



**REPORT FOR CONTRACT 2016 0083
Kopeopeo Canal Remediation Project - Dredging Trial**



**Bay of Plenty Regional Council
October 2015**

Executive Summary

EnviroWaste Services Ltd completed the sediment dredging and dewatering trial at Kopeopeo Canal for the Bay of Plenty Regional Council over the period 28th September to 5th October 2015.

The purpose of the trial was to:

1. Demonstrate that sediments can be effectively removed from within the dredge zone,
2. Demonstrate that the dredge method does not generate significant increases in turbidity outside the trial dredge area,
3. Demonstrate the water treatment method does not result in contaminants discharging from the Geotubes[®] at concentrations that may require further treatment prior to discharge back to the canal,
4. Demonstrate that the trial does not result in any non-compliance with the trial resource consent conditions, and
5. Enable the public and key stakeholders access to view and understand the trial operations through site tours.

The trial was anticipated to be completed over 3 days, however with a large volume of public and key stakeholders visiting the site during the open day(s) operational activities were restricted due to health and safety risks. In the end, the trial ran for 6 days, with the first day being establishment and commissioning, the next 3 being open day tours with sporadic operations, and the final 2 days being used for continuous trial activities.

During the trial period, we removed an estimated 360m³ of sediment and water (20 batches of 18m³ per batch) with an average dry solids content of 3.2%w/w (as measured by Ixom's moisture balance), which equates to 11.6 tonnes dry solids (i.e. 100% dry sediment).

We have not seen any turbidity test results so cannot make any comment about the monitoring associated with the dredging trial. We note there were a number of non-dredging related activities that did generate turbidity within the dredge zone which would have contributed to the actual turbidity test results. These included turbid stormwater discharging from the bunded area prior to dredging as a result of clay contaminated river rock from Waiotahi being used as the drainage material, stormwater and filtrate layflat discharge pipes slapping the clay canal bank during low tide creating turbidity, and filtrate returning into the dredge zone at low tide with minimal freeboard which created agitation of the base of the canal. The sediment curtain lifted at the base of the canal during high tidal discharge flows (outgoing tide) and stirred up the sediments also.

Other than the test results from one sample taken by Opus, we haven't seen any filtrate water quality test results. The one set of test results seen showed nil (0.00mg/L) total suspended solids (TSS) present, and a turbidity of 7.5NTU which indicates an excellent water quality returned to the canal. We did not undertake any chemical analysis of the filtrate water to establish the presence or absence of any contaminants.

BOPRC compliance staff visited the site regularly, and did not report any non-compliance issues.

Over 50 visitors attended the open day, and were given a detailed explanation and tour of the operations.

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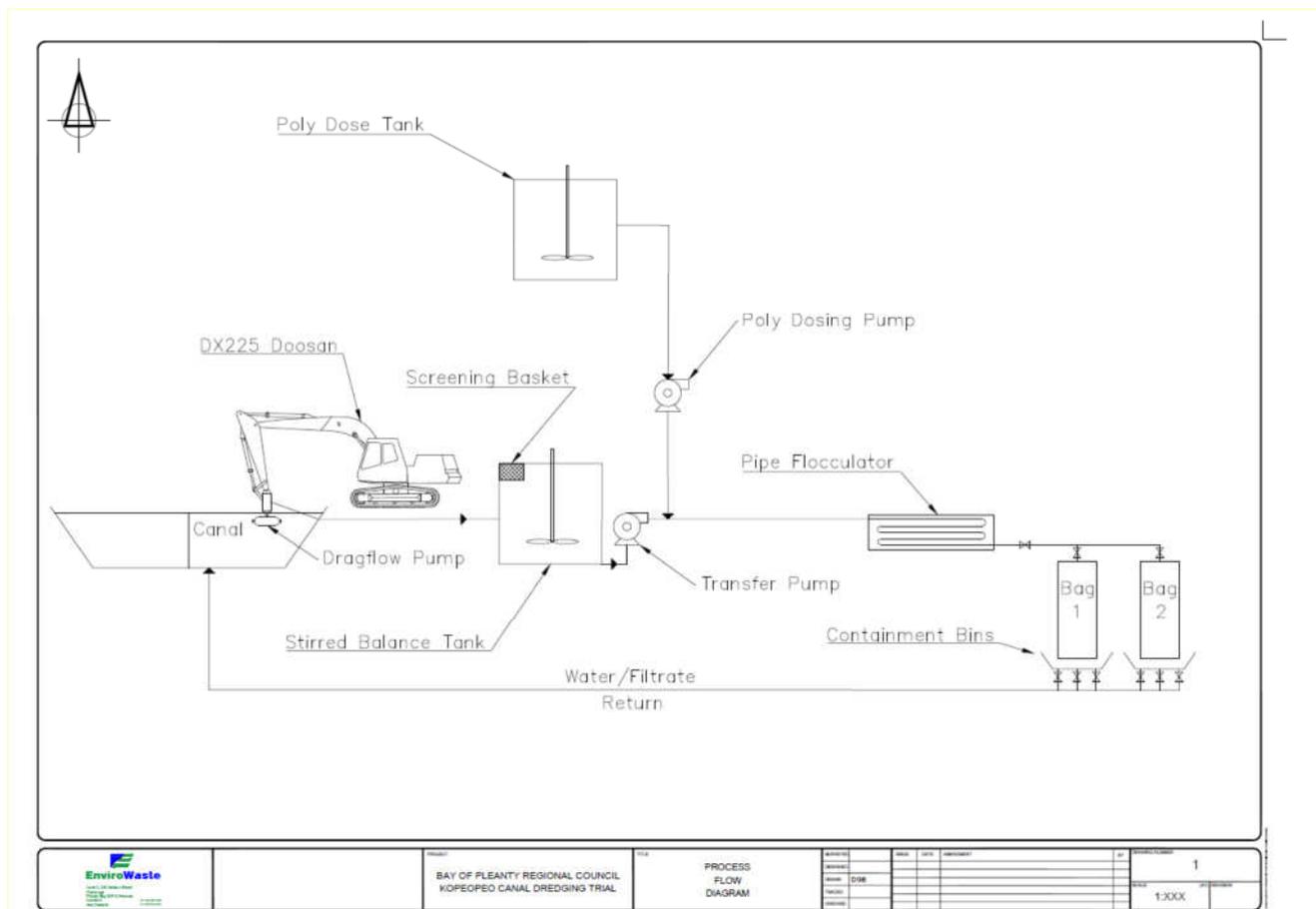
1 Overview

