in a smaller sample volume of 200 mL. Turbidity monitoring equipment can be sensitive to light penetration and reflections inside the sampling vessel, so it is generally preferred to take turbidity measurements in larger sample volumes. In any case, it is noted that the turbidity measurements taken during testing were quite similar to the laboratory measurements, and the use of either dataset does not result in significantly different TSS-turbidity relationships.

[12] As noted in **Section 3.1**, the Wetlab ECO-NTU sensor has a measurement range of 0-250 NTU, and generally takes turbidity measurements within a 5 cm field of view. The majority of samples collected during the Column Tests were characterised by turbidity levels beyond the measurement range of the sensor; this was not an issue for the laboratory measurements. Further, many of the remaining samples (i.e., the low TSS samples) were collected from the upper supernatant in the settling column when the thickness of this layer was less than 5 cm, so the turbidity measurements may have been influenced by the underlying mixed layer.

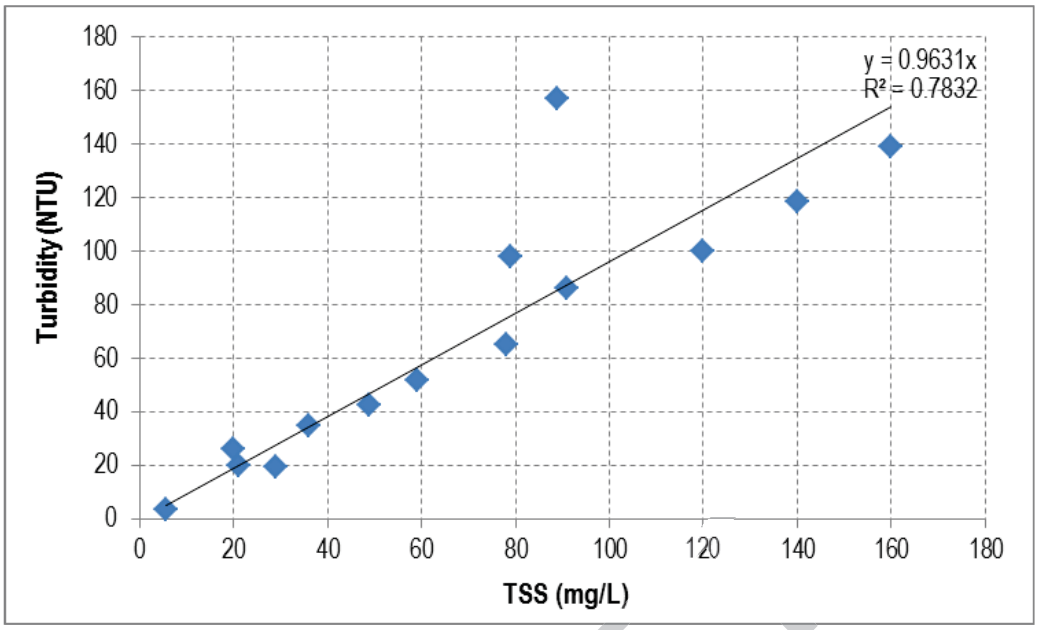


Figure 10: TSS-turbidity plot – stiff-hard clays

5.2 Silty/Clayey Sands

TSS-turbidity testing for silty/clayey sands comprised both a Column Test and Dilution Test, which were undertaken on 26/11/14 and 2/12/14 (respectively). Certificates of Analysis provided by Eurofins for the TSS and turbidity analyses undertaken for samples collected during both tests are provided in **Appendix G**. Test sheets completed during the TSS-turbidity tests for the silty/clayey sand material are also provided in **Appendix I**, which includes turbidity measurements undertaken during testing for each sample.

It is noted that 11 of the 26 samples collected during the Column Test were characterised by very high TSS concentrations ranging between 5,000 mg/L and 240,000 mg/L (Sample IDs SB1 to SB11, see **Appendix G**). As noted previously, including such high TSS values may skew the TSS-turbidity relationship and result in the establishment of an inaccurate turbidity limit for compliance monitoring. As such, results for Sample IDs SB1 to SB11 have not been included in the TSS-turbidity relationship for silty/clayey sands.

A plot of TSS versus turbidity for all other data collected during testing of the silty/clayey sands (i.e. both the Column Test and Dilution Test results) is provided in **Figure 11**. This dataset is plotted with a linear line of best fit. However, it can be seen that the TSS-turbidity relationship for this dataset is skewed by the two highest TSS results (300 mg/L and 630 mg/L), which has resulted in relatively low R^2 value of 0.56. It is possible that these samples included relatively coarse particles which settled quickly and therefore did not contribute to the turbidity measurement.

As such, it is reasonable to analyse subsets of the data which are characterised by lower TSS values. Therefore, a plot of TSS versus turbidity which only considers TSS values less

than 200 mg/L is also provided in **Figure 11**. This dataset is plotted with a linear line of best fit with an R^2 value of 0.93, which indicates good correlation.

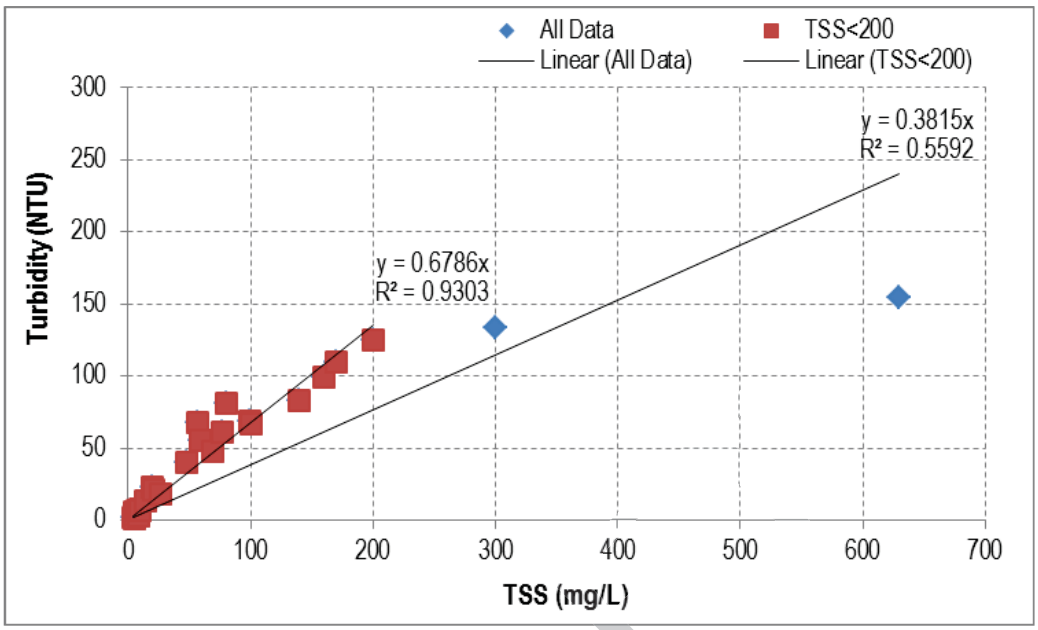


Figure 11: TSS-turbidity plot – silty/clayey sands

5.3 Soft Silty Clays

TSS-turbidity testing for soft silty clays (inshore material) comprised both a Column Test and Dilution Test, which were undertaken on 26/11/14 and 2/12/14 (respectively). Certificates of Analysis provided by Eurofins for the TSS and turbidity analyses undertaken for samples collected during both tests are provided in **Appendix G**. Test sheets completed during the TSS-turbidity tests for the soft silty clay material are also provided in **Appendix J**, which includes turbidity measurements undertaken during testing for each sample.

It is noted that 10 of the 22 samples collected during the Column Test were characterised by very high TSS concentrations ranging between 6,000 mg/L and 150,000 mg/L (Sample IDs MB1 to MB11, see **Appendix G**). As noted previously, including such high TSS values may skew the TSS-turbidity relationship and result in the establishment of an inaccurate turbidity limit for compliance monitoring. As such, results for Sample IDs MB1 to MB11 have not been included in the TSS-turbidity relationship for silty/clayey sands.

A plot of TSS versus turbidity for all other data collected during testing of the soft silty clays (i.e. both the Column Test and Dilution Test results) is provided in **Figure 12**, which includes TSS values up to 550 mg/L. This dataset is plotted with a linear line of best fit which has an R^2 value of 0.96.

As noted previously, the water quality limit for proposed dredging works would likely be specified in terms of a lower TSS concentration, e.g. 50 mg/L, and the TSS-turbidity relationship should therefore focus on values with a generally similar magnitude. As such, it is reasonable to analyse subsets of the data which are characterised by lower TSS values. Therefore, a plot of TSS versus turbidity which only considers TSS values less than

300 mg/L is also provided in **Figure 12**. This dataset is plotted with a linear line of best fit which has an R^2 value of 0.97.

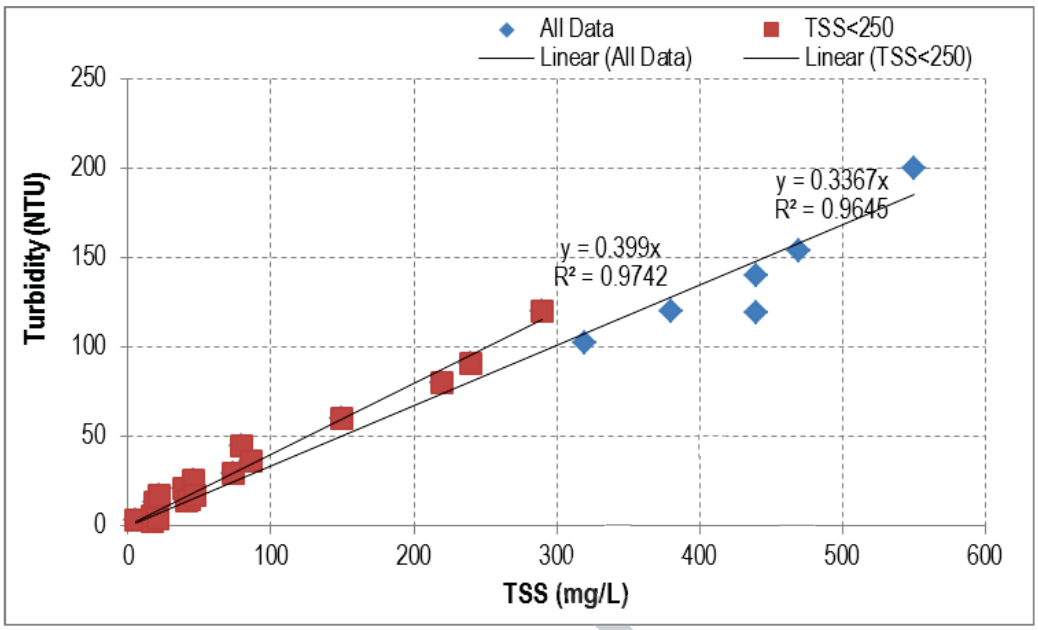


Figure 12: TSS-turbidity plot – soft silty clays

5.4 'Representative' Sand/Clay Material

TSS-turbidity testing for the sand/clay material that is representative of the undifferentiated interbedded sediments of Western Port comprised a Dilution Test only, which was undertaken on 16/12/14. A Column Test was not undertaken for this material. The Certificate of Analysis provided by Eurofins for the TSS and turbidity analyses undertaken for samples collected during testing is provided in **Appendix G**. Test sheets completed during the TSS-turbidity tests for the sand/clay material are also provided in **Appendix K**, which includes turbidity measurements undertaken during testing for each sample.

A plot of TSS versus turbidity for all data collected during testing of the representative sand/clay material (i.e. both the Column Test and Dilution Test results) is provided in **Figure 13**, which includes TSS values up to 450 mg/L. This dataset is plotted with a linear line of best fit which has an R^2 value of 0.97.

As discussed previously, it is reasonable to analyse subsets of the data which are characterised by lower TSS values. Therefore, a plot of TSS versus turbidity which only considers TSS values less than 300 mg/L is also provided in **Figure 13**. This dataset is plotted with a linear line of best fit which has an R^2 value of 0.99.

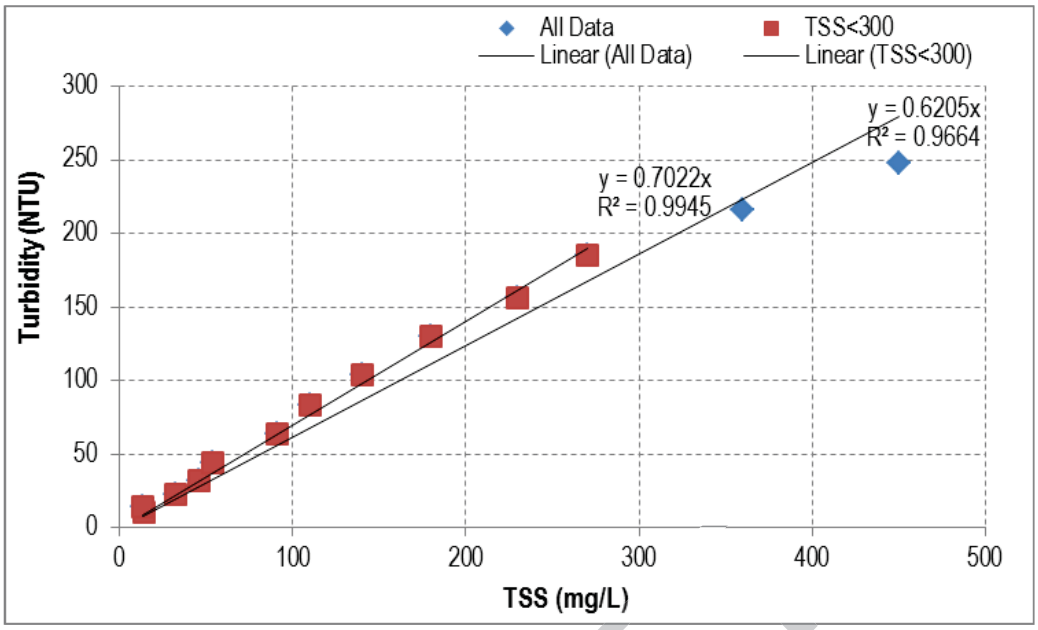


Figure 13: TSS-turbidity plot – 'representative' sand/clay material

5.5 Summary of TSS-Turbidity Relationships

A summary of the TSS-turbidity relationships determined for each material type and dataset considered is given in **Table 3**, including the turbidity value equivalent to 50 mg/L of suspended solids for each case considered.

Table 3: Summary of TSS-turbidity relationships for each material type

Material Type	Data Used	Number of values	R^2 value	Turbidity (NTU) equivalent to 50 mg/L
Stiff-hard clay	All (TSS<160)	14	0.78	48
Silty/clayey sand	All (TSS<630)	27	0.56	19
	TSS<300	25	0.93	34
Soft silty clay (inshore)	All (TSS<550)	24	0.96	17
	TSS<300	18	0.97	20
'Representative' sand/clay (undifferentiated interbedded sediments)	All (TSS<450)	13	0.97	31
	TSS<300	11	0.99	35

The turbidity value equivalent to 50 mg/L suspended solids was 48 NTU for the stiff-hard clay material, which was the highest for each material type and dataset. This is likely related to the relatively high proportion of fines present in this material.

For the silty/clayey sand, the turbidity value equivalent to 50 mg/L suspended solids ranged from 19 NTU (all data considered) to 34 NTU (TSS values less than 300 mg/L only). The R^2 values for these two datasets were 0.56 and 0.93 (respectively), which indicates that a much better correlation between TSS and turbidity exists for the smaller dataset.

For the soft silty clay (inshore), the turbidity value equivalent to 50 mg/L suspended solids ranged from 17 NTU (all data considered) to 20 NTU (TSS values less than 300 mg/L only). The R^2 values for these two datasets were 0.96 and 0.97 (respectively), which indicates strong correlations between TSS and turbidity for both datasets.

For the 'representative' sand/clay material, the turbidity value equivalent to 50 mg/L suspended solids ranged from 31 NTU (all data considered) to 35 NTU (TSS values less than 300 mg/L only). The R^2 values for these two datasets were 0.97 and 0.99 (respectively), which indicates strong correlations between TSS and turbidity for both datasets.

It can be seen that the turbidity values equivalent to 50 mg/L suspended solids increase when a reduced dataset (based on TSS values) is considered. This may be related to the higher proportion of coarser sediment particles that are generally present in samples with higher TSS values.

6 DISCUSSION

6.1 Settling Behaviour

A time series plot of the calculated bulking factors for each settlement test is presented in **Figure 14**. The stiff-hard clay material was characterised by the highest bulking factor at the end of testing (3.4), while similar bulking factors of around 2.0 were calculated at the end of testing for all other material types. This indicates that the clay material to be dredged would experience the highest degree of bulking, as expected. The findings presented herein should be considered further as part of the Dredging and Reclamation Design work package.

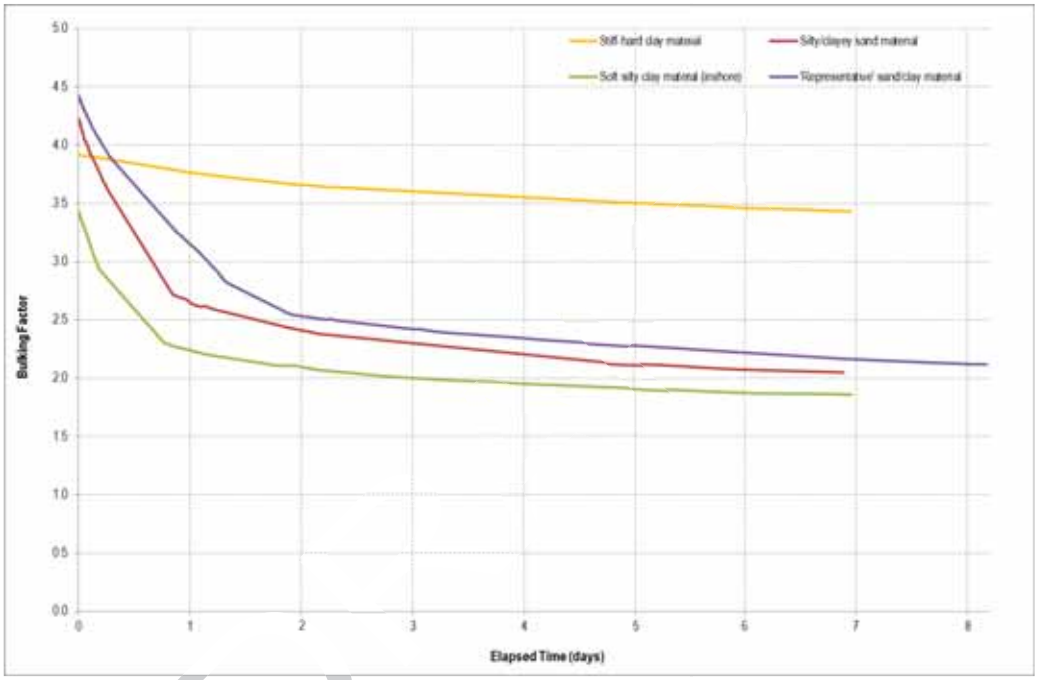


Figure 14: Calculated bulking factors for each settlement test

As discussed in **Section 4.1**, the bulking factor is the ratio of in situ volume of soil to the volume after dredging, and can therefore be expressed as a function of the in situ density of the soil and the density of the soil after being dredged. Time series plots of the calculated dry density for each settlement test are presented in **Figure 15**. These results indicate that the stiff-hard clay material is characterised by relatively low dry densities during settlement in comparison to the other material types. Again, these findings should be considered further as part of the Dredging and Reclamation Design work package.

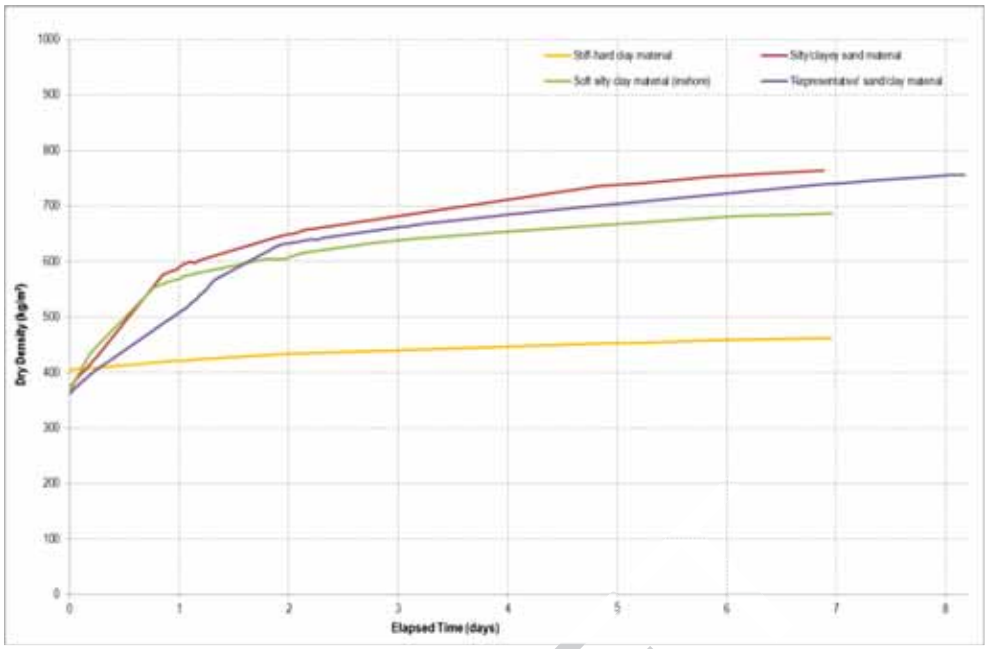


Figure 15: Calculated dry densities for each settlement test

Under controlled environmental conditions, two materials of the same composition should form a final product of the same density after dredging, regardless of the starting density. That is, two materials of the same composition but different densities when completely disturbed, which are then allowed to settle out hydraulically, should form a material of the same final density. Following this logic, the calculated dry densities for the tested materials reported herein should be relevant to other materials within the dredge area with similar compositions.

As such, classification tests were carried out on all samples tested, for reference against classification tests carried out during the geotechnical investigations. Laboratory reports for these classification tests are provided in **Appendix B**, and are summarised in **Table 4**.

Table 4: Summary of soil properties determined for materials used in settlement tests

Material Type	Assumed in situ dry density (t/m^3)	*Clay (%)	*Silt (%)	Total Fines (%)	Sand (%)	Gravel (%)	Plasticity Index (%)	Liquid Limit (%)
Stiff-hard clay	1.6	32	30	62	38	0	30	47
Silty/clayey sand	1.6	9	21	30	68	2	4	21
Soft silty clay (inshore)	1.3	22	25	47	47	6	15	33
'Representative' sand/clay	1.6	15	23	38	62	0	19	33

*Clay sized particles have been taken as being less than 0.002 mm and Silt sized particles between 0.002 mm and 0.075 mm.

It is noted that the in situ densities of the materials proposed to be dredged are quite variable, which would affect the degree of bulking observed during material placement activities. Therefore, the in situ densities of the materials to be dredged should be carefully considered when carrying out bulking calculations. This should be considered further as part of the Dredging and Reclamation Design work package.

6.2 TSS-Turbidity

The strong correlations between turbidity and suspended solids found in the testing means that turbidity can be confidently used as a surrogate for suspended solids in real time monitoring during dredging operations.

Samples with high TSS values (i.e. several hundred mg/L or greater) are often characterised by a relatively high proportion of coarser sediment particles which do not necessarily contribute to higher turbidity measurements (in comparison to lower TSS samples). As such, higher TSS values can skew the TSS-turbidity relationship.

Further, given that the turbidity limit for proposed dredging works would likely be specified in terms of a TSS concentration in the order of (say) 50 mg/L, the TSS-turbidity relationships used for the purposes of developing turbidity limits for compliance monitoring should focus on a range of TSS values that is consistent with this limit. Considering much higher TSS values may result in the establishment of an inaccurate turbidity limit for compliance monitoring.

The TSS-turbidity relationships presented herein which consider TSS values less than 300 mg/L are therefore considered most relevant for the purposes of informing the development of turbidity limits for compliance monitoring. For each material type tested, the turbidity values equivalent to 50 mg/L suspended solids for these relationships are as follows:

- stiff-hard clays – 48 NTU;
- silty/clayey sands – 34 NTU;
- very soft silty clays (located close to shore) – 20 NTU; and,
- 'representative' sand/clay material – 35 NTU.

It is evident that the TSS-turbidity relationships are reasonably variable for the different sediment types that would be dredged. This should be considered further as part of any establishment of turbidity limits for project activities.

It should also be noted that the TSS-turbidity relationships presented herein are based entirely on laboratory data. These results are generally considered to be suitable for establishing *preliminary* turbidity limits for compliance monitoring. Collection of field TSS-turbidity data prior to dredging (see below) and regular TSS sampling (and corresponding turbidity measurements) during dredging and material placement activities would be recommended so that the relationship between turbidity and suspended solids could be continually validated and improved.

It is important to develop an understanding of the TSS-turbidity relationship(s) for the waters of Western Port under existing conditions, i.e. in the absence of dredging works. This is because three of the four material types tested in the laboratory may not be representative of surface sediments in the Western Port[13]. Background turbidity should also be considered further as part of any establishment of turbidity limits for project activities.

It is noted that TSS sampling was undertaken in Western Port between March 2014 and October 2014 as part of several water quality profiling surveys undertaken for the project. This data was analysed as part of this investigation, however no clear relationship between TSS and turbidity was evident.

As such, it is recommended that ongoing TSS sampling (and corresponding turbidity measurements) be undertaken in Western Port as part of baseline data collection activities. It is envisaged that this sampling would be undertaken mainly during elevated turbidity events so that the TSS-turbidity relationship under existing conditions can be established. Ideally, this would involve sampling in response to a wide range of forcing conditions which influence turbidity levels in Western Port, such as rainfall events, spring tides, strong winds and large vessel movements. Opportunistic data collection could also be undertaken as part of other marine based data collection activities.

[13] Elevated turbidity events in Western Port under existing conditions are related to the suspension of surface sediments. Of the four material types tested, only the very soft silty clays (located close to shore) were predominantly comprised of surface sediments (refer **Appendix A**).

7 REFERENCES

Thackston, E.L. and Palmero M.R, (2000), “Improved methods for the correlation of turbidity and suspended solids for monitoring”, *DOER Technical Notes Collection* (ENDC TN-DOER-E8), U.S. Army Research and Development Centre, Vicksburg, MS.

WorleyParsons (2014), *Port of Hastings Container Expansion Project – Contract PoHDA 2013-001: Factual Report on Marine Geotechnical Investigation*, October 2014

APPENDIX A
Locations and Masses of Samples used for Testing

Table A1: Locations and Masses of Samples used for Testing

Borehole ref. no.	Sample Start Depth m	Sample Finish Depth m	Material Type	Surface RL m CD	Sample Start RL m CD	Sample Finish RL m CD	Sample Mass g
D18	0	0.45		-12.51	-12.5	-13.0	1256
	1	1.4		-12.51	-13.5	-13.9	776
	2.5	2.9		-12.51	-15.0	-15.4	1563
	4	4.4		-12.51	-16.5	-16.9	530
	4.5	4.95		-12.51	-17.0	-17.5	181
	6	6.4		-12.51	-18.5	-18.9	1045
	7.16	7.61		-12.51	-19.7	-20.1	681
R19	1	1.45		-5.83	-6.8	-7.3	2126
	4.5	4.95		-5.83	-10.3	-10.8	132
	13.5	13.95		-5.83	-19.3	-19.8	131
R21	0.5	0.8		-7.97	-8.5	-8.8	248
	1.2	1.5		-7.97	-9.2	-9.5	133
	3	3.3		-7.97	-11.0	-11.3	122
	3.3	3.75		-7.97	-11.3	-11.7	988
	4.5	4.95		-7.97	-12.5	-12.9	831
	5	5.45		-7.97	-13.0	-13.4	152
	6.45	6.9		-7.97	-14.4	-14.9	324
	8.5	8.95		-7.97	-16.5	-16.9	653
	10	10.45		-7.97	-18.0	-18.4	752
	11	11.1		-7.97	-19.0	-19.1	252
	11.5	11.95		-7.97	-19.5	-19.9	1942
S11	1	1.5		-8.02	-9.0	-9.5	1293
	4.5	4.95		-8.02	-12.5	-13.0	415
	6	6.45		-8.02	-14.0	-14.5	195
	8	8.45		-8.02	-16.0	-16.5	841
S12	0	0.1		-1.8	-1.8	-1.9	522
	2	2.4		-1.8	-3.8	-4.2	38
	2.5	2.9		-1.8	-4.3	-4.7	115
	1.5	1.9		-1.8	-3.3	-3.7	83
	3.5	3.9		-1.8	-5.3	-5.7	168
	4.5	5		-1.8	-6.3	-6.8	1576
	7.5	8		-1.8	-9.3	-9.8	1203
	9	9.5		-1.8	-10.8	-11.3	990
	10.5	11		-1.8	-12.3	-12.8	1735
	12	12.5		-1.8	-13.8	-14.3	1589
	13.8	13.9		-1.8	-15.6	-15.7	171
	15	15.45		-1.8	-16.8	-17.3	224

Borehole ref. no.	Sample Start Depth m	Sample Finish Depth m	Material Type	Surface RL m CD	Sample Start RL m CD	Sample Finish RL m CD	Sample Mass g
	16.5	16.95		-1.8	-18.3	-18.8	842
S13	4.5	4.95		-8.72	-13.2	-13.7	100
	3	3.45		-8.72	-11.7	-12.2	688
S14r	0.5	0.7		-10.7	-11.2	-11.4	1378
R1	0.5	0.95		0.55	0.1	-0.4	820
R5	0	0.1		-2.55	-2.6	-2.7	159
R15	0	0.4		-0.92	-0.9	-1.3	1570
	1	1.4		-0.92	-1.9	-2.3	37
	0.5	0.9		-0.92	-1.4	-1.8	235
	1	1.4		-0.92	-1.9	-2.3	168
R18	0	0.45		0.7	0.7	0.3	625
	0.5	0.9		0.7	0.2	-0.2	623
	3	3.4		0.7	-2.3	-2.7	1428
R23	1.5	2.5		0.92	-0.6	-1.6	660
	1	1.5		0.92	-0.1	-0.6	901
S17r	2	2.45		-2.03	-4.0	-4.5	133
	1	1.45		-2.03	-3.0	-3.5	423
	1.5	1.95		-2.03	-3.5	-4.0	810
	4.1	4.5		-2.03	-6.1	-6.5	1045
	5.6	6		-2.03	-7.6	-8.0	232
	3	3.45		-2.03	-5.0	-5.5	480
S15	0	0.4		1.2	1.2	0.8	225

Legend

- silty/clayey sand (common dredge area)
- stiff/hard clays (common dredge area)
- soft nearshore muds

APPENDIX B
Laboratory Reports for Geotechnical Testing of Samples used for Testing

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

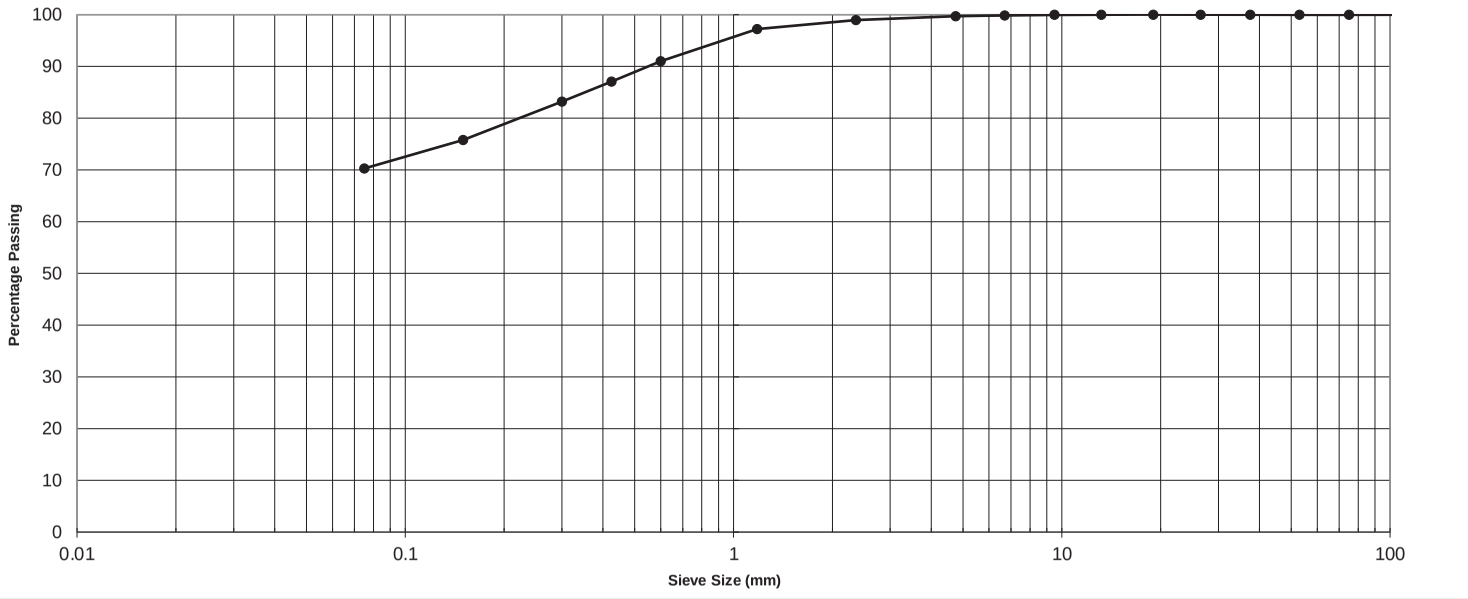
Customer: Royal Haskoning DVH
Customer Address: Suite 5, Level 5, 100 Walker Street, North Sydney, NSW, 2060
Project: Port of Hastings
Location: Common Area
Customer Order No.: -

Report Number: **307697** **- 3**
Report Date: 01/12/14
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1409280**
ID No.:	-
Lot No.:	-
Date Sampled:	20/11/2014
Time Sampled:	pm
Date Tested:	22/11/2014
Material Source:	Insitu
Material Type:	Mixed Clay
To Be Used As	-
Sample Location :	Common Area
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	-
Moisture Content (%) AS 1289 2.1.1	25.4
Liquid Limit (%) AS 1289.3.1.2	-
Plastic Limit (%) AS 1289.3.2.1	-
Plasticity Index AS 1289.3.3.1	-
Linear Shrinkage (%) AS 1289.3.4.1	-
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	-
L.S. x % Passing 0.425mm	-
Ratio of % Passing (0.075/0.425)	0.81

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
								100	100	100	99	97	91	87	83	76	70

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC - Grading Specification:

Remarks:

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

NATA Accreditation No. 12719

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

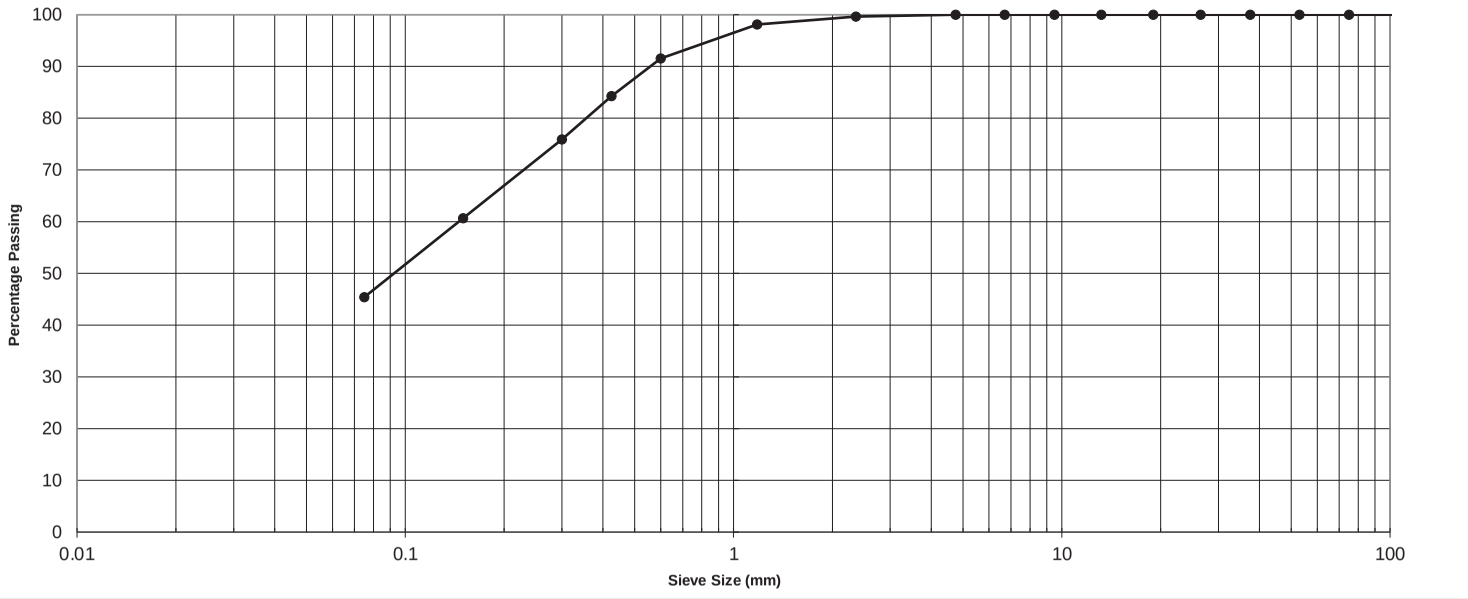
Customer: Royal Haskoning DVH
Customer Address: Suite 5, Level 5, 100 Walker Street, North Sydney, NSW, 2060
Project: Port of Hastings
Location: Common Area
Customer Order No.: -

