



Davidson Environmental Limited

Post-remediation
contaminant monitoring of
sediments and biota from
estuarine sites located
adjacent to the former
Fruitgrowers Chemical
Company (FCC) site, Mapua,
Nelson (2013-2015 update)

Research, survey and monitoring report number 842

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Summary

Following the completion of the remediation project, marine sediments and shellfish adjacent to the former Fruitgrowers Chemical Company (FCC) have been regularly sampled (Davidson *et al.*, 2010; 2011; 2012). The present report presents data collected in 2013, 2014 and 2015 by Paul Sheldon of the TDC using the same methodologies.

Data includes:

- Pesticide levels in sediments (shallow 0-2 cm, deep 6-10 cm).
- Pesticides levels in mollusc species (mudflat snail, topshell snail, cockle).
- Photographs of macroalgae cover to assess nutrient runoff levels.

Initial sampling during the first two sample events followed recommendations by the site auditor (Pattle Delamore, 2009). Since that time sampling has adopted additional recommendations made in a review after the first two-year sample events (Pattle Delamore, 2011).

Summary of results

ADL (Aldrin, Dieldrin, Lindane) and DDX levels in sediments continues to decline and is dramatically lower compared to historic contaminant levels.

At the **West FCC shore**, the Soil Acceptance Criteria (SAC) for ADL was rarely exceeded in 2015 (two shallow and one deep site). The SAC for DDX was exceeded at most West FCC sites in 2015, however, shallow contaminant levels declined at most sites throughout the study.

At the **East FCC shore**, the SAC for ADL was not exceeded in 2015 for shallow sediments and at only one deep sample site. For DDX, most East FCC surface and deep samples exceeded the SAC in 2015. DDX levels are now considerably lower than historic samples and are gradually declining.

The middle and upper West FCC tidal freshwater stream continues to support highest DDX and ADL levels. The West FCC (Stream 1 low) site remains above the SAC, but levels are considerably lower compared to the middle and upper Stream Sites. The concentrations of DDX and ADL at the middle and upper stream sites are relatively high compared to other sites in the study. Levels are variable between years and it is possible levels are no longer increasing (2015 DDX deep middle and upper sites = 5.74 and 3.49 mg/kg respectively). Shallow samples showed lower contaminant levels from 2013 onwards. CH2M Hill (2007) sampled sediment OCP's from three sites along the stream. Authors reported the SAC was exceeded at all sites

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and reported highest concentrations of DDX and ADL near the mouth of the stream where it entered the estuary (DDX 3.296 mg/kg, ADL 0.105 mg/kg). The mouth of the stream is well below these levels, but middle and upper sites remain high.

Apart from sediments at the West FCC freshwater tidal stream, most sites showed improvement for ADL and DDX levels.

Initially in the study, levels of ADL and DDX in cockles were comparable to other areas in New Zealand located close to large cities with associated contamination of estuarine areas. In 2015, contaminant levels in cockles reached an all-time low for the study.

ADL and DDX levels in mudflat snails were the highest of any mollusc sampled in the present study. This makes these snails the best molluscan indicator of contamination. Contaminant levels at one of the two impact sites dropped to a level below the control site (East FCC composite). At the West FCC site contaminants remained elevated, but much lower than previous years (e.g. DDX for 2015 = 1.39 mg/kg, 2009 = 22.1 mg/kg).

Nutrient levels initially detected seeping from the FCC site into the estuary appear to have subsided as indicated by a decline in macroalgae growth.

Recommendations about future monitoring conclude the present report.

1.0 Background

Environmental investigations at Mapua have historically reported elevated concentrations of contaminants in marine sediments adjacent to the FCC site (e.g. CH2M HILL, 2007). The major contaminants of concern were organochlorine pesticides (OCPs), which include DDT, DDD and DDE (collectively known as DDX), and aldrin, dieldrin and lindane (collectively known as ADL). A decision was made to remediate the site to prevent further effects on the marine environment. Following initial trials, remediation works commenced in October 2004 and were completed in early 2008. The Remediation Validation Report was submitted to MfE in December 2008.

During the works, two areas of foreshore adjacent to the FCC site were included in the remediation:

- the tidal beach in Mapua Channel located to the east of FCC East; and
- the tidal mudflats in Waimea Inlet located to the south of FCC Landfill, including a tidal channel that crosses the mudflats (the “swale”). Also included was a section of the tidal creek running along the north-west edge of FCC Landfill. This stream carries storm-water from adjacent housing developments.

The extent of contamination at these locations was broadly defined by previous investigation results and additional sampling during the remediation works. Based on the pre-remediation results, a surface layer of contaminated sediment was excavated down to the low tide contour in East FCC. In the west, the creek (for most of its length adjacent to the site), part of the foreshore, and part of the tidal swale were excavated and backfilled. The removal of contaminated sediments was completed in a series of cells, each backfilled with imported gravels following validation sampling from the base of the excavation. The resource consent required that excavated cells were sampled and backfilled within one tide. Consequently, the excavations were backfilled before the validation test results were received.

In June 2009, the audit report for the remediation of the former Fruitgrowers Chemical Company site, Mapua, was completed (Pattle Delamore, 2009). The auditor provided a comprehensive document that included a variety of recommendations with respect to monitoring marine sediments and biota. The general recommendations are outlined below, while the full recommendations can be viewed in Chapter 6 of the audit report.

The auditor has stated with respect to the marine sediments that:

“It is considered that remediation to the extent practicable has been broadly achieved in the marine foreshore areas. The benefits of further remediation are likely to be outweighed by the additional disruption and impacts to the environment. It is clear that the remediation in these

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areas has not been successful in meeting the SACs for DDX and ADL. However, re-deposition of non-complying sediment from the surrounding marine environment probably meant that compliance with the SACs could not be achieved within the foreshore surface sediments. In addition, re-contamination of the deeper backfill material has occurred during the remediation works. The mechanism(s) for this are not clear, but site runoff is probably a major contributor. While contamination remains within the backfilled material, there is evidence that the surface sediment quality has been improving since completion of the remediation. A key aspect of the foreshore remediation is the removal of the site as a source of ongoing sediment contamination. This will allow natural attenuation processes to slowly improve the foreshore sediment quality over the coming years. Apart from localised effects on the marine ecosystem, the effects of the residual sediment contamination on other receptors are not likely to be significant. In the case of risks to human health via seafood consumption, additional data is required to confirm this as the current dataset is limited.”

The auditor stated with respect to monitoring that:

“Sediment and snail sampling should continue, following a review of the sampling design to ensure it is adequately quantifying the risk via seafood consumption and is properly representing the quality of the surface sediments. The health and diversity of the foreshore ecosystems should be benchmarked relative to suitable control sites elsewhere in the Waimea Inlet. The information will contribute to assessing the significance of the residual contamination in the foreshore sediments and the local effects of contaminated groundwater discharge. The current annual monitoring of sediment and biota by TDC should be continued and expanded.

The aim of the monitoring will be to:

- 1. confirm OCP concentrations in snails (as appropriate bio-indicators) remain below levels that might present an unacceptable risk to human health;*
- 2. confirm apparent improving trends in the chemical quality of shallow sediment using a larger sample set; and*
- 3. provide additional information on localised effects of nutrients in groundwater discharges on the foreshores (see Section 7.10.2 of the audit report).”*

The present report is the first report since (Davidson *et al.*, 2012). That report presented data from the first three years of sampling, the first and second sample events were conducted in Spring 2009 and 2010, and were reported in Davidson *et al.* (2010, 2011). The first two sampling events followed recommendations by the site auditor (Pattle Delamore, 2009),

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while the third sampling event followed additional recommendations made in a review of sampling by Pattle Delamore (2011).

In 2013, 2014, and 2015 Paul Sheldon of the TDC collected sediment, shellfish and photographic records using methodology used in Davidson *et al.*, (2012). The present report, presents and discusses that data.

2.0 Site history

The following section on the history of operations at the site has been extracted from the auditor's report.

FCC operated an agrichemical formulation plant on FCC East and West from 1932 until 1988, producing pesticides, herbicides and fungicides that were used throughout the country. The north-eastern portion of FCC East was operated by a subsidiary company, originally known as Lime and Marble Limited and later as Mintech Ltd. The Mintech site was generally used for processing non-toxic minerals but also included the FCC micronising plant and some biocide preparation. Facilities used for agrichemical formulation and storage were operated on both FCC East and West.

From the 1950s, several areas were either in-filled or reclaimed, including: low lying areas of FCC East; the area now known as FCC Landfill, reclaimed from the Waimea Inlet; and the eastern portions of FCC East, reclaimed from the Mapua Channel. The fill material used contained waste material from site operations.

FCC ceased operations in 1988 and by 1996 TDC had either inherited or acquired the FCC portions of the site, i.e. FCC Landfill, FCC West and FCC East. FCC Landfill was inherited first, in the early 1990s. In May 1992, TDC installed a clay cut-off wall along the southern edge of FCC Landfill to reduce leachate migration into the Waimea Inlet. From the early 1990s onwards, the site was the subject of several environmental investigations and assessments. It was clear from the investigation results that some form of remediation or management of residual contamination at the site was required. Elevated contaminant concentrations were detected in soil on and adjacent to the site, groundwater and in nearby marine sediments. The major contaminants of concern which drove the need for remediation were organochlorine pesticides. Other contaminants included heavy metals, organonitrogen pesticides, organophosphorous pesticides, petroleum hydrocarbons, acid herbicides and elemental sulphur.