The dredging trial undertaken at Kopeopeo Canal followed the methodology specified in the RFP, and as per the Process Flow Diagram below.

In simplistic terms, a high volume sludge/sediment hydraulic pump was attached to a 22t excavator which was positioned on the bank of the Kopeopeo Canal. Sediment was removed from the canal, and pumped into a balance tank. The sediment/water was pumped through a 5mm static basket screen where the screenings were checked by the Cultural Monitor for kōiwi and taonga.

The sediment in the balance tank was tested for dry solids content (to determine the total amount of dry sediment per batch). Each batch was dosed with approximately 12.5kg lime (calcium carbonate as Aglime), and 40L of fungi inoculated woodchip. Each batch was pumped into one of 2 Geotube® bags with Crystalfloc B400 Series flocculant added prior to a static mixer, and then into the Geotube® bags.

The filtrate from the Geotube® bags drained from the bags through partitioned drainage media in the containment bins, and then directed back into the dredge zone.



Various parameters were measured and recorded by Envirowaste and associated contract personnel during the trial, including solids content, volume, pH, and a significant amount of monitoring was conducted to determine the potential effects of dredging and filtrate discharged on the turbidity of the water in the canal. Opus monitored the water quality independent of our operations. We simply monitored operational aspects and data for our portion of works, which are discussed in the following sections.

2 Health & Safety

A full Site Specific Safety Plan, and Hazard Register was completed for the trial. These are not included in this report.

All personnel involved in the trial were fully inducted, including any Bay of Plenty Regional Council staff, and contractors engaged by the Council.

All visitors to the site were inducted prior to any site tours, and details of those inducted have been recorded and retained.

There were no accidents or injuries on site during the trial.

3 Cultural Aspects

A karakia was conducted on the morning of 28th September 2015 by Ngāti Awa, blessing the site, the operations, and all those involved in the trial.

A Cultural Monitor, Eula Toko, was on site for the duration of the trial, observing operations, and inspecting the material screened out of the canal sediment for kōiwi and taonga. No kōiwi or taonga was discovered during the course of the trial.

4 Public Awareness

Members of the local community were given an opportunity to visit the site and view the operations on Wednesday 30th September. Over 50 visitors came, and were given a guided tour of the operations across the course of the day.

During the visit, the dredging and water treatment process was explained, and the visitors were shown all aspects of the operation including viewing of the screening process and the balance tank, the flocculation process (including a visual demonstration by Ixom and EnviroWaste personnel), and viewing into the Geotube[®] bag dewatering containers.

Whakatane District and Bay of Plenty Regional Councillors were also given a tour of the operations, as was the Bay of Plenty Regional Council consents and compliance team, plus a number of operational personnel from various departments with the local District, and regional Council.

5 Resource Consent Compliance

Throughout the trial, there were a number of visits by the Bay of Plenty Regional Council resource consent compliance officer.

To our knowledge, there were no non-compliance issues related to the trial or any operational aspects of the project.

Six Consents and Compliance Field Sheets can be found in Appendix I of this report confirming this.