Report Number: **307697** **- 3**
Report Date: 01/12/14
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1409281**
ID No.:	-
Lot No.:	-
Date Sampled:	20/11/2014
Time Sampled:	pm
Date Tested:	22/11/2014
Material Source:	Insitu
Material Type:	Sand
To Be Used As	-
Sample Location :	Common Area
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	-
Moisture Content (%) AS 1289 2.1.1	15.2
Liquid Limit (%) AS 1289.3.1.2	-
Plastic Limit (%) AS 1289.3.2.1	-
Plasticity Index AS 1289.3.3.1	-
Linear Shrinkage (%) AS 1289.3.4.1	-
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	-
L.S. x % Passing 0.425mm	-
Ratio of % Passing (0.075/0.425)	0.54

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	98	92	84	76	61	45

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC - Grading Specification:

Remarks:

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J Lamont

NATA Accreditation No. 12719

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

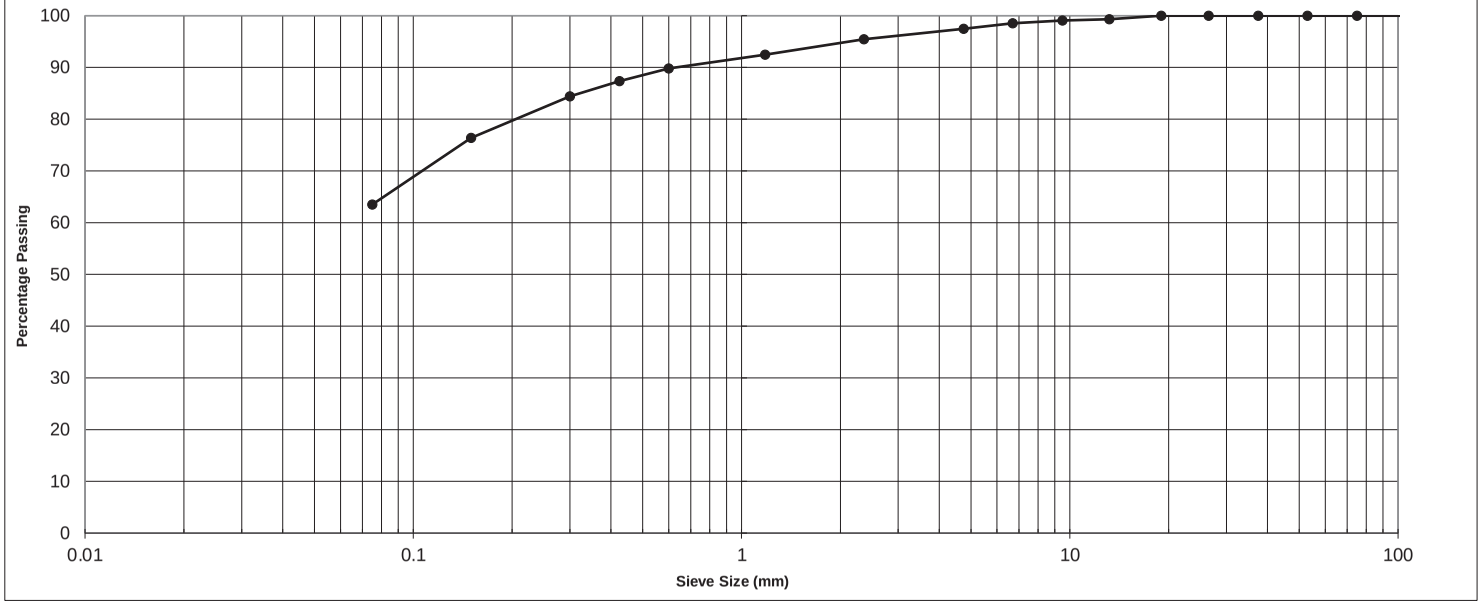
Customer: Royal Haskoning DVH
Customer Address: Suite 5, Level 5, 100 Walker Street, North Sydney, NSW, 2060
Project: Port of Hastings
Location: Common Area
Customer Order No.: -

Report Number: **307697** **- 3**
Report Date: 01/12/14
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 3 of 3

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1409282**
ID No.:	-
Lot No.:	-
Date Sampled:	20/11/2014
Time Sampled:	pm
Date Tested:	22/11/2014
Material Source:	Insitu
Material Type:	Mud
To Be Used As	-
Sample Location :	Common Area
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	-
Moisture Content (%) AS 1289 2.1.1	46.0
Liquid Limit (%) AS 1289.3.1.2	-
Plastic Limit (%) AS 1289.3.2.1	-
Plasticity Index AS 1289.3.3.1	-
Linear Shrinkage (%) AS 1289.3.4.1	-
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	-
L.S. x % Passing 0.425mm	-
Ratio of % Passing (0.075/0.425)	0.73

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	99	99	99	97	95	92	90	87	84	76	64

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC - Grading Specification:

Remarks:

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Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

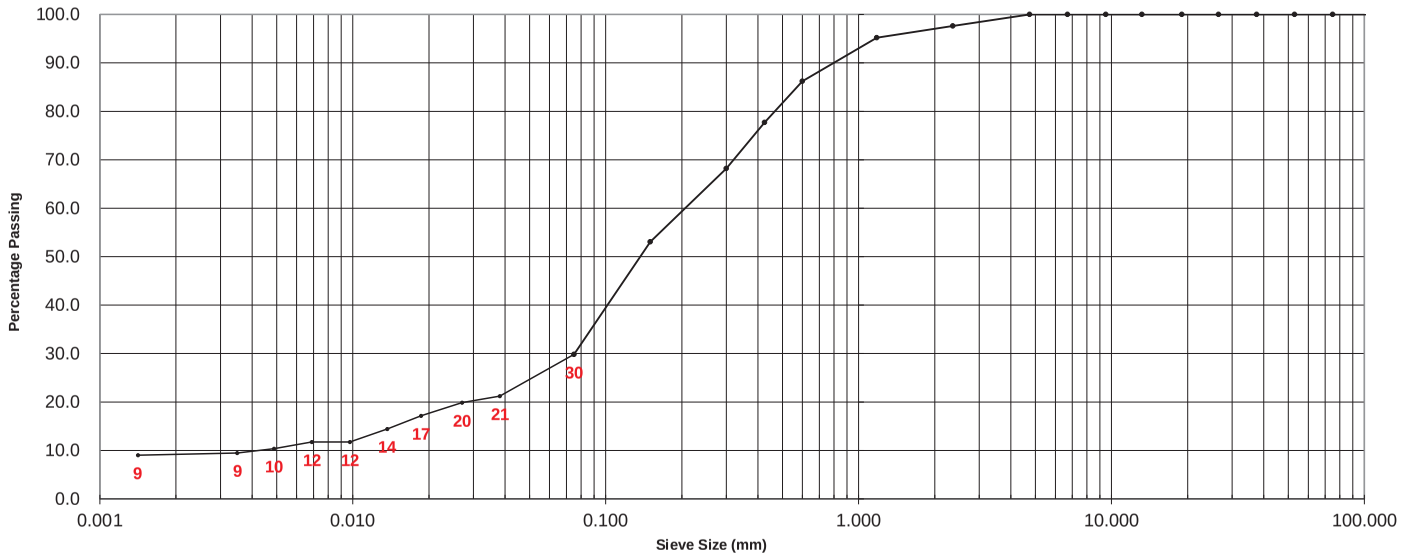
Customer: Royal Haskoning DVH
Customer Address: Suite 5, Level 5, 100 Walker Street, North Sydney, NSW 2060
Project: Port of Hastings
Location: Common Area
Customer Order No.: -

Report Number: **307697** **-3**
Report Date: 10/02/2015
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1409945**
ID No.:	1
Lot No:	-
Date Sampled:	20/11/2014
Time Sampled:	pm
Date Tested:	17/12/2014
Material Source:	Insitu
Material Type:	Sand
To Be Used As	-
Sample Location	-
	Common Area
	-
	-
	-
	-
Sampling Method	-
Moisture Content (%) AS 1289 2.1.1	0.0
Liquid Limit (%) AS 1289.3.1.2	21
Plastic Limit (%) AS 1289.3.2.1	17
Plasticity Index AS 1289.3.3.1	4
Linear Shrinkage (%) AS 1289.3.4.1	0.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	311
L.S. x % Passing 0.425mm	0
Ratio of % Passing (0.075/0.425)	0.38

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	98	95	86	78	68	53	30

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC [ ] Grading Specification:

Remarks: **Dispersion Method:** mechanical **Hydrometer:** grams per litre **Sample tested on fully dried out material**

NATA WORLD RECOGNISED ACCREDITATION

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NATA Accreditation No. 12719

Form No: **CG.349.001**

Issue Date: 19/02/2013

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

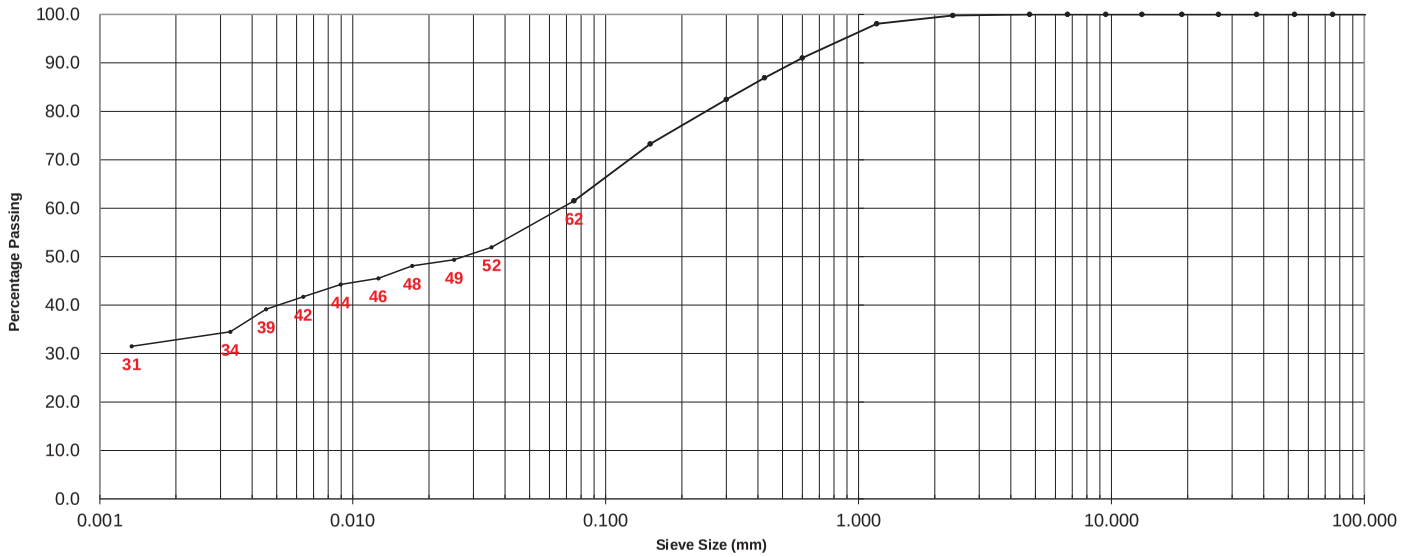
Customer: Royal Haskoning DVH
Customer Address: Suite 5, Level 5, 100 Walker Street, North Sydney, NSW 2060
Project: Port of Hastings
Location: Common Area
Customer Order No.: -

Report Number: **307697** **-3**
Report Date: 10/02/2015
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1409946**
ID No.:	2
Lot No:	-
Date Sampled:	20/11/2014
Time Sampled:	pm
Date Tested:	19/12/2014
Material Source:	Insitu
Material Type:	Clay
To Be Used As	-
Sample Location	-
	Common Area
	-
	-
	-
	-
Sampling Method	-
Moisture Content (%) AS 1289 2.1.1	-
Liquid Limit (%) AS 1289.3.1.2	47
Plastic Limit (%) AS 1289.3.2.1	17
Plasticity Index AS 1289.3.3.1	30
Linear Shrinkage (%) AS 1289.3.4.1	11.5
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	2608
L.S. x % Passing 0.425mm	1000
Ratio of % Passing (0.075/0.425)	0.71

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	98	91	87	82	73	62

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC [ ] Grading Specification:

Remarks: **Dispersion Method:** mechanical **Hydrometer:** grams per litre **Sample tested on fully dried out material**

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Form No: **CG.349.001**

Issue Date: 19/02/2013

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

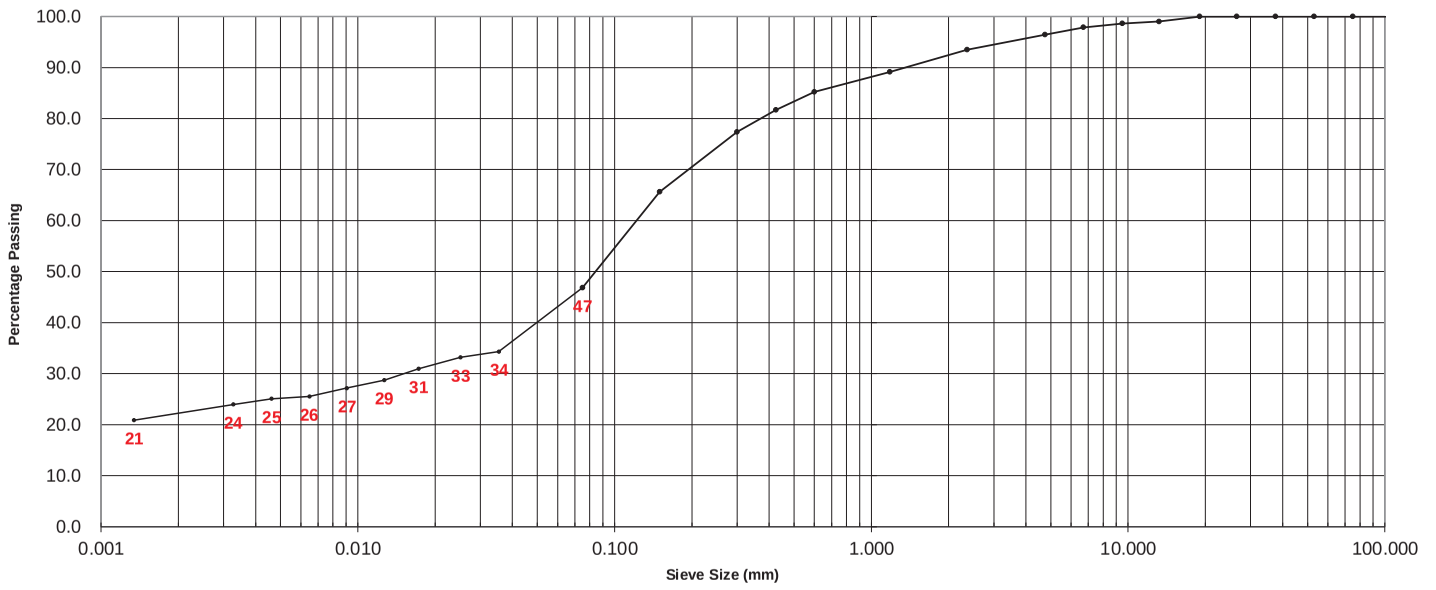
Customer: Royal Haskoning DVH
Customer Address: Suite 5, Level 5, 100 Walker Street, North Sydney, NSW 2060
Project: Port of Hastings
Location: Common Area
Customer Order No.: -

Report Number: **307697** **4**
Report Date: 12/01/2015
Request No: 0
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3
Page: 1 of 1

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1410107**
ID No.:	1
Lot No:	-
Date Sampled:	22/12/2014
Time Sampled:	AM
Date Tested:	8/01/2015
Material Source:	Client Sourced
Material Type:	Mud - Silty Clay
To Be Used As	-
Sample Location	Common Area
Sampling Method	-
Moisture Content (%) AS 1289 2.1.1	-
Liquid Limit (%) AS 1289.3.1.2	33
Plastic Limit (%) AS 1289.3.2.1	18
Plasticity Index AS 1289.3.3.1	15
Linear Shrinkage (%) AS 1289.3.4.1	5.5
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	1225
L.S. x % Passing 0.425mm	449
Ratio of % Passing (0.075/0.425)	0.57

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	99	99	98	96	94	89	85	82	77	66	47

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SC Grading Specification:

Remarks: Please see the original PSD for larger particle distribution **Dispersion Method:** mechanical **Hydrometer:** grams per litre **Sample tested on fully dried out material**

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A Catton

NATA Accreditation No. 12719

Form No: **CG.349.001**

Issue Date: 19/02/2013

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

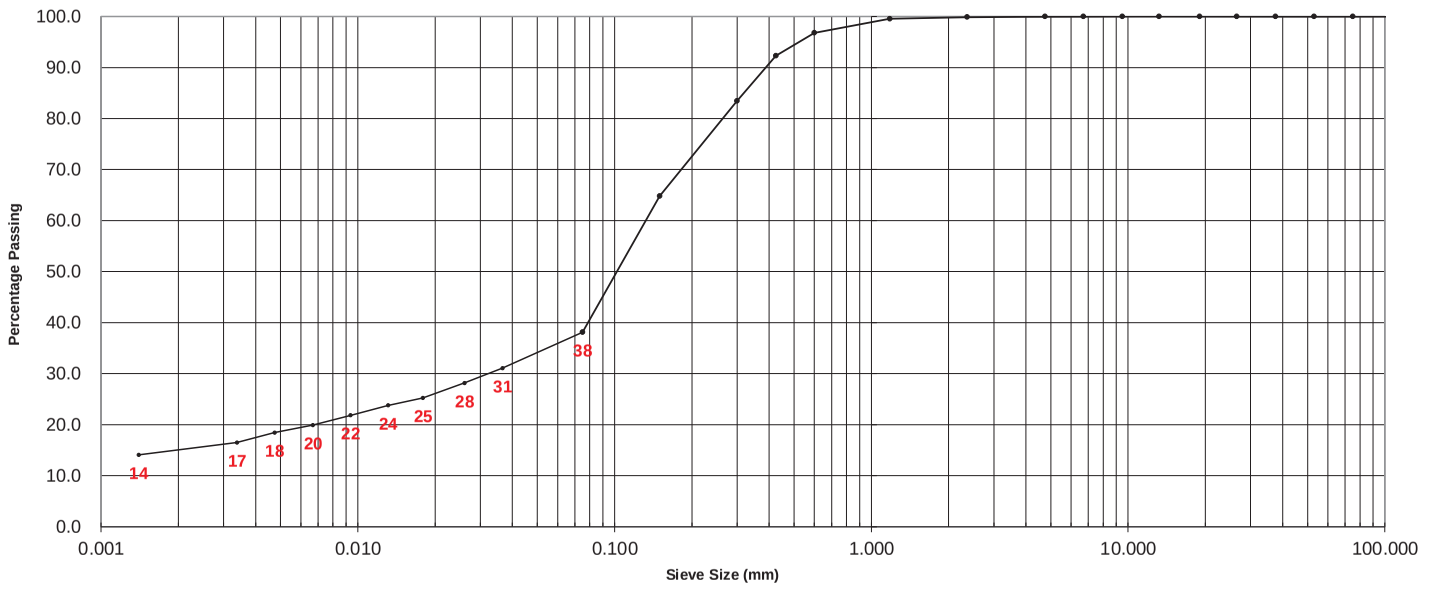
Customer: Royal Haskoning DVH
Customer Address: Suite 5, Level 5, 100 Walker Street, North Sydney, NSW 2060
Project: Port of Hastings
Location: Common Area
Customer Order No.: -

Report Number: **307697** **- 5**
Report Date: 10/02/2015
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1500277**
ID No.:	-
Lot No:	-
Date Sampled:	-
Time Sampled:	-
Date Tested:	10/02/2015
Material Source:	Common Area
Material Type:	Clay / Sand
To Be Used As	-
Sample Location	Common Area
Sampling Method	-
Moisture Content (%) AS 1289 2.1.1	-
Liquid Limit (%) AS 1289.3.1.2	33
Plastic Limit (%) AS 1289.3.2.1	14
Plasticity Index AS 1289.3.3.1	19
Linear Shrinkage (%) AS 1289.3.4.1	7.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	1754
L.S. x % Passing 0.425mm	646
Ratio of % Passing (0.075/0.425)	0.41

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	100	97	92	83	65	38

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SC Grading Specification:

Remarks: Please see the original PSD for larger particle distribution **Dispersion Method:** mechanical **Hydrometer:** grams per litre **Sample tested on fully dried out material**

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

A Catton

NATA Accreditation No. 12719

Form No: **CG.349.001**

Issue Date: 19/02/2013

APPENDIX C
Settlement Test Sheets – Stiff-Hard Clays

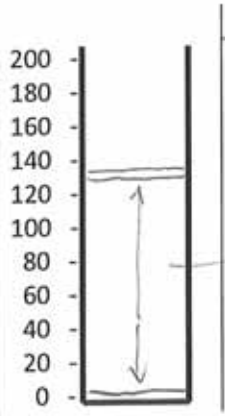
Royal HaskoningDHV
Enhancing Society Together

Personnel: P. Lindsay, J. Donald, S. Miller **Page** 1 of ____

Test Number: 1A	**Test Started:** 19/11/14 9:04
Material Type: CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: Common AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

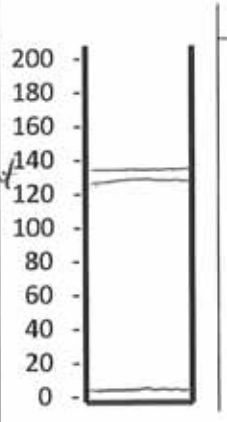
Date/Time: 19/11/14 9:07
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
1318	3mm supernatant
1315	fully mixed brown clay
10 mm	sand/silt

Comments:

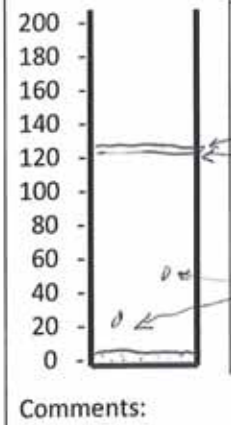
Date/Time: 19/11/14 9:11
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
1318	~4mm supernatant
1314	
10	Sand

Comments:

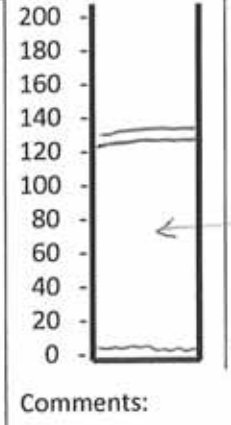
Date/Time: 19/11/14 9:40
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
1317	
1312	
0	some grey clay smears on side of column
~15	sand

Comments:

Date/Time: 19/11/14 10:15
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
1317	6 mm supernatant
1311	flocculating (photo taken)
15	sand

Comments:

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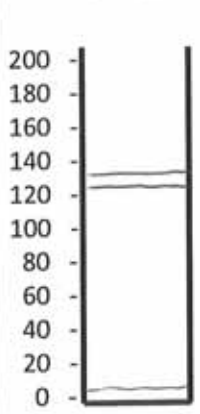
Personnel: P. Lawless, J. Dowdal, S. Miller **Page** 2 of ____

Test Number: 1A	**Test Started:** 19/11/14
Material Type: CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: Common AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 19/11/14 10:58

Turbidity: N/A (>250) NTU/depth

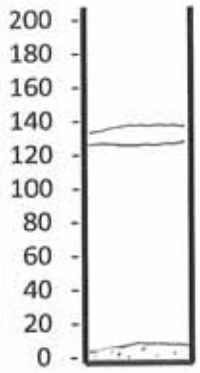


y (mm)	Description
1317	
1310	
15	

Comments:

Date/Time: 19/11/14 12:23

Turbidity: N/A (>250) NTU/depth

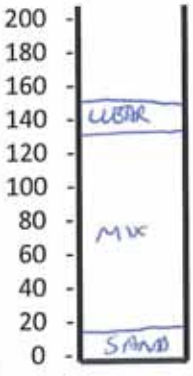


y (mm)	Description
1316	
1306	68mm supernatant
15	(sand)

Comments:

Date/Time: 19/11/14 1:00pm

Turbidity: ____ NTU/depth

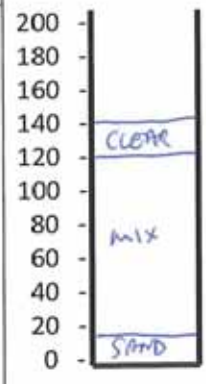


y (mm)	Description
1316 mm	
1307mm	
16mm	

Comments:

Date/Time: 19/11/14 2:00pm

Turbidity: ____ NTU/depth



y (mm)	Description
1316	
1306 mm	
16 mm	

Comments:

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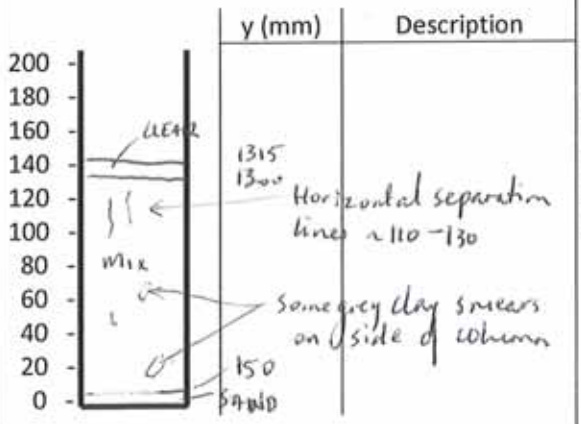
Personnel: P. Lawless; S. Miller **Page** 3 of ____

Test Number: 1A	**Test Started:** 19/11/14 9:04
Material Type: CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

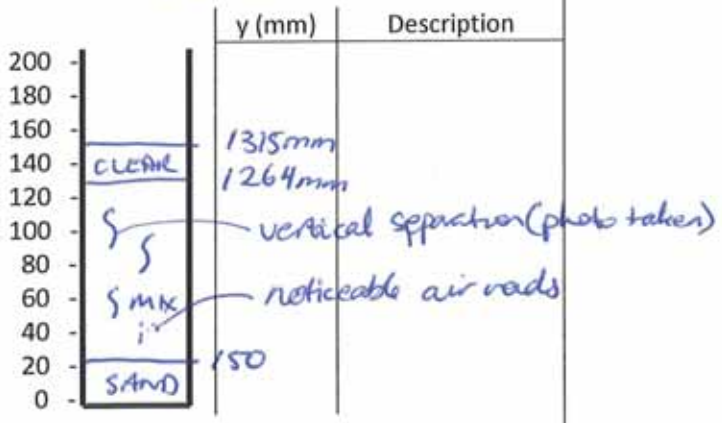
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 19/11/14 16:54
Turbidity: _____ NTU/depth



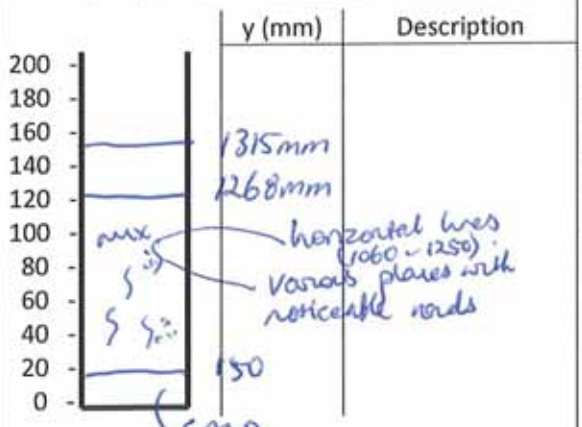
Comments:

Date/Time: 20/11/14 08:30
Turbidity: 9.6 NTU 1cm NTU/depth



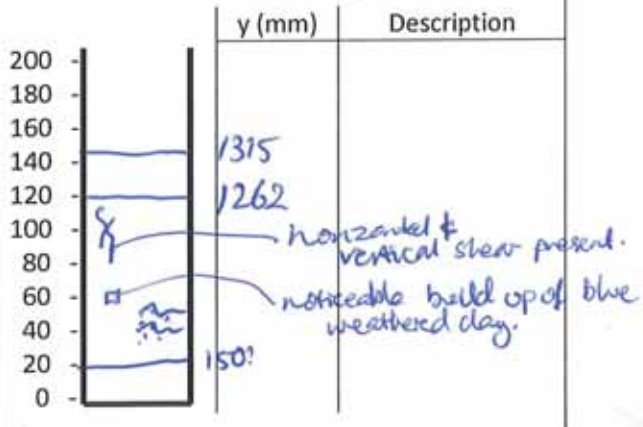
Comments:

Date/Time: 20/11/14 07:00
Turbidity: 10.1 NTU (1cm) NTU/depth



Comments:

Date/Time: 20/11/14 10:00
Turbidity: 20 NTU (1cm) NTU/depth



Comments:

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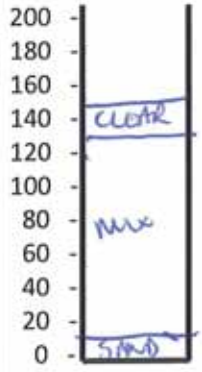
Personnel: S. MILLER **Page** 4 of ____

Test Number: 1A	**Test Started:** 19/11/14 9:04
Material Type: CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

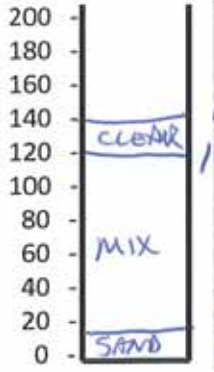
Date/Time: 20/11/14 12:00
Turbidity: 9.5 NTU @ 1cm NTU/depth



y (mm)	Description
1313	
1258	
150	

Comments:

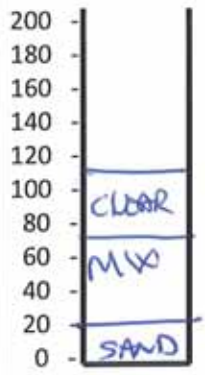
Date/Time: 20/11/14 13:00
Turbidity: 9.4 NTU @ 1cm NTU/depth



y (mm)	Description
1313	
1256	
150	

Comments:

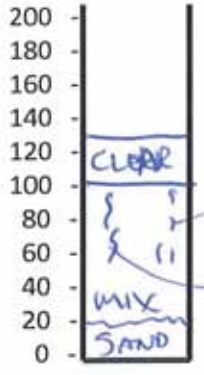
Date/Time: 20/11/14 15:30
Turbidity: 9.2 NTU @ 4cm NTU/depth



y (mm)	Description
1313	
1252	1252 & 1030 vertical lines.
150	

Comments:

Date/Time: 21/11/14 07:30
Turbidity: 4.85 NTU @ 5cm NTU/depth



y (mm)	Description
1313	
1230	noticeable air pockets have appeared. vertical/horizontal cracks extending
150	

Comments:

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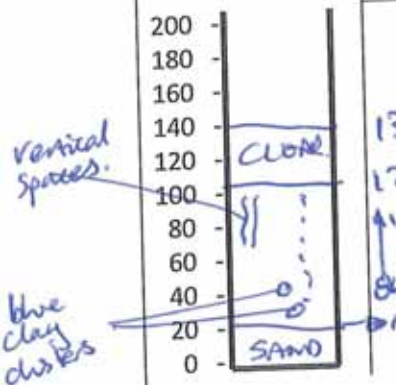
Personnel: S. MILLER (CHADWICK) **Page** 5 of ____

Test Number: 1A	**Test Started:** 19/11/14 9:04
Material Type: CLAY	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: Common Area	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

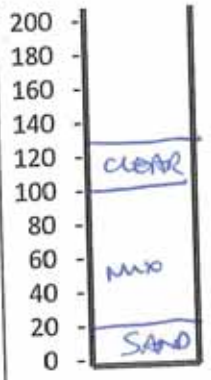
Date/Time: 21/11/14 10:00
Turbidity: 2.5 NTU dredge @ 2cm, 3.5 NTU centre @ 2cm NTU/depth



y (mm)	Description
1313	
1227	
1139	air bubbles
880	
150	

Comments:

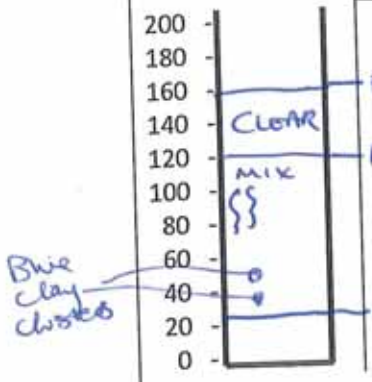
Date/Time: 21/11/14 12:00
Turbidity: _____ NTU/depth



y (mm)	Description
1313	no specific changes noted
1226	
150	

Comments:

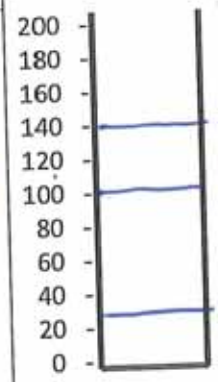
Date/Time: 21/11/14 14:30
Turbidity: 3.5 NTU @ 1cm NTU/depth



y (mm)	Description
1314	
1222, 1222	vertical sprees, shear?
1120	
1040	
880	air bubbles
160	

Comments:

Date/Time: 21/11/14 16:00
Turbidity: 3.2 NTU @ 1cm NTU/depth



y (mm)	Description
1314	no drastic/subtle changes
1222	
160	

Comments:

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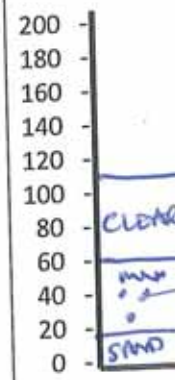
Personnel: S, MILLER (CHADWICK) **Page** 6 of ____

Test Number: 1A	**Test Started:** 19/11/14 9:04
Material Type: CLAY	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON AREA	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

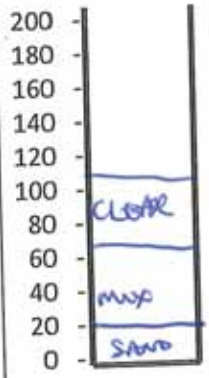
Date/Time: 24/11/14 @ 7AM
Turbidity: 2.05 @ 5cm. NTU/depth



y (mm)	Description
1313	
1177	
150	small blue clusters & no drastic changes

Comments:

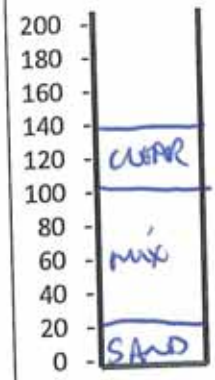
Date/Time: 24/11/14 @ 16:00
Turbidity: 1.40 @ 5cm NTU/depth



y (mm)	Description
1310	
1172	
150	

Comments:

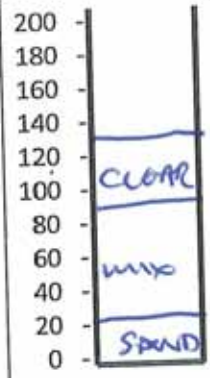
Date/Time: 25/11/14 07:00
Turbidity: 1.35 @ 5cm NTU/depth



y (mm)	Description
1308	
1162	
150	

Comments:

Date/Time: 25/11/14 16:00
Turbidity: 1NTU @ 5cm. NTU/depth



y (mm)	Description
1307	
1159	
150	no obvious change

Comments:

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Personnel: S. MILLER + S. DONALD

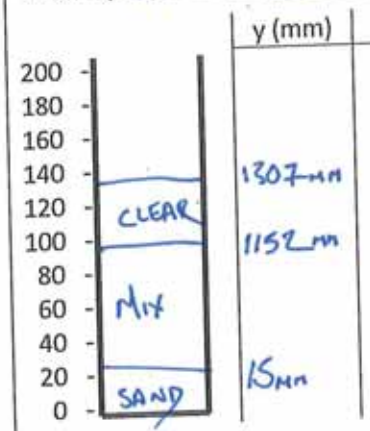
Page 7 of ____

Test Number: 1A	**Test Started:**
Material Type: CLAY	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON AREA	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 NOV 14 7:55

Turbidity: 0.7 NTU @ 5CM NTU/depth

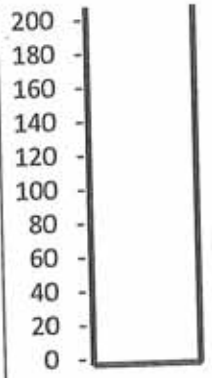


y (mm)	Description
130.7mm	
115.2mm	
15mm	

Comments:

Date/Time: ____

Turbidity: ____ NTU/depth

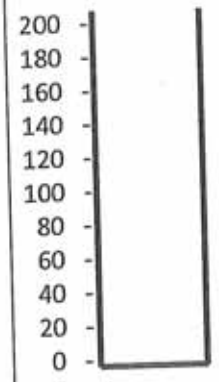


y (mm)	Description

Comments:

Date/Time: ____

Turbidity: ____ NTU/depth



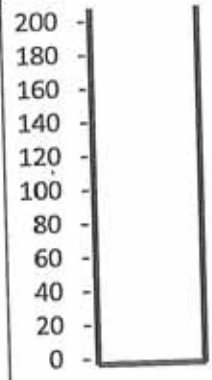
y (mm)	Description

Comments:

TSS - CA1

Date/Time: ____

Turbidity: ____ NTU/depth



y (mm)	Description

Comments:

APPENDIX D
Settlement Test Sheets – Silty/Clayey Sands

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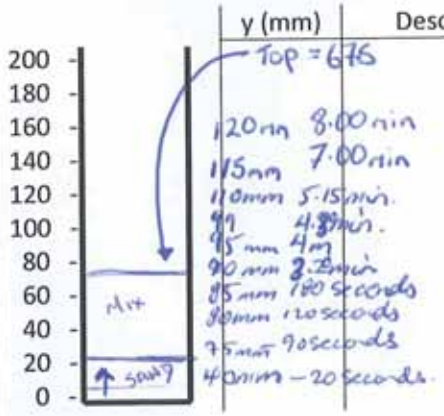
Personnel: P. Lankess, J. Donald, S. Miller **Page** 21 of ____

Test Number: # 2A	**Test Started:** 10:44 19/11/14
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: Common	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 19/11/14 10:44

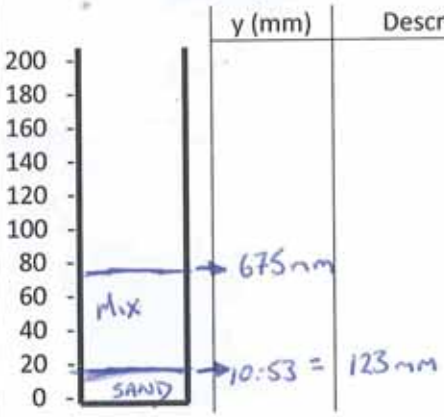
Turbidity: N/A (>250) NTU/depth



Comments:

Date/Time: 19/11/14 10:54

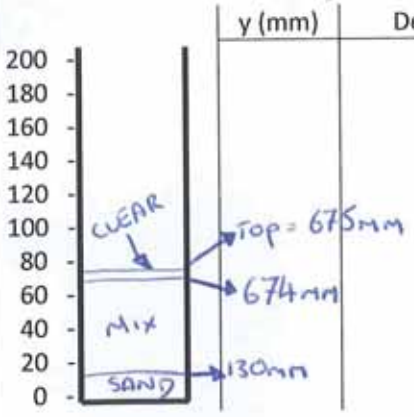
Turbidity: N/A (>250) NTU/depth



Comments:

Date/Time: 19/11/14 10:56

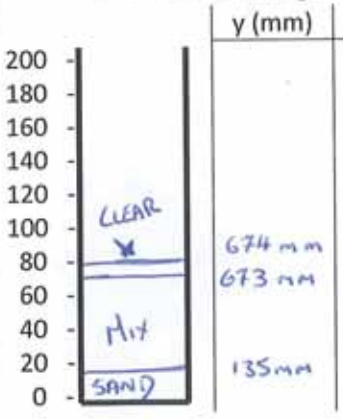
Turbidity: N/A (>250) NTU/depth



Comments: Supernatant visible for first time.