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The peak soil concentrations were typically found near historical processing areas. Marine sediments appear to have been contaminated from site runoff and drainage, including from the landfill, to the nearby estuary and Mapua Channel – see next section.

A decision was made to remediate the site after initial plans for capping the site were set aside. Soil treatment trials to select an appropriate technology were carried out in 1999 – 2000. Resource consents for the remediation were granted in November 2003.

3.0 Previous estuarine contaminant studies

Woodward Clyde (1996) presented contaminant monitoring data for a variety of biota sampled from estuarine habitats adjacent to the FCC site (east, west and general area). The species sampled included mudflat snail (*Amphibola crenata*), cockle (*Austrovenus stutchburyi*), green-lipped mussel (*Perna canaliculus*), and Pacific oyster (*Crassostrea gigas*). Most sampling occurred from areas adjacent to the FCC site between 1993 and 1996.

Landcare Research scientists sampled contaminants from sediments at upper and lower catchment positions of the western mudflat channel, as well as a western mudflat site (Tahi Street) and eastern site located adjacent to the FCC site (O’Halloran and Cavanagh, 2002; Cavanagh and O’Halloran, 2003). These authors also sampled contaminants from mudflat snail (*Amphibola crenata*), crab (Grapsid family), short-finned eel (*Anguilla australis*), cockle (*Austrovenus stutchburyi*), and Pacific oyster (*Crassostrea gigas*). They also collected samples from a control channel and a control mudflat site.

The authors reported that crabs and cockles did not accumulate high levels of organochlorine contaminants compared to snails (*Amphibola*). The authors reported that, apart from eels, snails accumulated much higher concentrations of organochlorine contaminants compared to other organisms sampled. Cavanagh and O’Halloran (2003) recommended that snail (*Amphibola*) was the most appropriate bioindicator to assess the success of remediation of the FCC site and its associated contaminated areas. The authors also recommended that some “opportunistic sampling be conducted of higher animals such as eels inhabiting the drain”.

TDC has sampled contaminants from sediments and snails on several occasions since 2005 (Easton, 2005; 2007a; 2007b; 2008; 2009; 2009a, 2010). Two sets of sampling sites have been used in repeat monitoring programmes. Samples of sediment and snail contamination were collected along the western estuary parallel to Tahi Street (Easton, 2007b; 2009). Another set of sample sites were repeat monitored for snail and sediment contamination as part of the consent condition 522/19 requiring testing of the sediments and macroinvertebrates 12, 24 and 36 months after the coastal marine area remediation (Easton, 2007a; 2008; 2009a). It is

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the latter set of samples that the site auditor suggested should be repeat sampled on at least two more occasions prior to a review of monitoring.

TDC sampled snails (*Amphibola crenata*) from the West FCC site and from a control site located further westward in the Waimea Inlet. Following remediation of the east FCC tidal shore, mudflat snails failed to recolonise. The author instead sampled a topshell (*Diloma subrostrata*). This species was also sampled from a control area located further eastwards in Waimea Inlet. *D. subrostrata* lives on a combination of rock, shell and soft substrata. Bioaccumulation levels recorded for this species were consistently lower than levels recorded for *Amphibola* samples collected from the west FCC site.

In Spring 2009, Davidson *et al.* (2010) sampled sediments for contaminant levels and organic content, and a grain size analysis was conducted. The authors also recorded macroalgal cover, surface dwelling macroinvertebrates and infaunal invertebrates from East and West estuarine areas adjacent to the FCC site. The same parameters were also sampled from two control sites well distant to the remediated area.

In response to results from the Davidson *et al.* (2010) study, TDC sampled sediment and DDX in mudflat snails from JMB 084 at the West FCC shore in January 2010 (see Easton, 2010). The author concluded the concentration of OCPs in mudflat snails and sediment from this site was lower than values recorded by Davidson *et al.* (2011) sample. Easton (2010) stated that this was, however, an increase compared to immediately after the remediation (i.e. 2009).

In Spring 2010, Davidson *et al.* (2011) again sampled sediments for contaminant levels. The authors also recorded macroalgal cover, surface dwelling macroinvertebrates and infaunal invertebrates from East and West FCC estuarine areas. The same parameters were also sampled from two control sites well distant to the remediated area. In the present study, 10 of the 16 shallow impact samples achieved the Soil Acceptance Criteria (SAC) for ADL (aldrin, dieldrin, lindane) (<0.01 mg/kg dry weight) compared to nine in the previous 2009 sample. In deeper sediments, seven sites achieved the SAC for ADL in 2010 compared to nine in 2009. Failure of more deep samples in the present study was due to an increase in ADL at East FCC sites.

For DDX (DDT, DDE, DDD), no sites achieved the SAC (<0.01 mg/kg dry weight) in 2009 or 2010. At West FCC sites, DDX levels in shallow sediments in 2010 remained comparable to levels recorded in 2009. For deep West FCC sediments, five sites showed small declines in DDX levels since 2009 and two showed small increases. In 2010, two West FCC deep sites achieved the SAC compared to three in 2009.

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At the East FCC shore DDX values remained comparable or dropped between 2009 and 2010. DDX in most deep sediments, however, increased beyond levels that could be explained by natural environmental variation.

Two of the shallow samples collected from the tidal-influenced freshwater stream at the West FCC shore, also showed increases in ADL and DDX beyond normal environmental variability. Deep stream sediments did not achieve the SAC for ADL or DDX, although values were considerably lower than recorded for shallow sediments.

ADL and DDX levels in cockles were comparable to other areas in New Zealand close to large cities with associated contamination of estuarine areas. Contaminants in cockles were, however, relatively low when compared to many contaminated sites overseas and were below the US and Canadian limits for the protection of human health. ADL and DDX levels in mudflat snails were the highest of any mollusc sampled in the present study. This makes these snails the best indicator of contamination in molluscs. Levels of contaminants in mudflat snails dropped in 2010 compared to the 2009 sample.

Davidson *et al.*, (2012) reported: “At the West FCC shore, the Soil Acceptance Criteria (SAC) for ADL (Aldrin, Dieldrin, Lindane) was exceeded at only one of the seven West FCC estuarine sites in 2010 and 2011. The SAC for DDX was exceeded at all West FCC sites in 2009 and 2010. For the first time in Spring 2011, one of the West FCC sites met the DDX SAC (West FCC new3). DDX in shallow estuarine sediments declined at all but one site between 2010 and 2011.

At the East FCC shore, the SAC for ADL in surface sediments was exceeded at one of the six sites in 2009 and two in 2010 and one site in 2011. These values were, however, relatively close to the SAC. For DDX, all East FCC surface samples exceeded the SAC on each sample occasion. In the present sample, all East FCC surface samples decreased below 2010 values.

For the West FCC tidal freshwater stream, all surface sediments sampled exceeded DDX and ADL SAC criteria for all years. The West FCC (stream1 low) site showed a decline for both contaminant groups since 2009, however, at the middle and upper sites, both ADL and DDX showed an increase. Of note was the concentrations of DDX at the middle and upper stream sites (4.604 and 3.093 mg/kg respectively). These levels are above those recorded in 2009 and during the CH2M Hill (2007) study. CH2M Hill (2007) sampled sediment OCP's from three sites along the stream. Authors reported the SAC was exceeded at all sites and reported highest concentrations of DDX and ADL near the mouth of the stream where it entered the estuary (DDX 3.296 mg/kg, ADL 0.105 mg/kg).

For deep sediments at West FCC sites, ADL levels remained relatively consistent with five small decreases and two small increases between 2010 and 2011. The increases were

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recorded in the estuarine ditch that drains the West FCC stream. Increases in deep DDX concentrations also occurred at estuarine sites along the ditch. It is probable that the elevated ADL and DDX concentrations found in the West FCC stream sites are responsible for the elevated levels found in the downstream estuarine ditch.

ADL and DDX levels in deep sediment samples at the West FCC stream increased from 2010. Highest values were recorded from the middle of the stream followed by the upper sample. Lowest values were recorded from the bottom of the stream. This is consistent with shallow contaminant values suggesting that contamination continues to enter the middle and upper parts of the stream.

DDX levels at all deep East FCC sites increased between 2009 and 2010 and declined between 2010 and 2011. Contaminant levels from the deep East FCC samples in 2011 are comparable to levels recorded in 2009 and well below 2010 levels.

Apart from sediments at the West FCC freshwater tidal stream, most sites showed some improvement, little change, or small increases for ADL and DDX. Only one site in the eastern estuary had ADL levels above the SAC, while western estuary sites above the SAC were in a ditch draining the West FCC stream.

ADL and DDX levels in cockles were comparable to other areas in New Zealand located close to large cities with associated contamination of estuarine areas. Contaminants in cockles were, however, relatively low when compared to many contaminated sites overseas and were below the US and Canadian limits for the protection of human health.