6 Sediment Removal

The methodology employed during the trial utilised a specialised high volume solids handling pump to remove sediment from the canal. The pump has the capacity to remove sediment/water at 250m³/hr operating at 3,625 psi.

With the restricted Geotube[®] bag sizes, and orientation in the containment bins, we operated at very conservative pressure of between 2100 – 2400 psi. This operating pressure resulted in an average sediment/water removal rate of between 180-200m³/hr.

As part of the trial, we also took the opportunity to introduce lime and also test the transfer of woodchip into the geobags during the dredging process. Approximately 1m³ of fungi inoculated woodchip was successfully introduced into the Geotube[®] bags with the sediment by this pump methodology.

The lime and woodchip had to be introduced at specified ratios dependent on the amount of dry solids in the sediment removed from the canal. Without any in-line dry solids measuring equipment on site, it was decided that a batch treatment process would be used to provide optimum results.

In total, we transferred 20 batches (approximately 18.6m³ per batch) of sediment/water into the two 6.5m circumference x 6.7m long Geotube[®] bags – approximately 360m³ of sediment/water. These batches of sediment were tested using the Ixom moisture balance, and had dry solids concentrations of between 1.81%w/w (weight/weight) and 6.85%w/w. The average dry solids concentration over the 20 batches was 3.22% - i.e. for every tonne of sediment/water pumped into the Geotube[®] bags, there is 32.2kg of purely dry product (powdered sediment). Therefore, we transferred a total of 11.61 tonnes of 100% dry solid sediment into the Geotube[®] bags. We refer to this as dry tonnes solid (DTS).

In terms of volume of in-situ sediment removed, this is difficult to assess as we don't know the in-situ dry solids composition of the sediment removed. We estimate that we have removed between 18-20m³ of sediment, including the screenings which were separated by the basket screen, and returned to the canal during disestablishing the site.

Following the dewatering process, in other words, as the water drains out of the Geotube[®] bags, we would anticipate the solids content to increase from 3.22%w/w up to, at the very least, 20-25%w/w – or 200-250kg of sediment, and 750-800kg of retained moisture or water.

We have recently completed a similar project where the solids concentration after 5 weeks of dewatering has increased from 2.83%w/w to an average of 32.91%w/w for the 6 samples taken across the length of the 2 x 30m long Geotube[®] bags.

As discussed in the introduction, a Crystalfloc B400 Series flocculant was used to enable the solids to efficiently settle/separate from the water. Over the course of the trial 47kg of flocculant was used to process the 11.61 tonnes of dry solids. This equates to 4.04kg/DTS polymer use. This is at the upper end of the dose rates for flocculant, and it is envisaged that with larger volumes and continuous processing that this dose rate will drop slightly.

7 Turbidity Management

During the trial, a number of operational techniques were tested to visually assess turbidity generation in the dredge zone.

As seen in the cover page photo, the sediment curtain contained the vast majority of any turbid water that was generated during the project. The cover photo was taken on the 30th September 2015, at which point we were still commissioning and trialling various dredging techniques, which is discussed in more detail below.

Initially the pump was operated at an idle speed (2100 psi). The pump was primed at idle in the water fraction, and then lowered into the sediment. While the pump was above the sediment, a “cloud” of turbidity appeared around the dredge head. We believe this is due to the draw of water across the top of the sediment – in particular the lighter top fraction of the sediment, which effectively created a turbulent flow across the surface prior to lowering the dredge head into the sediment. Once the dredge head was in the sediment, the turbid “cloud” remained, but didn’t appear to increase in size.

We then increased the speed of the pump (2300 psi), and using the same “prime then submerge technique”, noticed an increase in turbidity generation prior to lowering into the sediment. However once lowered into the sediment, the turbidity plume within the sediment curtain did not get any larger, but in fact appeared to decrease – as the turbid water was pulled into the pump head.

The operational breakthrough was when we left the dredge head in the sediment following one transfer, and slowed the speed of the pump before switching off – where the dredging technician noticed no plume was generated following the shutdown. We left the dredge head in the sediment, and then commenced the next batch with the head in the sediment, and started on idle briefly, before increasing the speed to 2400 psi. During this period it was visibly noticeable that the small plume generated on start-up, quickly decreased once the pump speed was increased. The higher pump speed created a “negative flow environment” pulling turbidity into the pump head with only minimal agitation and turbidity generation. This technique was employed for the remainder of the project, and the dredge operator was able to effectively manage/control turbidity generation within the dredge zone.

A number of other factors resulted in an increase in turbidity within the dredge zone.

Initially the rainwater that was contained within lined bunded area where the processing equipment was placed had to be discharged back inside the sediment curtain once the monitoring equipment was in place. The river stone sourced by Waiotahi Contactors was not washed, and clearly contained some clay fines, which when initially discharged back to the canal, created an increase in turbidity inside the dredge zone (refer photos below). This was not an operational issue, but is certainly a key learning for the full scale project. Any drainage media used for the large scale bag dewatering project must be clean and washed river stone, or some other inert/clean media.