Date/Time: 19/11/14 1059

Turbidity: N/A (>250) NTU/depth



Comments:

Timer STARTED @ 10:54 - will be visible in subsequent photos
∴ Add 10 mins to clock time (on timer) to verify test duration.

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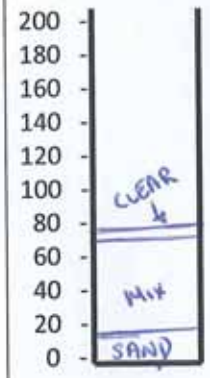
Personnel: P. Lawless, J. Donald, S. Miller **Page** 2 of ____

Test Number: ~~1~~ 2A	**Test Started:** 10:44 19/11/14
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: Common	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 19/11/14 1103

Turbidity: N/A (7250) NTU/depth

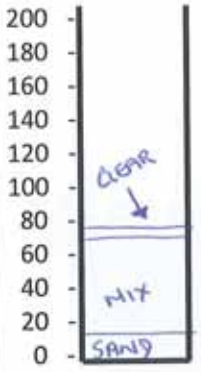


y (mm)	Description
675 mm	
671 mm	
139 mm	

Comments:

Date/Time: 19/11/14 1109

Turbidity: N/A (7250) NTU/depth

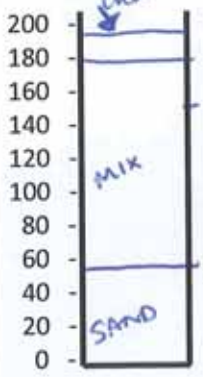


y (mm)	Description
675 mm	
669 mm	
142 mm	

Comments:

Date/Time: 19/11/14 11:15

Turbidity: N/A (7250) NTU/depth

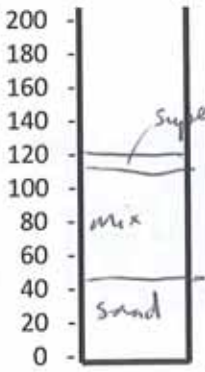


y (mm)	Description
675 mm	
666 mm	
145 mm.	

Comments:

Date/Time: 19/11/14 11:25

Turbidity: N/A (7250) NTU/depth



y (mm)	Description
675	
663	
48	

Comments:

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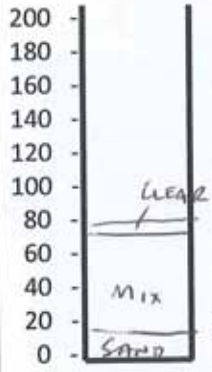
Personnel: P. Lawless, J. Donald, S. Miller **Page** 3 of ____

Test Number: 2A	**Test Started:** 19/11/14 10:44
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: Common Area	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

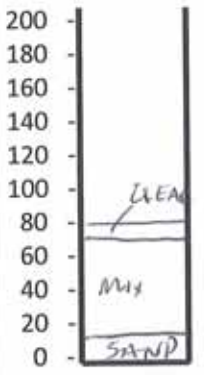
Date/Time: 19/11/14 11:33
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
675	
659	
150	

Comments:

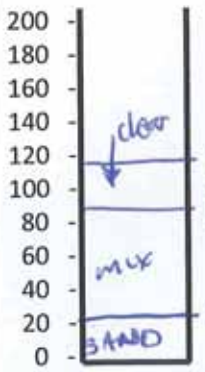
Date/Time: 19/11/14 11:44
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
675	
655	
153	

Comments:

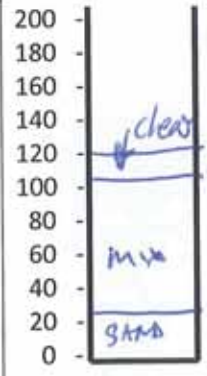
Date/Time: 19/11/14 12:00
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
675	
647	
158mm	

Comments:

Date/Time: 19/11/14 12:15
Turbidity: N/A (7250) NTU/depth



y (mm)	Description
675	
646	
159mm	

Comments:

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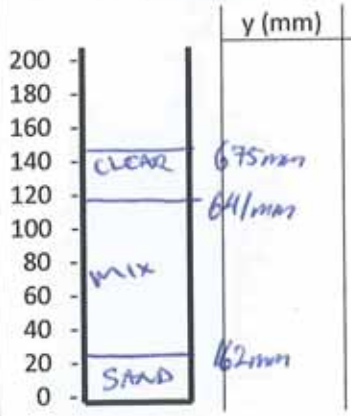
Personnel: P. Lawless, S. Miller **Page** 4 of ____

Test Number: 1A	**Test Started:** 19/11/14 10:44
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: Common AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 19/11/14 12:30pm

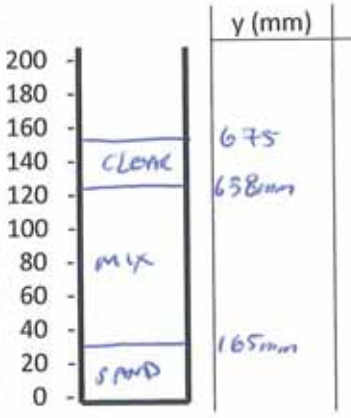
Turbidity: _____ NTU/depth



Comments:

Date/Time: 19/11/14 12:45

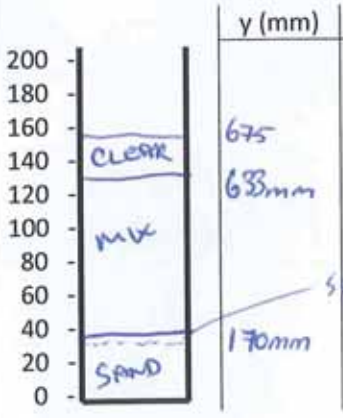
Turbidity: _____ NTU/depth



Comments:

Date/Time: 19/11/14 1:00pm

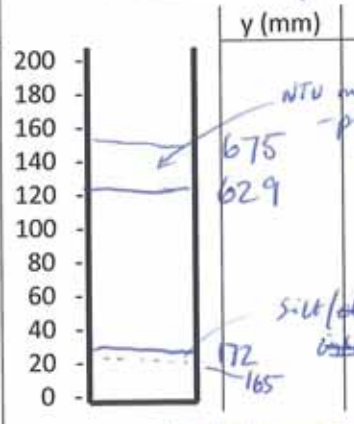
Turbidity: _____ NTU/depth



Comments:

Date/Time: 19/11/14 1:44pm

Turbidity: ~~120~~ 230 NTU/1cm NTU/depth



Comments: Turbidity = 120 NTU initially, then ↑ to ~230 NTU, possibly due to surface scum on probe face. Rinsed probe then measured again, reading around 100 NTU then ↑ up to 230 NTU.

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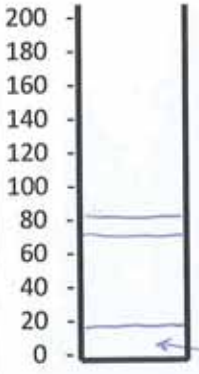
Personnel: P. Lawless / S. Miller **Page** 5 of ____

Test Number: 2A	**Test Started:**
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: Common AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 19/11/14 13:35

Turbidity: 210 NTU / 1cm NTU/depth

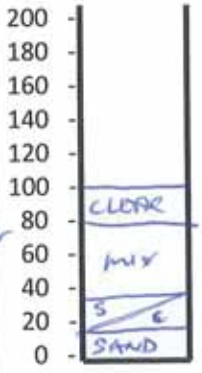


y (mm)	Description
675	
625	Top of sand layer no longer clear - interbedded with silt.
~190	

Comments: Submerging probe possibly ↑ turbidity. Lowered probe with wiper closed so scum didn't affect readings.

Date/Time: 19/11/14 13:57

Turbidity: 90 NTU / 1cm NTU/depth

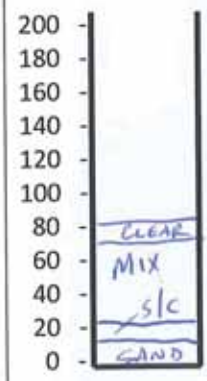


y (mm)	Description
675mm	
620mm	
200mm	
165mm	

Comments: ← Possibly agitated mix.

Date/Time: 19/11/14 14:07

Turbidity: 91 NTU / 1cm NTU/depth

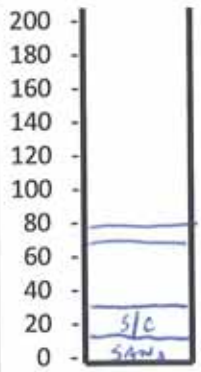


y (mm)	Description
675	
618	
205	
167	

Comments:

Date/Time: 19/11/14 14:24

Turbidity: 90 NTU / 1cm NTU/depth



y (mm)	Description
675	
614	
210	
166	

Comments:

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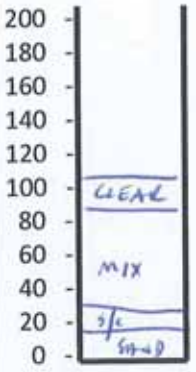
Personnel: P. Lawless / S. Miller **Page** 6 of ____

Test Number: 2A	**Test Started:** 19/11/14 10:44
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: Common AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

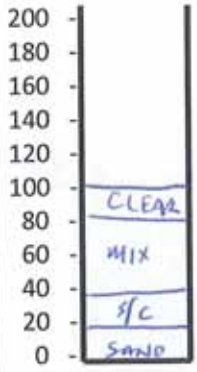
Date/Time: 19/11/14 14:45
Turbidity: _____ NTU/depth



y (mm)	Description
675	
610	
218	
166	

Comments: Could not take turbidity measurement – laptop in concurrent use

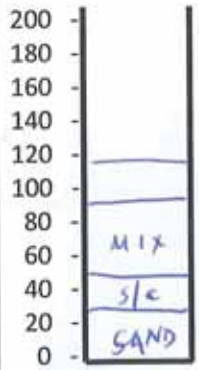
Date/Time: 19/11/14 15:16
Turbidity: 52 NTU (15:22) NTU/depth



y (mm)	Description
675	
602	
234	
166	

Comments:

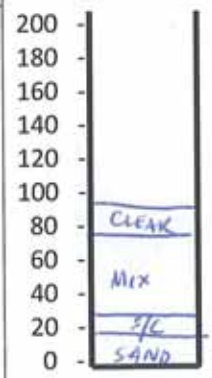
Date/Time: 19/11/14 15:~~42~~
Turbidity: 49 NTU NTU/depth



y (mm)	Description
675	
596	
244	
~~195~~ 166	

Comments:

Date/Time: 19/11/14 16:05
Turbidity: 42 NTU / 1 cm NTU/depth



y (mm)	Description
695	
591	
250	
166	

Comments:

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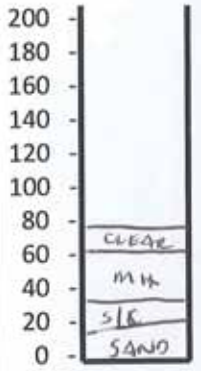
Personnel: P. Lawless / S. Miller **Page** 1 of ____

Test Number: 2A	**Test Started:** 19/11/14 10:44
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: Common Area	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

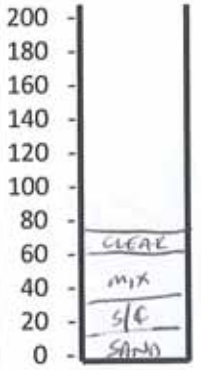
Date/Time: 19/11/14 16:37
Turbidity: 40 NTU / 1 cm NTU/depth



y (mm)	Description
675	
585	
272	
160	

Comments:

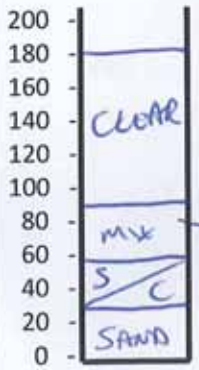
Date/Time: 19/11/14 17:03
Turbidity: 33.2 NTU NTU/depth



y (mm)	Description
675	
579	
280	
160	

Comments:

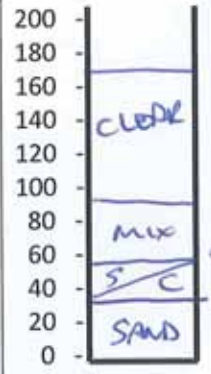
Date/Time: 20/11/14 07:00 7NTU (15cm)
Turbidity: 13.2NTU (1cm) NTU/depth



y (mm)	Description
675	
435	some air pockets visible
280	
160	

Comments:

Date/Time: 20/11/14 8:30
Turbidity: 11.5 NTU (1cm) NTU/depth



y (mm)	Description
6745mm	
431 mm	
280	
160	

Comments:

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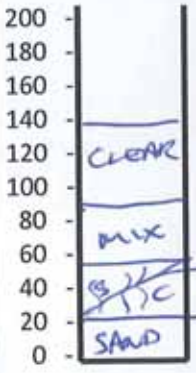
Personnel: S. MILLER **Page** 8 of ____

Test Number: 2A	**Test Started:** 19/11/14 10.44
Material Type: SAND	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

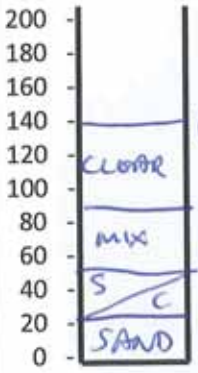
Date/Time: 20/11/14 10AM
Turbidity: 11NTU@1cm / 9NTU@10cm NTU/depth



y (mm)	Description
675	
428	
280	Separation observed looks like natural leaching.
160	

Comments:

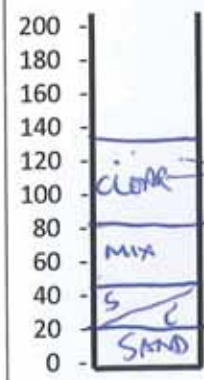
Date/Time: 20/11/14 11AM
Turbidity: 11NTU/1cm NTU/depth



y (mm)	Description
675	
423	
290	
160	

Comments:

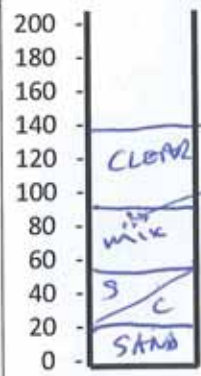
Date/Time: 20/11/14 12PM
Turbidity: 11 NTU @ 1cm NTU/depth



y (mm)	Description
675	noticeable little clusters of sand on cylinder plastic.
420	
290	
162	

Comments:

Date/Time: 20/11/14 13:00 @ 10cm
Turbidity: 9.3 NTU @ 1cm NTU/depth



y (mm)	Description
675	
418	air bubbles noticeable
290	
162	

Comments:

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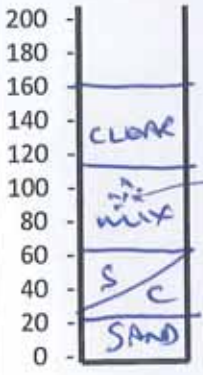
Personnel: SMULLER **Page** 9 of ____

Test Number: 2A	**Test Started:** 19/11/14 10:44
Material Type: SAND	**Test Type:** ☒ Settlement Only
Dredge Location: Common Area.	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

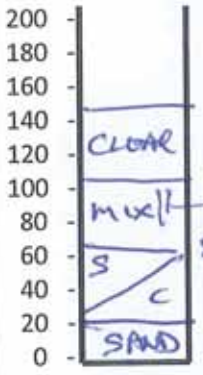
Date/Time: 20/11/14 14:00
Turbidity: 7.1NTU @ 1cm 12NTU @ 10cm NTU/depth



y (mm)	Description
675	
419	more noticeable air bubbles
290	
162	

Comments:

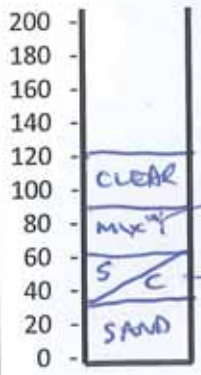
Date/Time: 20/11/14 15:30 7-3 @ 10cm
Turbidity: 7.5 @ 1cm NTU/depth



y (mm)	Description
675	
415	tails can be seen from some air bubbles.
290	
162	

Comments:

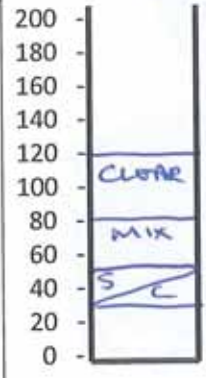
Date/Time: 21/11/14 07:30
Turbidity: 4.6 NTU @ 10cm NTU/depth
3.5 NTU @ 20cm



y (mm)	Description
674	
390	reduced bubbles as settling occurs
290	
162	much more defined "grade change".

Comments:

Date/Time: 21/11/14 10:00
Turbidity: 5.2 NTU @ 1cm NTU/depth
4.2 NTU @ 20cm



y (mm)	Description
674	
386	
290	
162	

Comments:

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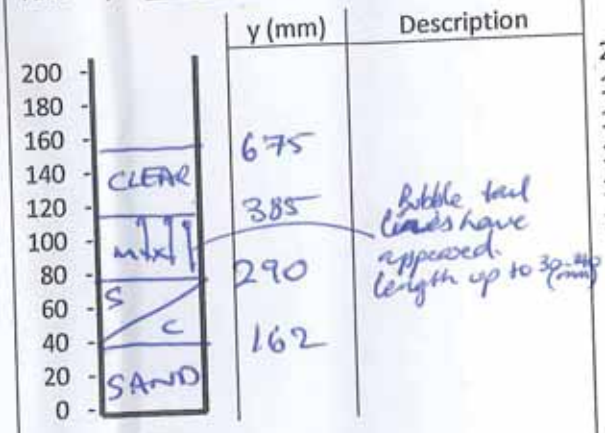
Personnel: S. MILLAR (C. HADWICK) **Page** 9 of ____

Test Number: 2A	**Test Started:** 19/11/14 10.44
Material Type: SAND	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON AREA	

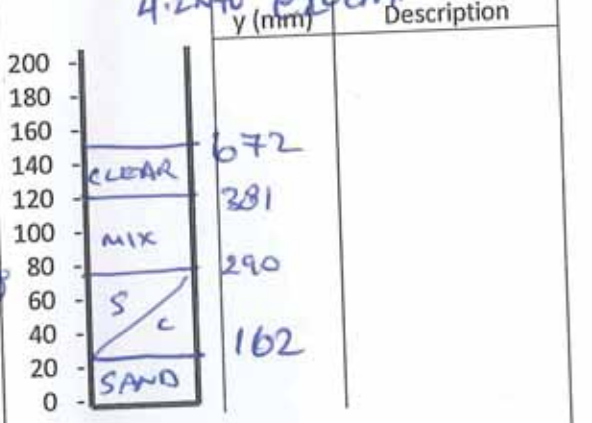
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 21/11/14 12:00
Turbidity: 4.9 NTU @ 15cm. NTU/depth



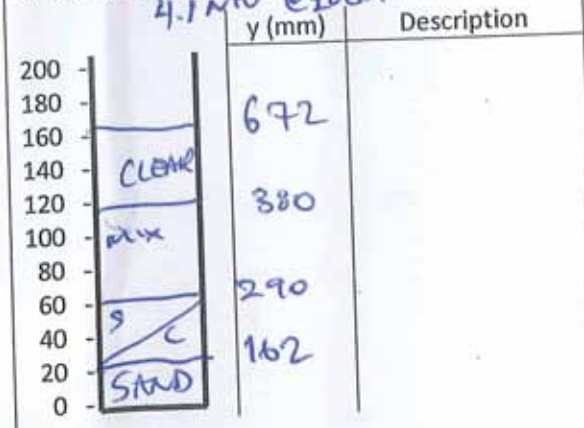
Comments:

Date/Time: 21/11/14 12:30
Turbidity: 6.4 NTU @ 1cm 4.2 NTU @ 20cm. NTU/depth



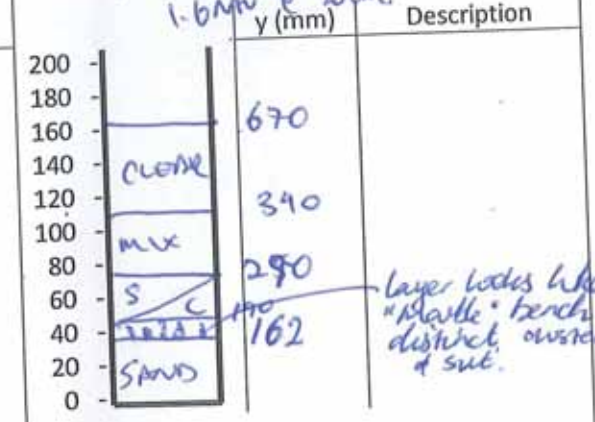
Comments:

Date/Time: 21/11/14 16:00
Turbidity: 6.2 NTU @ 1cm 4.1 NTU @ 20cm NTU/depth



Comments:

Date/Time: 24/11/14 07:00
Turbidity: 3.4 NTU @ 10cm. 1.6 NTU @ 20cm. NTU/depth



Comments:

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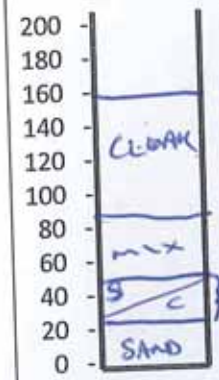
Personnel: S. MILLER (CHADWICKS) **Page** ____ of ____

Test Number: 2A	**Test Started:**
Material Type: SAND	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

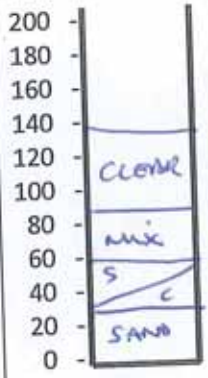
Date/Time: 24/11/14 16:00
Turbidity: 1.1 @ 20cm NTU/depth



y (mm)	Description
668	
338	① more obvious contrasted silt/clay and sand layers on left side of cylinder. * bodies well graded.
290	
162	

Comments:

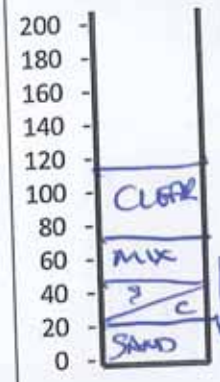
Date/Time: 25/11/14 07:00
Turbidity: 2.2 NTU @ 25cm NTU/depth



y (mm)	Description
668	
333	
290	
162	

Comments:

Date/Time: 25/11/14 16:00
Turbidity: 1 NTU @ 25cms NTU/depth

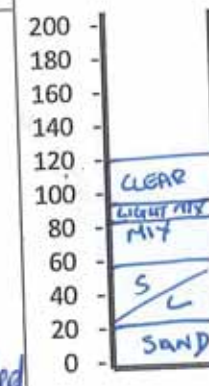


y (mm)	Description
668	
351	
290	
162	bodies well graded * photo taken above

Comments:

TSS - SA1

Date/Time: 26 Nov 14 0800
Turbidity: 1.3 NTU @ 15cm NTU/depth



y (mm)	Description
668	
328	
320	
290	
162½	

Comments:

APPENDIX E
Settlement Test Sheets – Soft Silty Clays

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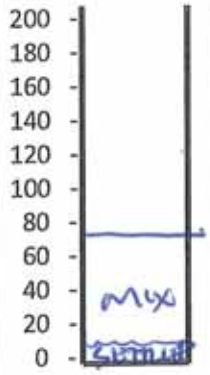
Personnel: S. MILLER **Page** 1 of ____

Test Number: 3B	**Test Started:** 12:11
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

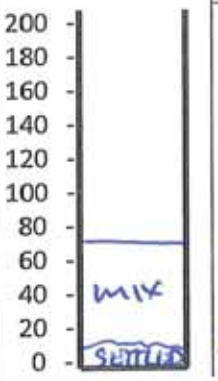
Date/Time: 15/12/14 12:45
Turbidity: _____ NTU/depth



y (mm)	Description
723	

Comments:

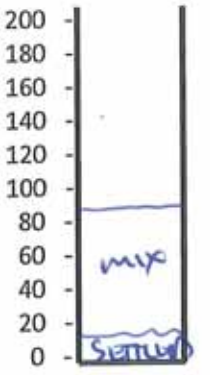
Date/Time: 15/12/14 12:47
Turbidity: _____ NTU/depth



y (mm)	Description
723	
25	

Comments:

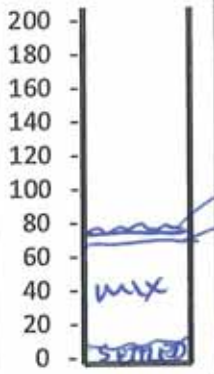
Date/Time: 15/12/14 12:49
Turbidity: _____ NTU/depth



y (mm)	Description
723	
35	

Comments:

Date/Time: 15/12/14 12:51
Turbidity: >250 NTU/depth



y (mm)	Description
723 / 722	layer of organics. clear
65	

Comments:

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Personnel: S. MILLER **Page** 2 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MWD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 15/12/14 11:53
Turbidity: _____ NTU/depth

y (mm)	Description
723	CLEAR
719	MIX
80	SETTLED

Comments:

Date/Time: 15/12/14 11:55
Turbidity: >250 NTU/depth

y (mm)	Description
723	CLEAR
718	MIX
85	SETTLED

Comments:

Date/Time: 15/12/14 11:57
Turbidity: _____ NTU/depth

y (mm)	Description
723	CLEAR
717	MIX
95	SETTLED

Comments:

Date/Time: 15/12/14 11:59
Turbidity: 7250 NTU/depth

y (mm)	Description
723	CLEAR
716	MIX
103	SETTLED

Comments:

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Personnel: S. MILLER **Page** 3 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 15/12/14 13:01
Turbidity: _____ NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100	723	
80	716	CLEAR
60		
40		MIX
20		
0	110	SETTLED

Comments:

Date/Time: 15/12/14 13:03
Turbidity: 7250 NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100	723	
80	714	CLEAR
60		
40		MIX
20		
0	116	SETTLED

Comments:

Date/Time: 15/12/14 13:05
Turbidity: 7250 NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100		
80	723	CLEAR
60	713	
40		MIX
20		
0	120	SETTLED

Comments:

Date/Time: 15/12/14 13:07
Turbidity: _____ NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100		
80	723	
60	712	CLEAR
40		MIX
20		
0	124	SETTLED

Comments:

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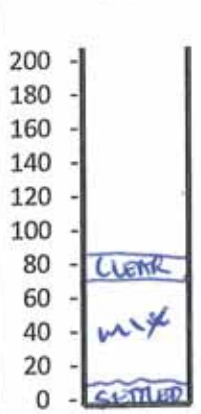
Personnel: S. MILLER **Page** 4 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

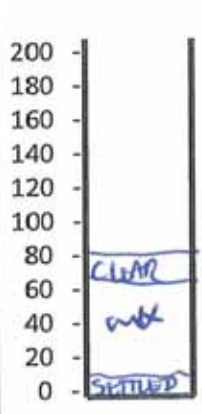
Date/Time: 15/12/14 13:09
Turbidity: _____ NTU/depth



y (mm)	Description
723	
713	
129	

Comments:

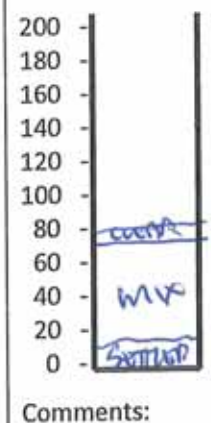
Date/Time: 15/12/14 13:11
Turbidity: _____ NTU/depth



y (mm)	Description
723	
712	
131	

Comments:

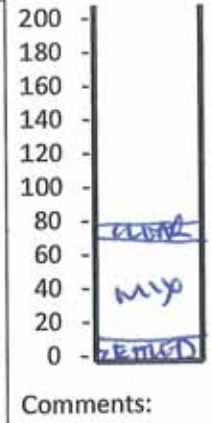
Date/Time: 15/12/14 13:13
Turbidity: _____ NTU/depth



y (mm)	Description
723	
712	
136	

Comments:

Date/Time: 15/12/14 13:15
Turbidity: >250 NTU/depth



y (mm)	Description
723	
710	
140	

Comments:

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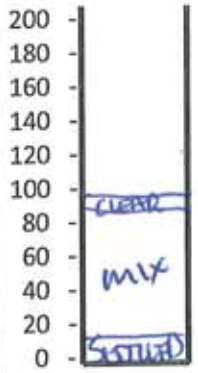
Personnel: S. MILLER **Page** 5 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

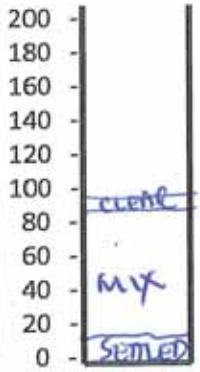
Date/Time: 15/12/14 13:17
Turbidity: _____ NTU/depth



y (mm)	Description
723	
709	
142	

Comments:

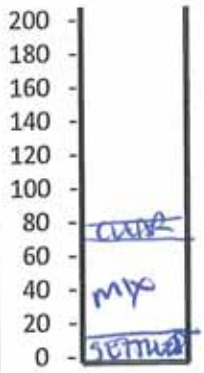
Date/Time: 15/12/14 13:19
Turbidity: >250 NTU/depth



y (mm)	Description
723	
708	
146	

Comments:

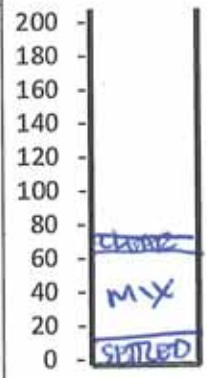
Date/Time: 15/12/14 13:21
Turbidity: _____ NTU/depth



y (mm)	Description
723	
708	
150	

Comments:

Date/Time: 15/12/14 13:23
Turbidity: _____ NTU/depth



y (mm)	Description
723	
707	
152.	