ADL and DDX levels in mudflat snails were the highest of any mollusc sampled in the present study. Levels of contaminants in mudflat snails remained low, however, in the West FCC site, contaminants returned to 2009 levels.

The Spring of 2011 was very wet and should have been optimal for macroalgal growth. The decline of macroalgae compared to 2009 and 2010 samples is therefore most likely due to a decline in nutrients required for growth.”

4.0 Review of sampling (Pattle Delamore, 2011)

The present document presents data for the fourth, fifth and sixth sample events after the completion of the remediation. The first and second sample events followed recommendations by the site auditor (Pattle Delamore, 2009), while all sampling events since have followed additional recommendations made in a review of sampling by Pattle Delamore

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(2011). Based on their recommendations, the methodology of all sample events during and after Spring 2011 was modified in the following way.

Changes to the biota and sediment monitoring protocol for Spring 2011 were:

1. Surface and within sediment monitoring of estuarine invertebrate species and their abundance were not collected in Spring 2011;
2. Macroalgae quadrats were not collected in Spring 2011 unless macroalgae levels increased above levels recorded in the previous two samples;
3. Deep OCP sediment samples were collected from 2-10 cm depth;
4. A visual description of sediments was collected from all OCP sample sites;
5. Redox photographs were no longer collected;
6. An inspection of the West FCC stream was conducted in an effort to detect any seeps that may carry contaminants;
7. Top shells living on rocks at the East FCC site were no longer sampled.

5.0 Methods (present study)

A summary of the laboratory methods and tests are displayed in Appendix 6 for contaminant sampling of macroinvertebrates and sediment (OCP's).

5.1 Mollusc and sediment contaminant sampling

On 11th December 2013, 11th December 2014 and 21st December 2015 sediment for contaminant analysis was collected from the surface layer (0-2 cm) and deep layer (2-10 cm) from estuarine soft sediments adjacent to the FCC site and at control sites (Table 1, Figures 1 and 2). The same surface sites were sampled from Spring 2011 onwards (Davidson *et al.*, 2012) (Table 1).

Surface sediment for analyses was collected using a stainless-steel scoop sampler from undisturbed substratum. Deep sediment samples were collected by first extracting a core of sediment to a depth of up to 10 cm. The depth varied depending on the substratum at each sample site. Some sites were characterised by soft sediment at all depths, while many, especially the remediated sites had high level of pebbles, granule and small cobble substrata making coring difficult. All deep sediment samples collected in the present study were collected from between 2 and 10 cm depth (Table 1). Once the core had been removed, a stainless steel scoop was used to extract soft sediment from the excavation. Notes on sediment composition, depth of the sample, colour and smell were collected at each site. Samples were placed in containers supplied by Hill Laboratories. Stainless steel collection devices were washed between each replicate sample and between each site.

A variety of macroinvertebrates were also collected for contaminant analysis from East and West FCC impact sites and Waimea Inlet control sites (Table 2, Figures 3 and 4). At one control site and two impact sites (West FCC and East FCC), the mudflat snail (*Amphibola crenata*) was collected. Low numbers of mudflat snail were available at the East FCC site. In addition, a cockle sample was collected from the East FCC site and the eastern control site, some 1.4 km south-east of Mapua (Table 2, Figures 3 and 4).

Mudflat snails and topshells on soft sediment were collected by hand using a haphazard sampling technique from an area of approximately 10m² at each site (Table 2). The only exception was the composite mudflat snail sample collected at the East FCC site (see yellow area in Figure 3). At this site, mudflat snails were relatively uncommon; therefore, the whole shoreline was used to provide sufficient snail specimens for analysis. Cockles were collected by shoveling sediment into a 40 mm aperture sieve, followed by washing to extract cockles. Cockles >20 mm width were collected from the sieve.



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Table 1. Sediment contaminant monitoring sites located at East and West (FCC) impact and control sites (November 2011 onwards).

Type	Site number	Coordinates	Strata	OCP surface	OCP deep
West control	JME 080	41° 15.482'S, 173° 5.540'E	0-2 cm & 8-10 cm	1	1
Impact (west)	JME 083	41° 15.463'S, 173° 5.819'E	0-2 cm & 8-10 cm	1	1
Impact (west)	JME 081	41° 15.484'S, 173° 5.821'E	0-2 cm & 8-10 cm	1	1
Impact (west)	JME 082	41° 15.501'S, 173° 5.825'E	0-2 cm & 8-10 cm	1	1
Impact (west)	West FCC new 1 (west)	41° 15.471'S, 173° 5.849'E	0-2 cm & 8-10 cm	1	1
Impact (west)	West FCC new 2 (middle)	41° 15.473'S, 173° 5.867'E	0-2 cm & 8-10 cm	1	1
Impact (west)	West FCC new 3 (east)	41° 15.480'S, 173° 5.879'E	0-2 cm & 8-10 cm	1	1
Impact (west)	JME 084	41° 15.484'S, 173° 5.859'E	0-2 cm & 8-10 cm	1	1
Impact (west)	West FCC Stream 1 (lower)	41° 15.446'S, 173° 5.839'E	0-2 cm & 8-10 cm	1	1
Impact (west)	West FCC Stream 2 (middle)	41° 15.433'S, 173° 5.863'E	0-2 cm & 8-10 cm	1	1
Impact (west)	West FCC Stream 1 (upper)	41° 15.425'S, 173° 5.877'E	0-2 cm & 8-10 cm	1	1
Impact (east)	JME 088	41° 15.418'S, 173° 6.089'E	0-2 cm & 6-8 cm	1	1
Impact (east)	JME 087	41° 15.421'S, 173° 6.093'E	0-2 cm & 6-8 cm	1	1
Impact (east)	JME 086	41° 15.423'S, 173° 6.097'E	0-2 cm & 8-10 cm	1	1
Impact (east)	East FCC New 1 (north)	41° 15.410'S, 173° 6.097'E	0-2 cm & 6-8 cm	1	1
Impact (east)	East FCC New 2 (south)	41° 15.428'S, 173° 6.083'E	0-2 cm & 6-8 cm	1	1
Impact (east)	JME 090	41° 15.436'S, 173° 6.079'E	0-2 cm & 6-10 cm	1	1
East control	Hunter-Brown	41° 16.187'S, 173° 6.497'E	0-2 cm & 6-8 cm	1	1
TOTAL SAMPLES				18	18

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All macroinvertebrates were kept in seawater for a period of 24 hours prior to transportation to Hill Laboratories to enable sediment purging from their digestive tracts prior to analysis. Seawater was regularly replaced during this period to ensure their survival during this process.

Mudflat snail (n = 3), topshell (n = 1), cockle (n = 2) and sediment samples (18 shallow, 18 deep) were sent to Hill Laboratories for analysis on the day following collection and the 24 hour sediment purging from invertebrates.

Both sediment and invertebrate samples were chilled during transportation.

Table 2. Invertebrate contaminant sample sites located at impact (FCC) and control sites.

Type	Site number	Coordinates	Samples per site
West control	JME 080 (<i>Amphibola</i>)	41° 15.482'S, 173° 5.540'E	1
West FCC	JME 084 (<i>Amphibola</i>)	41° 15.484'S, 173° 5.859'E	1
East FCC (composite)	East FCC (<i>Amphibola</i>)	see Figure 4	1
East FCC	New2 (south) (<i>Diloma</i>)	41° 15.428'S, 173° 6.083'E	1
East FCC (JME 090)	East FCC (cockle)	41° 15.436'S, 173° 6.079'E	1
East control	Hunter-Brown (cockle)	41° 16.190'S, 173° 6.497'E	1
TOTAL SAMPLES			6



Figure 1. Location of sediment contaminant sites at West FCC location. Insert is West control site JME080 (1st bay to the west of West FCC).



Figure 2. Location of sediment contaminant sites at East FCC location. Insert is East control site at Hunter-Brown Reserve.



Figure 3. Location of invertebrate contaminant samples collected from West FCC site and West control site.



Figure 4. Location of invertebrate contaminant samples collected from East FCC site. Yellow area indicates the composite *Amphibola* collection area. Insert map is East control cockle sample site located at Hunter-Brown Reserve.

5.2 Macroalgae photographs

Macroalgae photographs were initially collected in October 2009 (Davidson *et al.*, 2010). These were repeated in November 2010 (Davidson *et al.*, 2011) and again in November 2011 (Davidson *et al.*, 2012). Photographs have been collected on two new occasions (11th December 2013 and 21st December 2015). Some of the most recent photographs were collected using slightly different perspectives, however the coverage is sufficient to determine macroalgal cover.

Photographs of macroalgae cover were collected from impact and control sites on all occasions. At each site, reference points selected by Davidson *et al.*, (2010) were relocated using maps and GPS. At the West FCC site, a total of three fixed points were resampled, while two fixed points were resampled at the East FCC site (Table 3, Figure 5). One set of panoramic photos were also collected at the two control sites.

A series of photographs were collected spanning the adjacent estuarine area. Photographs were rendered into a panoramic photograph using the software program Autostitch. The authors noted that this process may result in a small level of distortion and image-bending.