Figure 1 – Turbid Stormwater - Bund

The second factor contributing to turbidity in the dredge zone was the initial water testing product we used to leak/pressure test the lines and bags with. We did not use any polymer during the leak/pressure test process and as a result some sediment/turbid water was pumped into and around the bags. The residues did not floc out and stay inside the bags, and effectively stayed in the transfer pipework initially, and settled inside and outside the Geotube[®] bags on the first night. On start up the next day, and for several days following, sludge/silt accumulated on the outsides of the Geotube[®] bags, until they had filled to the point where the bags could be brushed clean. The filtrate quality would have been compromised by this, but also it created some initial turbidity until it was flushed back to the canal.

The third factor affecting turbidity was the layflat hose used to discharge the filtrate and stormwater back to the dredge zone. The layflat lay down and over the edge of the canal, and discharged into the water. While the ends of the layflat were suspended at water level using buoys (to minimise any potential of disturbance of the sediment below the water level), as the tide went out, the layflat was lying in the canal bank and sediment, and as the layflat surged with the filtrate coming out of the Geotube[®] bags, the layflat hose slapped the clay bank creating a turbidity cloud at those points. With 2 hoses continually discharging from the Geotube[®] dewatering process into the dredge zone an increase in turbidity was noticed during the trial from this, especially at low tide (see photo on the following page). We extended the length of the layflat, and secured this to the sediment curtain, as there was some turbidity being generated from the discharge of filtrate in low tide water levels. Rigid hose discharging into the centre of the canal into the surface water, rather than layflat would have eliminated this issue, however we did not have spare rigid hose on site to adapt and implement the change.



Figure 2 – Filtrate Hose Turbidity Plume

The fourth factor that resulted in an increase in turbidity, although only slightly, was during the initial stages of filling of the Geotube® bags, and from the filtrate sample drum. The Geotube® bags were 3.25m wide (6.5m circumference), and 6.7m long. The containment bin is only 2.2m wide, and 6m long. The Geotube® bags therefore needed to be folded into the bin prior to filling. The filling port into these bags is vertical – compared to larger Geotube® bags, where the filling port piping is inserted with a gooseneck to direct the sediment flow in a horizontal flow direction into the bags as opposed to vertical. As a result of the Geotube® bags being creased at the entry port, the sediment was being forced directly into the Geotube® fabric crease, at high velocity, and being forced right through. Once the Geotube® bag was inflated, and we adjusted the feed piping to take out the creases, there were no further sediment issues from the Geotube® bags. The residue on top of the bags was removed by broom from the top of the bags, and had to be discharged back into the canal, which created two issues. One – it added to the turbidity within the dredge zone, and secondly, it put silt/sediment into the filtrate sampling drum we set up for Opus to take samples from. To rectify this we had to wash the drum out, which also created a small amount of turbidity as it discharged back into the dredge zone.

We also experienced some issues during high tidal flows with the sediment curtain bellowing inwards on an outgoing tide and creating turbidity issues inside the dredging zone (refer to the photo on the following page). This was rectified by the addition of some additional heavy chain, which we cable tied to the base of the curtain. This eliminated any further turbidity generation from this source.



Figure 3 – Sediment Curtain Turbidity Plume

8 Filtrate Quality

Other than the issues reported earlier in the Turbidity Management section the quality of filtrate appeared clear with little to no turbidity noted during the trial.

We did not qualitatively monitor the quality of filtrate being discharged from the Geotube® bags or containers, as this was the responsibility of Opus, but visually checked periodically by viewing from the top of the scaffold structure, and also visually checking the filtrate sample drum.

On one occasion, we did see a result from a discharge of the filtrate that showed Total Suspended Solids (TSS) in the filtrate measured by Opus to be 0.00mg/L (i.e. 100% removal of suspended solids), and turbidity of 7.9 NTU (refer photo on the page below).