Comments:

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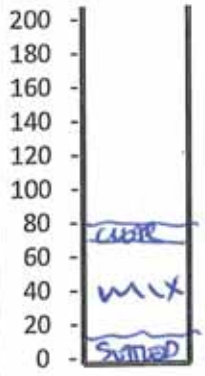
Personnel: SIMILCHER **Page** 6 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☐ Settlement Only ☐ TSS-Turbidity
Dredge Location: INSHORE	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 15/12/14 13:25

Turbidity: _____ NTU/depth

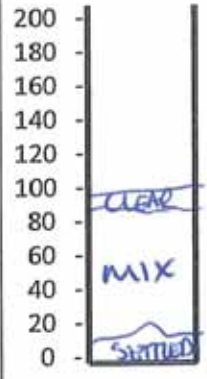


y (mm)	Description
723	
706	
155	

Comments:

Date/Time: 15/12/14 13:27

Turbidity: 7250 NTU/depth

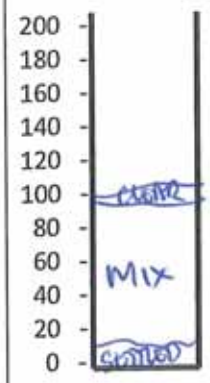


y (mm)	Description
723	
705	
156	

Comments:

Date/Time: 13:29

Turbidity: _____ NTU/depth

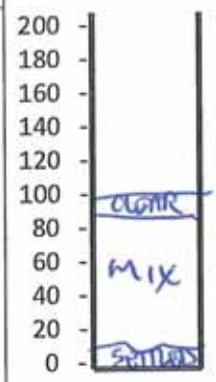


y (mm)	Description
723	
705	
158	

Comments:

Date/Time: 13:31

Turbidity: _____ NTU/depth



y (mm)	Description
722	
704	
160	

Comments:

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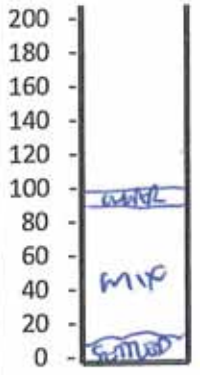
Personnel: S. MILLER **Page** 7 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

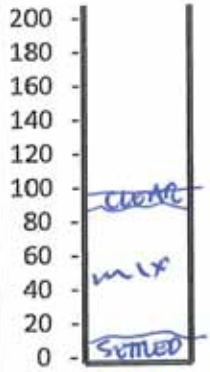
Date/Time: 15/12/14 13:33
Turbidity: 7250 NTU/depth



y (mm)	Description
721	
703	
162	

Comments:

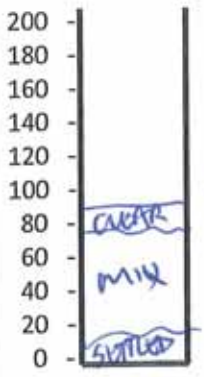
Date/Time: 15/12/14 13:35
Turbidity: _____ NTU/depth



y (mm)	Description
721	
702	
163	

Comments:

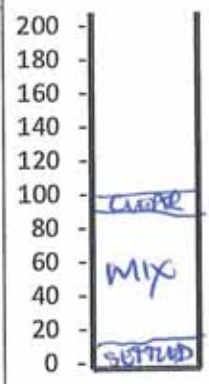
Date/Time: 15/12/14 13:37
Turbidity: _____ NTU/depth



y (mm)	Description
721	
702	
163	

Comments:

Date/Time: 15/12/14 13:39
Turbidity: 7250. NTU/depth



y (mm)	Description
721	
701	
164	

Comments:

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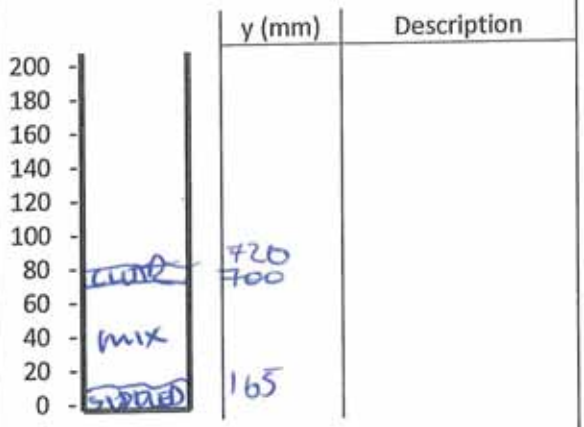
Personnel: S.MILLER **Page** 8 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☐ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

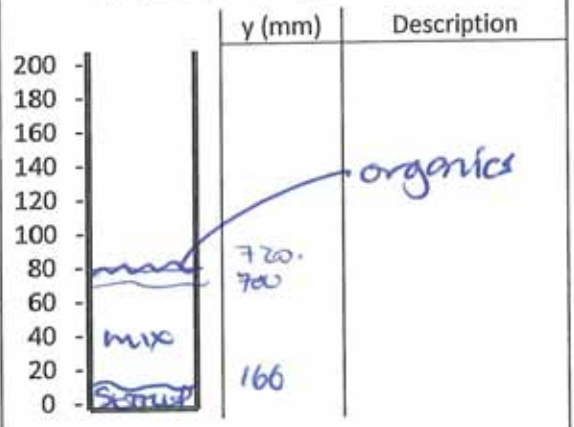
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 15/12/14 13:41
Turbidity: _____ NTU/depth



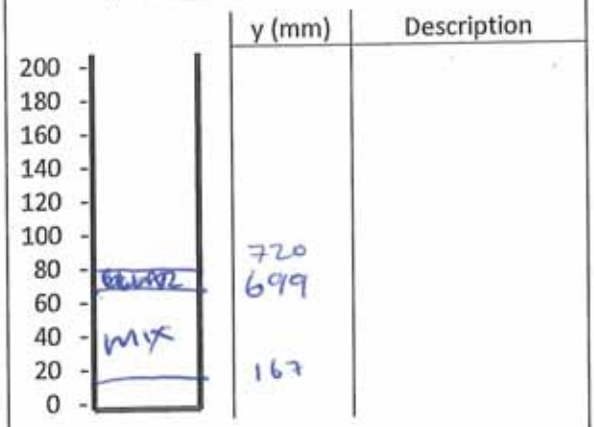
Comments:

Date/Time: 15/12/14 13:43
Turbidity: >250 NTU/depth



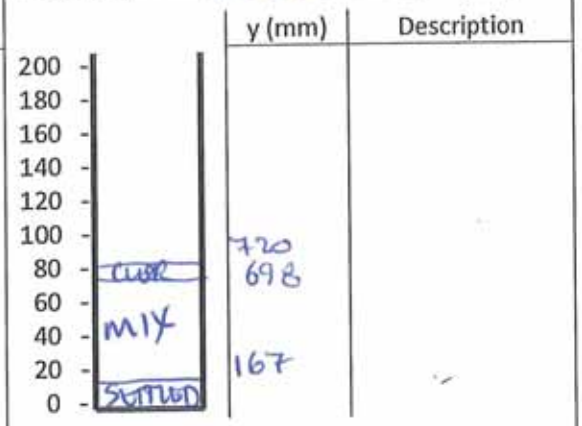
Comments:

Date/Time: 15/12/14 13:45
Turbidity: _____ NTU/depth



Comments:

Date/Time: 15/12/14 13:47
Turbidity: >250 NTU/depth



Comments:

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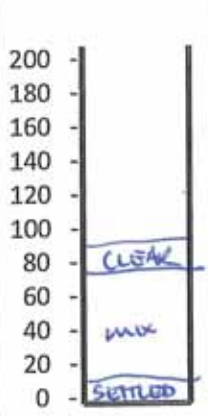
Personnel: S. MILLER **Page** 9 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☒ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

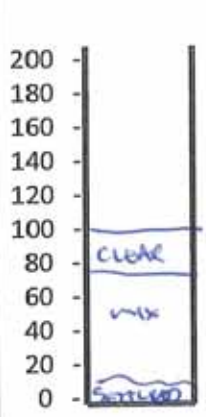
Date/Time: 15/12/14 13:57
Turbidity: _____ NTU/depth



y (mm)	Description
720	
694	
173	

Comments:

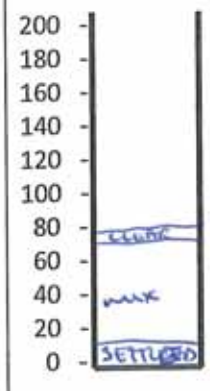
Date/Time: 15/12/14 14:07
Turbidity: >250 NTU/depth



y (mm)	Description
719	
690	
175	

Comments:

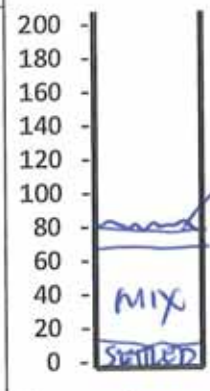
Date/Time: 15/12/14 14:17
Turbidity: _____ NTU/depth



y (mm)	Description
719	
687	
179	

Comments:

Date/Time: 15/12/14 14:30
Turbidity: _____ NTU/depth



y (mm)	Description
	organics
719	
681	
182	

Comments:

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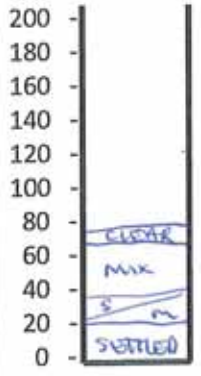
Personnel: S. MILLER **Page** 10 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSKOLE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 15/12/14 14:40

Turbidity: _____ NTU/depth

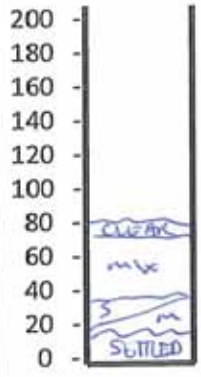


y (mm)	Description
719	
677	
210	
182	

Comments:

Date/Time: 15/12/14 14:50

Turbidity: _____ NTU/depth

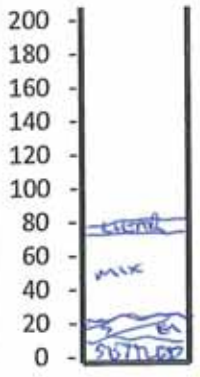


y (mm)	Description
719	
673	
214	
186	

Comments:

Date/Time: 15/12/14 15:00

Turbidity: _____ NTU/depth

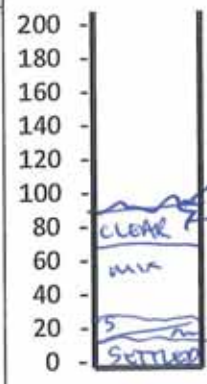


y (mm)	Description
719	
670	
221	
186	

Comments:

Date/Time: 15/12/14 15:10

Turbidity: 7250 NTU/depth



y (mm)	Description
	organics
719	
666	slight drop in organics.
230	
186	

Comments:

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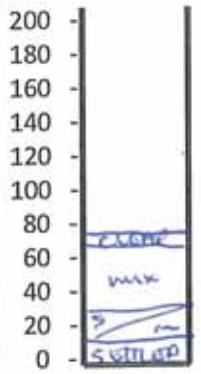
Personnel: S. MULLER **Page** 11 of ____

Test Number: BB	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ~~☐~~ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 15/12/14 15:30

Turbidity: _____ NTU/depth

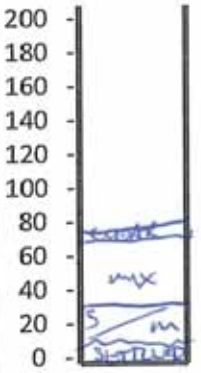


y (mm)	Description
719	
654	
240	
186	

Comments:

Date/Time: 15/12/14 15:50

Turbidity: _____ NTU/depth

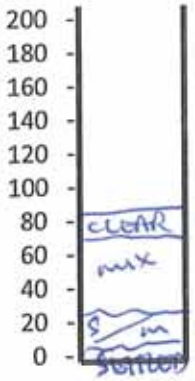


y (mm)	Description
719	
648	
~~250~~ 250	
186	

Comments:

Date/Time: 15/12/14 16:10

Turbidity: >250 NTU/depth

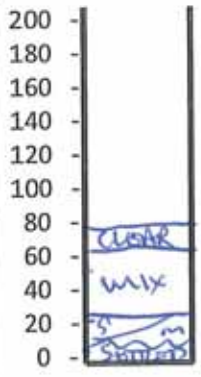


y (mm)	Description
~~640~~	
719	
640	
253	
180	

Comments:

Date/Time: 15/12/14 16:30

Turbidity: _____ NTU/depth



y (mm)	Description
719	
634	
254	
180	

Comments:

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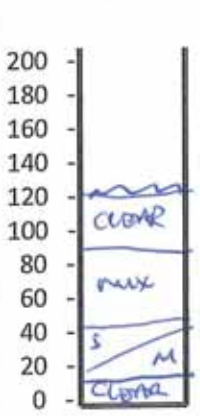
Personnel: S. MILLER **Page** 12 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

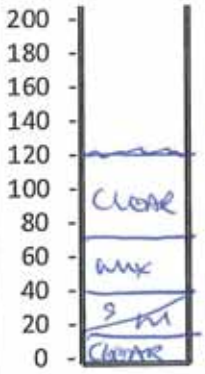
Date/Time: 15/12/14 16:45
Turbidity: >250 NTU/depth



y (mm)	Description
719	
628	
260	
173	

Comments:

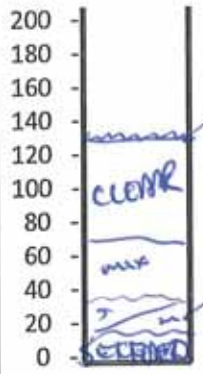
Date/Time: 15/12/14 17:10
Turbidity: >250 NTU/depth



y (mm)	Description
719	
619	
265	
174	

Comments:

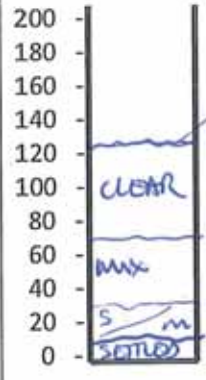
Date/Time: 16/12/14 07:15
Turbidity: 61 @ 10cm NTU/depth



y (mm)	Description
719	layer of organics.
485	obvious mixing layer has reduced.
320	
180	

Comments:

Date/Time: 16/12/14 08:45
Turbidity: _____ NTU/depth



y (mm)	Description
719	layer of organics
481	
315	→ faint change.
180	

Comments:

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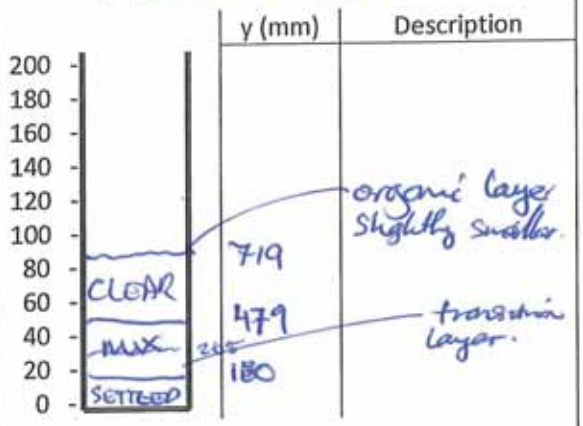
Personnel: S. MILLER **Page** 18 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

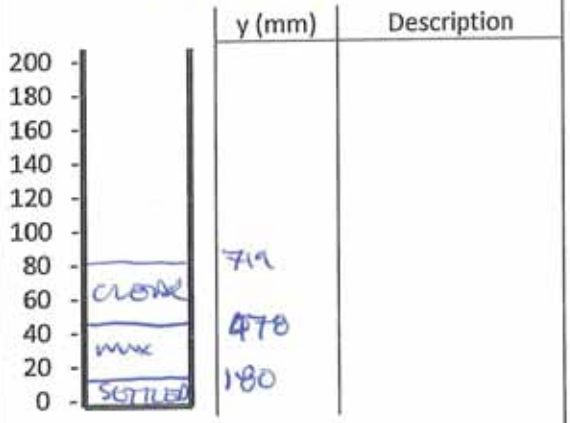
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 16/12/14 09:15
Turbidity: 39.8 @10cm NTU/depth



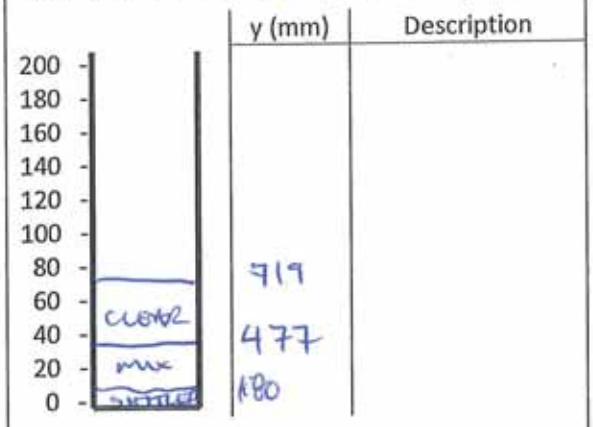
Comments:

Date/Time: 16/12/14 ~~10:00~~ 9:45
Turbidity: 37.3 @10cm NTU/depth



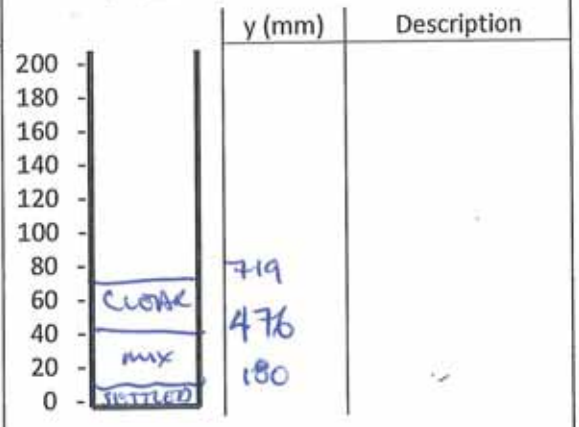
Comments:

Date/Time: 16/12/14 10:00
Turbidity: 30.3 @10cm NTU/depth



Comments:

Date/Time: 16/11/14 10:30
Turbidity: 32.1 @10cm NTU/depth



Comments:

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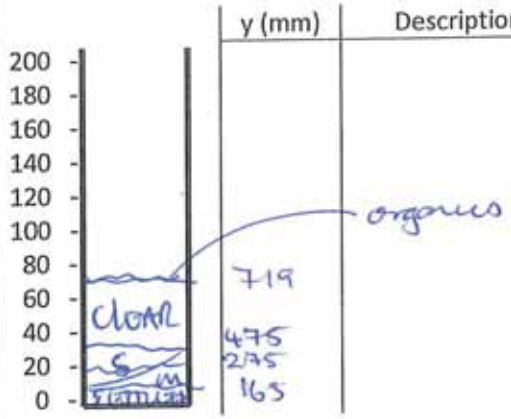
Personnel: S, Miller

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MWD	**Test Type:** ~~☐~~ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 16/11/14 11AM

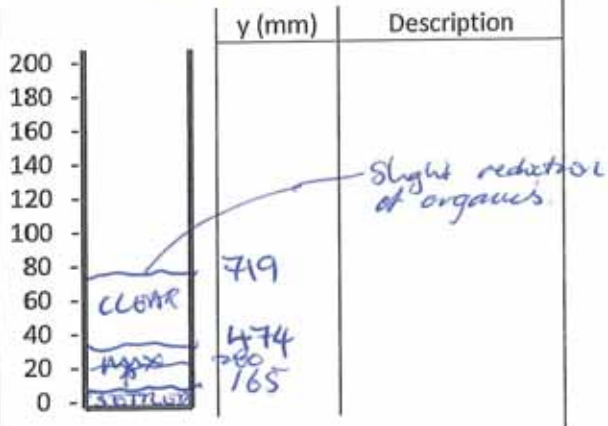
Turbidity: 28.6 @ 10cm NTU/depth



Comments:

Date/Time: 16/11/14 11:30

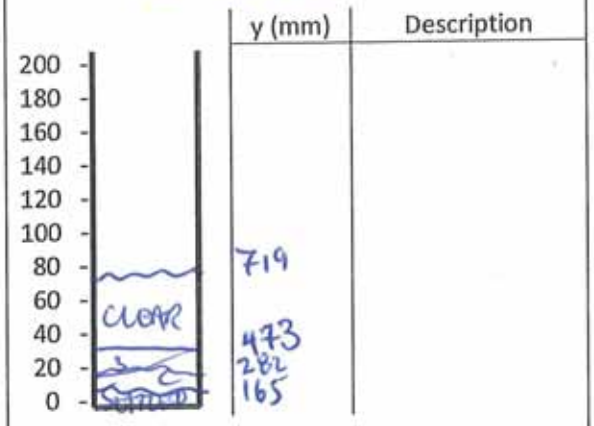
Turbidity: 30.4 @ 10cm NTU/depth



Comments:

Date/Time: 16/11/14 12:00

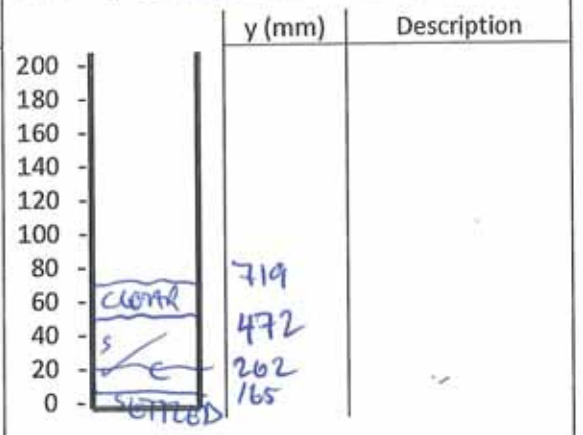
Turbidity: 26.2 @ 10cm NTU/depth



Comments:

Date/Time: 16/11/14 13:00

Turbidity: 25.6 @ 10cm. NTU/depth



Comments:

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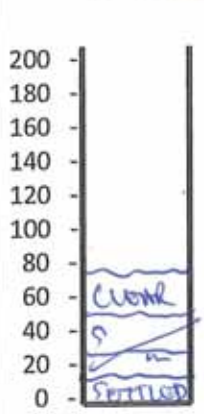
Personnel: S. MILLER **Page** 15 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☒ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

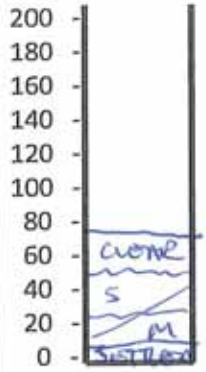
Date/Time: 16/11/14 13:45
Turbidity: 17.81 @ 10cm NTU/depth



y (mm)	Description
719	
468	
264	
165	

Comments:

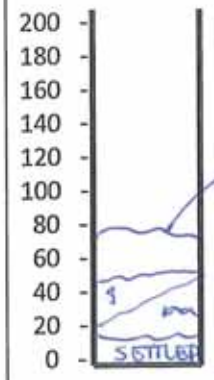
Date/Time: 16/11/14 14:30
Turbidity: 29.0 @ 10cm NTU/depth



y (mm)	Description
719	
468	
260	
165	

Comments:

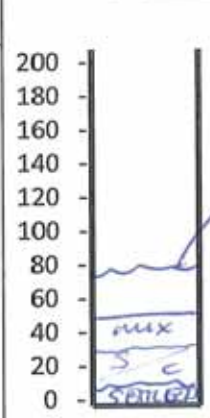
Date/Time: 16/11/14 15:00
Turbidity: 30.38 @ 10cm NTU/depth



y (mm)	Description
719	organic layer
467	
260	
165	

Comments:

Date/Time: 16/11/14 16:00
Turbidity: 43.3 @ 10cm NTU/depth



y (mm)	Description
719	organic layer slightly reduced
465	
260	
165	

Comments:

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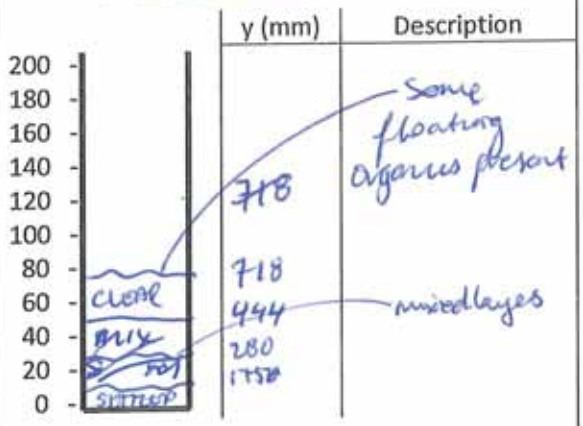
Personnel: S. MILLER **Page** 16 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

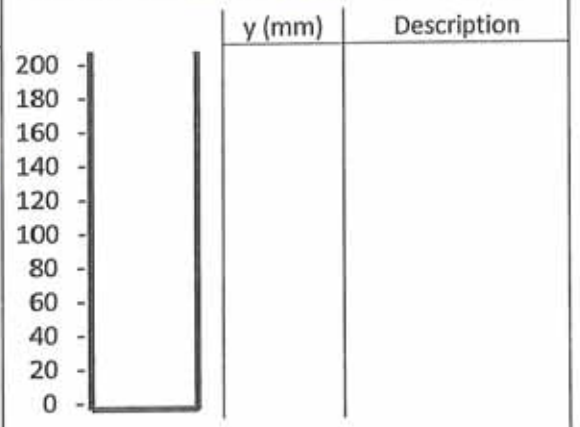
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 17/11/14 07:30
Turbidity: 13.58 @ 10cm NTU/depth



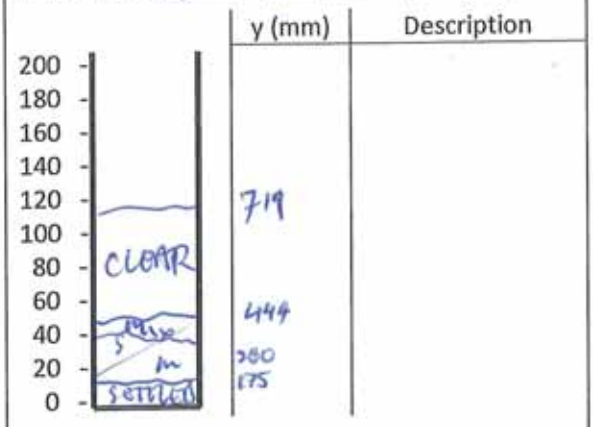
Comments:

Date/Time: 17/11/14 9:30
Turbidity: 17.2 @ 10cm NTU/depth



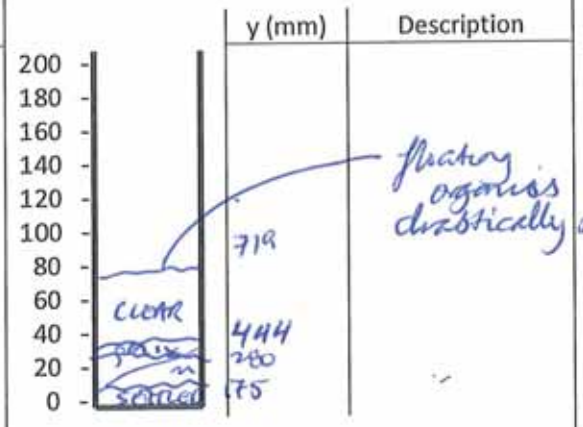
Comments:

Date/Time: 17/11/14 10:30
Turbidity: 15.7 @ 10cm NTU/depth



Comments:

Date/Time: 17/11/14 11:30
Turbidity: 14.6 @ 10cm. NTU/depth



Comments:

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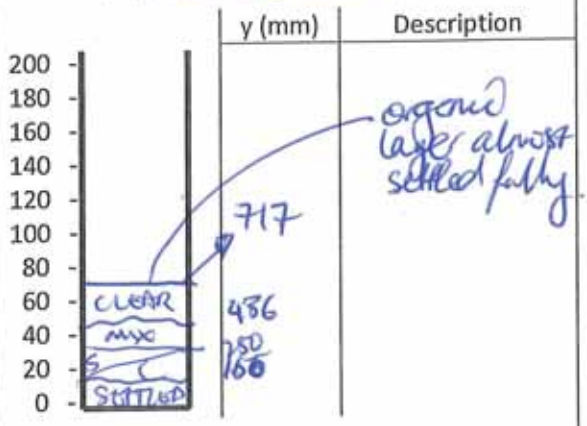
Personnel: S. MILLER **Page** 17 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only
Dredge Location: INSHORE	☐ TSS-Turbidity

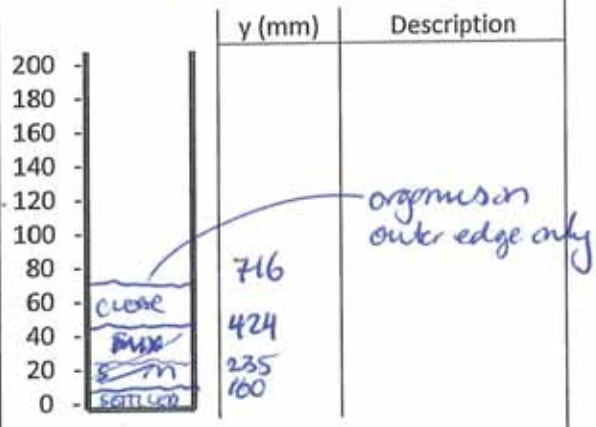
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 17/12/14 16:00
Turbidity: 14.0 @10cm NTU/depth



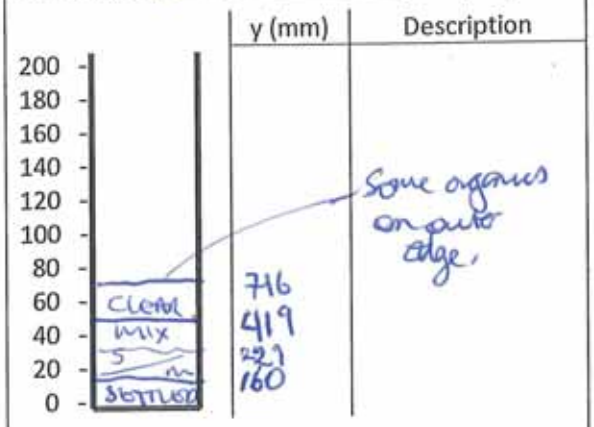
Comments:

Date/Time: 18/12/14 07:15
Turbidity: 7.4@10cm. NTU/depth



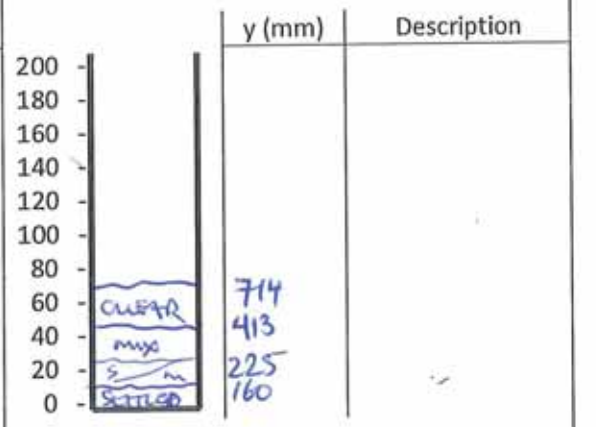
Comments:

Date/Time: 18/12/14 16:30
Turbidity: 6.9@10cm NTU/depth



Comments:

Date/Time: 19/12/14 07.30
Turbidity: 3.6 @10cm. NTU/depth



Comments:

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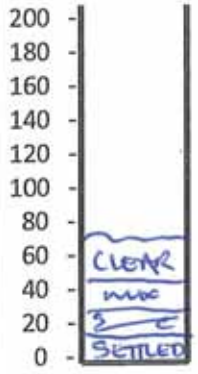
Personnel: S. MILLER **Page** 18 of ____

Test Number: 3B	**Test Started:** 15/12/14 12:45
Material Type: MUD	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: INSHORE	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

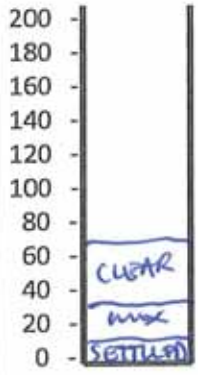
Date/Time: 19/12/14 17:00
Turbidity: 3.5 @ 10cm NTU/depth



y (mm)	Description
714	
409	

Comments:

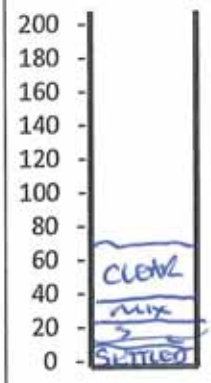
Date/Time: 21/12/14 15:00
Turbidity: 3.8 @ 10cm NTU/depth



y (mm)	Description
713	
394	
164	

Comments:

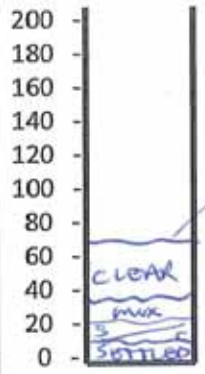
Date/Time: 22/12/14 07:15
Turbidity: 0.82 @ 10cm NTU/depth



y (mm)	Description
711	
392	
215	
162	

Comments:

Date/Time: 22/12/14 11:45
Turbidity: 0.68 @ 10cm NTU/depth



y (mm)	Description
710	
391	
215	
162	

only a small quantity of lgones at the top.

Comments:
END OF TEST

APPENDIX F
Settlement Test Sheets – 'Representative' Sand/Clay Material

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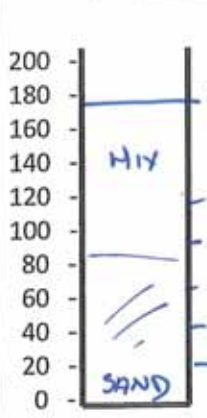
Personnel: JAMES. D & SIMON M **Page** 1 of ____

Test Number: 1D	**Test Started:** 8 DEC 14 0940
Material Type: SAND & CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 0947

Turbidity: _____ NTU/depth

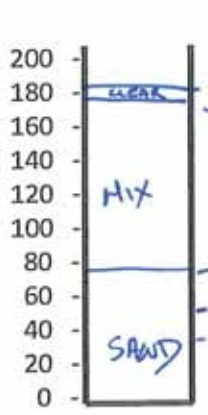


y (mm)	Description
1760	@ 0940
90	@ 0942
85	@ 0941:30
70	@ 0941
60	@ 0940:30
25	@ 0940

Comments:

Date/Time: 0943 (8 DEC 14)

Turbidity: _____ NTU/depth

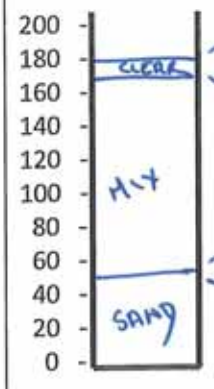


y (mm)	Description
1760	@ 0943
1758	
106	@ 0945
103	@ 0944
98	@ 0943

Comments:

Date/Time: 8 DEC 14 @ 0946

Turbidity: _____ NTU/depth

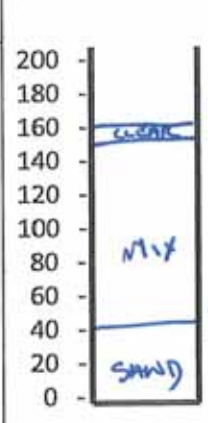


y (mm)	Description
1760	@ 0946
1756	
114	@ 0947
108	@ 0946

Comments:

Date/Time: 8 DEC 14 0948

Turbidity: _____ NTU/depth



y (mm)	Description
1760	@ 0948
1755	
120	@ 0949
118	@ 0948

Comments:

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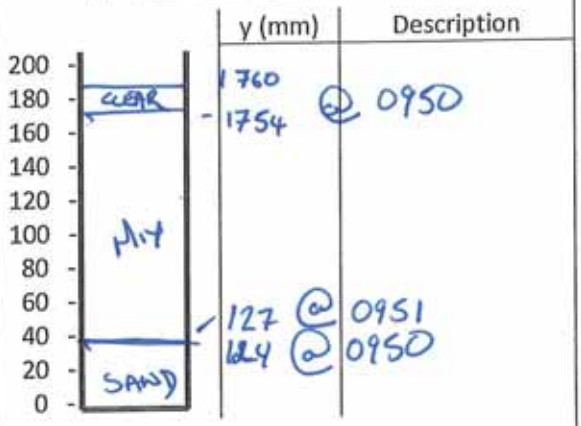
Personnel: JAMES D + Simon M **Page** 2 of ____

Test Number: 1D	**Test Started:** 8 DEC 14 0940
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 0950

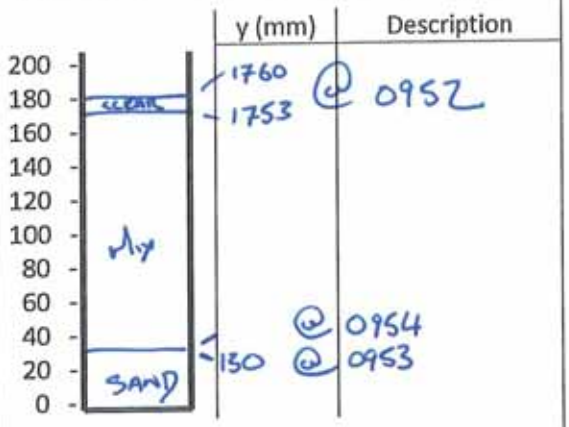
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 0952

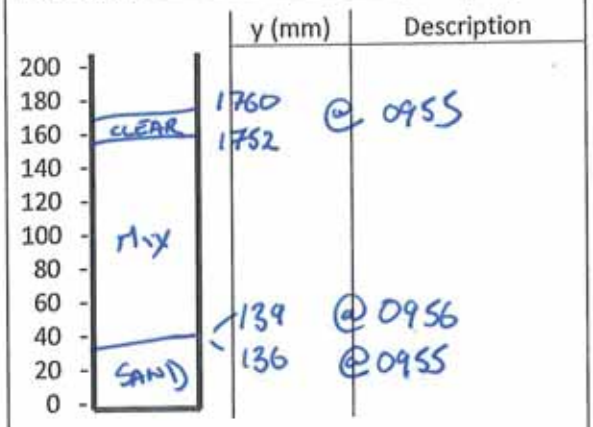
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 0955

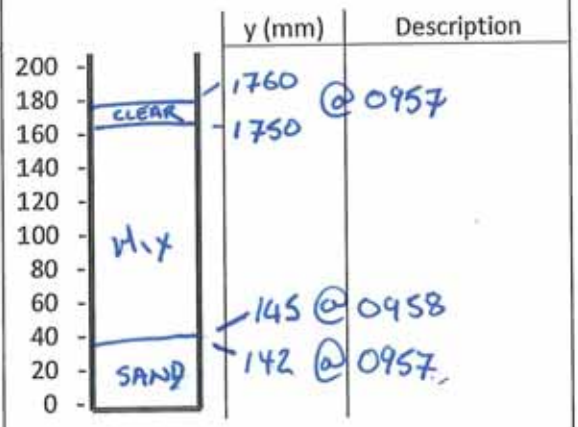
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 0957

Turbidity: _____ NTU/depth



Comments:

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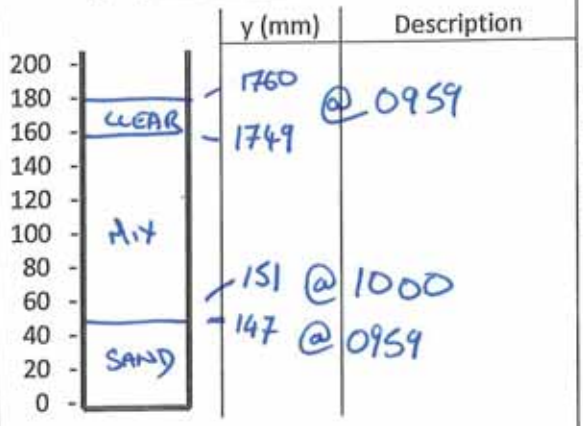
Personnel: JD + S.M **Page** 3 of ____