Occasional close-up photos were also collected at these sites.

Table 3. Macroalgae photo-points at Mapua FCC impact and control sites.

Location	Site	Description	Coordinates
West control	North	Located at seaward edge of rushes	41° 15.487'S, 173° 5.544'E
West FCC	Western	At embedded marble rocks at foot of bank	41° 15.458'S, 173° 5.825'E
West FCC	Middle	At embedded marble rocks at foot of bank	41° 15.461'S, 173° 5.859'E
West FCC	Eastern	At embedded marble rocks at foot of bank	41° 15.463'S, 173° 5.897'E
East FCC	Drain	On top of storm water pipe	41° 15.408'S, 173° 6.095'E
East FCC	South	At southern end of shoreline rock wall	41° 15.442'S, 173° 6.072'E
East control		12 m seaward of large tree lucerne	41° 16.187'S, 173° 6.492'E



Figure 5. Location of macroalgae photo points. Insert is East control (Hunter-Brown Reserve).

6.0 Results

6.1 Mollusc and sediment contaminant sampling

6.1.1 Contaminants in sediment

Contaminants in estuarine and stream sediments varied with depth and sample year. Levels also varied years at the same sites (Figures 8 and 9, Tables 6a and 6b, Appendix 1-3).

In 2013, ADL (aldrin, dieldrin, lindane) exceeded the Soil Acceptance Criteria (SAC) at four shallow and six deep impact sites (Table 6a). In 2014, ADL exceedances were again recorded at four shallow and three deep impact sites (Table 6a). In 2015, ADL exceedances were recorded at two shallow and five deep impact sites (Table 6a). No elevated ADL values were recorded from control sites at either depth strata.

Between 2013 and 2015, highest ADL values were usually recorded from both depth strata at the middle and upper West FCC stream sites (Tables 6a and 6b, Figures 1 and 8). Overall, stream values in the shallow samples declined compared to records prior to 2013, however, deep ADL values increased (Tables 6a and 6b).

One East FCC sample site exhibited a spike for ADL. This occurred at a deep sample at FCC New2 east. In 2014 and 2015 ADL values returned to normal levels for this site (Figure 8).

Elevated ADL values were also recorded from sediments at West FCC JME083 (deep) and at JME081 in 2013. These sites are located in the estuarine ditch that drains the West FCC stream (Figures 1 and 8). East FCC samples at JME86 (deep) were normally well above the SAC, however in 2015, ADL dropped below the SAC for the first time. Overall, ADL values at most sites declined between 2013 and 2015 (Tables 6a and 6b).

DDX (2,4 DDT; 4,4 DDT; 2,4 DDD; 4,4 DDD; 2,4 DDE; 4,4 DDE) in sediment was above the SAC at more sites compared to ADL values. Again, highest values for DDX were usually recorded at shallow and deep West FCC middle and upper stream sites (Table 6a and 6b, Figure 9). Unlike samples collected between 2009 and 2011, deep stream samples usually showed higher levels of DDX compared to shallow samples. Shallow samples did however, remain above the SAC.

As expected, DDX values for the closest sites in the ditch draining the stream also showed elevated DDX levels, particularly deep samples (JME083 and JME081). The sample site located further seaward of the stream, had lower DDX levels.

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In 2013 a DDX spike was recorded at deep East FCC New2 (Figure 9). In 2014 and 2015 DDX values returned to levels comparable to 2009 to 2011, but were elevated above the SAC (Figure 9).

Comparison of DDX, dieldrin and lindane levels sampled from the same shallow sites on 10 occasions between 2005 and 2015, showed very high mean values in 2005 and 2007. Mean DDX, dieldrin and lindane values collected in 2008 and 2009 showed a dramatic decline (Figure 10, Table 7). The overall pattern for the 10-year study period has shown a decline in mean DDX, dieldrin and lindane. Lindane is consistently below the SAC, dieldrin is now at the SAC, however, DDX remains above the SAC. Mean DDX values are gradually declining with a mean of 0.15 mg/kg dry weight recorded in 2015.

Analysis of all shallow samples since 2009 shows a similar pattern of decline (Figure 11, Table 8). Mean lindane has been below the SAC since 2008 and mean dieldrin levels reached the SAC for the first time in 2015. DDX in 2015 remains above the SAC at 0.28 mg/kg dry weight. Mean DDX values have, however, declined on every sample event (Figure 11).

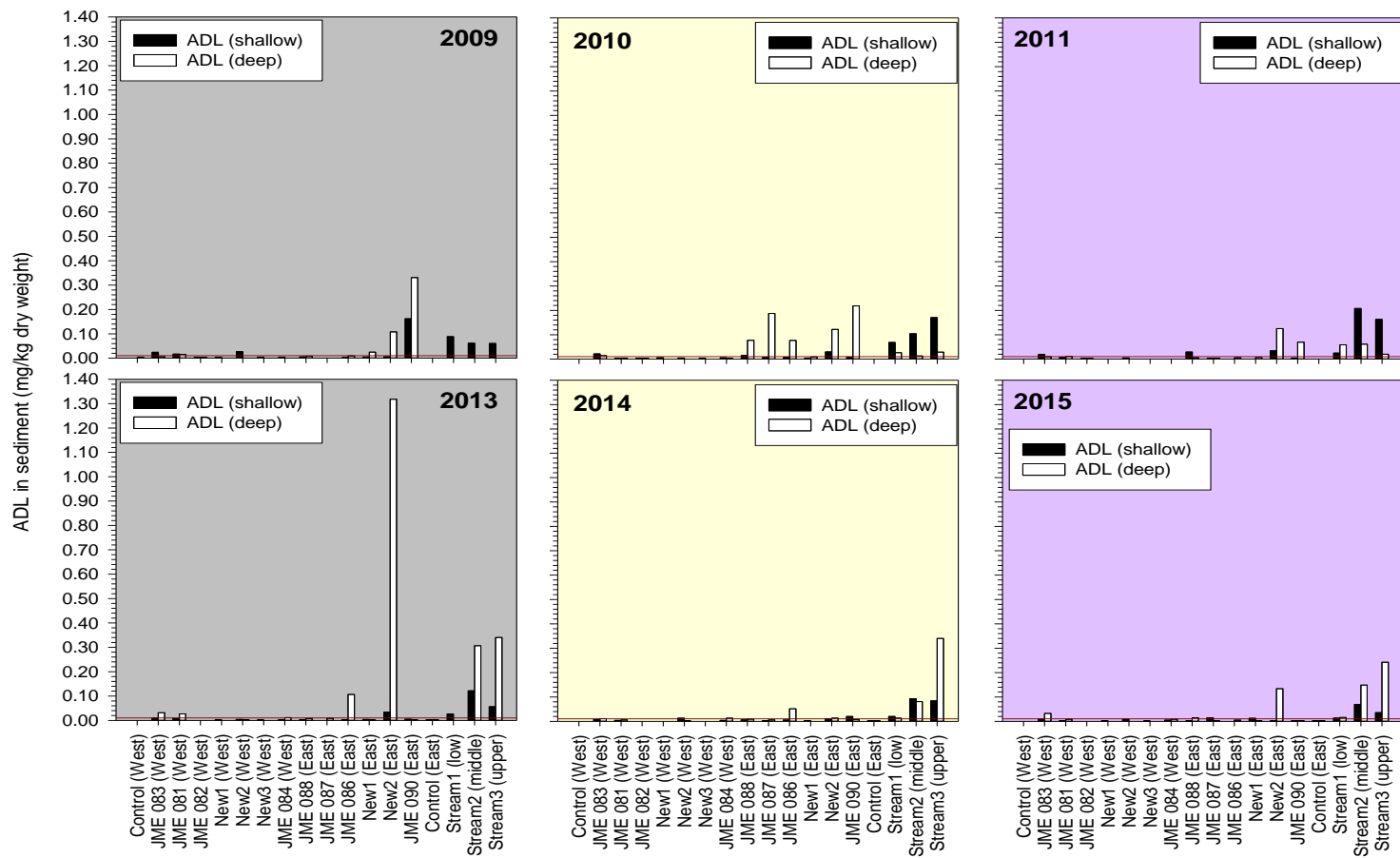


Figure 8. Levels of ADL (aldrin, dieldrin, lindane) (mg/kg dry weight) recorded from sediment samples collected at control and impact sites in from 2009 to 2015. Note: deep stream sediments were not sampled in 2009. Red line is SAC (0.01 mg/kg dry weight).