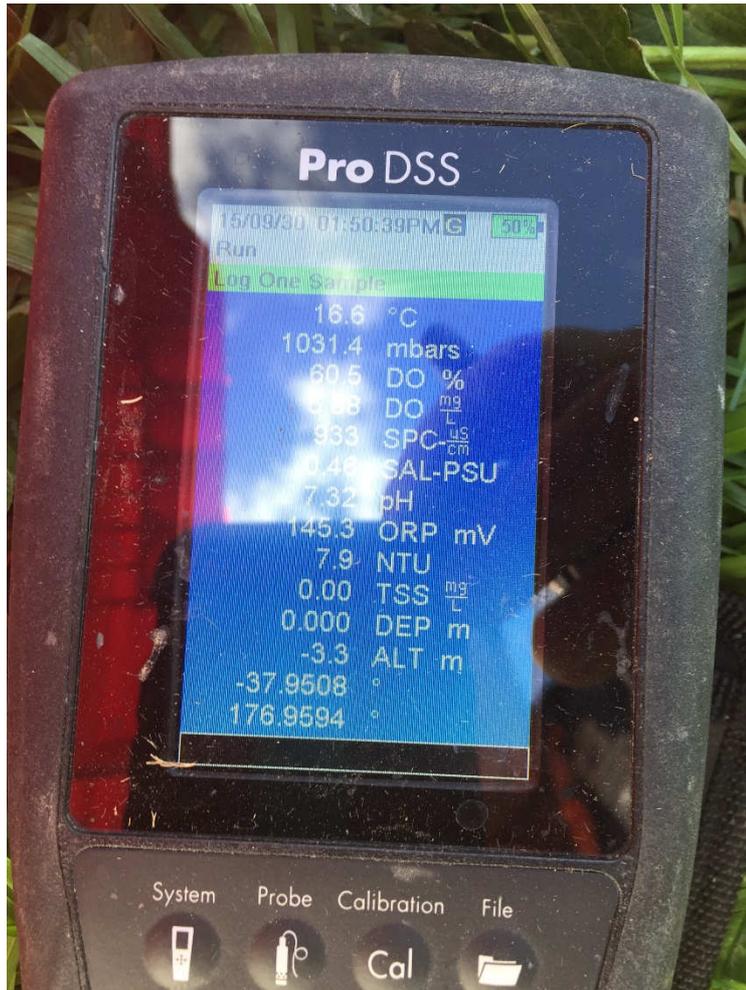


Figure 4 – Filtrate Water Quality – 30/09/15 – 13:50pm

Appendix I: Consents and Compliance Field Sheets



Bay of Plenty Regional Council

Consents and Compliance Field Sheet

Name of Property Owner or Consent Holder: BOP Regional Council

Consent Number: 68275

Site Description: Kopeopeo Canal, Whakatane

Officer: Jessica Hunter-Smith **Date of Inspection:** 24 September 2015

Contact Person(s) During Inspection: Brendon Love, Des McCleary

Reason for Inspection: Compliance

Level of Compliance: Complying

Comments:

Site Induction completed with Pete McLaren from WDC. Dredging equipment on site – agitation tank (yellow container), polymer tank, water tank and 2x geobag containers (blue containers) have been installed inside bunded area and all connected up. Heavy rainfall over night has resulted in a lot of water in the bunded area. Silt curtain has not yet been installed. Signage is to be erected at Keepa Rd entrance.

The pad for the dredging excavator is still to be constructed. The fibre optic cable in the roadway limits the construction of an access ramp to the canal edge. A pad will have to be built up for the dredge – a silt fences should installed between the pad and the canal.

2x viewing platforms for the visitor tours currently being constructed – security guards organised for site.

Works or Actions Required:

NIL

Next Monitoring Date: N/A

Next Follow Up Date: N/A

Served by: Email to Brendon.Love@boprc.govt.nz; Stephanie.Fraser@boprc.govt.nz; Des.McCleary@envirowaste.co.nz; Wayne.Plummer@envirowaste.co.nz

Name of Person(s) Field Sheet Served On:

Brendon Love, Stephanie Fraser, Des McCleary, Wayne Plummer, Pete McLaren



Bay of Plenty Regional Council

Consents and Compliance Field Sheet

Name of Property Owner or Consent Holder: BOP Regional Council

Consent Number: 68275

Site Description: Kopeopeo Canal, Whakatane

Officer: Jessica Hunter-Smith **Date of Inspection:** 28 September 2015

Contact Person(s) During Inspection: Brendon Love, Des McCleary, Wayne Plummer

Reason for Inspection: Compliance

Level of Compliance: Complying

Comments:

Signage has been erected. The silt curtain has had to be moved due to the amount of debris coming down the Kope Canal after the rain. Additional chain has been added to the silt curtain to ensure that it remains in place. There is a high tidal flow which is causing a few problems with the silt curtain. An oil boom cordon has been attached inside the main wall of the curtain to contain any oil in the event of a breakdown or spill.

Security fencing has been installed around the whole dredging site. The terrace site is restricted access requiring lifejackets to be worn due to proximity of the canal. Monitoring equipment is still to be set up and tested. A short duration dredging test has been conducted to ensure that everything is pressurised up and sealed.

Works or Actions Required:

No issues noted.