Test Number: 17	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location:	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 0959

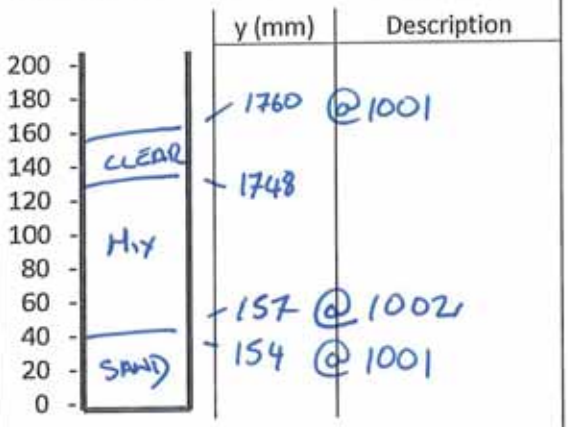
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 1001

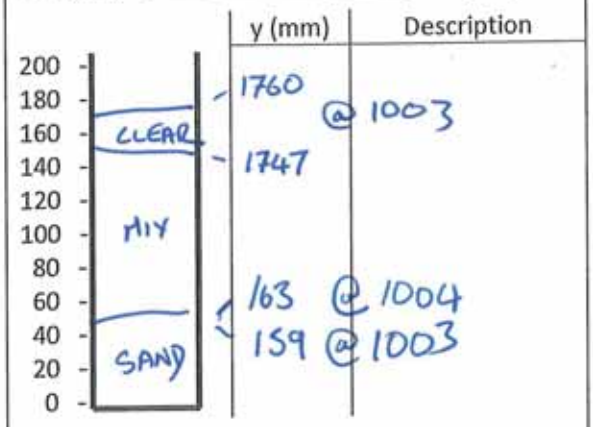
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 1003

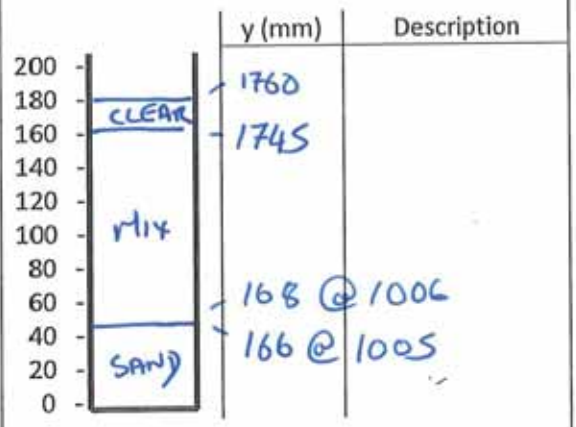
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 1005

Turbidity: _____ NTU/depth



Comments:

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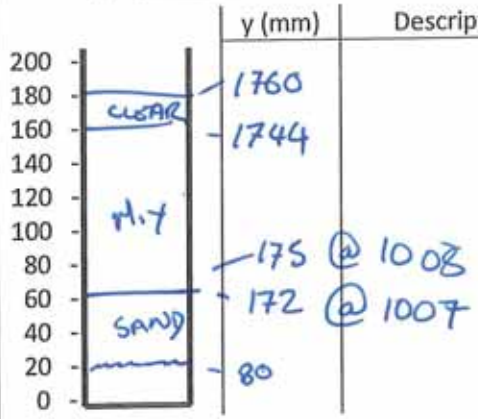
Personnel: S. MILLER **Page** 4 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ ~~Settlement Only~~
Dredge Location: COMMON AREA	☐ TSS-Turbidity

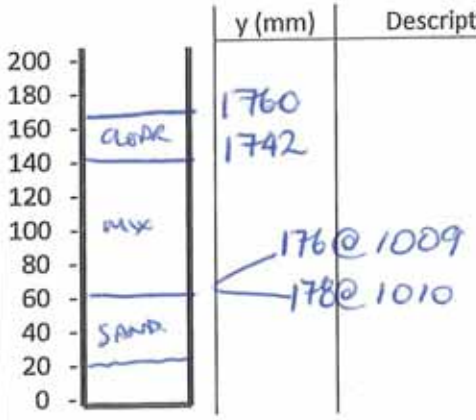
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 1007
Turbidity: _____ NTU/depth



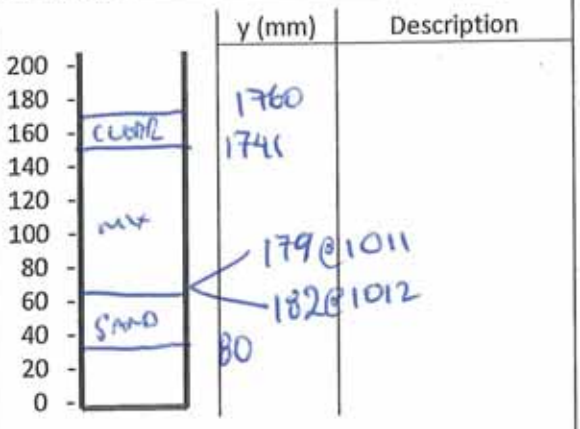
Comments:

Date/Time: 8 DEC 14 1009
Turbidity: _____ NTU/depth



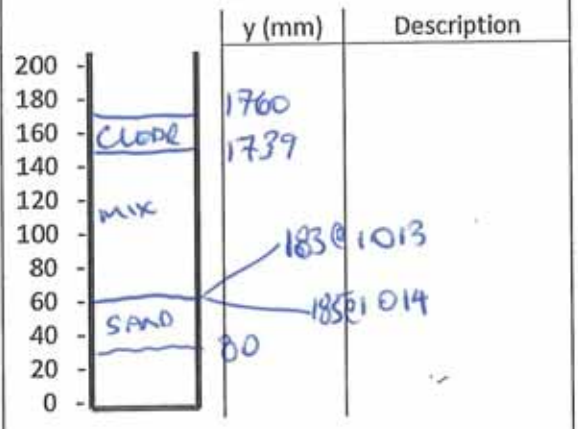
Comments:

Date/Time: 8 DEC 14 1011
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 1013
Turbidity: 224 NTU/depth



Comments:

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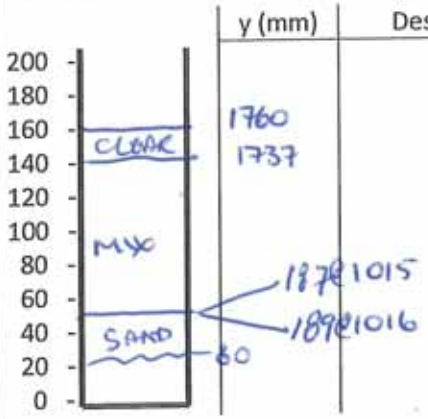
Personnel: S. MILLER **Page** 5 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

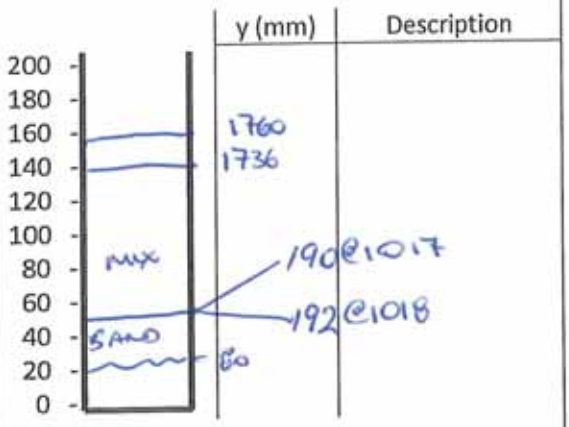
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 1015
Turbidity: _____ NTU/depth



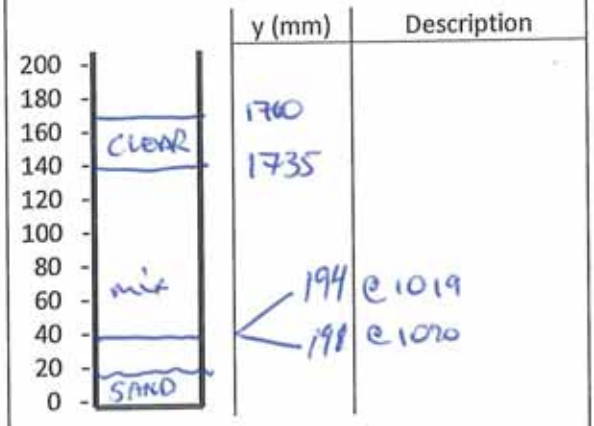
Comments:

Date/Time: 8 DEC 14 1017
Turbidity: _____ NTU/depth



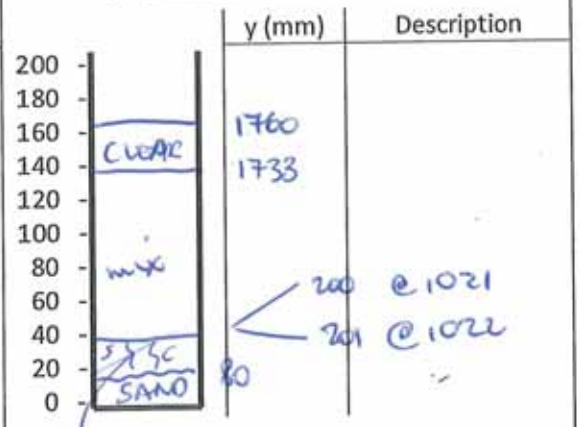
Comments:

Date/Time: 8 DEC 14 1019
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 1021
Turbidity: 196 @ 2cm NTU/depth



Comments: visible vertical lines

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Personnel: S. MILLER

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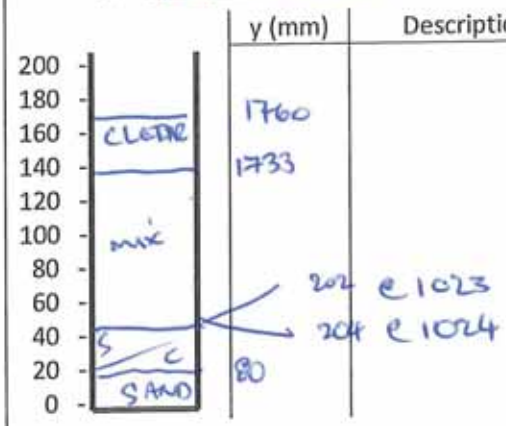
Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 1023

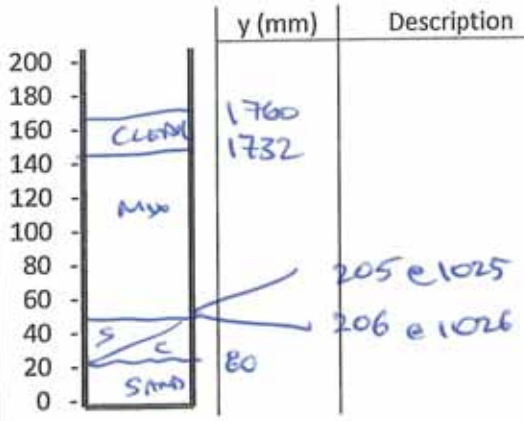
Turbidity: 129 @ 2 cm NTU/depth



Comments:

Date/Time: 8 DEC 14 10:25

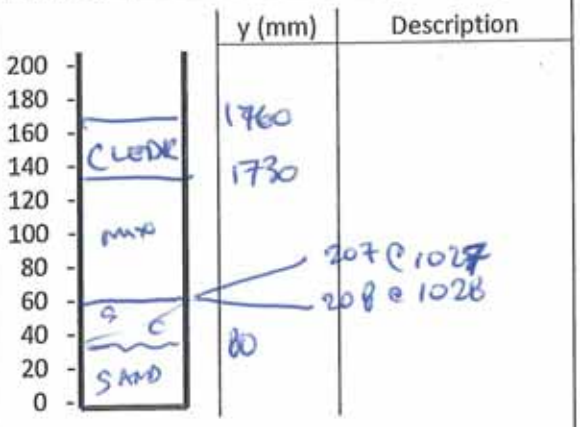
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 10:27

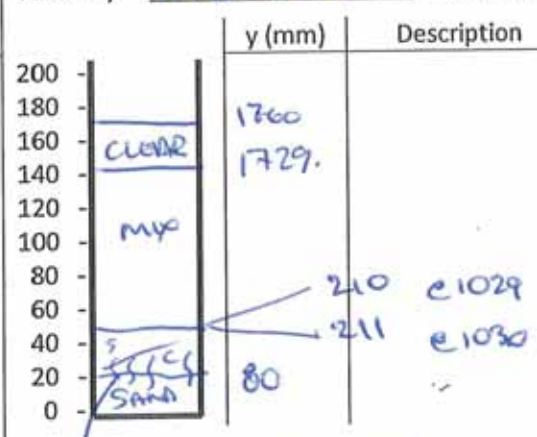
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 10:29

Turbidity: 120 @ 3 cm NTU/depth



Comments: lines entering SAND AREA

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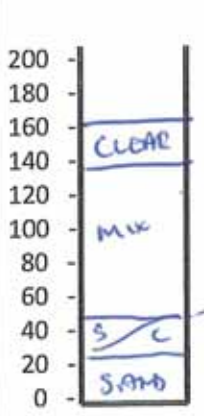
Personnel: S. MILLER **Page** 7 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☒ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 10:31

Turbidity: _____ NTU/depth

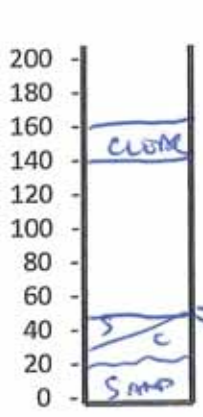


y (mm)	Description
1760	
1727	
212	@ 1031
214	@ 1032
80	

Comments:

Date/Time: 8 DEC 14 10:33

Turbidity: _____ NTU/depth

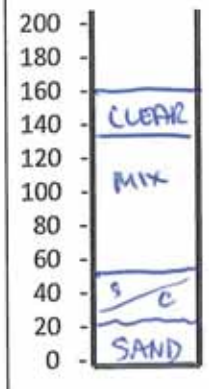


y (mm)	Description
1760	
1726	
216	@ 1033
217	@ 1034

Comments:

Date/Time: 8 DEC 14 10:35

Turbidity: _____ NTU/depth

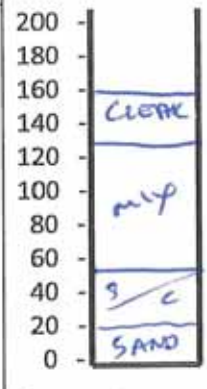


y (mm)	Description
1760	
1725	
218	@ 1035
219	@ 1036
80	

Comments:

Date/Time: 8 DEC 14 10:37

Turbidity: _____ NTU/depth



y (mm)	Description
1760	
1724	
220	@ 1037
221	@ 1038

Comments:

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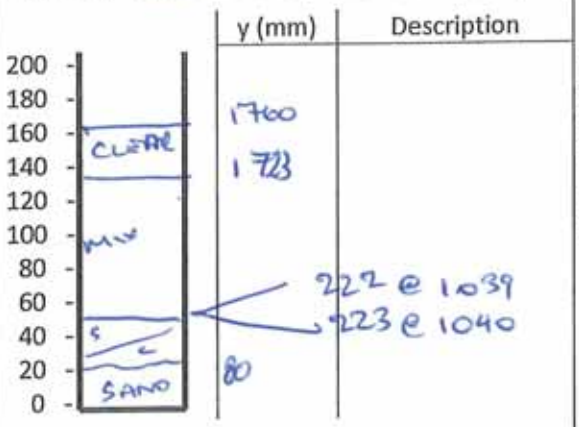
Personnel: S. MILLER **Page** 8 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

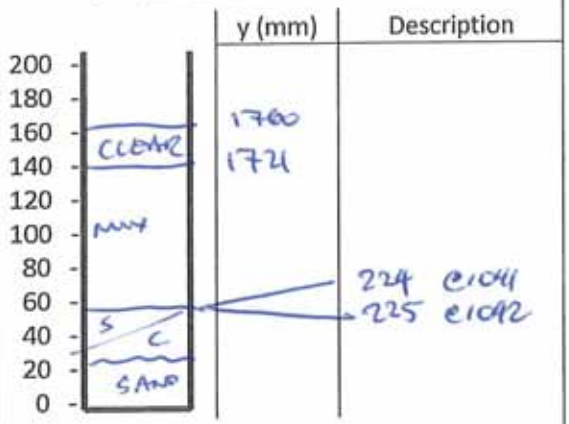
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 1039
Turbidity: 186 NTU/depth



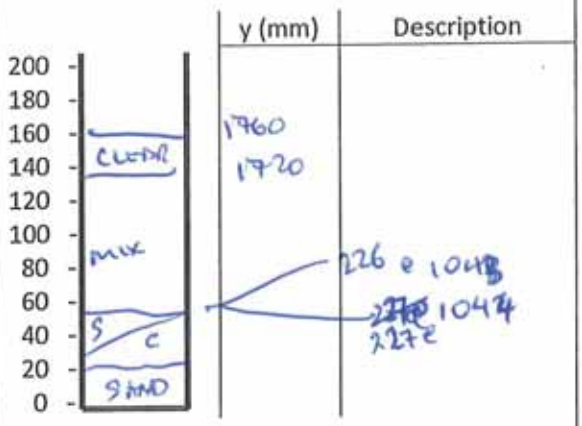
Comments:

Date/Time: 8 DEC 14 1041
Turbidity: ____ NTU/depth



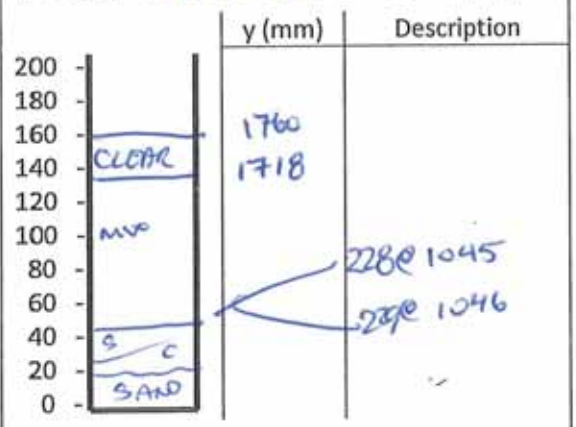
Comments:

Date/Time: 8 DEC 14 1043
Turbidity: ____ NTU/depth



Comments:

Date/Time: 8 DEC 14 1045
Turbidity: 101.4 NTU/depth



Comments:

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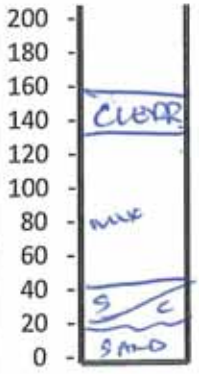
Personnel: S. MILLER **Page** 9 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND & CLAY	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON AREA	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

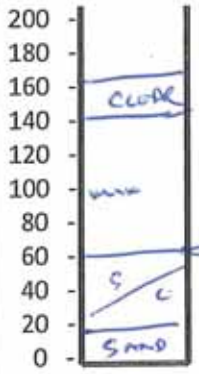
Date/Time: 8 DEC 14 1047
Turbidity: _____ NTU/depth



y (mm)	Description
1760	
1717	
232 @ 1047	
231 @ 1048	
80	

Comments:

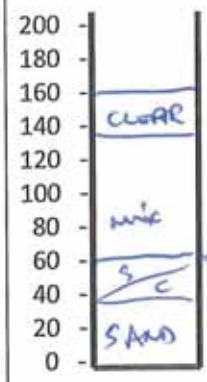
Date/Time: 8 DEC 14 1049
Turbidity: 104 @ 9cm NTU/depth



y (mm)	Description
1760	
1716	
232 @ 1049	
231 @ 1050	
80	

Comments:

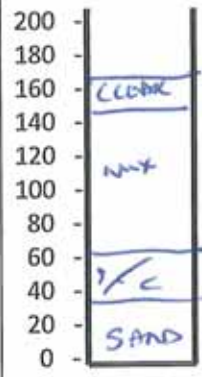
Date/Time: 8 DEC 14 1051
Turbidity: _____ NTU/depth



y (mm)	Description
1760	
1714	
232 @ 1051	
234 @ 1052	

Comments:

Date/Time: 8 DEC 14 1053
Turbidity: _____ NTU/depth



y (mm)	Description
1760	
1712	
236 @ 1053	
237 @ 1054	
80	

Comments:

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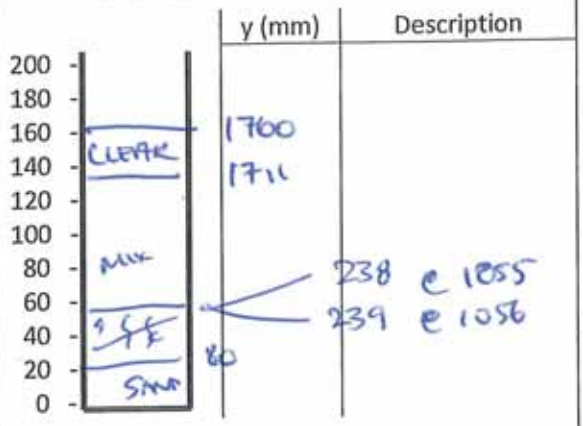
Personnel: S, MILLER **Page** 10 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8DEC14 1055

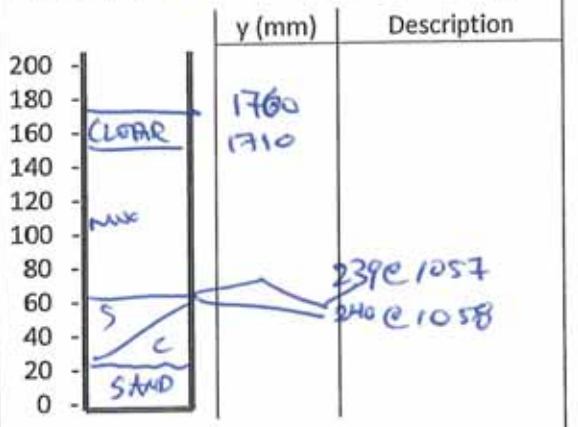
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8DEC14 1057

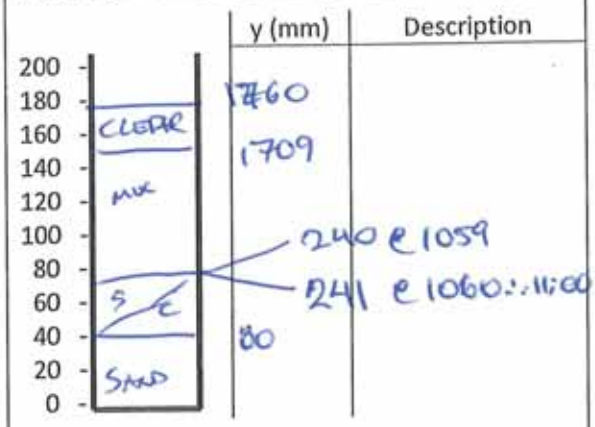
Turbidity: 108 NTU/depth



Comments:

Date/Time: 8DEC14 1059

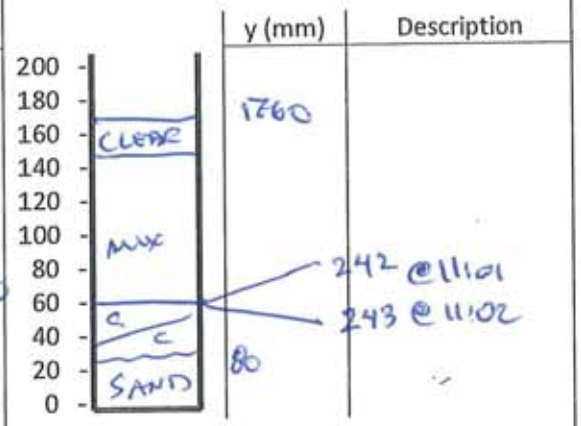
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC 14 1101

Turbidity: _____ NTU/depth



Comments:

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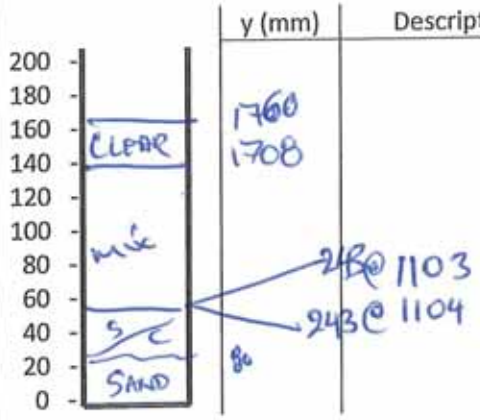
Personnel: S. MILLER **Page** 01 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC14 11:03

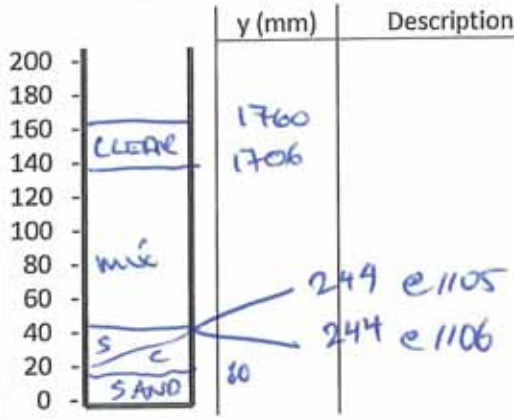
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC14 1105

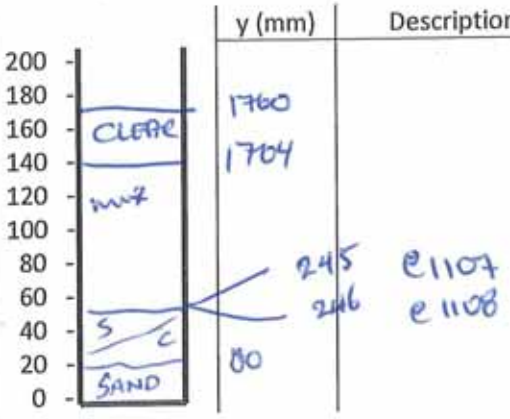
Turbidity: 72 NTU/depth



Comments:

Date/Time: 8 DEC14 1107

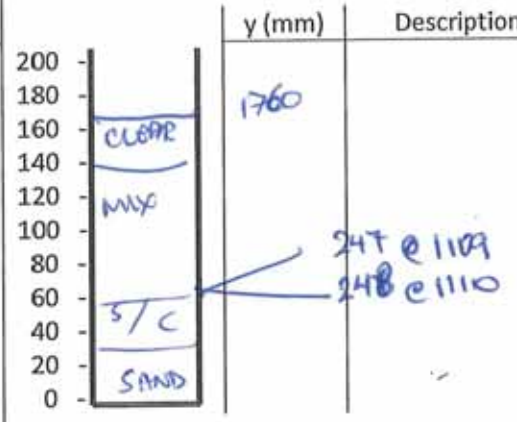
Turbidity: _____ NTU/depth



Comments:

Date/Time: 8 DEC14 1109

Turbidity: _____ NTU/depth



Comments:

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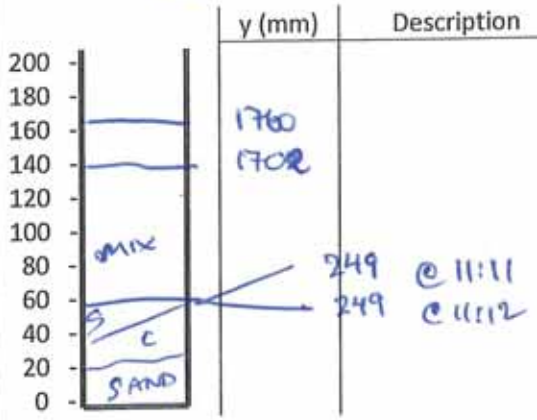
Personnel: S. MILLER **Page** 12 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

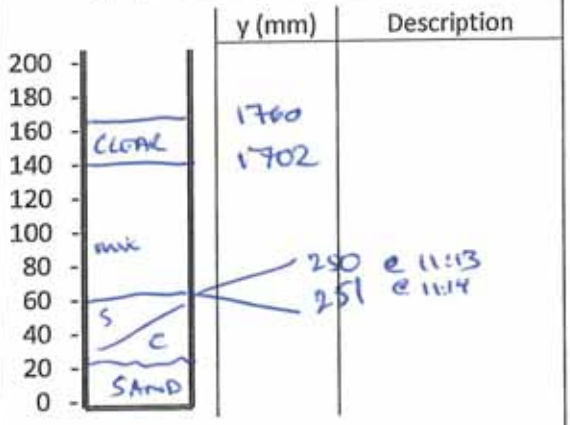
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 8 DEC 14 11:11
Turbidity: 60 NTU/depth



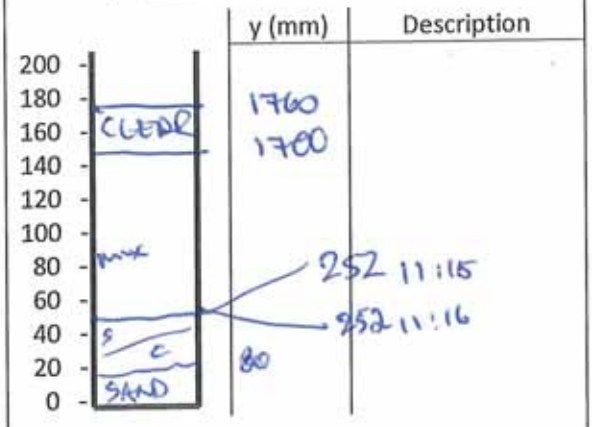
Comments:

Date/Time: 8 DEC 14 11:13
Turbidity: 72 NTU/depth



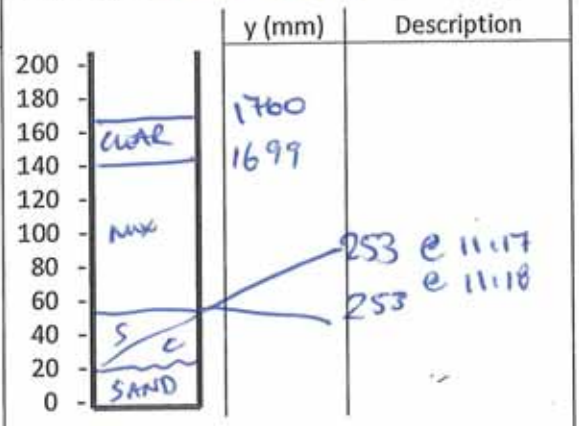
Comments:

Date/Time: 8 DEC 14 11:15
Turbidity: ____ NTU/depth



Comments:

Date/Time: 8 DEC 14 11:17
Turbidity: 44 @ 5cm NTU/depth



Comments:

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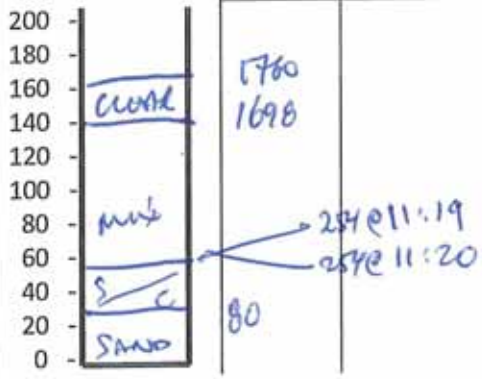
Personnel: S.MILLER **Page** 13 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

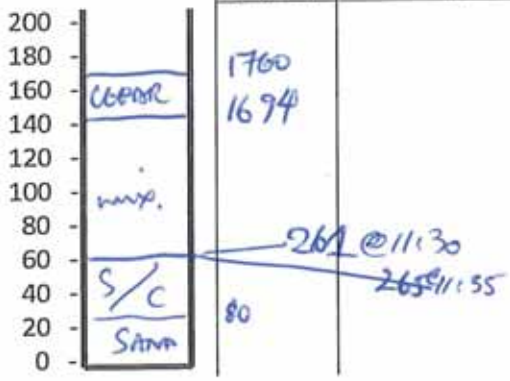
Date/Time: 8 DEC 14 1149
Turbidity: 38 @ 5CM NTU/depth



y (mm)	Description
1760	
1698	
254 @ 11:19	
254 @ 11:20	
80	

Comments:

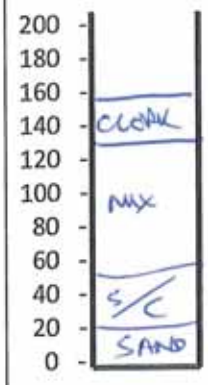
Date/Time: 8 DEC 14 11:30
Turbidity: 30 @ 5CM NTU/depth



y (mm)	Description
1760	
1694	
261 @ 11:30	
265 11:55	
80	

Comments:

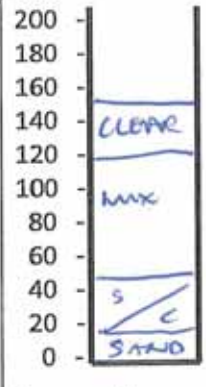
Date/Time: 8 DEC 14 11:40
Turbidity: 26.3 @ 5CM NTU/depth



y (mm)	Description
1760	
1686	
268	
80	

Comments:

Date/Time: 8 DEC 14 11:45
Turbidity: 30.9 @ 5CM NTU/depth



y (mm)	Description
1760	
1682	
272	
80	

Comments:

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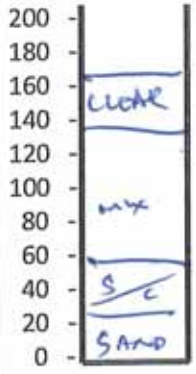
Personnel: S. MILLER

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

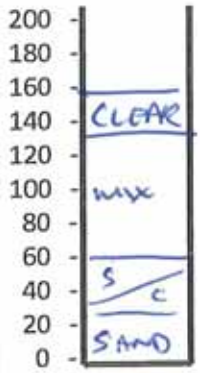
Date/Time: 8 DEC 14 11:50
Turbidity: 33.6 NTU/depth



y (mm)	Description
1760	
1681	
274	
80	

Comments:

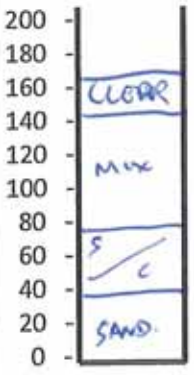
Date/Time: 8 DEC 14 12:00
Turbidity: ~~3~~ 286. NTU/depth



y (mm)	Description
1760	
1675	
275	
75	

Comments:

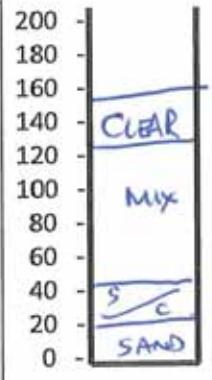
Date/Time: 8 DEC 14 12:10
Turbidity: 29.9. NTU/depth



y (mm)	Description
1760	
1669	
280	
75	

Comments:

Date/Time: 8 DEC 14 12:20
Turbidity: 30.16 NTU/depth



y (mm)	Description
1760.	
1665	
285	
75	

Comments:

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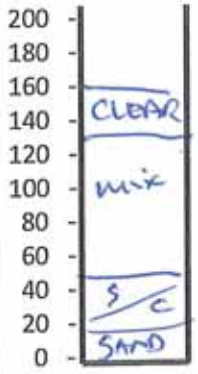
Personnel: S. MILLER **Page** 15 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

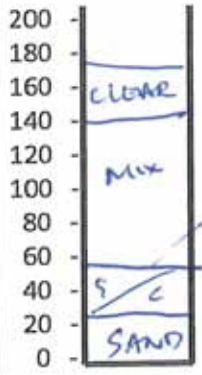
Date/Time: 8 DEC 14 12:30
Turbidity: 26.8 NTU/depth



y (mm)	Description
1760	
1660	
290	
75	

Comments:

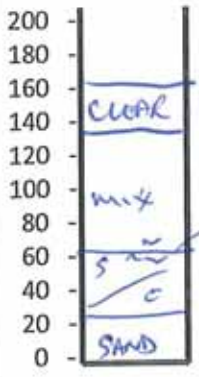
Date/Time: 8 DEC 14 12:40
Turbidity: 30.14 NTU/depth



y (mm)	Description
1760	
1653	
	horizontal separation noted
295	
75	

Comments:

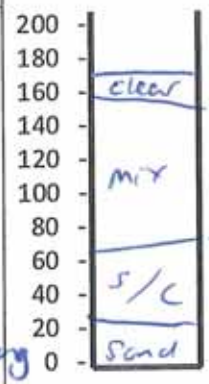
Date/Time: 8 DEC 14 12:50
Turbidity: 25.9 NTU/depth



y (mm)	Description
1760	
1647	
	mixing of layers difficult to determine sediment grade. - horizontal layers still present - cracking or shearing at 300mm noted.
300	
75	