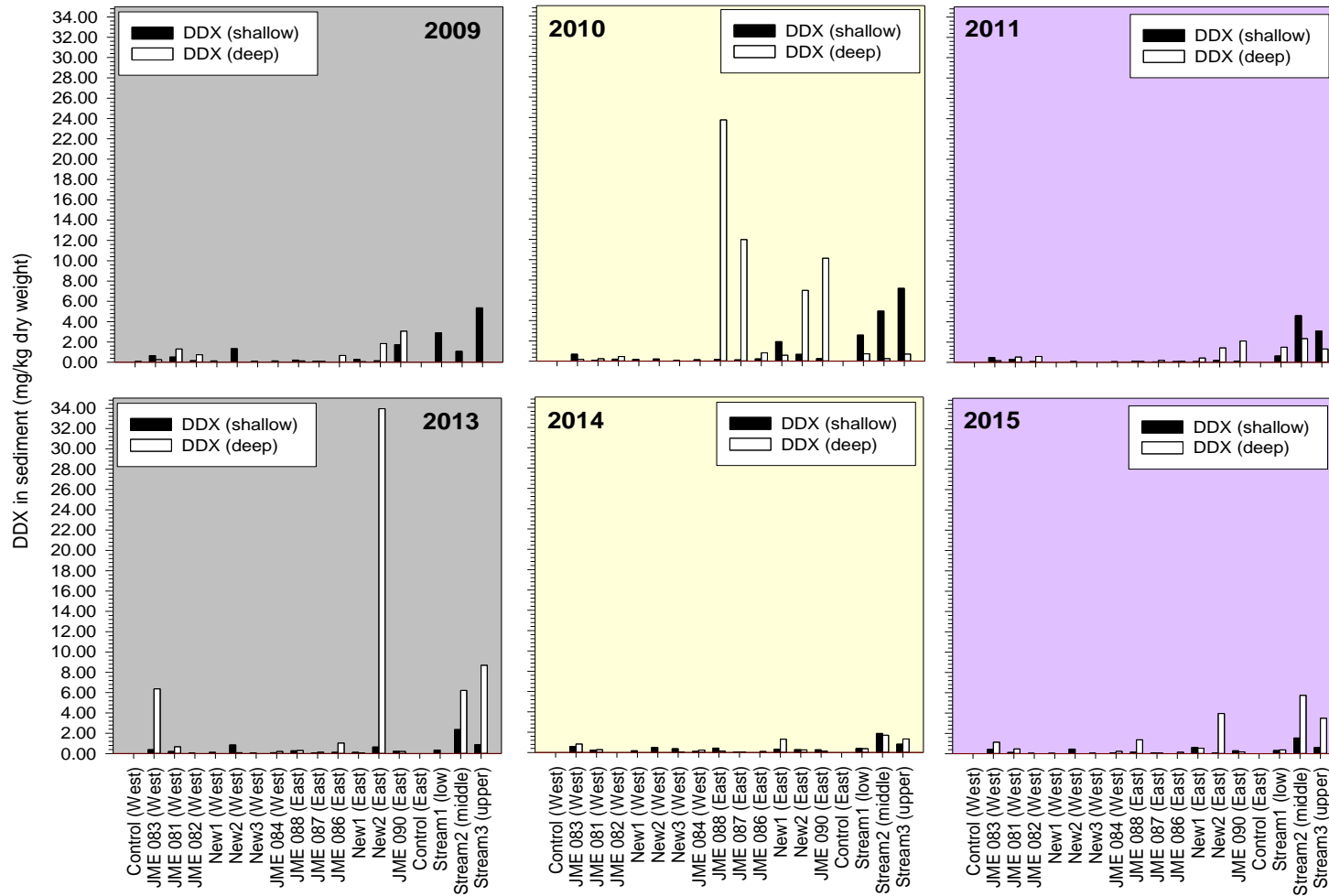


Figure 9. Levels of DDX (2,4DDT; 4,4DDT; 2,4DDD; 4,4DDD; 2,4DDE; 4,4DDE) (mg/kg dry weight) recorded from sediment samples collected at control and impact sites from 2009 to 2015. Note: deep stream sediments were not sampled in 2009. Red line is SAC (0.01 mg/kg dry weight).

Table 6a. Shallow sediment ADL and DDX levels and their component analytes sampled in 2013, 2014 and 2015 from FCC and control sites.

December 2013																			
SURFACE (0 - 2 cm) 2013																			
Test	SAC	West Control	West FCC JME 083	West FCC JME 081	West FCC JME 082	West FCC new1 (west)	West FCC new2 (middle)	West FCC new3 (east)	West FCC JME 084	East FCC JME 088	East FCC JME 087	East FCC JME 086	East FCC new1 (north)	East FCC new2 (south)	East FCC JME 090	East Control	West FCC Stream1 (low)	West FCC Stream2 (middle)	West FCC Stream3 (upper)
Aldrin		<0.001	0.0011	0.0014	<0.001	<0.001	0.0022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0015	0.0058	<0.001
Dieldrin		<0.001	0.0082	0.0063	<0.001	0.002	0.00192	0.0015	0.0027	0.0037	<0.001	0.0024	0.004	0.031	0.0048	<0.001	0.025	0.114	0.056
gamma-BHC (Lindane)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
2,4-DDD		<0.001	0.042	0.024	0.004	0.0127	0.166	0.041	0.0092	0.0149	0.0028	0.0042	0.0144	0.03	0.0104	<0.001	0.035	0.25	0.122
4,4 DDD		<0.001	0.156	0.063	0.0104	0.022	0.3	0.0083	0.033	0.084	0.0168	0.022	0.037	0.119	0.038	0.0023	0.092	0.7	0.31
2,4 DDE		0.0011	0.0098	0.0096	0.0011	0.004	0.024	0.0013	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0121	0.105	0.042
4,4 DDE		<0.001	0.114	0.09	0.0136	0.067	0.34	0.0178	0.035	0.025	0.0075	0.0067	0.025	0.034	0.044	0.0013	0.168	1.06	0.35
2,4 DDT		<0.001	0.0054	0.0035	0.0019	0.0012	0.0022	<0.001	<0.001	0.0154	0.008	0.023	0.0066	0.064	0.0179	<0.001	0.0082	0.03	0.0146
4,4 DDT		<0.001	0.059	0.0159	0.026	0.021	0.0114	0.0037	0.0053	0.141	0.04	0.065	0.036	0.4	0.111	0.0033	0.03	0.22	0.046
ADL (aldrin, dieldrin, lindane) ¹	0.01	<0.0011	0.0093	0.0077	0	0.002	0.00412	0.0015	0.0027	0.0037	0	0.0024	0.004	0.0332	0.0048	0.0015	0.0265	0.1218	0.056
Comparison 2011 to 2013		No change	Decline	Increase	Decline	Increase	Decline	Increase	Increase	Decline	Decline	Increase	Increase	Increase	Decline	Decline	Increase	Decline	Decline
DDX ¹	0.01	0.0011	0.3862	0.206	0.057	0.1279	0.8436	0.0721	0.0845	0.2803	0.0751	0.1209	0.119	0.647	0.2213	0.0069	0.3453	2.365	0.8846
Comparison 2011 to 2013		Decline	Decline	Decline	Decline	Increase	Increase	Increase	Increase	Increase	Increase	Increase	Increase	Increase	Increase	Increase	Decline	Decline	Decline
December 2014																			
SURFACE (0 - 2 cm) 2014																			
Test	SAC	West Control	West FCC JME 083	West FCC JME 081	West FCC JME 082	West FCC new1 (west)	West FCC new2 (middle)	West FCC new3 (east)	West FCC JME 084	East FCC JME 088	East FCC JME 087	East FCC JME 086	East FCC new1 (north)	East FCC new2 (south)	East FCC JME 090	East Control	West FCC Stream1 (low)	West FCC Stream2 (middle)	West FCC Stream3 (upper)
Aldrin		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0025	<0.001
Dieldrin		<0.001	0.0076	0.0038	<0.001	<0.001	0.0119	<0.001	0.0042	0.006	0.0016	0.0053	0.0033	0.0106	0.02	<0.001	0.02	0.089	0.084
gamma-BHC (Lindane)		<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0013	<0.001
2,4-DDD		<0.001	0.31	0.021	<0.001	0.0042	0.111	0.0047	0.013	0.029	0.0028	0.0014	0.041	0.0186	0.035	<0.001	0.049	0.28	0.116
4,4 DDD		<0.001	0.065	0.053	<0.001	0.0078	0.154	0.0117	0.047	0.101	0.009	0.0035	0.128	0.057	0.106	<0.001	0.109	0.6	0.29
2,4 DDE		<0.0011	0.0131	0.083	<0.001	0.0015	0.0188	0.002	<0.001	<0.001	<0.001	<0.001	0.0035	<0.001	<0.001	<0.001	0.0176	0.121	0.049
4,4 DDE		<0.001	0.166	0.063	0.0088	0.021	0.21	0.027	0.049	0.026	0.0068	0.0019	0.074	0.039	0.047	<0.001	0.182	0.75	0.33
2,4 DDT		<0.001	0.006	0.0016	<0.001	0.005	0.0019	0.02	0.0017	0.116	0.0025	<0.001	0.031	0.041	0.0078	<0.001	0.0063	0.0197	0.0068
4,4 DDT		<0.001	0.04	0.02	0.0059	0.128	0.013	0.31	0.0076	0.159	0.024	0.0038	0.038	0.119	0.065	<0.001	0.034	0.11	0.029
ADL (aldrin, dieldrin, lindane) ¹	0.01	<0.001	0.0076	0.0038	0	0	0.013	0	0.0042	0.006	0.0016	0.0053	0.0033	0.0106	0.02	0.0015	0.02	0.0928	0.084
Comparison 2013 to 2014		Decline	Decline	Decline	No change	Decline	Increase	Decline	Increase	Increase	Increase	Decline	Decline	Decline	Increase	No change	Decline	Decline	Increase
DDX ¹	0.01	<0.001	0.6001	0.2416	0.0147	0.1675	0.5087	0.3754	0.1183	0.431	0.0451	0.0106	0.3155	0.2746	0.2608	0.003	0.3979	1.8807	0.8208
Comparison 2013 to 2014		Increase	Increase	Increase	Decline	Increase	Decline	Increase	Increase	Increase	Decline	Decline	Increase	Decline	Increase	Decline	Increase	Decline	Decline
December 2015																			
SURFACE (0 - 2 cm) 2015																			
Test	SAC	West Control	West FCC JME 083	West FCC JME 081	West FCC JME 082	West FCC new1 (west)	West FCC new2 (middle)	West FCC new3 (east)	West FCC JME 084	East FCC JME 088	East FCC JME 087	East FCC JME 086	East FCC new1 (north)	East FCC new2 (south)	East FCC JME 090	East Control	West FCC Stream1 (low)	West FCC Stream2 (middle)	West FCC Stream3 (upper)
Aldrin		<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0019	<0.0010
Dieldrin		0.0033	0.0078	0.0024	<0.0010	<0.0010	0.0081	<0.0010	0.0039	0.0018	0.0143	<0.0010	0.0125	0.0016	0.0017	<0.0010	0.0134	0.066	0.036
gamma-BHC (Lindane)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	<0.0010
2,4-DDD		<0.0010	0.049	0.0145	0.0024	0.0032	0.106	0.07	0.0094	0.0067	0.0046	0.0011	0.042	0.0048	0.0087	<0.0010	0.034	0.183	0.073
4,4 DDD		<0.0010	0.134	0.033	0.0078	0.0052	0.124	0.0133	0.0198	0.018	0.0105	0.0029	0.1	0.0122	0.023	<0.0010	0.069	0.46	0.185
2,4 DDE		<0.0010	0.02	0.0066	<0.0010	0.0014	0.0105	0.0034	0.0032	<0.0010	<0.0010	<0.0010	0.0087	<0.0010	<0.0010	<0.0010	0.0174	0.093	0.041
4,4 DDE		<0.0010	0.156	0.052	0.0085	0.021	0.21	0.031	0.035	0.0122	0.0076	0.0029	0.141	0.0072	0.0173	<0.0010	0.178	0.61	0.26
2,4 DDT		<0.0010	0.013	0.0021	0.0022	<0.0010	0.0024	<0.0010	<0.0010	0.0148	0.0074	0.0018	0.094	0.005	0.159	<0.0010	0.0043	0.038	0.0168
4,4 DDT		<0.0010	0.048	0.0105	0.0154	0.0078	0.009	0.0028	0.002	0.103	0.041	0.0055	0.24	0.031	0.081	<0.0010	0.0167	0.159	0.04
ADL (aldrin, dieldrin, lindane) ¹	0.01	<0.0011	0.0089	0.0024	0.001	0.002	0.0081	0.0015	0.0052	0.0018	0.0143	0	0.0125	0.0016	0.0017	0.0015	0.0134	0.0694	0.036
Comparison 2014 to 2015		Increase	Increase	Decline	Increase	Increase	Decline	Increase	Increase	Decline	Increase	Decline	Increase	Decline	Decline	No change	Decline	Decline	Decline
DDX ¹	0.01	<0.001	0.42	0.1187	0.0363	0.0386	0.4619	0.0575	0.0694	0.1547	0.0711	0.0142	0.6257	0.0602	0.289	0.003	0.3194	1.543	0.6158
Comparison 2014 to 2015		No change	Decline	Decline	Increase	Decline	Decline	Decline	Decline	Decline	Increase	Increase	Increase	Decline	Increase	No change	Decline	Decline	Decline
Notes:																			
¹	For multiple analyte totals, the concentration detected below the LOR is assumed to have a concentration of 0.5 the LOR																		
SAC	Soil acceptance criteria																		
LOR	Limit of laboratory reporting																		
ND	Not detected above LOR's																		
	Value exceeds Soil Acceptance Criteria (SAC)																		