Next Monitoring Date: N/A

Next Follow Up Date: N/A

Served by: Email to Brendon.Love@boprc.govt.nz; Stephanie.Fraser@boprc.govt.nz; Des.McCleary@envirowaste.co.nz; Wayne.Plummer@envirowaste.co.nz; Pete.McLaren@whakatane.govt.nz

Name of Person(s) Field Sheet Served On:

Brendon Love, Stephanie Fraser, Des McCleary, Wayne Plummer, Pete McLaren



Bay of Plenty Regional Council

Consents and Compliance Field Sheet

Name of Property Owner or Consent Holder: BOP Regional Council

Consent Number: 68275

Site Description: Kopeopeo Canal, Whakatane

Officer: Jessica Hunter-Smith **Date of Inspection:** 29 September 2015

Contact Person(s) During Inspection: Brendon Love, Des McCleary, Wayne Plummer

Reason for Inspection: Compliance

Level of Compliance: Complying

Comments:

The water quality monitoring equipment was all set up by OPUS. Background monitoring undertaken upstream, adjacent to and downstream of the silt curtain. The water quality within the silt curtain is also monitored. The water quality downstream must remain within 20% of upstream monitoring. The figure for turbidity in the Kope Canal is about 16-20 NTU which is relatively low. The dredging must stop if the water quality is >20% which happened on one occasion during dredging today. Dredging resumed when the levels dropped to complying. The readings show that there is very little sediment released through the silt curtain and the increase is only about 3-5 NTU which is considered low.

The levels are within the tolerances of the equipment so it is not deemed as a non-compliance.

Works or Actions Required:

Continue to monitor as required by consent.

Next Monitoring Date: N/A

Next Follow Up Date: N/A

Served by: Email to Brendon.Love@boprc.govt.nz;
Stephanie.Fraser@boprc.govt.nz; Des.McCleary@envirowaste.co.nz;
Wayne.Plummer@envirowaste.co.nz; Pete.McLaren@whakatane.govt.nz

Name of Person(s) Field Sheet Served On:

Brendon Love, Stephanie Fraser, Des McCleary, Wayne Plummer, Pete McLaren



Bay of Plenty Regional Council

Consents and Compliance Field Sheet

Name of Property Owner or Consent Holder: BOP Regional Council

Consent Number: 68275

Site Description: Kopeopeo Canal, Whakatane

Officer: Jessica Hunter-Smith **Date of Inspection:** 30 September 2015

Contact Person(s) During Inspection: Brendon Love, Des McCleary, Wayne Plummer

Reason for Inspection: Compliance

Level of Compliance: Complying

Comments:

Dredging is going slowly due to the visitor tours during the day. The geobags are starting to be filled with sediment and can be seen releasing the aqueous fraction through the bag pores. This is pumped back into the Canal within the confines of the silt curtain. The mesh box is collecting any material larger than about 10mm for inspection by the Cultural Monitor, Eura Toko. To date that has been no taonga of koiwi found.

The monitoring of water quality is ongoing and there have been no instances of elevated turbidity or pH outside the silt curtain. There is quite a lot of debris still flowing down the Kope Canal which is getting hooked up on the sampling guy ropes.

Works or Actions Required:

NIL

Next Monitoring Date: N/A

Next Follow Up Date: N/A

Served by: Email to Brendon.Love@boprc.govt.nz; Stephanie.Fraser@boprc.govt.nz; Des.McCleary@envirowaste.co.nz; Wayne.Plummer@envirowaste.co.nz; Pete.McLaren@whakatane.govt.nz

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Bay of Plenty Regional Council

Consents and Compliance Field Sheet

Name of Property Owner or Consent Holder: BOP Regional Council

Consent Number: 68275

Site Description: Kopeopeo Canal, Whakatane

Officer: Jessica Hunter-Smith **Date of Inspection:** 5 October 2015

Contact Person(s) During Inspection: Des McCleary

Reason for Inspection: Compliance

Level of Compliance: Complying

Comments:

The dredging is almost complete with topping up of the geobags being done today. Work to start removing equipment from site will start tomorrow. All equipment will be cleaned and wash water discharged back into the Canal within the silt curtain. This will stay in place until the water quality monitoring meets the standard required by condition 15.4. The blue geobag containment bins will remain in place on the canal edge and continue to dewater over time. These may remain on site for up to 2 years (cond 22.3).

Works or Actions Required:

Please notify when dredging complete (cond 7.2) and when the silt curtain is removed (cond 15.5).

Next Monitoring Date: N/A

Next Follow Up Date: N/A

Served by: Email to Brendon.Love@boprc.govt.nz; Stephanie.Fraser@boprc.govt.nz; Des.McCleary@envirowaste.co.nz; Wayne.Plummer@envirowaste.co.nz; Pete.McLaren@whakatane.govt.nz

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Bay of Plenty Regional Council

Consents and Compliance Field Sheet

Name of Property Owner or Consent Holder: BOP Regional Council

Consent Number: 68275

Site Description: Kopeopeo Canal, Whakatane

Officer: Jessica Hunter-Smith **Date of Inspection:** 7 October 2015

Contact Person(s) During Inspection: Des McCleary

Reason for Inspection: Compliance

Level of Compliance: Complying

Comments:

The site is being decommissioned. The sediment in the agitation tank has to be removed. Flushing of tanks and lines are to the area designated by the silt curtain. The excavator wash down area has been set up and lined with black plastic. This drains back into the canal with silt curtain cordon. All equipment used is being decontaminated prior to leaving the site. The 2x blue Envirowaste containment bins will remain on site with discharge pipes remaining in place. The security fence will remain around the containment bins indefinitely. The whole bunded area may remain in place for future use. All silt fences will remain until all exposed areas are adequately stabilised. Monitoring upstream and downstream is still being undertaken until results meet the requirements of 15.4 (b).