Comments:

Date/Time: 8/12 1,00
Turbidity: 28.3 NTU/depth



y (mm)	Description
1760	
1643	
285	
75	

Comments:

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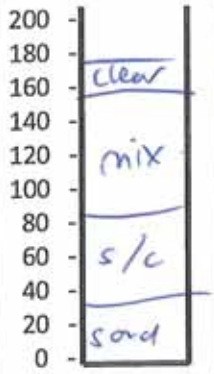
Personnel: S. MILLER **Page** 16 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND & CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

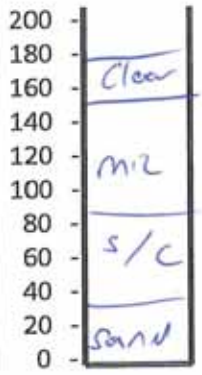
Date/Time: 8/12 1:10
Turbidity: 26.55 NTU/depth



y (mm)	Description
1760	
1629	
285	
75	

Comments:

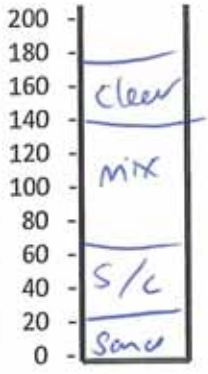
Date/Time: 8/12 1:20
Turbidity: 26.22 NTU/depth



y (mm)	Description
1760	
1634	
285	
75	

Comments:

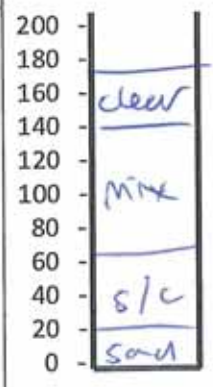
Date/Time: 8/12 1:30
Turbidity: 25.70 NTU/depth



y (mm)	Description
1760	
1629	
285	
75	

Comments:

Date/Time: 8/12 1:40
Turbidity: 25.06 NTU/depth



y (mm)	Description
1760	
1625	
285	
78	

Comments:

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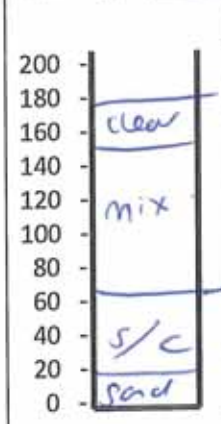
Personnel: S. MILLER **Page** 17 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMONWEALTH	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

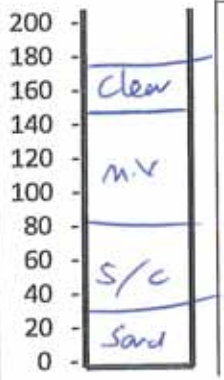
Date/Time: 8/12 1:50
Turbidity: 2420 NTU/depth



y (mm)	Description
1760	
1620	
285	
75	

Comments:

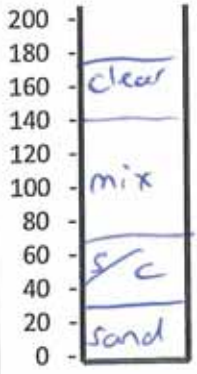
Date/Time: 8/12 2:00
Turbidity: 23.80 NTU/depth



y (mm)	Description
1760	
1615	
285	
75	

Comments:

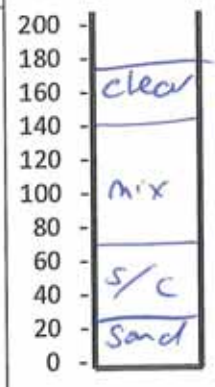
Date/Time: 8/12 2:10
Turbidity: 22.45 NTU/depth



y (mm)	Description
1760	
1612	
285	
75	

Comments:

Date/Time: 8/12 2:20
Turbidity: 22.56 NTU/depth



y (mm)	Description
1760	
1606	
285	
75	

Comments:

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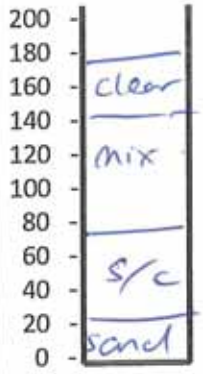
Personnel: S. MILLER **Page** 18 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☒ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

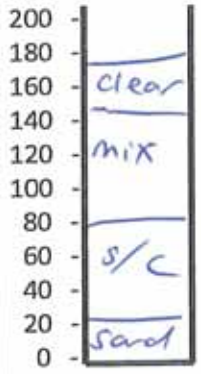
Date/Time: 8/12 2:30
Turbidity: 22.92 NTU/depth



y (mm)	Description
1760	
1602	
785	
75	

Comments:

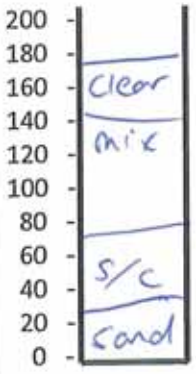
Date/Time: 8/12 2:40
Turbidity: 24.59 NTU/depth



y (mm)	Description
1760	
1598	
285	
75	

Comments:

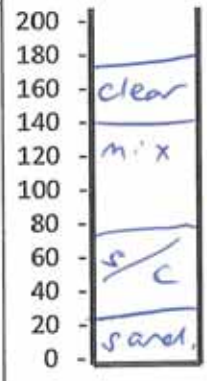
Date/Time: 8/12 2:50
Turbidity: 21.83 NTU/depth



y (mm)	Description
1760	
1594	
285	
75	

Comments:

Date/Time: 8/12 3:00
Turbidity: 22.75 NTU/depth



y (mm)	Description
1760	
1589	
285	
75	

Comments:

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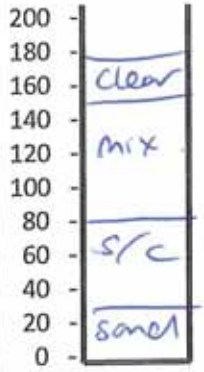
Personnel: S.MILLER **Page** 19 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND+ CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

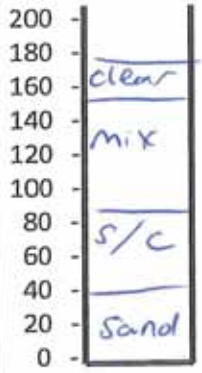
Date/Time: 8/12 3:10
Turbidity: 21.07 NTU/depth



y (mm)	Description
1760	
1585	
285	
75	

Comments:

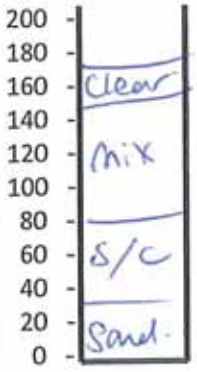
Date/Time: 8/12 3:20
Turbidity: 22.85 NTU/depth



y (mm)	Description
1780	
1580	
285	
75	

Comments:

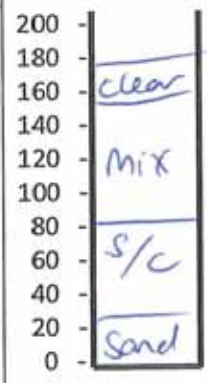
Date/Time: 8/12 3:30
Turbidity: 20.80 NTU/depth



y (mm)	Description
1760	
1576	
285	
75	

Comments:

Date/Time: 8/12 3:40
Turbidity: 19.75 NTU/depth



y (mm)	Description
1760	
1572	
285	
75	

Comments:

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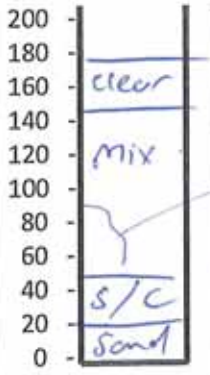
Personnel: S. MILLER **Page** 20 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☒ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

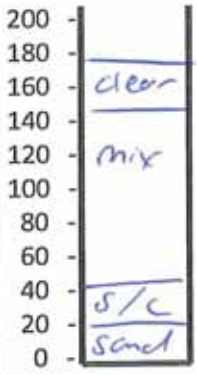
Date/Time: 8/12 3:50
Turbidity: 18.15 NTU/depth



y (mm)	Description
1760	
1568	
	noticeable grouping of grad absent near of sample
285	
75	

Comments:

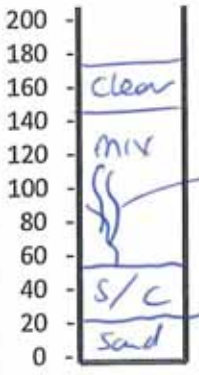
Date/Time: 8/12 4:00
Turbidity: 17.6 NTU/depth



y (mm)	Description
1760	
1564	
290	
75	

Comments:

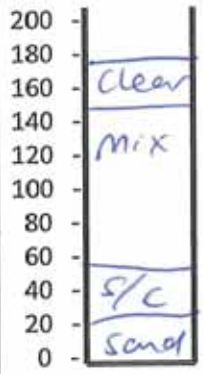
Date/Time: 8/12 4:10
Turbidity: 18.1 NTU/depth



y (mm)	Description
1760	
1560	
	Vertical flow and a cluster of dark brown material
290	
75	

Comments:

Date/Time: 8/12 4:20
Turbidity: 17.2 NTU/depth



y (mm)	Description
1760	
1556	
300	
75	

Comments:

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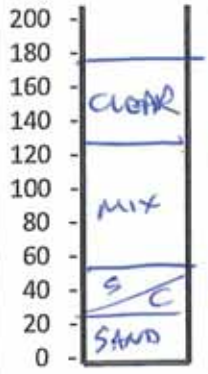
Personnel: S. MILLER **Page** 21 of ____

Test Number: ~~S. MILLER~~ 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON AREA	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

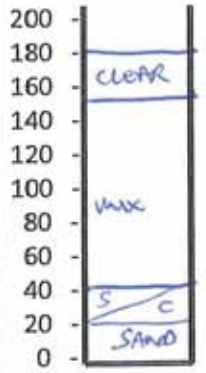
Date/Time: 8 DEC 14 4:30
Turbidity: 17.65 NTU/depth



y (mm)	Description
1758	
1551	
290	
75	

Comments:

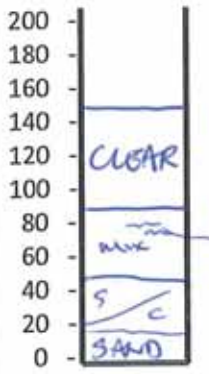
Date/Time: 08 DEC 14 17:00
Turbidity: 16.9 NTU/depth



y (mm)	Description
1758	
1542	
290	
75	

Comments:

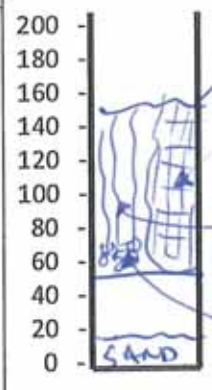
Date/Time: 09 DEC 14 07:00
Turbidity: 12.41 NTU/depth



y (mm)	Description
1757	
1292	770 & 690 horizontal movement present na cracks
290	
75	

Comments:
FRONT

Date/Time: 09 DEC 14 07:00
Turbidity: ____ NTU/depth



y (mm)	Description
	enlargement
	Large plume of light brown
	darker material with vertical lines present "looks like marble" or milky. lower data looks conglomerate.
290	
75	

Comments:
LEFT SIDE

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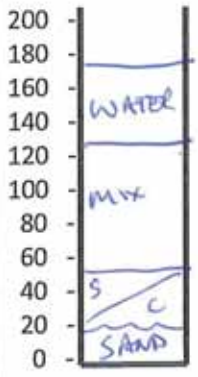
Personnel: S. MILLER **Page** 22 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON AREA	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

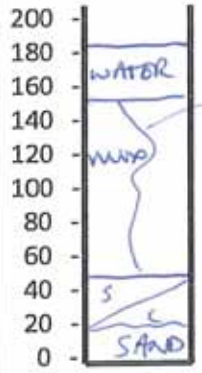
Date/Time: 09 DEC 14 07:30
Turbidity: 11.22 @ 9@ 30cms NTU/depth



y (mm)	Description
1757	
1288	
290	
75	

Comments:

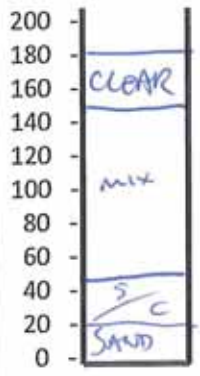
Date/Time: 09 DEC 14 08:00
Turbidity: _____ NTU/depth



y (mm)	Description
1757	
1280	top of phone has extended slightly. ~~Slightly~~
290	
75	

Comments:

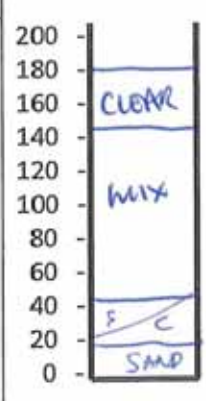
Date/Time: 9 DEC 14 8:30
Turbidity: 10.44 @ 20cm, 7.5 @ 30cms NTU/depth



y (mm)	Description
1757	
1272	
290	
75	

Comments:

Date/Time: 9 DEC 14 09:00
Turbidity: 12.8 @ 20 ; 7.0 @ 30cm. NTU/depth



y (mm)	Description
1757	
1265	
290	
75.	

Comments:

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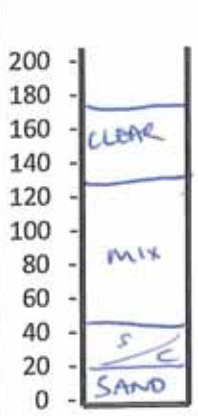
Personnel: S. MILLER **Page** 23 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: sand + clay	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

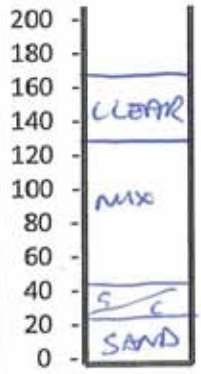
Date/Time: 9 DEC 14 09:30
Turbidity: 11.5 @ 20cm; 8.35 @ 30cm NTU/depth



y (mm)	Description
1757	
1258	
290	
75	

Comments:

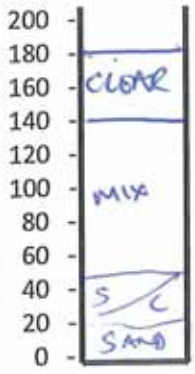
Date/Time: 9 DEC 14 10:00
Turbidity: 11.48 @ 20cm 8.0 @ 30cm NTU/depth



y (mm)	Description
1757	
1250	
295	
75	

Comments:

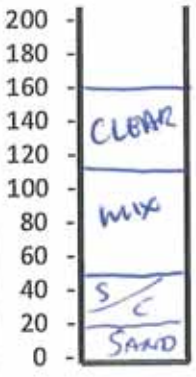
Date/Time: 9 DEC 14 10:30
Turbidity: 11.4 @ 10cm 7.07 @ 30cm NTU/depth



y (mm)	Description
1757	
1244	
290	
75	

Comments:

Date/Time: 9 DEC 14 11:00
Turbidity: 11.0 NTU/depth



y (mm)	Description
1756	
1237	
290	
75	

Comments:

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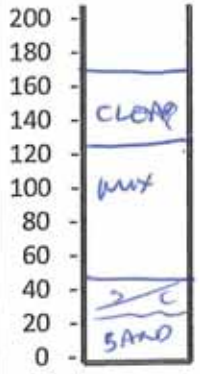
Personnel: S. MILLER **Page** 24 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: Sand + clay	**Test Type:** ☒ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

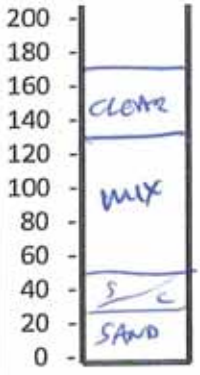
Date/Time: 9 DEC 14 11:30
Turbidity: _____ NTU/depth



y (mm)	Description
1756	
1229	
290	
75	

Comments:

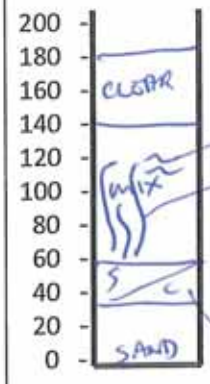
Date/Time: 9 DEC 14 12:00
Turbidity: 11.3 @ 10cm; 8.2 @ 30cm NTU/depth



y (mm)	Description
1756	
1221	
290	
75	

Comments:

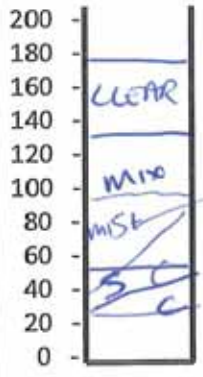
Date/Time: 9 DEC 14 12:30
Turbidity: 9.97 @ 10cm; 9.17 @ 30cm. NTU/depth



y (mm)	Description
1756	(830–890) horizontal movement
1212	large 'veins' have appeared (430–910) (left side) * photo.
290	
75	*conglomerate look

Comments:

Date/Time: 9 DEC 14 13:00
Turbidity: 10.5 @ 10cm; 8.13 @ 30cm NTU/depth



y (mm)	Description
1756	
1205	slight mist noted
290	
75	

Comments:

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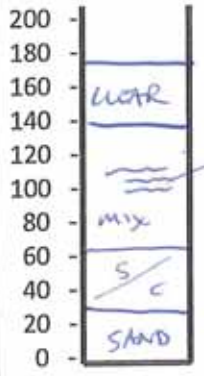
Personnel: S. MILLER **Page** 25 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND & CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

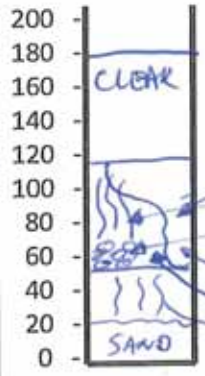
Date/Time: 9/DEC/14 13:30
Turbidity: 9.99 @ 10cm NTU/depth



y (mm)	Description
1755	
1197	horizontal space more dense (850-910)
290	
75	

Comments:
FRONT

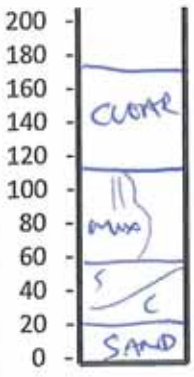
Date/Time: 9/DEC/14 13:30
Turbidity: 7.55 @ 30cms NTU/depth



y (mm)	Description
1755	
1197	horizontal
	vertical
	conglomerate
	large light consistent plane
	large dark consistent plane
	good gradation

Comments:
SIDE

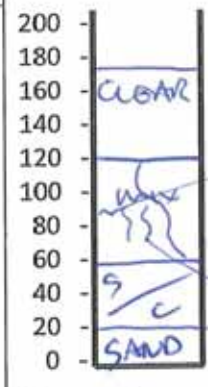
Date/Time: 9 DEC 14 14:00
Turbidity: 10.35 @ 10; 7.8 @ 30cm. NTU/depth



y (mm)	Description
1755	
1186	
290	
75	

Comments:

Date/Time: 9 DEC 14 14:30
Turbidity: 9.67 @ 10cm; 40cm = 7.45 NTU/depth



y (mm)	Description
1755	
1178	horizontal lines (820-900)
290	
75	vertical lines (370-950)

Comments:

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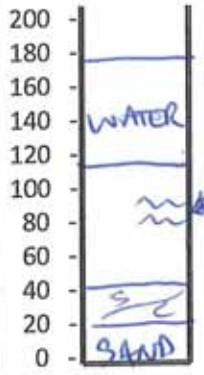
Personnel: S. MILLER **Page** 26 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

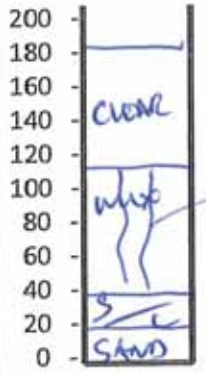
Date/Time: 9 DEC 14 15:00
Turbidity: 11.25 @ 10cm NTU/depth



y (mm)	Description
1755	
1170	(800-910)
290	
75	

Comments:
FRONT

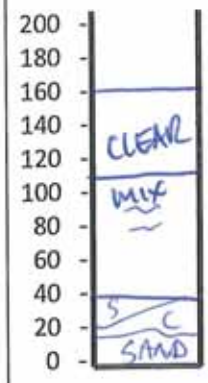
Date/Time: 9 DEC 14 15:00
Turbidity: 7.40 @ 40cm NTU/depth



y (mm)	Description
1758	
1170	very obvious air channels (450-870)
290	
75	

Comments:
RIGHT

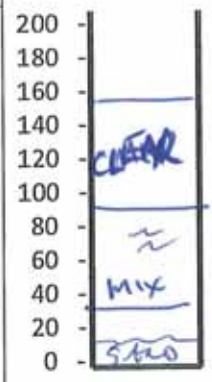
Date/Time: 9 DEC 14 15:30
Turbidity: 10.2 @ 10cm 7.7 @ 30cm NTU/depth



y (mm)	Description
1755	
1162	
290	
75	

Comments:
FRONT

Date/Time: 9 DEC 14 16:00
Turbidity: 10.0 @ 10 7.5 @ 30cm NTU/depth



y (mm)	Description
1755	
1152	
290	
75	

Comments:

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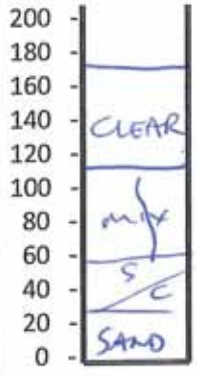
Personnel: S. MULLER **Page** 27 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

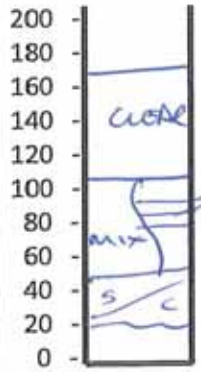
Date/Time: 9 DEC 14 16:30
Turbidity: _____ NTU/depth



y (mm)	Description
1755	
1141	
290	

Comments:

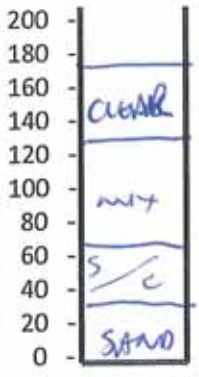
Date/Time: 9 DEC 14 17:00
Turbidity: 8.5 @ 10cm 7.05 @ 30cm NTU/depth



y (mm)	Description
1755	
1132	horizontal cracks. (970 - 850)
270	
75	

Comments:

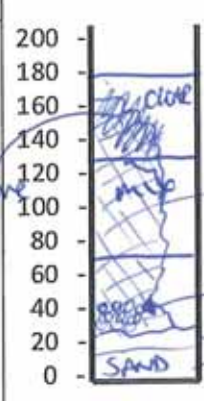
Date/Time: 9/DEC/14 17:30
Turbidity: 8.1 @ 10cm 6.8 @ 30cm NTU/depth



y (mm)	Description
1755	
1124	
290	
75	

Comments:

Date/Time: 10/DEC/14 07:15
Turbidity: 6.4 NTU @ 10cm 7.2 NTU @ 30cm NTU/depth



y (mm)	Description
1754	# dark colour ☐ light colour
1014	
280	no horizontal cracks.
	milky, conglomerate
	two fine layers, good grading.

ignore

Comments:

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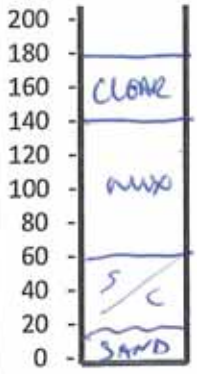
Personnel: S. MILLER **Page** 28 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND & CLAY	**Test Type:** ☒ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON AREA	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 10 DEC 14 07:30
Turbidity: 6.2 NTU @ 10 ; 7.4 NTU @ 30 NTU/depth

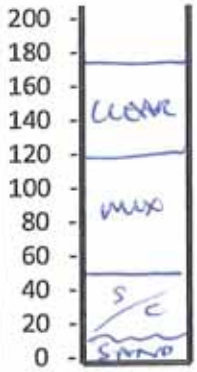
y (mm)	Description
1754	
1014	
280	
75	



Comments:

Date/Time: 10 DEC 14 09:00
Turbidity: 8.06 @ 10cm ; 12 @ 40cm NTU/depth

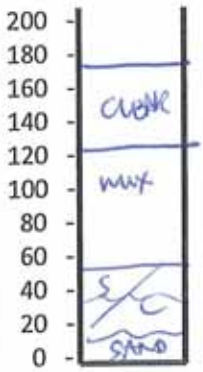
y (mm)	Description
1754	
1012	
280	
75	



Comments:

Date/Time: 10 DEC 14 09:00
Turbidity: _____ NTU/depth

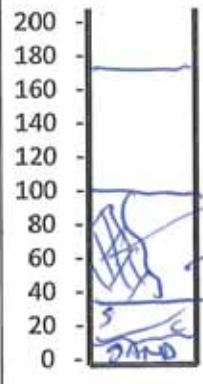
y (mm)	Description
1754	
1010	
280	
75	



Comments:

Date/Time: 10 DEC 14 10:00
Turbidity: 7.90 @ 10cm ; 11.86 @ 40cm NTU/depth

y (mm)	Description
1754	
1007	Dark
	light.
280	
75	



Comments:

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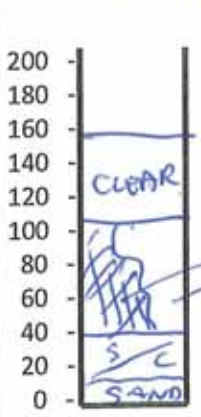
Personnel: S. MILLER **Page** 29 of ____

Test Number: 10	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☒ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

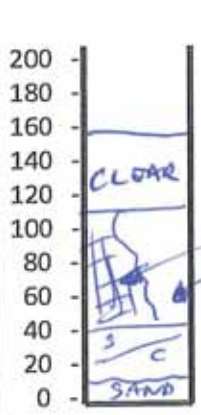
Date/Time: 10 DEC 14 11:00
Turbidity: 6.16 @ 10cm; 10.52 @ 40cm NTU/depth



y (mm)	Description
1754	
1005	Dark, light.
280	
75	

Comments:

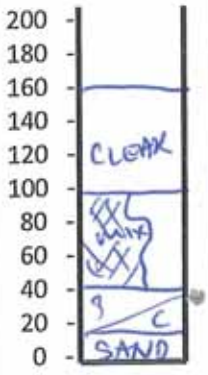
Date/Time: 10 DEC 14 12:00
Turbidity: _____ NTU/depth



y (mm)	Description
1754	
1003	Dark - light
280	
75	

Comments:

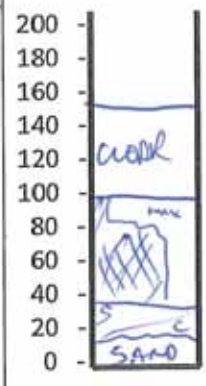
Date/Time: 10 DEC 14 13:00
Turbidity: 6.05 @ 10cm; 5.3 @ 40cm NTU/depth



y (mm)	Description
1754	
1000	
280	
75	

Comments:

Date/Time: 10 DEC 14 14:00
Turbidity: 8.66 @ 30cm; 6.3 @ 40cm NTU/depth



y (mm)	Description
1754	
998	
280	
75	

Comments:

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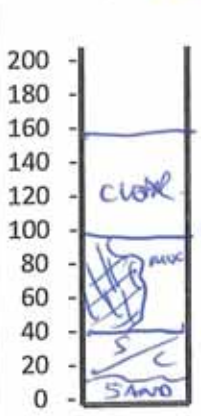
Personnel: S. MILLER **Page** 3 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

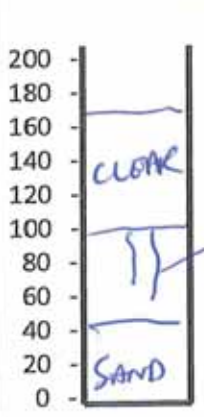
Date/Time: 10 DEC 14 15:00
Turbidity: 8.09 @ 30cm. NTU/depth



y (mm)	Description
1753	
996	
280	
76	

Comments:

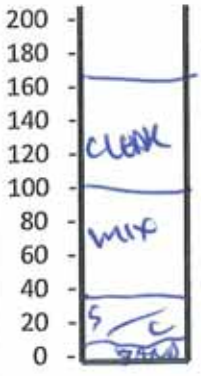
Date/Time: 10 DEC 14 15:00
Turbidity: 7.81 @ 40cm NTU/depth



y (mm)	Description
1753	
996	vertical cracks present.
280	

Comments:
REAR

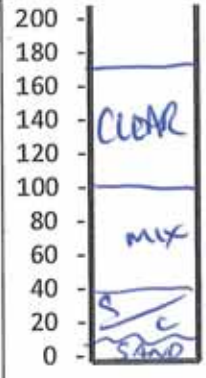
Date/Time: 10 DEC 14 16:00
Turbidity: _____ NTU/depth



y (mm)	Description
1753	
998	
280	
75.	

Comments:

Date/Time: 10 DEC 14 17:00
Turbidity: 6.78 @ 20cm, 6.79 @ 40cm NTU/depth



y (mm)	Description
1753	
993	
280	
75	

Comments:

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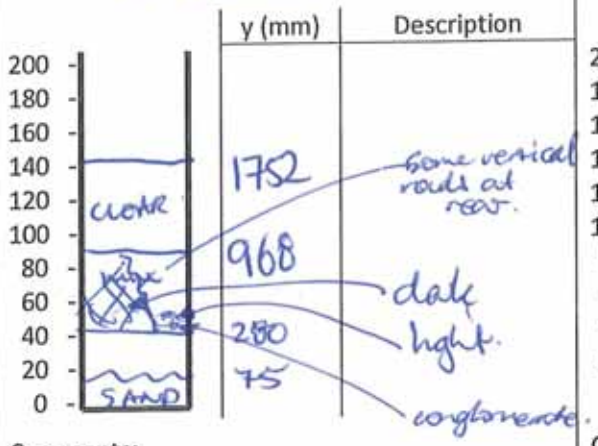
Personnel: S. MILLER **Page** 31 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

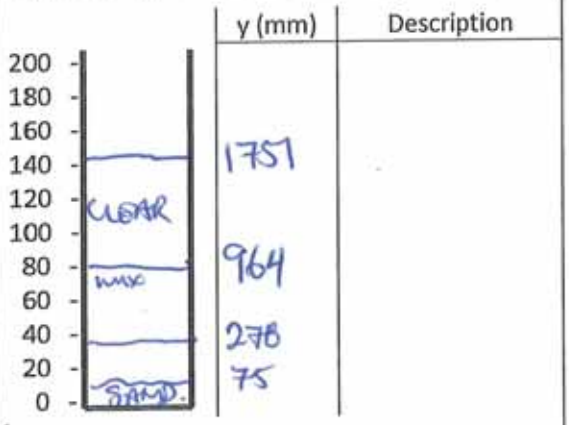
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 11 DEC 14 07:00
Turbidity: 5.4 @ 10cm; 4.7 @ 30cm NTU/depth



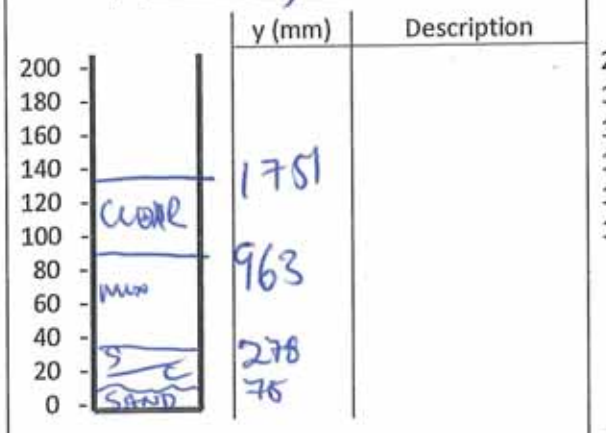
Comments:

Date/Time: 11 DEC 14 10:00
Turbidity: 4.5 @ 10cm 5-2 @ 30cm NTU/depth



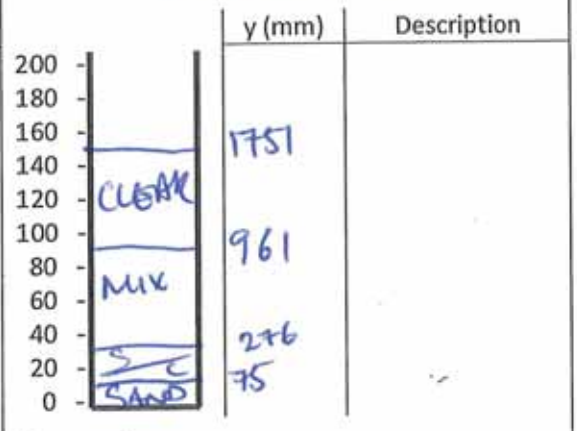
Comments:

Date/Time: 11 DEC 14 11:00
Turbidity: 4.9 @ 10cm; 5.0 @ 30cm NTU/depth



Comments:

Date/Time: 11 DEC 14 12:00
Turbidity: 5.10 @ 10cm NTU/depth



Comments:

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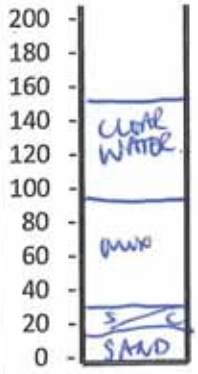
Personnel: S MILLER **Page** 32 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

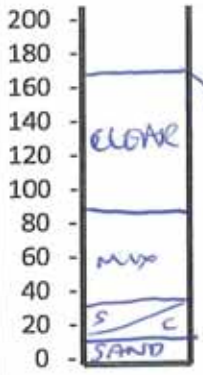
Date/Time: 11 DEC 14 13:00
Turbidity: 5.1 @ 10cm 4.2 @ 30cm NTU/depth



y (mm)	Description
975	
959	
275	
75	

Comments:

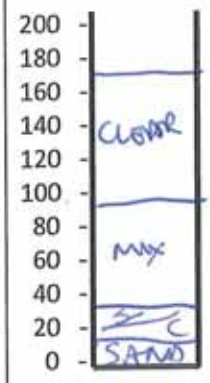
Date/Time: 11 DEC 14 14:00
Turbidity: 4.0 @ 30cm NTU/depth



y (mm)	Description
1752	
958	
275	
75	

Comments:

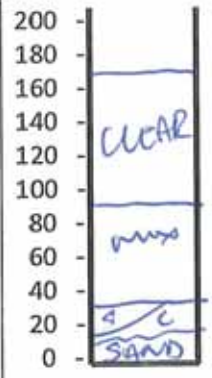
Date/Time: 11 DEC 14 15:00
Turbidity: 5.1 @ 10cm 4.0 @ 30cm NTU/depth



y (mm)	Description
1752	
955	
275	
75	

Comments:

Date/Time: 11 DEC 14 16:30
Turbidity: 5.2 @ 10cm 4.4 @ 30cm, NTU/depth



y (mm)	Description
1752	
953	
275	
75	

Comments:

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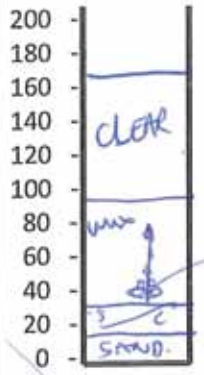
Personnel: S. MILLER **Page** 33 of ____

Test Number: 1D	**Test Started:** 8/12/14 09.45
Material Type: SAND & CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

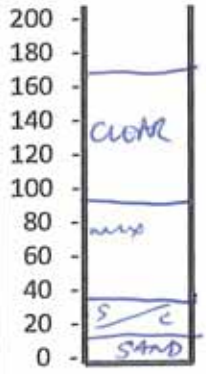
Date/Time: 12 DEC 14 07:00
Turbidity: 4.44 @10cm; 3.71 @40cm NTU/depth



y (mm)	Description
1751	
935	clusters in what looks well graded.
275	
95	

Comments:

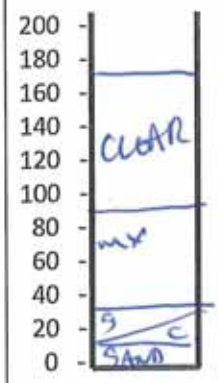
Date/Time: 12 DEC 14 09:00
Turbidity: 4.24 @10cm; 3.6 @40cm NTU/depth



y (mm)	Description
1751	
933	
275	
75	

Comments:

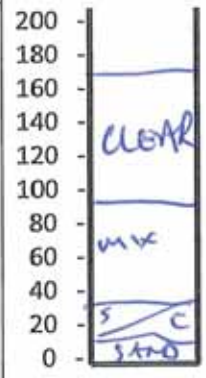
Date/Time: 12 DEC 14 12:00
Turbidity: 4.5 @10cm; 4.0 @40cm NTU/depth



y (mm)	Description
1750	
929	
275	
75	

Comments:

Date/Time: 12 DEC 14 16:00
Turbidity: 4.6 @10cm 3.5 @40cm. NTU/depth



y (mm)	Description
1750	
924	
275	
75	

Comments:

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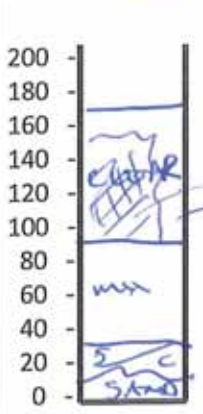
Personnel: S. MILLER **Page** 34 of ____

Test Number: 1D	**Test Started:** 8/12/14 09:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

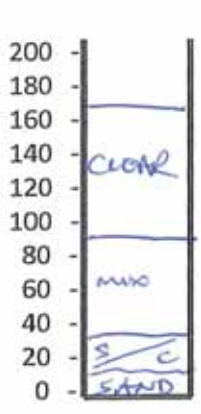
Date/Time: 15 DEC 14 07:30
Turbidity: 356 @ 10cm; 4.5 NTU @ 90cm NTU/depth



y (mm)	Description
1746	Darker
863	lighter
285	well graded
75	

Comments:

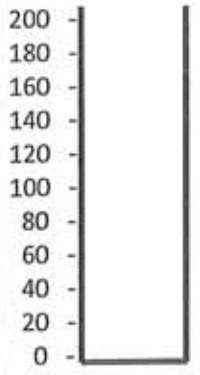
Date/Time: 15 DEC 14 10:45
Turbidity: 32 @ 40cm. NTU/depth



y (mm)	Description
1746	
861	
285	
75	

Comments:

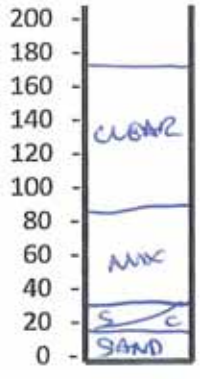
Date/Time: 15 DEC 14 16:00
Turbidity: _____ NTU/depth



y (mm)	Description

Comments:

Date/Time: 15 DEC 14 17:00
Turbidity: 3.1 @ 40cm NTU/depth



y (mm)	Description
1746	
856	
285	
75	

Comments:

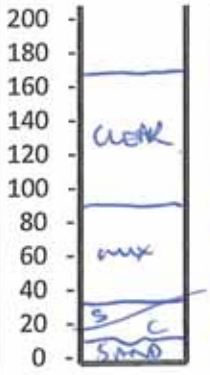
Royal HaskoningDHV
Enhancing Society Together

Personnel: S. MILLER **Page** 35 of ____

Test Number: 1D	**Test Started:** 8/12/14 9:40
Material Type: SAND + CLAY	**Test Type:** ☑ Settlement Only
Dredge Location: COMMON AREA	☐ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

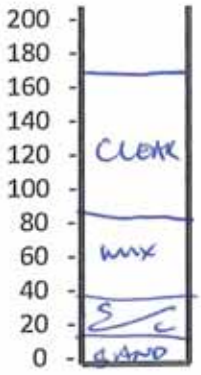
Date/Time: 15 DEC 14 07:20
Turbidity: 2.61 @ 10CM. NTU/depth



y (mm)	Description
1745	
846	
285	
75	

Comments:

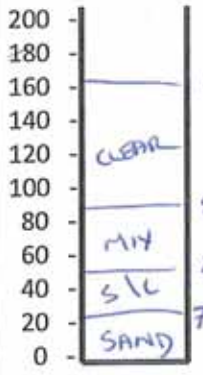
Date/Time: 16 DEC 14 10:30.
Turbidity: 7.3 @ 40CM NTU/depth



y (mm)	Description
1745	
844	
285	
75	

Comments:

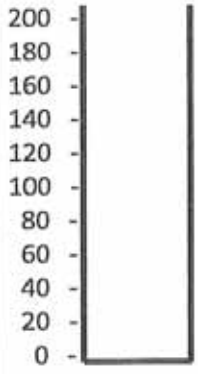
Date/Time: 16 DEC 14 1346
Turbidity: _____ NTU/depth



y (mm)	Description
1745	TEST STOPPED!
844	
285	
75	

Comments:

Date/Time: _____
Turbidity: _____ NTU/depth



y (mm)	Description

Comments:

APPENDIX G
Laboratory Certificates of Analysis for Water Samples

eurofins | mgt

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Chadwick Geotechnics Pty Ltd
32 Fiveways Boulevard
Keysborough
VIC 3173

Attention: **Simon Miller**

Report **440757-W**
Project name PORT OF HASTINGS
Project ID 307697
Received Date Dec 02, 2014

Client Sample ID			**CB1**	**CB2**	**CB3**	**CB4**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01390**	**M14-De01391**	**M14-De01392**	**M14-De01393**
Date Sampled			**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	240000	240000	240000	200000
Turbidity	1	NTU	210000	200000	200000	170000

Client Sample ID			**CB5**	**CB6**	**CB7**	**CB8**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01394**	**M14-De01395**	**M14-De01396**	**M14-De01397**
Date Sampled			**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	230000	180000	200000	190000
Turbidity	1	NTU	180000	180000	170000	180000

Client Sample ID			**CB9**	**CB10**	**CB11**	**CB12**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01398**	**M14-De01399**	**M14-De01400**	**M14-De01401**
Date Sampled			**Nov 27, 2014**	**Nov 27, 2014**	**Nov 27, 2014**	**Nov 27, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	12000	6600	80000	44000
Turbidity	1	NTU	8200	4800	53000	74000

Client Sample ID			**CB13**	**CB14**	**CB15**	**CB16**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01402**	**M14-De01403**	**M14-De01404**	**M14-De01405**
Date Sampled			**Nov 27, 2014**	**Nov 28, 2014**	**Nov 28, 2014**	**Dec 01, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	140000	5000	13000	21
Turbidity	1	NTU	120000	4000	11000	20

Client Sample ID			CB17	CB18	SB1	SB2
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De01406	M14-De01407	M14-De01408	M14-De01409
Date Sampled			Dec 01, 2014	Dec 01, 2014	Nov 26, 2014	Nov 26, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	79	20	120000	110000
Turbidity	1	NTU	98	26	62000	60000

Client Sample ID			SB3	SB4	SB5	SB6
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De01410	M14-De01411	M14-De01412	M14-De01413
Date Sampled			Nov 26, 2014	Nov 26, 2014	Nov 26, 2014	Nov 26, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	91000	86000	65000	70000
Turbidity	1	NTU	59000	59000	50000	49000

Client Sample ID			SB7	SB8	SB9	SB10
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De01414	M14-De01415	M14-De01416	M14-De01417
Date Sampled			Nov 26, 2014	Nov 26, 2014	Nov 26, 2014	Nov 26, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	30000	25000	17000	16000
Turbidity	1	NTU	23000	21000	64000	13000

Client Sample ID			SB11	SB12	SB13	SB14
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De01418	M14-De01419	M14-De01420	M14-De01421
Date Sampled			Nov 26, 2014	Nov 26, 2014	Nov 26, 2014	Nov 26, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	2200	80	100	77
Turbidity	1	NTU	1600	81	67	61

Client Sample ID			SB15	SB16	SB17	SB18
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De01422	M14-De01423	M14-De01424	M14-De01425
Date Sampled			Nov 26, 2014	Nov 27, 2014	Nov 27, 2014	Nov 27, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	57	14	59	7.3
Turbidity	1	NTU	68	13	55	6.9

Client Sample ID			SB19	SB20	SB21	SB22
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De01426	M14-De01427	M14-De01428	M14-De01429
Date Sampled			Nov 27, 2014	Nov 27, 2014	Nov 28, 2014	Nov 28, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	21	20	10	10
Turbidity	1	NTU	21	23	7.8	6.3

Client Sample ID			SB23	SB24	SB25	SB26
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De01430	M14-De01431	M14-De01432	M14-De01433
Date Sampled			Nov 28, 2014	Nov 28, 2014	Dec 01, 2014	Dec 01, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	5.2	5.2	5.3	4.2
Turbidity	1	NTU	4.6	5.6	< 1	1.5

Client Sample ID			SB27
Sample Matrix			Water
Eurofins | mgt Sample No.			M14-De01434
Date Sampled			Dec 01, 2014
Test/Reference	LOR	Unit	
Suspended Solids	1	mg/L	8.0
Turbidity	1	NTU	2.5

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Suspended Solids	Melbourne	Dec 02, 2014	7 Day
- Method: APHA 2540D Total Suspended Solids			
Turbidity	Melbourne	Dec 03, 2014	2 Day
- Method: APHA 2130 Turbidity			

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name: Chadwick Geotechnics Pty Ltd
Address: 32 Fiveways Boulevard
Keysborough
VIC 3173

Project Name: PORT OF HASTINGS
Project ID: 307697

Order No.:
Report #: 440757
Phone: 03 8796 7900
Fax: 03 8796 7944

Received: Dec 2, 2014 9:11 AM
Due: Dec 4, 2014
Priority: 2 Day
Contact Name: Simon Miller

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					HOLD	Suspended Solids	Turbidity
Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
CB1	Nov 26, 2014	1:05PM	Water	M14-De01390		X	X
CB2	Nov 26, 2014	1:20PM	Water	M14-De01391		X	X
CB3	Nov 26, 2014	1:50PM	Water	M14-De01392		X	X
CB4	Nov 26, 2014	2:20PM	Water	M14-De01393		X	X
CB5	Nov 26, 2014	2:50PM	Water	M14-De01394		X	X
CB6	Nov 26, 2014	3:20PM	Water	M14-De01395		X	X
CB7	Nov 26, 2014	4:20PM	Water	M14-De01396		X	X
CB8	Nov 26, 2014	5:00PM	Water	M14-De01397		X	X
CB9	Nov 27, 2014	7:00AM	Water	M14-De01398		X	X

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Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
CB10	Nov 27, 2014	10:00AM	Water	M14-De01399		X	X
CB11	Nov 27, 2014	1:00PM	Water	M14-De01400		X	X
CB12	Nov 27, 2014	2:55PM	Water	M14-De01401		X	X
CB13	Nov 27, 2014	4:40PM	Water	M14-De01402		X	X
CB14	Nov 28, 2014	7:30AM	Water	M14-De01403		X	X
CB15	Nov 28, 2014	1:40PM	Water	M14-De01404		X	X
CB16	Dec 01, 2014	7:15AM	Water	M14-De01405		X	X
CB17	Dec 01, 2014	11:30AM	Water	M14-De01406		X	X
CB18	Dec 01, 2014	3:00PM	Water	M14-De01407		X	X
SB1	Nov 26, 2014	9:24AM	Water	M14-De01408		X	X

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Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
SB2	Nov 26, 2014	9:24AM	Water	M14-De01409		X	X
SB3	Nov 26, 2014	9:40AM	Water	M14-De01410		X	X
SB4	Nov 26, 2014	9:50AM	Water	M14-De01411		X	X
SB5	Nov 26, 2014	10:00AM	Water	M14-De01412		X	X
SB6	Nov 26, 2014	10:10AM	Water	M14-De01413		X	X
SB7	Nov 26, 2014	10:40AM	Water	M14-De01414		X	X
SB8	Nov 26, 2014	11:10AM	Water	M14-De01415		X	X
SB9	Nov 26, 2014	12:10PM	Water	M14-De01416		X	X
SB10	Nov 26, 2014	1:10PM	Water	M14-De01417		X	X
SB11	Nov 26, 2014	2:10PM	Water	M14-De01418		X	X

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Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
SB12	Nov 26, 2014	3:10PM	Water	M14-De01419		X	X
SB13	Nov 26, 2014	3:40PM	Water	M14-De01420		X	X
SB14	Nov 26, 2014	4:10PM	Water	M14-De01421		X	X
SB15	Nov 26, 2014	5:00PM	Water	M14-De01422		X	X
SB16	Nov 27, 2014	7:00AM	Water	M14-De01423		X	X
SB17	Nov 27, 2014	10:00AM	Water	M14-De01424		X	X
SB18	Nov 27, 2014	1:00PM	Water	M14-De01425		X	X
SB19	Nov 27, 2014	3:00PM	Water	M14-De01426		X	X
SB20	Nov 27, 2014	4:40PM	Water	M14-De01427		X	X
SB21	Nov 28, 2014	7:35AM	Water	M14-De01428		X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
SB22	Nov 28, 2014	9:55AM	Water	M14-De01429		X	X
SB23	Nov 28, 2014	12:50PM	Water	M14-De01430		X	X
SB24	Nov 28, 2014	3:35PM	Water	M14-De01431		X	X
SB25	Dec 01, 2014	7:10AM	Water	M14-De01432		X	X
SB26	Dec 01, 2014	11:30AM	Water	M14-De01433		X	X
SB27	Dec 01, 2014	3:00PM	Water	M14-De01434		X	X
CA1	Nov 26, 2014		Water	M14-De01439	X		
SA1	Nov 26, 2014		Water	M14-De01440	X		

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Suspended Solids	mg/L	< 1			1	Pass	
LCS - % Recovery							
Suspended Solids	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	M14-De01390	CP	NTU	210000	200000	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De01398	CP	mg/L	12000	12000	5.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	M14-De01409	CP	NTU	60000	61000	2.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De01419	CP	mg/L	80	84	4.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	M14-De01428	CP	NTU	7.8	7.6	3.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De01429	CP	mg/L	10	13	21	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Mary Makarios	Analytical Services Manager
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Chadwick Geotechnics Pty Ltd
32 Fiveways Boulevard
Keysborough
VIC 3173

Attention: **Simon Miller**

Report **440761-W**
Project name PORT OF HASTINGS
Project ID 307697
Received Date Dec 02, 2014

Client Sample ID			**MB1**	**MB2**	**MB3**	**MB4**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01442**	**M14-De01443**	**M14-De01444**	**M14-De01445**
Date Sampled			**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	150000	140000	140000	100000
Turbidity	1	NTU	66000	53000	56000	50000

Client Sample ID			**MB5**	**MB6**	**MB7**	**MB8**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01446**	**M14-De01447**	**M14-De01448**	**M14-De01449**
Date Sampled			**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**	**Nov 26, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	17000	10000	6000	10000
Turbidity	1	NTU	7700	2300	2000	4300

Client Sample ID			**MB9**	**MB11**	**MB12**	**MB13**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01450**	**M14-De01451**	**M14-De01452**	**M14-De01453**
Date Sampled			**Nov 26, 2014**	**Nov 26, 2014**	**Nov 27, 2014**	**Nov 27, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	48000	50000	19	550
Turbidity	1	NTU	13000	20000	13	200

Client Sample ID			**MB14**	**MB15**	**MB16**	**MB17**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01454**	**M14-De01455**	**M14-De01456**	**M14-De01457**
Date Sampled			**Nov 27, 2014**	**Nov 27, 2014**	**Nov 27, 2014**	**Nov 28, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	39	380	290	43
Turbidity	1	NTU	21	120	120	15

Client Sample ID			MB19	MB20	MB21	MB22
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01458**	**M14-De01459**	**M14-De01460**	**M14-De01461**
Date Sampled			**Nov 28, 2014**	**Nov 28, 2014**	**Nov 28, 2014**	**Dec 01, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	22	41	74	17
Turbidity	1	NTU	17	14	29	2.3

Client Sample ID			MB23	MB24
Sample Matrix			**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De01462**	**M14-De01463**
Date Sampled			**Dec 01, 2014**	**Dec 01, 2014**
Test/Reference	LOR	Unit		
Suspended Solids	1	mg/L	17	21
Turbidity	1	NTU	5.5	4.1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Suspended Solids	Melbourne	Dec 02, 2014	7 Day
- Method: APHA 2540D Total Suspended Solids			
Turbidity	Melbourne	Dec 03, 2014	2 Day
- Method: APHA 2130 Turbidity			

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ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name: Chadwick Geotechnics Pty Ltd
Address: 32 Fiveways Boulevard
Keysborough
VIC 3173

Project Name: PORT OF HASTINGS
Project ID: 307697

Order No.:
Report #: 440761
Phone: 03 8796 7900
Fax: 03 8796 7944

Received: Dec 2, 2014 9:11 AM
Due: Dec 4, 2014
Priority: 2 Day
Contact Name: Simon Miller

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					HOLD	Suspended Solids	Turbidity
Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
MB1	Nov 26, 2014	10:20AM	Water	M14-De01442		X	X
MB2	Nov 26, 2014	10:35AM	Water	M14-De01443		X	X
MB3	Nov 26, 2014	10:50AM	Water	M14-De01444		X	X
MB4	Nov 26, 2014	11:20AM	Water	M14-De01445		X	X
MB5	Nov 26, 2014	11:20AM	Water	M14-De01446		X	X
MB6	Nov 26, 2014	1:15PM	Water	M14-De01447		X	X
MB7	Nov 26, 2014	2:10PM	Water	M14-De01448		X	X
MB8	Nov 26, 2014	3:15PM	Water	M14-De01449		X	X
MB9	Nov 26, 2014	4:15PM	Water	M14-De01450		X	X

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
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Company Name: Chadwick Geotechnics Pty Ltd
Address: 32 Fiveways Boulevard
Keysborough
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Project Name: PORT OF HASTINGS
Project ID: 307697

Order No.:
Report #: 440761
Phone: 03 8796 7900
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Received: Dec 2, 2014 9:11 AM
Due: Dec 4, 2014
Priority: 2 Day
Contact Name: Simon Miller

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					HOLD	Suspended Solids	Turbidity
Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
MB11	Nov 26, 2014	5:00PM	Water	M14-De01451		X	X
MB12	Nov 27, 2014	7:00AM	Water	M14-De01452		X	X
MB13	Nov 27, 2014	10:00AM	Water	M14-De01453		X	X
MB14	Nov 27, 2014	1:00PM	Water	M14-De01454		X	X
MB15	Nov 27, 2014	3:00PM	Water	M14-De01455		X	X
MB16	Nov 27, 2014	4:30PM	Water	M14-De01456		X	X
MB17	Nov 28, 2014	7:30AM	Water	M14-De01457		X	X
MB19	Nov 28, 2014	9:50AM	Water	M14-De01458		X	X
MB20	Nov 28, 2014	12:55PM	Water	M14-De01459		X	X
MB21	Nov 28, 2014	3:30PM	Water	M14-De01460		X	X

Company Name:	Chadwick Geotechnics Pty Ltd	**Order No.:**		**Received:**	Dec 2, 2014 9:11 AM
Address:	32 Fiveways Boulevard Keysborough VIC 3173	**Report #:** **Phone:** **Fax:**	440761 03 8796 7900 03 8796 7944	**Due:** **Priority:** **Contact Name:**	Dec 4, 2014 2 Day Simon Miller
Project Name:	PORT OF HASTINGS				
Project ID:	307697				

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					HOLD	Suspended Solids	Turbidity
Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
MB22	Dec 01, 2014	7:20AM	Water	M14-De01461		X	X
MB23	Dec 01, 2014	11:30AM	Water	M14-De01462		X	X
MB24	Dec 01, 2014	3:00PM	Water	M14-De01463		X	X
MA1	Nov 26, 2014		Water	M14-De01464	X		

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Suspended Solids	mg/L	< 1			1	Pass	
LCS - % Recovery							
Suspended Solids	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De01446	CP	mg/L	17000	21000	23	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	M14-De01454	CP	NTU	21	21	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De01456	CP	mg/L	290	330	13	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Mary Makarios	Analytical Services Manager
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Chadwick Geotechnics Pty Ltd
32 Fiveways Boulevard
Keysborough
VIC 3173

Attention: **Simon Miller**

Report **441031-W**
Project name PORT OF HASTINGS
Project ID 307697
Received Date Dec 03, 2014

Client Sample ID			**MC1**	**MC2**	**MC3**	**MC4**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De03627**	**M14-De03628**	**M14-De03629**	**M14-De03630**
Date Sampled			**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	47	46	86	79
Turbidity	1	NTU	18	34	48	54

Client Sample ID			**MC5**	**MC6**	**MC7**	**MC8**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De03631**	**M14-De03632**	**M14-De03633**	**M14-De03634**
Date Sampled			**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	150	220	240	320
Turbidity	1	NTU	53	100	120	130

Client Sample ID			**MC9**	**MC10**	**MC11**	**CC1**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De03635**	**M14-De03636**	**M14-De03637**	**M14-De03638**
Date Sampled			**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	440	440	470	29
Turbidity	1	NTU	160	200	210	21

Client Sample ID			**CC2**	**CC3**	**CC4**	**CC5**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De03639**	**M14-De03640**	**M14-De03641**	**M14-De03642**
Date Sampled			**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**	**Dec 02, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	36	49	59	78
Turbidity	1	NTU	43	49	61	61

Client Sample ID			CC6	CC7	CC8	CC9
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De03643	M14-De03644	M14-De03645	M14-De03646
Date Sampled			Dec 02, 2014	Dec 02, 2014	Dec 02, 2014	Dec 02, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	91	120	140	160
Turbidity	1	NTU	89	110	120	140

Client Sample ID			CC10	SC1	SC2	SC3
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De03647	M14-De03648	M14-De03649	M14-De03650
Date Sampled			Dec 02, 2014	Dec 02, 2014	Dec 02, 2014	Dec 02, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	89	5.6	27	48
Turbidity	1	NTU	160	1.3	22	47

Client Sample ID			SC4	SC5	SC6	SC7
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De03651	M14-De03652	M14-De03653	M14-De03654
Date Sampled			Dec 02, 2014	Dec 02, 2014	Dec 02, 2014	Dec 02, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	69	99	140	160
Turbidity	1	NTU	48	77	96	110

Client Sample ID			SC8	SC9	SC10	SC11
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M14-De03655	M14-De03656	M14-De03657	M14-De03658
Date Sampled			Dec 02, 2014	Dec 02, 2014	Dec 02, 2014	Dec 02, 2014
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	200	300	170	630
Turbidity	1	NTU	120	110	130	130

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Suspended Solids	Melbourne	Dec 04, 2014	7 Day
- Method: APHA 2540D Total Suspended Solids			
Turbidity	Melbourne	Dec 04, 2014	2 Day
- Method: APHA 2130 Turbidity			

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
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16 Mars Road
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NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name:	Chadwick Geotechnics Pty Ltd	**Order No.:**		**Received:**	Dec 3, 2014 4:47 PM
Address:	32 Fiveways Boulevard	**Report #:**	441031	**Due:**	Dec 10, 2014
	Keysborough	**Phone:**	03 8796 7900	**Priority:**	5 Day
	VIC 3173	**Fax:**	03 8796 7944	**Contact Name:**	Simon Miller
Project Name:	PORT OF HASTINGS				
Project ID:	307697				

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					Suspended Solids	Turbidity
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
MC1	Dec 02, 2014	1:30PM	Water	M14-De03627	X	X
MC2	Dec 02, 2014	1:34PM	Water	M14-De03628	X	X
MC3	Dec 02, 2014	1:36PM	Water	M14-De03629	X	X
MC4	Dec 02, 2014	1:39PM	Water	M14-De03630	X	X
MC5	Dec 02, 2014	1:42PM	Water	M14-De03631	X	X
MC6	Dec 02, 2014	1:46PM	Water	M14-De03632	X	X
MC7	Dec 02, 2014	1:50PM	Water	M14-De03633	X	X
MC8	Dec 02, 2014	1:53PM	Water	M14-De03634	X	X
MC9	Dec 02, 2014	1:57PM	Water	M14-De03635	X	X

eurofins | mgt

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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Unit F3, Building F
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Lane Cove West NSW 2066
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Company Name: Chadwick Geotechnics Pty Ltd
Address: 32 Fiveways Boulevard
Keysborough
VIC 3173

Project Name: PORT OF HASTINGS
Project ID: 307697

Order No.:
Report #: 441031
Phone: 03 8796 7900
Fax: 03 8796 7944

Received: Dec 3, 2014 4:47 PM
Due: Dec 10, 2014
Priority: 5 Day
Contact Name: Simon Miller

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					Suspended Solids	Turbidity
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
MC10	Dec 02, 2014	2:00PM	Water	M14-De03636	X	X
MC11	Dec 02, 2014	2:02PM	Water	M14-De03637	X	X
CC1	Dec 02, 2014	11:11AM	Water	M14-De03638	X	X
CC2	Dec 02, 2014	11:12AM	Water	M14-De03639	X	X
CC3	Dec 02, 2014	11:15AM	Water	M14-De03640	X	X
CC4	Dec 02, 2014	11:16AM	Water	M14-De03641	X	X
CC5	Dec 02, 2014	11:18AM	Water	M14-De03642	X	X
CC6	Dec 02, 2014	11:21AM	Water	M14-De03643	X	X
CC7	Dec 02, 2014	11:24AM	Water	M14-De03644	X	X
CC8	Dec 02, 2014	11:26AM	Water	M14-De03645	X	X

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ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
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Sample Detail					Suspended Solids	Turbidity
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
CC9	Dec 02, 2014	11:27AM	Water	M14-De03646	X	X
CC10	Dec 02, 2014	11:29AM	Water	M14-De03647	X	X
SC1	Dec 02, 2014	9:50AM	Water	M14-De03648	X	X
SC2	Dec 02, 2014	10:00AM	Water	M14-De03649	X	X
SC3	Dec 02, 2014	10:05AM	Water	M14-De03650	X	X
SC4	Dec 02, 2014	10:10AM	Water	M14-De03651	X	X
SC5	Dec 02, 2014	10:15AM	Water	M14-De03652	X	X
SC6	Dec 02, 2014	10:20AM	Water	M14-De03653	X	X
SC7	Dec 02, 2014	10:25AM	Water	M14-De03654	X	X
SC8	Dec 02, 2014	10:30AM	Water	M14-De03655	X	X

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Contact Name: Simon Miller

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Sample Detail					Suspended Solids	Turbidity
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
SC9	Dec 02, 2014	10:35AM	Water	M14-De03656	X	X
SC10	Dec 02, 2014	10:37AM	Water	M14-De03657	X	X
SC11	Dec 02, 2014	10:40AM	Water	M14-De03658	X	X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Suspended Solids			mg/L	< 1			1	Pass	
LCS - % Recovery									
Suspended Solids			%	99			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	M14-De03639	CP	NTU	43	43	1.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De03642	CP	mg/L	78	97	22	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De03652	CP	mg/L	99	110	12	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	M14-De03658	CP	NTU	130	130	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Mary Makarios	Analytical Services Manager
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Chadwick Geotechnics Pty Ltd
32 Fiveways Boulevard
Keysborough
VIC 3173

Attention: **Simon Miller**

Report **442632-W**
Project name
Project ID 307697
Received Date Dec 16, 2014

Client Sample ID			**SCC1**	**SCC2**	**SCC3**	**SCC4**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De15526**	**M14-De15527**	**M14-De15528**	**M14-De15529**
Date Sampled			**Dec 16, 2014**	**Dec 16, 2014**	**Dec 16, 2014**	**Dec 16, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	14	13	32	46
Turbidity	1	NTU	9.1	12	21	35

Client Sample ID			**SCC5**	**SCC6**	**SCC7**	**SCC8**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De15530**	**M14-De15531**	**M14-De15532**	**M14-De15533**
Date Sampled			**Dec 16, 2014**	**Dec 16, 2014**	**Dec 16, 2014**	**Dec 16, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	54	91	110	140
Turbidity	1	NTU	50	80	84	91

Client Sample ID			**SCC9**	**SCC10**	**SCC11**	**SCC12**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M14-De15534**	**M14-De15535**	**M14-De15536**	**M14-De15537**
Date Sampled			**Dec 16, 2014**	**Dec 16, 2014**	**Dec 16, 2014**	**Dec 16, 2014**
Test/Reference	LOR	Unit				
Suspended Solids	1	mg/L	180	230	270	360
Turbidity	1	NTU	130	160	190	190

Client Sample ID			**SCC12**
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**M14-De15538**
Date Sampled			**Dec 16, 2014**
Test/Reference	LOR	Unit	
Suspended Solids	1	mg/L	450
Turbidity	1	NTU	250

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Suspended Solids	Melbourne	Dec 17, 2014	7 Day
- Method: APHA 2540D Total Suspended Solids			
Turbidity	Melbourne	Dec 17, 2014	2 Day
- Method: APHA 2130 Turbidity			

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
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NATA # 1261
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NATA # 1261 Site # 20794

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Address: 32 Fiveways Boulevard
Keysborough
VIC 3173

Project Name:
Project ID: 307697

Order No.:
Report #: 442632
Phone: 03 8796 7900
Fax: 03 8796 7944

Received: Dec 16, 2014 5:16 PM
Due: Dec 23, 2014
Priority: 5 Day
Contact Name: Simon Miller

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					Suspended Solids	Turbidity
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
SCC1	Dec 16, 2014	2:00PM	Water	M14-De15526	X	X
SCC2	Dec 16, 2014	2:09PM	Water	M14-De15527	X	X
SCC3	Dec 16, 2014	2:13PM	Water	M14-De15528	X	X
SCC4	Dec 16, 2014	2:17PM	Water	M14-De15529	X	X
SCC5	Dec 16, 2014	2:18PM	Water	M14-De15530	X	X
SCC6	Dec 16, 2014	2:22PM	Water	M14-De15531	X	X
SCC7	Dec 16, 2014	2:27PM	Water	M14-De15532	X	X
SCC8	Dec 16, 2014	2:29PM	Water	M14-De15533	X	X
SCC9	Dec 16, 2014	2:31PM	Water	M14-De15534	X	X

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

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Company Name:	Chadwick Geotechnics Pty Ltd	**Order No.:**	
Address:	32 Fiveways Boulevard Keysborough VIC 3173	**Report #:** **Phone:** **Fax:**	442632 03 8796 7900 03 8796 7944
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Project ID:	307697		

Received:	Dec 16, 2014 5:16 PM
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Contact Name:	Simon Miller

Eurofins | mgt Client Manager: Mary Makarios

Sample Detail					Suspended Solids	Turbidity
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
SCC10	Dec 16, 2014	2:35PM	Water	M14-De15535	X	X
SCC11	Dec 16, 2014	2:37PM	Water	M14-De15536	X	X
SCC12	Dec 16, 2014	2:40PM	Water	M14-De15537	X	X
SCC12	Dec 16, 2014	2:42PM	Water	M14-De15538	X	X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

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****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Suspended Solids	mg/L	< 1			1	Pass	
LCS - % Recovery							
Suspended Solids	%	101			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Suspended Solids	M14-De14220	NCP	mg/L	250	250	<1	30%	Pass	
Turbidity	M14-De15526	CP	NTU	9.1	9.1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	No
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Mary Makarios	Analytical Services Manager
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

APPENDIX H
TSS-Turbidity Test Sheets – Stiff-Hard Clays

Table H1: Turbidity measurements and sampling information – stiff-hard clays (Dilution Test)

Test Material	Turbidity (NTU)	TSS Sample	Date / Time
Seawater	3.86	No Sample - See Sample SC-1	2 Dec 2014 /1110
Seawater + Clay Mixture	19.4	CC-1	2 Dec 2014 /1111
Seawater + Clay Mixture	35	CC-2	2 Dec 2014 /1112
Seawater + Clay Mixture	42.6	CC-3	2 Dec 2014 /1115
Seawater + Clay Mixture	51.7	CC-4	2 Dec 2014 /1116
Seawater + Clay Mixture	65.2	CC-5	2 Dec 2014 /1118
Seawater + Clay Mixture	86.2	CC-6	2 Dec 2014 /1121
Seawater + Clay Mixture	100.1	CC-7	2 Dec 2014 /1124
Seawater + Clay Mixture	118.6	CC-8	2 Dec 2014 /1126
Seawater + Clay Mixture	139	CC-9	2 Dec 2014 /1127
Seawater + Clay Mixture	157.2	CC-10	2 Dec 2014 /1130

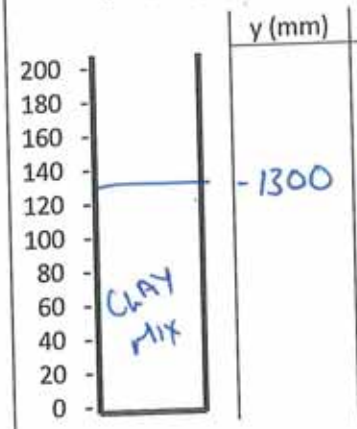
Royal HaskoningDHV
Enhancing Society Together

Personnel: SIMON M + JAMES D **Page** 1 of ____

Test Number: 1B	**Test Started:** 26 NOV 14 1305
Material Type: CLAY	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: COMMON	

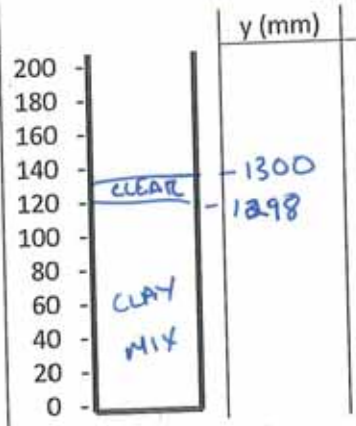
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26/11/14 1305
Turbidity: <250 NTU/depth



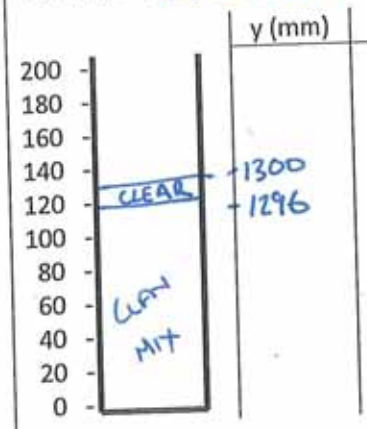
Comments:
TSS - CB1

Date/Time: 1307
Turbidity: <250 NTU NTU/depth



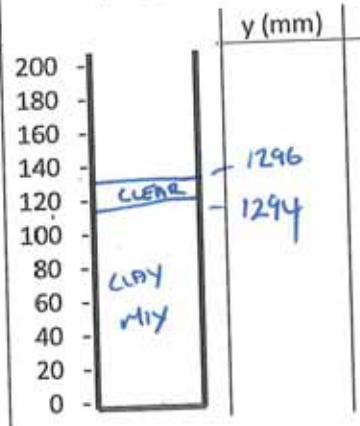
Comments:

Date/Time: 26/11/14 1320
Turbidity: >250 NTU NTU/depth



Comments:
TSS - CB2

Date/Time: 26/11/14 1350
Turbidity: <250 NTU NTU/depth



Comments:
TSS - CB3

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Personnel: SIMON M, JAMES D

Test Number: 1B

Test Started: 26 NOV 14 13:05

Material Type: CLAY

Test Type: ☐ Settlement Only ☑ TSS-Turbidity

Dredge Location: COMMON

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26/11/14 14:20
Turbidity: <250NTU NTU/depth

y (mm)	Description
1290 mm	CLEAR
1288 mm	MIX

Comments: TSS - CB4

Date/Time: 26/11/14 14:50
Turbidity: < 250 NTU NTU/depth

y (mm)	Description
1285 mm	CLEAR
1283 mm	MIX

Comments: TSS - CB5

Date/Time: 26/11/14 15:20
Turbidity: <250 NTU/depth

y (mm)	Description
1280 mm	CLEAR
1277 mm	MIX

Comments: TSS - CB6

Date/Time: 26/11/14 1550
Turbidity: <250 NTU NTU/depth

y (mm)	Description
1267	CLEAR
1273	MIX

Comments:

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Personnel: Simon M + James D

Test Number: 1B	**Test Started:** 26 Nov 14 1305
Material Type: CLAY	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: Common	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 Nov 14 16:20
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100	1274 mm	
80 CLEAR	1272 mm	
60		
40 MIX		
20		
0		

Comments:
TSS - CB7

Date/Time: 26 Nov 14 17:00
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100		
80 CLEAR	1269 mm	
60	1266 mm	
40 MIX		
20		
0		

Comments:
TSS - CB8

Date/Time: 27/11/14 07:00
Turbidity: <250 NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120	1263	
100 CLEAR		
80	1250	
60		
40 MIX		
20	10	
0 SAND		

Comments:
TSS - CB9.