Table 6b. Deep sediment ADL and DDX levels (west) and their component analytes sampled in 2013, 2014 and 2015 from FCC and control sites.

December 2013																			
DEEP (6 - 10 cm)	SAC	West Control	West FCC JME 083	West FCC JME 081	West FCC JME 082	West FCC new1 (west)	West FCC new2 (middle)	West FCC new3 (east)	West FCC JME 084	West FCC JME 088	West FCC JME 087	West FCC JME 086	West FCC new1 (north)	West FCC new2 (south)	West FCC JME 090	East Control	West FCC Stream1 (low)	West FCC Stream2 (middle)	West FCC Stream3 (upper)
Aldrin	<.001	<.001	0.0054	0.002	<.001	<.001	<.001	<.001	0.001	<.001	0.0015	0.0153	<.001	0.165	<.001	<.001	<.001	0.012	0.0093
Dieldrin	<.001	<.001	0.029	0.025	<.001	<.001	0.0028	<.001	0.0105	0.0077	0.0067	0.091	0.0018	1.1	0.0026	<.001	0.0011	0.29	0.34
gamma-BHC (Lindane)	<.001	<.001	0.0019	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.053	<.001	<.001	<.001	0.0047	0.0085
2,4-DDD	<.001	<.001	0.37	0.09	<.001	<.001	0.0092	0.0011	0.034	0.0168	0.022	0.135	<.001	1.84	0.0095	<.001	<.001	0.84	1.23
4,4 DDD	<.001	<.001	1.16	0.25	<.001	<.001	0.033	0.0034	0.065	0.073	0.076	0.59	0.0063	6.8	0.03	<.001	<.001	2.2	3.1
2,4 DDE	<.001	<.001	0.056	0.035	<.001	<.001	0.002	<.001	0.0073	0.0018	<.001	<.001	0.0195	<.001	<.001	<.001	<.001	0.44	0.72
4,4 DDE	<.001	<.001	0.5	0.23	0.0022	0.0025	0.035	0.0048	0.086	0.044	0.032	0.091	<.001	1.12	0.044	<.001	0.0058	2.3	3.1
2,4 DDT	<.001	<.001	0.29	0.0078	<.001	<.001	<.001	<.001	0.0021	0.023	0.012	0.036	0.0186	3.2	0.0179	<.001	<.001	0.062	0.124
4,4 DDT	<.001	<.001	4	0.052	0.0023	0.0025	0.0053	0.0048	0.0109	0.148	0.0067	0.189	0.028	21	0.111	<.001	0.0016	0.37	0.42
ADL (aldrin, dieldrin, lindane) ¹	0.01	<.0010	0.03144	0.027	0	0	0.0028	0	0.0115	0.0077	0.0082	0.1063	0.0018	1.318	0.0026	0.0015	0.0011	0.3067	0.3578
Comparison 2011 to 2013		No change	Increase	Increase	Decline	Decline	Increase	No change	Increase	Increase	Increase	Increase	Decline	Increase	Increase	Decline	Decline	Increase	Increase
DDX ¹	0.01	<.001	6.376	0.6648	0.0045	0.005	0.0845	0.0141	0.2053	0.3066	0.1379	1.041	0.0724	33.96	0.2124	0.003	0.0074	6.212	8.694
Comparison 2011 to 2013		No change	Increase	Increase	Decline	Decline	Increase	Increase	Increase	Increase	Decline	Increase	Decline	Increase	Increase	No change	Decline	Increase	Increase
December 2014																			
DEEP (6 - 10 cm)	SAC	West Control	West FCC JME 083	West FCC JME 081	West FCC JME 082	West FCC new1 (west)	West FCC new2 (middle)	West FCC new3 (east)	West FCC JME 084	West FCC JME 088	West FCC JME 087	West FCC JME 086	West FCC new1 (north)	West FCC new2 (south)	West FCC JME 090	East Control	West FCC Stream1 (low)	West FCC Stream2 (middle)	West FCC Stream3 (upper)
Aldrin	<.001	<.001	0.0014	0.0014	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	0.0017	0.0034	ND	ND	ND	<.0010	<.0010	0.005	0.0079
Dieldrin	<.001	<.001	0.0111	0.0046	<.0010	<.0010	0.0016	<.0010	0.0131	0.0086	0.0041	0.048	ND	0.0132	0.0072	<.0010	0.0132	0.081	0.096
gamma-BHC (Lindane)	<.001	<.001	<.001	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	ND	ND	ND	<.0010	<.0010	0.0022	0.0018
2,4-DDD	<.001	<.001	0.037	0.037	<.0010	<.0010	0.0037	0.0016	0.029	0.0194	0.0106	0.0181	0.022	0.0172	0.0125	<.0010	0.038	0.32	0.33
4,4 DDD	0.0011	<.001	0.038	0.103	<.0010	0.001	0.0092	0.0075	0.064	0.05	0.028	0.05	0.8	0.045	0.036	<.0010	0.089	0.48	0.45
2,4 DDE	<.001	<.001	0.024	0.0161	<.0010	<.0010	<.0010	<.0010	0.0103	<.0010	<.0010	0.0047	0.0028	0.0022	0.0013	<.0010	0.0186	0.171	0.116
4,4 DDE	0.0014	<.001	0.36	0.098	0.0047	0.0048	0.0114	0.0075	0.115	0.033	0.0121	0.023	0.047	0.033	0.022	<.0010	0.194	0.58	0.36
2,4 DDT	<.001	<.001	0.069	0.0029	0.0019	<.0010	<.0010	<.0010	0.0015	0.0059	0.0018	<.0010	0.11	0.0099	0.0068	<.0010	0.0065	0.027	0.0101
4,4 DDT	<.001	<.001	0.31	0.0181	<.0010	0.0034	0.0018	0.023	0.008	0.034	0.0112	0.0059	0.33	0.15	0.055	<.0010	0.028	0.128	0.067
ADL (aldrin, dieldrin, lindane) ¹	0.01	<.0010	0.0111	0.006	0	0	0.0016	0	0.0131	0.0086	0.0058	0.0514	0	0.0132	0.0072	0.0015	0.0132	0.0882	0.1057
Comparison 2013 to 2014		No change	Decline	Decline	No change	No change	Decline	No change	Increase	Increase	Decline	Decline	Decline	Decline	Increase	No change	Increase	Decline	Decline
DDX ¹	0.01	<.001	0.838	0.2751	0.0066	0.0092	0.0261	0.0396	0.2278	0.1423	0.0637	0.1017	1.3118	0.2573	0.1336	0.003	0.3741	1.706	1.3331
Comparison 2013 to 2014		No change	Decline	Decline	Increase	Increase	Decline	Increase	Increase	Decline	Decline	Decline	Increase	Decline	Decline	No change	Increase	Decline	Decline
December 2015																			
DEEP (6 - 10 cm)	SAC	West Control	West FCC JME 083	West FCC JME 081	West FCC JME 082	West FCC new1 (west)	West FCC new2 (middle)	West FCC new3 (east)	West FCC JME 084	West FCC JME 088	West FCC JME 087	West FCC JME 086	West FCC new1 (north)	West FCC new2 (south)	West FCC JME 090	East Control	West FCC Stream1 (low)	West FCC Stream2 (middle)	West FCC Stream3 (upper)
Aldrin	<.0010	<.0010	0.0023	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	0.0014	<.0010	0.0041	<.0010	<.0010	<.0010	0.0025	0.006