The site has been very well managed throughout the period of the trial, and there have been no issues noted. Envirowaste staff have been very helpful and friendly while I have been on site - I appreciate the efforts that Des and Wayne have gone to in order to accommodate my compliance visits - thank you

Works or Actions Required:

Notifications required when works are complete (cond 7.2 and 15.5)

Next Monitoring Date: N/A

Next Follow Up Date: N/A

Served by: Email to Brendon.Love@boprc.govt.nz; Stephanie.Fraser@boprc.govt.nz; Des.McCleary@envirowaste.co.nz; Wayne.Plummer@envirowaste.co.nz; Pete.McLaren@whakatane.govt.nz

Name of Person(s) Field Sheet Served On:

Brendon Love, Stephanie Fraser, Des McCleary, Wayne Plummer, Pete McLaren

Appendix II: Tabulated Operational Data

Kopeopeo Canal Dredging Trial - Operational Statistics

DREDGING									SEDIMENT TREATMENT & TRANSFER				SEDIMENT BAG DEWATERING				
Date	Batch	Dredge times	Pump Time	Pump Pressure	Volume Pumped (m3)	Solids (%DS)	Solids Removed (t DS)	Comments	Date	Transfer Times	Transfer Time	Tank (A or B)	Date	Dewatering Times	Drainage Time	Tank (A or B)	Comments
28-Sep	0	17:15 - 17:23	8 mins	2100	22.6	0.20%	0.05	Water test tank & system							Closed	A	
															Closed	B	
29-Sep									29-Sep	10:35 - 10:40	5mins	A	29-Sep	10:15 - 15:49	334 mins	A	
										10:45 - 10:51	6mins	B		10:50 - 13:30	220 mins	B	
	1	10:51 - 10:53	2 mins	2200	6.2	2.76%	0.17	Measured DS content						13:55 - 15:43	108 mins	B	
		10:56 - 11:00	4 mins	2200	12.4		0.34			11:02 - 11:05	3mins	A		16:34 - 16:36	2 mins	A	
	2	13:25 - 13:30	5 mins	2200	15.5	2.78%	0.43	Measured DS content		13:25 - 13:35	10 mins	A		17:12 - 17:18	6 mins	A	Continuous dredging
	3	13:51 - 13:54	3 mins	2100	9.3	1.76%	0.16	Measured DS content		15:25 - 15:35	10 mins	A		17:37 - 18:37	60 mins	A	
										15:43 - 15:47	4mins	A			Closed	A	
	4	17:46 - 17:49	3 mins	2100	9.3	2.06%	0.19	Measured DS content							Closed	B	
30-Sep									30-Sep	8:20 - 8:25	5mins	A	30-Sep	8:58 - 9:11	13 mins	A	
	5	8:53 - 8:57	4 mins	2100	12.4	2.13%	0.26	Average batches 2,3,4,9,10		10:56 - 11:08	12 mins	B		9:15 - 9:45	30 mins		Drain/clean blue water sample drum
	6	11:25 - 11:31	6 mins	2100	18.6		0.40	Average batches 2,3,4,9,10		16:06 - 16:17	11 mins	A		9:48 - 9:56	8 mins	A	
										17:08 - 17:13	5mins	A		10:52 - 11:12	20 mins	A	Too much flow to sample drum - amend piping with valve
	7	17:22 - 17:24	2 mins	2200	6.2	2.13%	0.13	Average batches 2,3,4,9,10						11:29 - 12:55	86 mins	A	
		17:32 - 17:33	1 min	2100	3.1		0.07	Average batches 2,3,4,9,10						12:55 - 15:08	133 mins	B	Filtrate discharge: TSS - 0.00mg/L, Turbidity - 7.9NTU
		17:37 - 17:40	3 mins	2100	9.3		0.20	Average batches 2,3,4,9,10						15:08 - 16:05	57 mins	A	
														16:17 - 17:08	51 mins	A	
														17:14	Over night	A	
															Closed	B	
1-Oct									1-Oct	9:26 - 9:32	6mins	A	1-Oct	8:35 - 9:22	47 mins	A	
										12:21 - 12:29	8mins	B		10:24 - 12:20	116 mins	A	
	8	12:57 - 13:04	7 mins	2300	18.6	1.81%	0.34	Measured DS content		13:11 - 13:16	5mins	A		12:44 - 13:20	36 mins	B	
										13:45 - 13:52	7mins	B		13:21 - 14:41	80 mins	A	
	9	14:08 - 14:12	4 mins	2200	12.4	2.24%	0.28	Measured DS content		14:26 - 14:32	6mins	A		15:31 - 17:10	99 mins	B	
										16:38 - 16:44	6mins	B		17:10 - 17:30	20 mins	A	
	10	16:56 - 17:02	6 mins	2300	18.6	4.28%	0.80	Measured DS content		17:17 - 17:21	4mins	A		17:30	Over night	B	
										17:25 - 17:28	3mins	B		17:55	Over night	A	
										17:40 - 17:47	7mins	B					