Date/Time: 27/11/14 10:00
Turbidity: <250. NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120	1261	
100 CLEAR		
80	1248	
60		
40 MIX		
20	10	
0 SAND		

Comments:
CB10

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Personnel: S. MILLER

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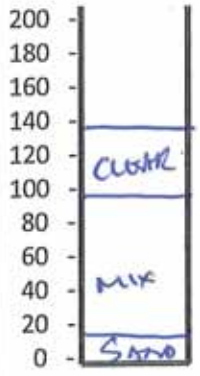
Test Number: 1B	**Test Started:** 26/11/14 13:05
Material Type: CLAY	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: COMMON	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 27/11/14 13:00

Turbidity: <250 NTU/depth



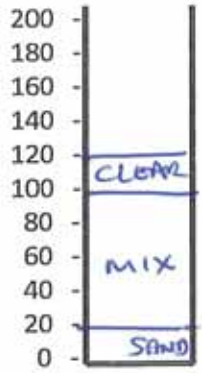
y (mm)	Description
1260	
1240	
20	

Comments:

CB11

Date/Time: 27/11/14 14:55

Turbidity: <250 NTU/depth



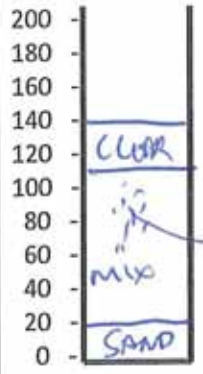
y (mm)	Description
1245	
1237	
20	

Comments:

CB12

Date/Time: 27/11/14 16:40

Turbidity: <250 NTU/depth



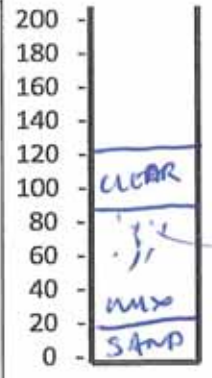
y (mm)	Description
1240	
1235	
	air bubbles
20	

Comments:

CB13

Date/Time: 28/11/14 07:30

Turbidity: <250 NTU/depth



y (mm)	Description
1235 ~~1235~~	
1223	
	large amount of air bubbles
20	

Comments:

CB14

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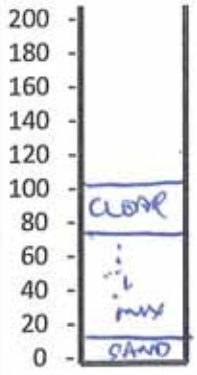
Personnel: S. MILLER **Page** 5 of ____

Test Number: 1B	**Test Started:** 26/11/14 13:05
Material Type: CLAY	**Test Type:** ☐ Settlement Only ☐ TSS-Turbidity
Dredge Location: COMMON	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

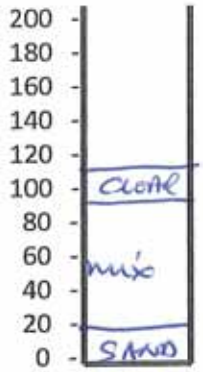
Date/Time: 28/11/14 12:45
Turbidity: <250 NTU/depth



y (mm)	Description
1228	
1219	
20	

Comments: no tss taken. CB15

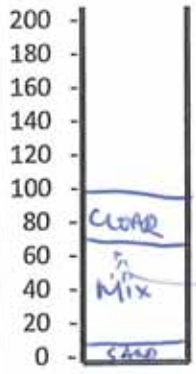
Date/Time: 28/11/14 15:40
Turbidity: <250 NTU/depth



y (mm)	Description
1228	
1217	
20	

Comments: CB15

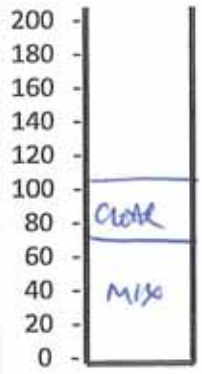
Date/Time: 01/12/14 07:15
Turbidity: 15 NTU NTU/depth



y (mm)	Description
1223	
1186	air bubbles still present.

Comments: CB16

Date/Time: 1/12/14 11:30
Turbidity: 10 NTU NTU/depth



y (mm)	Description
1219	
1184	

Comments: CB17

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Personnel: S. MILLER **Page** 6 of ____

Test Number: 1B	**Test Started:**
Material Type: CLAY	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ ~~TSS~~-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 1/12/14 15:00
Turbidity: 9NTU NTU/depth

y (mm)	Description
1217	CLEAR
1182	MIX

Comments:
CB18

Date/Time: 1/12/14 17:00
Turbidity: 80NTU NTU/depth

y (mm)	Description
1208	CLEAR
1182	MIX

Comments:
NO TSS

Date/Time: 02 Dec 14 0920
Turbidity: 10 NTU NTU/depth

y (mm)	Description
1207	CLEAR
1178	MIX

Comments:
No TSS

Date/Time: _____
Turbidity: _____ NTU/depth

y (mm)	Description

Comments:

APPENDIX I
TSS-Turbidity Test Sheets – Silty/Clayey Sands

Table I1: Turbidity measurements and sampling information – silty/clayey sands (Dilution Test)

Test Material	Turbidity (NTU)	TSS Sample ID	Date / Time
Seawater	3.6	SC-1	2 Dec 2014 /0950
Seawater + Sand Mixture	18.3	SC-2	2 Dec 2014 /1000
Seawater + Sand Mixture	39.7	SC-3	2 Dec 2014 /1005
Seawater + Sand Mixture	48.1	SC-4	2 Dec 2014 /1010
Seawater + Sand Mixture	68.6	SC-5	2 Dec 2014 /1015
Seawater + Sand Mixture	83.2	SC-6	2 Dec 2014 /1020
Seawater + Sand Mixture	99.4	SC-7	2 Dec 2014 /1025
Seawater + Sand Mixture	110	SC-8	2 Dec 2014 /1030
Seawater + Sand Mixture	124.8	SC-9	2 Dec 2014 /1035
Seawater + Sand Mixture	133.2	SC-10	2 Dec 2014 /1040
Seawater + Sand Mixture	154.9	SC-11	2 Dec 2014 /1045

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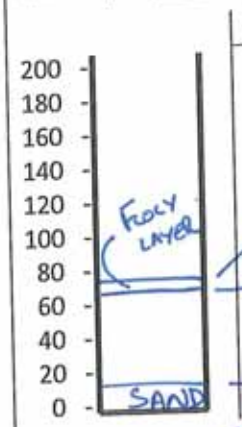
Personnel: JAMES D + SIMON M **Page** 1 of ____

Test Number: 2B	**Test Started:** 0924 26 NOV 14
Material Type: SAND	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: COMMON	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

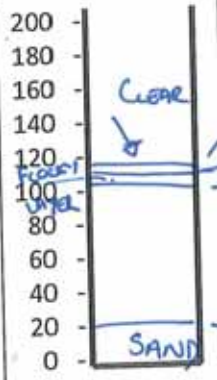
Date/Time: 26 NOV 14 924
Turbidity: <250 NTU NTU/depth



y (mm) | Description
658mm @ 0min
652 mm @ 3min
74mm @ 0min
77mm @ 1min
80 mm @ 3min
84mm @ 4min

Comments:
TSS - SB1

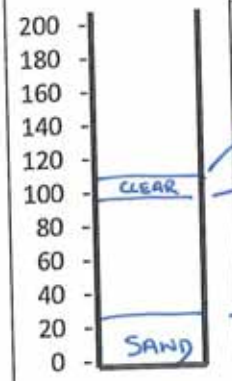
Date/Time: 26 NOV 14 924
Turbidity: <250 NTU NTU/depth



y (mm) | Description
657mm @ 5min
657mm @ 5min
656 mm @ 6min
651mm @ 5min
90mm @ 5min
96mm @ 6min
100mm @ 7min
104mm @ 8min

Comments:

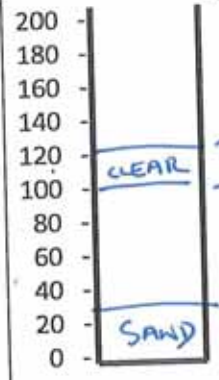
Date/Time: 26 NOV 14 924
Turbidity: <250 NTU NTU/depth



y (mm) | Description
657mm @ 10min
654 mm @ 10min
110mm @ 10min

Comments:
TSS - SB2

Date/Time: 26 NOV 14 - 0940
Turbidity: <250 NTU NTU/depth



y (mm) | Description
655mm
650mm
724 mm

Comments:
TSS - SB3

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Personnel: JAMES D & SIMON M **Page** 2 of ____

Test Number: 2B	**Test Started:** 0924 26 NOV 14
Material Type: SAND	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 NOV 14 0950
Turbidity: <250 NTU NTU/depth

y (mm)	Description
650 mm	
646 mm	
134 mm	SAND

Comments:
TSS - SB4

Date/Time: 26 NOV 14 10:00
Turbidity: < 250 NTU NTU/depth

y (mm)	Description
645 mm	CLEAR
640 mm	
139 mm	SAND

Comments:
TSS - SB5

Date/Time: 26 NOV 14 1010
Turbidity: <250 NTU NTU/depth

y (mm)	Description
643 mm	CLEAR
638 mm	
	MIX
143 mm	SAND

Comments:
TSS - SB6

Date/Time: 26 NOV 14 1030
Turbidity: <250 NTU NTU/depth

y (mm)	Description
639	CLEAR
631	
	MIX
152	SAND

Comments:
NO TSS SAMPLE

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Personnel: JAMES D + SIMON M **Page** 3 of ____

Test Number: 2B	**Test Started:** 0924 26 Nov 14
Material Type: SAND	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 Nov 14 1040
Turbidity: <250 NTU NTU/depth

y (mm)	Description
638	CLEAR
627	MIX
153	SAND

Comments:
TSS - SB7

Date/Time: 26 Nov 14 1110
Turbidity: <250 NTU NTU/depth

y (mm)	Description
634	CLEAR
620	MIX
158 mm	SAND

Comments:
TSS - SB8

Date/Time: 26 Nov 14 1150
Turbidity: <250 NTU NTU/depth

y (mm)	Description
630 mm	CLEAR
610 mm	MIX
160 mm	SAND

Comments:
No TSS

Date/Time: 26 Nov 14 1210
Turbidity: 230 NTU NTU/depth

y (mm)	Description
630 mm	CLEAR
604 mm	MIX
160 mm	SAND

Comments:
TSS - SB9

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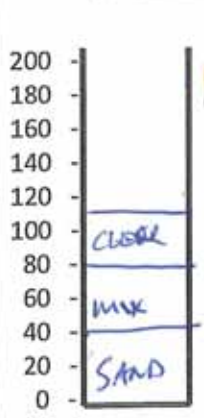
Personnel: JAMES D + SIMON M **Page** 4 of ____

Test Number: 2B	**Test Started:** 09:24 26/11/14
Material Type: SAND	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☐ ~~TSS~~-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

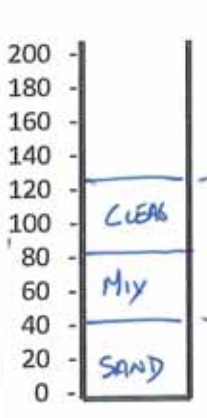
Date/Time: 26/11/14 12:50
Turbidity: _____ NTU/depth



y (mm)	Description
625	
596	
160	

Comments:

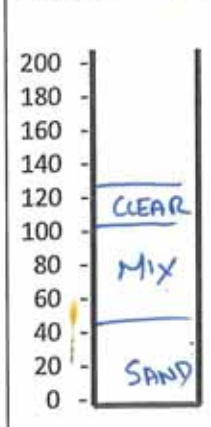
Date/Time: 26/11/14 13:10
Turbidity: 65 NTU NTU/depth



y (mm)	Description
625	
591	
160	

Comments:
TSS – SB10

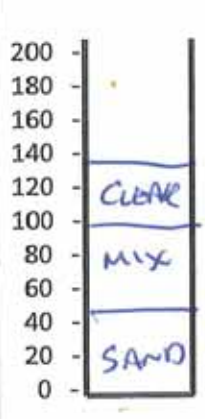
Date/Time: 26 Nov 14 14:10
Turbidity: 100 NTU NTU/depth



y (mm)	Description
620	
578	
160	

Comments:
TSS – SB11

Date/Time: 26/11/14 14:40
Turbidity: 90 NTU @3cm. NTU/depth



y (mm)	Description
614	
573	
160	

Comments:

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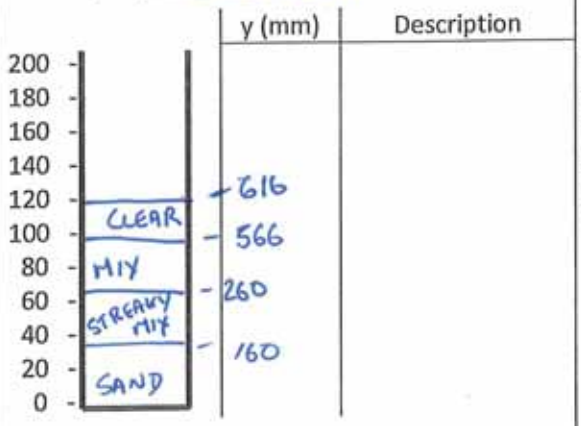
Personnel: JAMES. D + SIMON M **Page** 5 of ____

Test Number: 2B	**Test Started:** 26 Nov 14 0924
Material Type: SAND	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: COMMON	

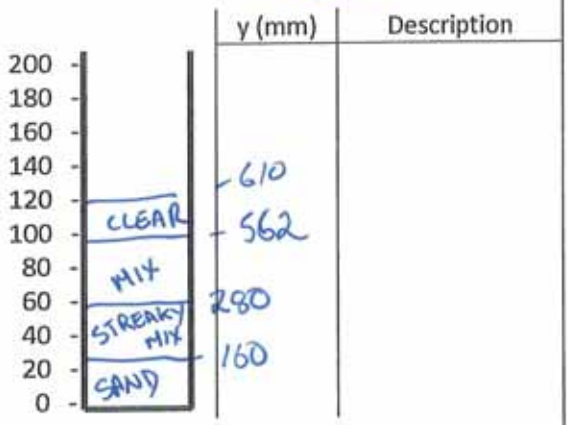
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 Nov 14 15:10
Turbidity: 89 NTU @ 1cm DEPTH NTU/depth



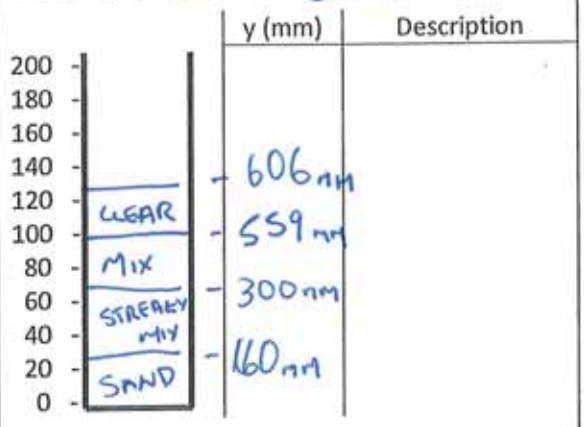
Comments:
TSS - SB12

Date/Time: 26 Nov 14 1540
Turbidity: 74 NTU @ 1cm NTU/depth



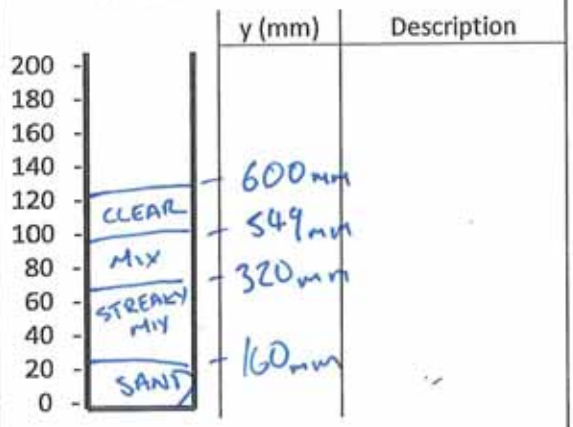
Comments:
TSS - SB13

Date/Time: 26 Nov 14 1610
Turbidity: 65 NTU @ 1cm NTU/depth



Comments:
TSS - SB14

Date/Time: 26 Nov 14 17:00
Turbidity: _____ NTU/depth



Comments:
TSS - SB15

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Personnel: SIMON M

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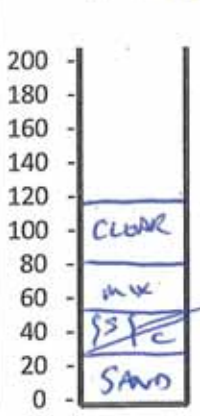
Test Number: 2B	**Test Started:** 26/11/14 09:24
Material Type: SAND	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: COMMON	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

SB16

Date/Time: 27/11/14 07:00

Turbidity: 10.8 NTU NTU/depth



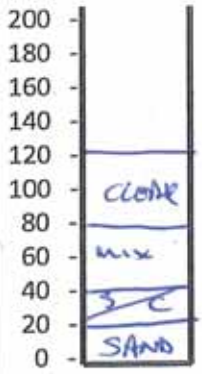
y (mm)	Description
594	
426	
320	noticeable lines.
160	

Comments:

SB17

Date/Time: 27/11/14 10:00

Turbidity: 9.2 NTU NTU/depth



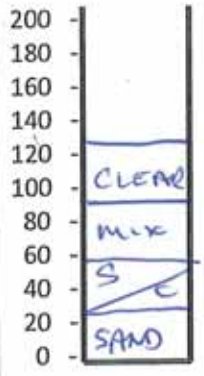
y (mm)	Description
586	
420	
340	
160	

Comments:

SB18

Date/Time: 27/11/14 13:00

Turbidity: 8.5 NTU NTU/depth



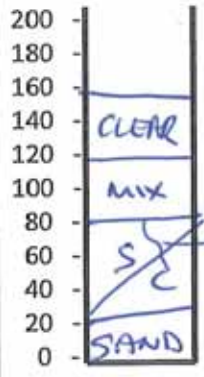
y (mm)	Description
580	
415	
350	
160	

Comments:

SB19

Date/Time: 27/11/14 15:00

Turbidity: 23 NTU NTU/depth



y (mm)	Description
578	
413	
350	air bubble path observed.
160	

Comments:

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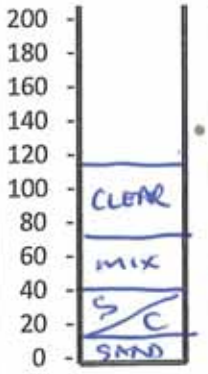
Personnel: SIMON. M **Page** 7 of ____

Test Number: 2B	**Test Started:**
Material Type: SAND	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

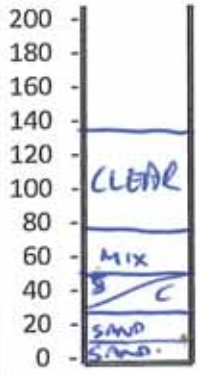
Date/Time: 27/11/14 16:40
Turbidity: 16 NTU NTU/depth



y (mm)	Description
574	
411	
360	
160	

Comments:
SB20

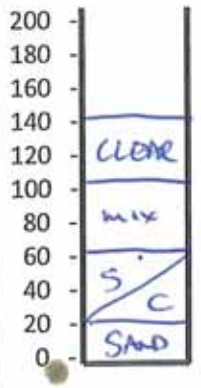
Date/Time: 28/11/14 07:35
Turbidity: 8.5 NTU @ 50M NTU/depth



y (mm)	Description
569	
391	
345	
155	
20	

Comments:
SB 21

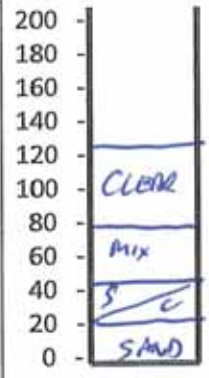
Date/Time: 28/11/14 09:55
Turbidity: 6.8 NTU NTU/depth



y (mm)	Description
563	
386	
346	
160	

Comments:
SB22

Date/Time: 28/11/14 12:50
Turbidity: 6.7 NTU NTU/depth



y (mm)	Description
557	
386	
340	
160	

Comments:
SB 23

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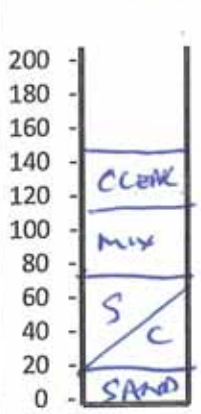
Personnel: S. MILLER **Page** 8 of ____

Test Number: 2B	**Test Started:** 26/11/14 09:24
Material Type: SAND	**Test Type:** ☐ Settlement Only
Dredge Location: COMMEN	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 28/11/14 15.35
Turbidity: 6.32 NTU NTU/depth

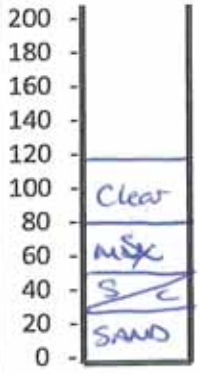


y (mm)	Description
551	
383	
340	
160	

Comments:

SB24

Date/Time: 01/12/14 07:10
Turbidity: 1.75 NTU NTU/depth

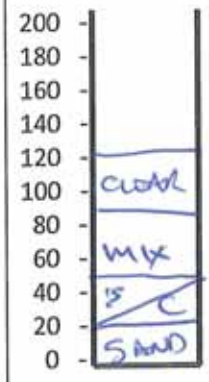


y (mm)	Description
545	well graded
344	
300	
150	

Comments:

SB25

Date/Time: 1/12/14 11:30
Turbidity: 1 NTU NTU/depth

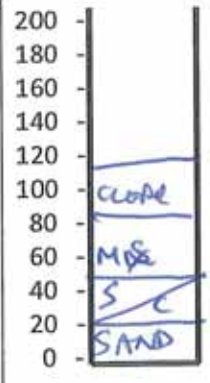


y (mm)	Description
535	
343	
300	
160	

Comments:

SB26

Date/Time: 1/12/14 15:00
Turbidity: 1 NTU NTU/depth



y (mm)	Description
528	
341	
300	
160	

Comments:

SB27

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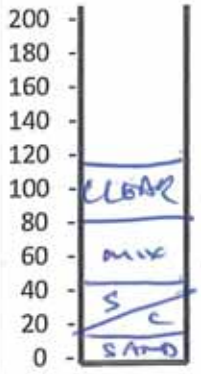
Personnel: S. MILLER **Page** 9 of ____

Test Number: 2B	**Test Started:**
Material Type: SAND	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 1/12/14 17:00

Turbidity: 7·0 NTU/depth



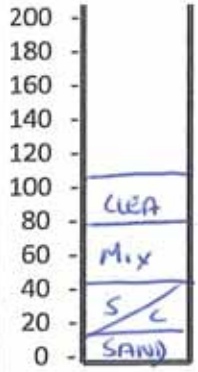
y (mm)	Description
527	
339	
300	
150	

Comments:

SB28

Date/Time: 2/12/14 0900

Turbidity: 7·00 NTU/depth

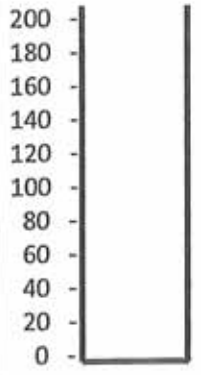


y (mm)	Description
523	
337	
300	
150	

Comments:

Date/Time: ____

Turbidity: ____ NTU/depth

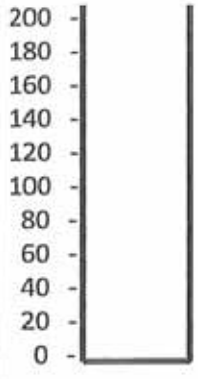


y (mm)	Description

Comments:

Date/Time: ____

Turbidity: ____ NTU/depth



y (mm)	Description

Comments:

APPENDIX J
TSS-Turbidity Test Sheets – Soft Silty Clays

Table J1: Turbidity measurements and sampling information – soft silty clays (Dilution Test)

Test Material	Turbidity (NTU)	TSS Sample	Date / Time
Seawater	3.6	No Sample - See Sample SC-1	2 Dec 2014 /1320
Seawater + Mud Mixture	17.3	MC-1	2 Dec 2014 /1330
Seawater + Mud Mixture	25.2	MC-2	2 Dec 2014 /1334
Seawater + Mud Mixture	36.4	MC-3	2 Dec 2014 /1336
Seawater + Mud Mixture	44.5	MC-4	2 Dec 2014 /1339
Seawater + Mud Mixture	59.8	MC-5	2 Dec 2014 /1342
Seawater + Mud Mixture	80.4	MC-6	2 Dec 2014 /1346
Seawater + Mud Mixture	91	MC-7	2 Dec 2014 /1350
Seawater + Mud Mixture	102.6	MC-8	2 Dec 2014 /1353
Seawater + Mud Mixture	118.9	MC-9	2 Dec 2014 /1357
Seawater + Mud Mixture	140	MC-10	2 Dec 2014 /1400
Seawater + Mud Mixture	153.7	MC-11	2 Dec 2014 /1402

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Personnel: SIMON M, JAMES D **Page** 1 of ____

Test Number: 3B	**Test Started:** 26 NOV 14 1020
Material Type: MUD	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: COMMON	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 NOV 14 1020
Turbidity: < 250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100		
80	525 MM	
60		
40		
20		
0		

Comments:
TSS- MB1

Date/Time: 26 NOV 14 1030
Turbidity: < 250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140	CLEAR	
120		
100	526MM	
80	524 MM	
60		
40		
20		
0		

Comments:

Date/Time: 26 NOV 14 1035
Turbidity: < 250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100	521 MM	
80	520 MM	
60		
40		
20		
0		

Comments:
TSS - MB2

Date/Time: 26 NOV 14 1050
Turbidity: < 250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100	516 MM	
80	515 MM	
60		
40		
20		
0		

Comments:
TSS - MB3

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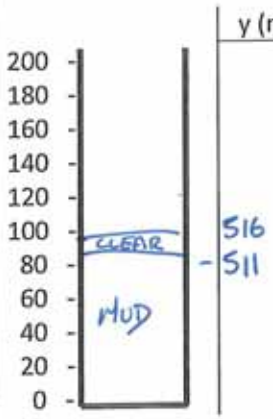
Personnel: Simon M, James D **Page** 2 of ____

Test Number: 3B	**Test Started:** 26/Nov/14 1020
Material Type: Mud	**Test Type:** ☐ Settlement Only
Dredge Location:	☑ TSS-Turbidity

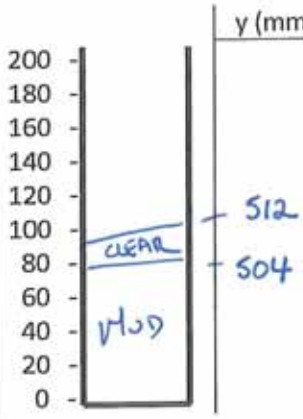
Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 Nov 14 1120
Turbidity: _____ NTU/depth



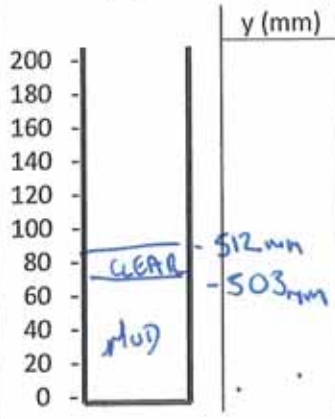
Comments:
TSS - MB4

Date/Time: 26 Nov 14 1150
Turbidity: _____ NTU/depth



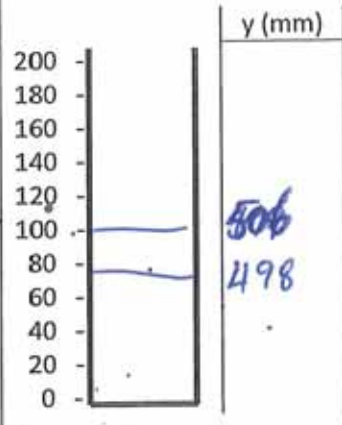
Comments:
No TSS

Date/Time: 26 Nov 14 1120
Turbidity: <250 NTU NTU/depth



Comments:
TSS - MB5

Date/Time: 26 Nov 14 12:50
Turbidity: <250 NTU NTU/depth



Comments:

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Personnel: SIMON M + JAMES D **Page** 3 of ____

Test Number: 3B	**Test Started:** 26 NOV 14 10:20
Material Type: MUD	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 NOV 14 13:15
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100		
80	507 mm	CLEAR
60		
40	497 mm	MUD
20		
0		

Comments:
TSS - MB6

Date/Time: 26 NOV 14 14:10
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100		
80		
60	504	CLEAR
40	493	MUD
20		
0		

Comments:
TSS - MB7

Date/Time: 26/11/14 14.45
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140	498	CLEAR
120		
100	490	MUD
80		
60		
40		
20		
0		

Comments:

Date/Time: 26 NOV 14 15:15
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120	498	CLEAR
100	489	MUD
80		
60		
40		
20		
0		

Comments:
TSS - MB 8

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Personnel: Simon M + James D

Page 4 of ____

Test Number: 3B	**Test Started:** 26 Nov 14 1020
Material Type: Mud	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: Common	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 26 Nov 14 15:45
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120	493	
100 CLEAR		
80	487	
60		
40 Mix		
20		
0		

Comments:

Date/Time: 26 Nov 14 16:15
Turbidity: <250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100 CLEAR	494	
80	486	
60 Mix		
40		
20		
0		

Comments:
TSS - MB10

Date/Time: 26 Nov 14 17:00
Turbidity: 2250 NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100		
80 CLEAR	489 mm	
60	482 mm	
40 Mix		
20		
0		

Comments:
TSS - MB 11

Date/Time: 27/11/14 7.00
Turbidity: 11.6NTU NTU/depth

	y (mm)	Description
200		
180		
160		
140		
120		
100	483	
80 CLEAR		
60	453	
40 Mix		
20		
0		

Comments:
TSS- MB12

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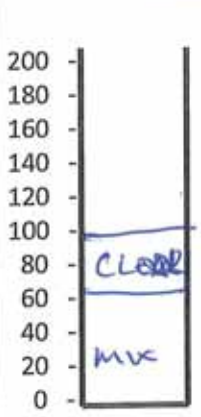
Personnel: S. MILLER **Page** 5 of ____

Test Number: 3B	**Test Started:** 26/11/14 10:20
Material Type: MUD	**Test Type:** ☐ Settlement Only ☑ TSS-Turbidity
Dredge Location: COMMON	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

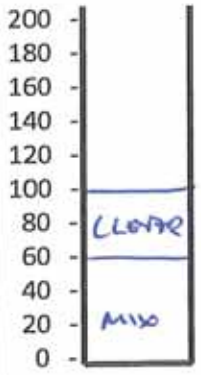
Date/Time: 27/11/14 10:00
Turbidity: 80NTU. NTU/depth



y (mm)	Description
477	
446	

Comments:
MB13

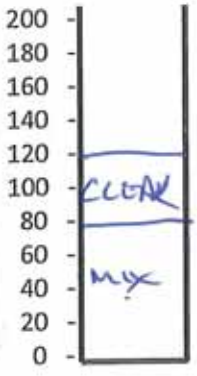
Date/Time: 27/11/14 13:00
Turbidity: 38NTU NTU/depth



y (mm)	Description
467	
444	

Comments:
MB14

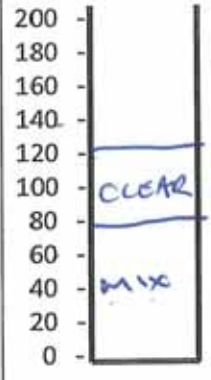
Date/Time: 27/11/14 15:00.
Turbidity: 42NTU NTU/depth



y (mm)	Description
465	
443	

Comments:
MB15

Date/Time: 27/11/14 16:30
Turbidity: 32NTU NTU/depth



y (mm)	Description
464	
443	

Comments:
MB16

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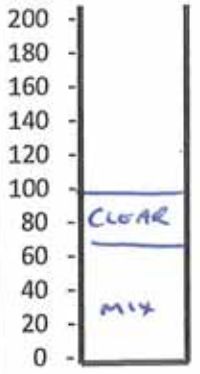
Personnel: S. MILLER **Page** 6 of ____

Test Number: 3B	**Test Started:** 26/11/14 10:20
Material Type: MUD	**Test Type:** ☐ Settlement Only ☑ ~~TSS~~-Turbidity
Dredge Location: COMMON	

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

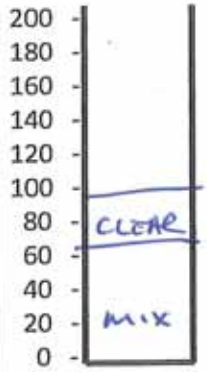
Date/Time: 28/11/14 07:30
Turbidity: 20.8NTU NTU/depth



y (mm)	Description
455	
428	

Comments:
MB17

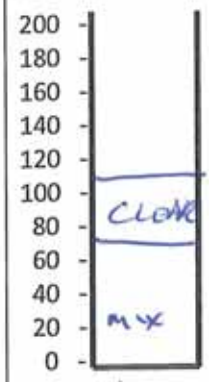
Date/Time: 28/11/14 09:50
Turbidity: 29.2 NTU NTU/depth



y (mm)	Description
451	
426	

Comments:
MB19

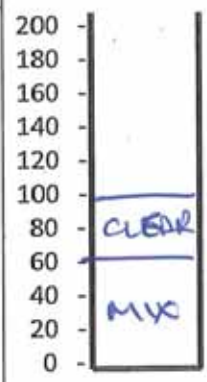
Date/Time: 28/11/14 12:55
Turbidity: 24.8NTU. NTU/depth



y (mm)	Description
446	
424	

Comments:
MB20

Date/Time: 28/11/14 15:30
Turbidity: 22NTU NTU/depth



y (mm)	Description
442	
422	

Comments:
MB21

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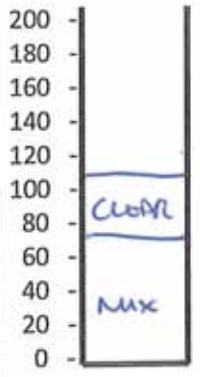
Personnel: S, MILLER **Page** 7 of ____

Test Number: 3B	**Test Started:**
Material Type: MUD	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

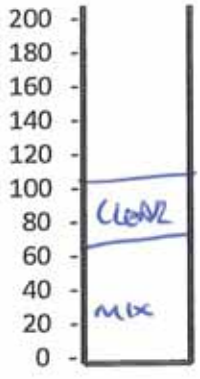
Date/Time: 01/12/14 07:20
Turbidity: 2.5NTU NTU/depth



y (mm)	Description
437	
~~487~~	
383	

Comments:
MB22

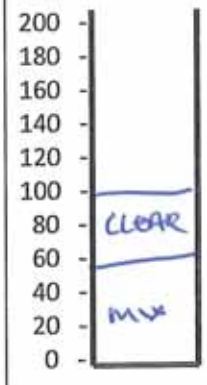
Date/Time: 01/12/14 11:30
Turbidity: 1.5NTU NTU/depth



y (mm)	Description
433	
~~493~~	
381	

Comments:
MB23

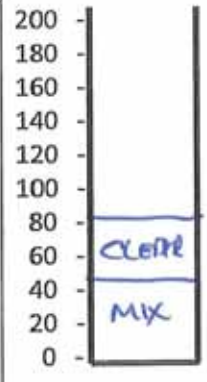
Date/Time: 01/12/14 15:00
Turbidity: LNTU NTU/depth



y (mm)	Description
422	
379	

Comments:
MB 24

Date/Time: 01/12/14 17:00
Turbidity: 4.5 NTU/depth



y (mm)	Description
421	
379.	

Comments:
MB25

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Personnel: J DONALD, S MILLER

Test Number: 35	**Test Started:** 26 Nov 14
Material Type: MUD	**Test Type:** ☐ Settlement Only
Dredge Location: COMMON	☑ TSS-Turbidity

Observations: (e.g. settlement layer depths, turbidity in supernatant etc

Date/Time: 2 DEC 14

Turbidity: 1 NTU NTU/depth

Scale	y (mm)	Description
200		
180		
160		
140		
120		
100 (CLEAR)	418	
80		
60	376	
40 (MIX)		
20		
0		

Comments:

NO SAMPLE

Date/Time: ____________

Turbidity: ____________ NTU/depth

Scale	y (mm)	Description
200		
180		
160		
140		
120		
100		
80		
60		
40		
20		
0		

Comments:

Date/Time: ____________

Turbidity: ____________ NTU/depth

Scale	y (mm)	Description
200		
180		
160		
140		
120		
100		
80		
60		
40		
20		
0		

Comments:

Date/Time: ____________

Turbidity: ____________ NTU/depth

Scale	y (mm)	Description
200		
180		
160		
140		
120		
100		
80		
60		
40		
20		
0		

Comments:

APPENDIX K
TSS-Turbidity Test Sheets – 'Representative' Sand/Clay Material

Table K1: Turbidity measurements and sampling information – 'representative' sand/clay material (Dilution Test)

Test Material	Turbidity (NTU)	TSS Sample
Seawater	3.6	No Sample - See Sample SC-1
Seawater + sand/clay Mixture	10.7	SSC-1
Seawater + sand/clay Mixture	14.5	SSC -2
Seawater + sand/clay Mixture	23	SSC -3
Seawater + sand/clay Mixture	32	SSC -4
Seawater + sand/clay Mixture	44	SSC -5
Seawater + sand/clay Mixture	64	SSC -6
Seawater + sand/clay Mixture	83	SSC -7
Seawater + sand/clay Mixture	104	SSC -8
Seawater + sand/clay Mixture	130	SSC -9
Seawater + sand/clay Mixture	156	SSC -10
Seawater + sand/clay Mixture	185	SSC -11
Seawater + sand/clay Mixture	216	SSC -12
Seawater + sand/clay Mixture	248	SSC -13