Dieldrin	<.0010	<.0010	0.028	0.0082	<.0010	<.0010	<.0010	<.0010	0.0085	0.0144	0.0029	0.0038	0.0031	0.128	0.003	<.0010	0.0158	0.143	0.23
gamma-BHC (Lindane)	<.0010	<.0010	0.0023	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	<.0010	0.0017	<.0010	<.0010	<.0010	0.0033	0.0063
2,4-DDD	<.0010	<.0010	0.14	0.041	<.0010	<.0010	0.003	<.0010	0.041	0.041	0.0067	0.0171	0.029	0.34	0.0072	<.0010	0.041	0.48	0.4
4,4 DDD	<.0010	<.0010	0.33	0.093	0.0013	<.0010	0.0071	0.0014	0.063	0.133	0.0189	0.056	0.088	1.44	0.0159	<.0010	0.102	2.6	0.92
2,4 DDE	<.0010	<.0010	0.067	0.181	<.0010	<.0010	<.0010	<.0010	0.0066	0.0031	0.0015	0.0079	0.0026	0.0159	0.0049	<.0010	0.0175	0.28	0.22
4,4 DDE	0.0012	<.001	0.45	0.134	0.0023	0.0039	0.0062	0.0022	0.124	0.068	0.0103	0.037	0.052	0.31	0.057	<.0010	0.188	2.2	1.21
2,4 DDT	<.0010	<.0010	0.021	0.004	<.0010	<.0010	<.0010	<.0010	<.0010	0.078	0.0021	0.0021	0.057	0.22	0.0173	<.0010	0.0047	0.036	0.6
4,4 DDT	<.0010	<.0010	0.128	0.021	<.0010	0.0029	0.002	<.0010	0.0023	1.04	0.0084	0.03	0.31	1.63	0.08	<.0010	0.022	0.148	0.136
ADL (aldrin, dieldrin, lindane) ¹	0.01	<.0010	0.0326	0.0082	0	0	0	0	0.0085	0.0144	0.0029	0.0052	0.0031	0.1338	0.003	0.0015	0.0158	0.1488	0.2423
Comparison 2014 to 2015		No change	Increase	Increase	No change	No change	Decline	No change	Decline	Increase	Decline	Decline	Increase	Increase	Decline	No change	Increase	Increase	Increase
DDX ¹	0.01	<.001	1.136	0.474	0.0036	0.0068	0.0183	0.0036	0.2369	1.3631	0.0479	0.1501	0.5386	3.9559	0.1823	0.003	0.3752	5.744	3.486
Comparison 2014 to 2015		No change	Increase	Increase	Decline	Decline	Decline	Decline	Increase	Increase	Decline	Increase	Decline	Increase	Increase	No change	Increase	Increase	Increase
Notes:																			
¹ For multiple analyte totals, the concentration detected below the LOR is assumed to have a concentration of 0.5 the LOR																			
SAC Soil acceptance criteria																			
LOR Limit of laboratory reporting																			
ND Not detected above LOR's																			
Value exceeds Soil Acceptance Criteria (SAC)																			

Table 7. Summary of DDX, dieldrin and lindane levels from surface samples collected between 2005 and 2015 from impact (FCC) and control sites. Note: in most cases, only sites common to all studies have been included. Several new sites sampled from 2009 onwards are included in Table 8.

Location	Area	DDX (mg/kg)								Dieldrin (mg/kg)								Lindane (mg/kg)														
		2005	2007	2008	2009a	2009b	2010a	2010b	2011	2013	2014	2015	2005	2007	2008	2009a	2009b	2010a	2010b	2011	2013	2014	2015	2005	2007	2008	2009a	2009b	2010b	2011	2013	2014
Control	West (1 bay west of FCC)	0.0056	ND	ND	0.005	0.0015	0.0015	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
JME 084(see note)	West FCC	1.64	16.6	0.987	0.23	0.1416	0.49	0.144	0.0815	0.0845	0.1183	0.0694	0.022	0.19	0.025	0.009	0.0025	0.014	0.0049	0.0017	0.0027	0.0042	0.0039	0.003	0.008	0.003	ND	ND	ND	ND	ND	ND
JME 083 (at concrete bridge)	West FCC	12	3.9	1.8	0.129	0.657		0.6931	0.4812	0.3862	0.6001	0.42	0.0018	0.08	0.067	0.005	0.023	0.0193	0.0169	0.0082	0.0076	0.0078	0.007	0.003	0.003	0.0057	ND	0.001	ND	ND	ND	ND
JME 081 (40 m down ditch)	West FCC	0.26	1.43	2	0.62	0.518		0.1064	0.2892	0.206	0.2416	0.1187	0.129	0.08	0.06	0.02	0.015		0.003	0.0071	0.0063	0.0038	0.0024	-	0.004	0.0039	0.0016	0.001	ND	ND	ND	ND
JME 082 (80 m down ditch)	West FCC	0.17	0.42	0.41	0.12	0.1565		0.2118	0.088	0.057	0.0147	0.0363	0.0035	0.013	0.013	0.004	0.0028		0.0027	0.0020	ND	ND	ND	0.0005	0.004	ND	ND	ND	ND	ND	ND	ND
JME 090	East FCC	0.63	2.12	0.187	0.13	1.7395		0.2492	0.1244	0.2213	0.2608	0.289	0.12	0.071	0.026	0.006	0.16		0.0074	0.0045	0.0048	0.02	0.0017	-	0.68	ND	ND	ND	ND	ND	ND	ND
JME 088 (top of beach)	East FCC	273.5	2.4	0.477	0.3	0.2251		0.169	0.1161	0.2803	0.431	0.1547	77.13	0.58	0.078	0.054	0.0044		0.014	0.0290	0.0037	0.006	0.0018	0.36	ND	ND	ND	ND	ND	ND	ND	ND
JME 087 (10 m down beach) ¹	East FCC	5.2	0.24	0.24	0.016	0.1043		0.1399	0.0564	0.0751	0.0451	0.0711	1.3	0.0108	0.28	0.005	ND		0.006	0.0024	ND	0.0016	0.0143	0.004	ND	ND	ND	ND	ND	ND	ND	ND
JME 086 (15 m down beach) ²	East FCC	0.34	0.023	0.044	0.013	0.0402		0.2344	0.0838	0.1209	0.106	0.0142	0.15	0.0057	0.004	ND	0.0013		0.0068	0.0012	0.0024	0.0053	ND	0.004	ND	ND	ND	ND	ND	ND	ND	
Control	East (Hunter-Brown)	-	-	-	-	0.00148		0.0015	ND	0.0069			-	-	-	-	ND		ND	ND	ND	ND	ND	-	-	-	-	ND	ND	ND	ND	ND

Notes:	
JME 084	(West FCC snail sample site) 10m (2005, 2007), 40 m (2008), 45m (2009) from MHWS
1	10m (2005, 2009b), 5m (2007), 4.8m (2008), 8m (2009a)
2	22m (2005), 15m (2007, 2009a, 2009b), 10.5m (2008)
2009a	Easton (2009) (sample February and October 2009)
2009b	Davidson et al., (2010) (Sample October 2009)
2010a	Easton (2010) (sample January 2010)
2010b	Davidson et al., (2011) (Sample November 2010)
2011	Davidson et al., (2012) (sample November 2011)
2013	Paul Sheldon TDC (sample December 2013)
2014	Paul Sheldon TDC (sample December 2014)
2015	Paul Sheldon TDC (sample December 2015)
	Values greater than Soil Acceptance Criteria (SAC)

Table 8. Summary of DDX, dieldrin and lindane levels from surface samples collected from all sites from 2009 to 2015.