Kopeopeo Canal Dredging Trial - Operational Statistics

DREDGING									SEDIMENT TREATMENT & TRANSFER				SEDIMENT BAG DEWATERING				
Date	Batch	Dredge times	Pump Time	Pump Pressure	Volume Pumped (m3)	Solids (%DS)	Solids Removed (t DS)	Comments	Date	Transfer Times	Transfer Time	Tank (A or B)	Date	Dewatering Times	Drainage Time	Tank (A or B)	Comments
2-Oct	11	9:08 - 9:14	6 mins	2400	18.6	6.48%	1.21	Measured DS content	2-Oct	9:16 - 9:23	7 mins	A	2-Oct	9:15 - 9:55	40 mins	A	
										9:28 - 9:35	7 mins	B		9:55 - 11:32	37 mins	B	
	12	9:44 - 9:48	4 mins	2400	12.4	4.31%	0.53	Measured DS content						10:48 - 11:14	26 mins	A	
		9:50 - 9:52	2 mins	2400	6.2		0.27			9:57 - 10:01	4 mins	A		11:27 - 11:41	14 mins	A	
										10:08 - 10:15	12 mins	B		11:41	Over weekend	B	
	13	10:23 - 10:24	1 min	2300	3.1	2.04%	0.06	Measured DS content						12:35	Over weekend	A	
		10:28 - 10:33	5 mins	2400	15.5		0.32			10:39 - 10:44	5 mins	B					
										11:16 - 11:21	5 mins	B					
										11:28 - 11:30	2 mins	B					
	14	11:49 - 11:55	6 mins	2300	18.6	4.48%	0.83	Measured DS content		12:08 - 12:07	4 mins	A					
										12:10 - 12:16	6 mins	B					
										12:21 - 12:23	2 mins	B					
5-Oct	15	12:15 - 12:20	5 mins	2400	18.6	2.15%	0.40	Measured DS content	5-Oct	12:22 - 12:29	7 mins	A	5-Oct	12:55 - 13:26	31 mins	B	
										12:31 - 12:35	4 mins	B		13:10 - 13:31	21 mins	A	
	16	12:40 - 12:45	5 mins	2400	18.6	3.38%	0.63	Measured DS content		12:47 - 12:50	3 mins	A		13:32 - 13:55	24 mins	B	
										13:00 - 13:07	7 mins	B		13:47 - 15:15	78 mins	A	
	17	13:15 - 13:20	5 mins	2400	18.6	4.79%	0.89	Measured DS content		13:27 - 13:31	4 mins	A		14:05 - 16:18	133 mins	B	
										13:33 - 13:39	6 mins	B		16:10 - 16:30	20 mins	A	
										13:42 - 13:46	4 mins	B		16:30 - 16:44	14 mins	B	
	18	13:51 - 13:56	5 mins	2300	18.6	3.74%	0.70	Measured DS content		13:56 - 13:58	2 mins	A		16:44 - 16:57	13 mins	A	
										14:00 - 14:01	1 min	A		16:57 - 17:22	25 mins	B	
										14:10 - 14:13	3 mins	B		17:22	Over night	A	
										15:19 - 15:24	5 mins	B		17:28	Over night	B	
	19	15:29 - 15:34	5 mins	2400	18.6	3.71%	0.69	Average batches 15,16,17,18,19		16:08 - 16:07	4 mins	A					
										16:10 - 16:14	4 mins	B					
										16:20 - 16:23	3 mins	A					
										16:24 - 16:27	3 mins	B					
	20	16:39 - 16:44	5 mins	2400	18.6	6.85%	1.27	Measured DS content		16:45 - 16:48	3 mins	A					
										16:50 - 16:51	1 min	A					
										16:55 - 16:56	1 min	A					
										16:59 - 17:03	4 mins	B					
										17:08 - 17:11	3 mins	B					
										17:15 - 17:19	4 mins	B					
					Total:	360.47	m3										
					Average:	3.22%	DS										
					TDS	11.61	DTS										