Location	Area	DDX (mg/kg)						Dieldrin (mg/kg)						Lindane (mg/kg)						
		2009	2010	2011	2013	2014	2015	2009	2010	2011	2013	2014	2015	2009	2010	2011	2013	2014	2015	
West	Control	0.0039	0.0101	0.0005	0.0011	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	JME 083	0.657	0.6931	0.4812	0.3862	0.6001	0.4200	0.0230	0.0193	0.1690	0.0082	0.0076	0.0078	0.0010	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	JME 081	0.518	0.1064	0.2892	0.2060	0.2416	0.1187	0.0150	0.0030	0.0071	0.0063	0.0038	0.0024	0.0010	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	JME 082	0.1565	0.2118	0.0880	0.0570	0.0147	0.0363	0.0028	0.0027	0.0020	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	new1 (west)	0.1409	0.1976	0.0274	0.1279	0.1675	0.0386	0.0027	0.0048	0.0005	0.0020	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	new2 (middle)	1.343	0.2230	0.0932	0.8436	0.5087	0.4619	0.0240	0.0036	0.0049	0.0019	0.0119	0.0081	0.0022	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	new3 (east)	0.1242	0.0760	0.0089	0.0721	0.3754	0.0575	0.0036	0.0029	0.0005	0.0015	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	JME 084	0.1416	0.1440	0.0805	0.0845	0.1183	0.0694	0.0025	0.0049	0.0017	0.0027	0.0042	0.0039	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
East FCC	JME 088	0.2251	0.1690	0.1161	0.2803	0.4310	0.1547	0.0044	0.0140	0.0290	0.0037	0.0060	0.0018	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
East FCC	JME 087	0.10429	0.1399	0.0564	0.0751	0.0451	0.0711	0.0005	0.0060	0.0024	0.0005	0.0016	0.0143	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
East FCC	JME 086	0.0402	0.2344	0.0828	0.1209	0.0106	0.0142	0.0013	0.0068	0.0012	0.0024	0.0053	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
East FCC	new1 (north)	0.2843	1.9270	0.0889	0.1190	0.3155	0.6257	0.0038	0.0022	0.0014	0.0040	0.0033	0.0125	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
East FCC	new2 (south)	0.1448	0.6870	0.1946	0.6470	0.2746	0.0602	0.0050	0.0270	0.0038	0.0310	0.0106	0.0016	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
East FCC	JME 090	1.7395	0.2492	0.0996	0.2213	0.2608	0.2890	0.1600	0.0074	0.0058	0.0048	0.0200	0.0017	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
East	Control	0.0030	0.0137	0.0005	0.0069	0.0030	0.0030	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	Stream1 (low)	2.911	2.5750	0.6338	0.3453	0.3979	0.3194	0.0760	0.0610	0.0250	0.0250	0.0200	0.0134	0.0038	0.0026	0.0005	0.0005	0.0005	0.0005	0.0005
West FCC	Stream2 (middle)	1.087	4.9400	4.6040	2.3650	1.8807	1.5430	0.0540	0.0950	0.1900	0.1140	0.0890	0.0660	0.0025	0.0041	0.0036	0.0020	0.0013	0.0015	0.0015
West FCC	Stream3 (upper)	5.36	7.1810	3.0930	0.8846	0.8208	0.6158	0.0500	0.1600	0.1570	0.0560	0.0840	0.0360	0.0028	0.0038	0.0023	0.0005	0.0005	0.0005	0.0005

Mean	0.8952	1.1922	0.5973	0.4035	0.3666	0.2799	0.0254	0.0251	0.0271	0.0161	0.0164	0.0103	0.0011	0.0011	0.0008	0.0006	0.0006	0.0006
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SD	1.44	2.07	1.31	0.59	0.46	0.40	0.04	0.04	0.06	0.03	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.36	0.52	0.33	0.15	0.11	0.10	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: 0.001 values have been halved to calculate means

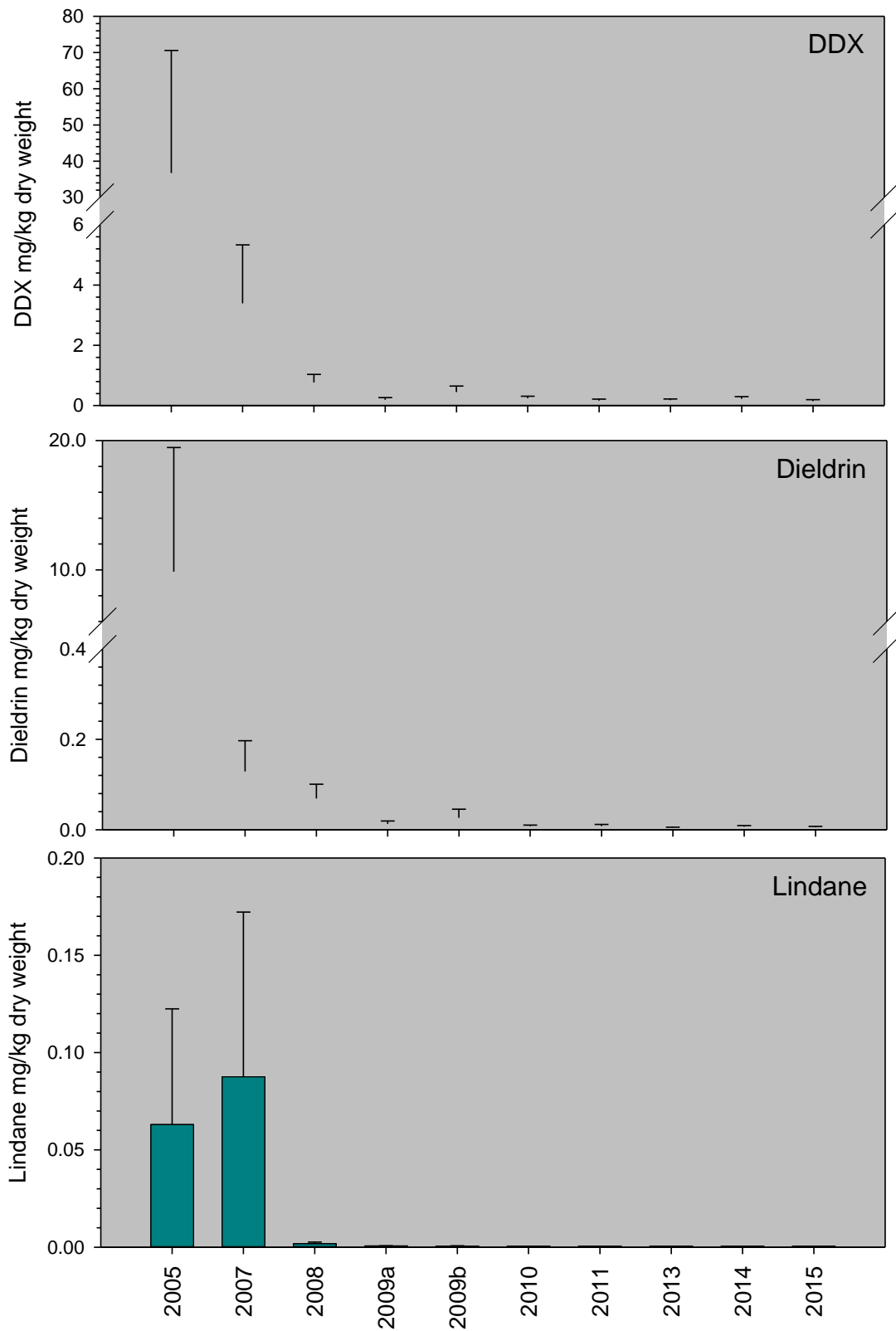


Figure 10. Mean DDX (2,4DDT; 4,4DDT; 2,4DDD; 4,4DDD; 2,4DDE; 4,4DDE), dieldrin and lindane (mg/kg dry weight) pooled from the selected impact sites from 2005 onwards. Note: x axis values are variable between graphs. Error bars +/- 1 se. Note: not all sites are included.

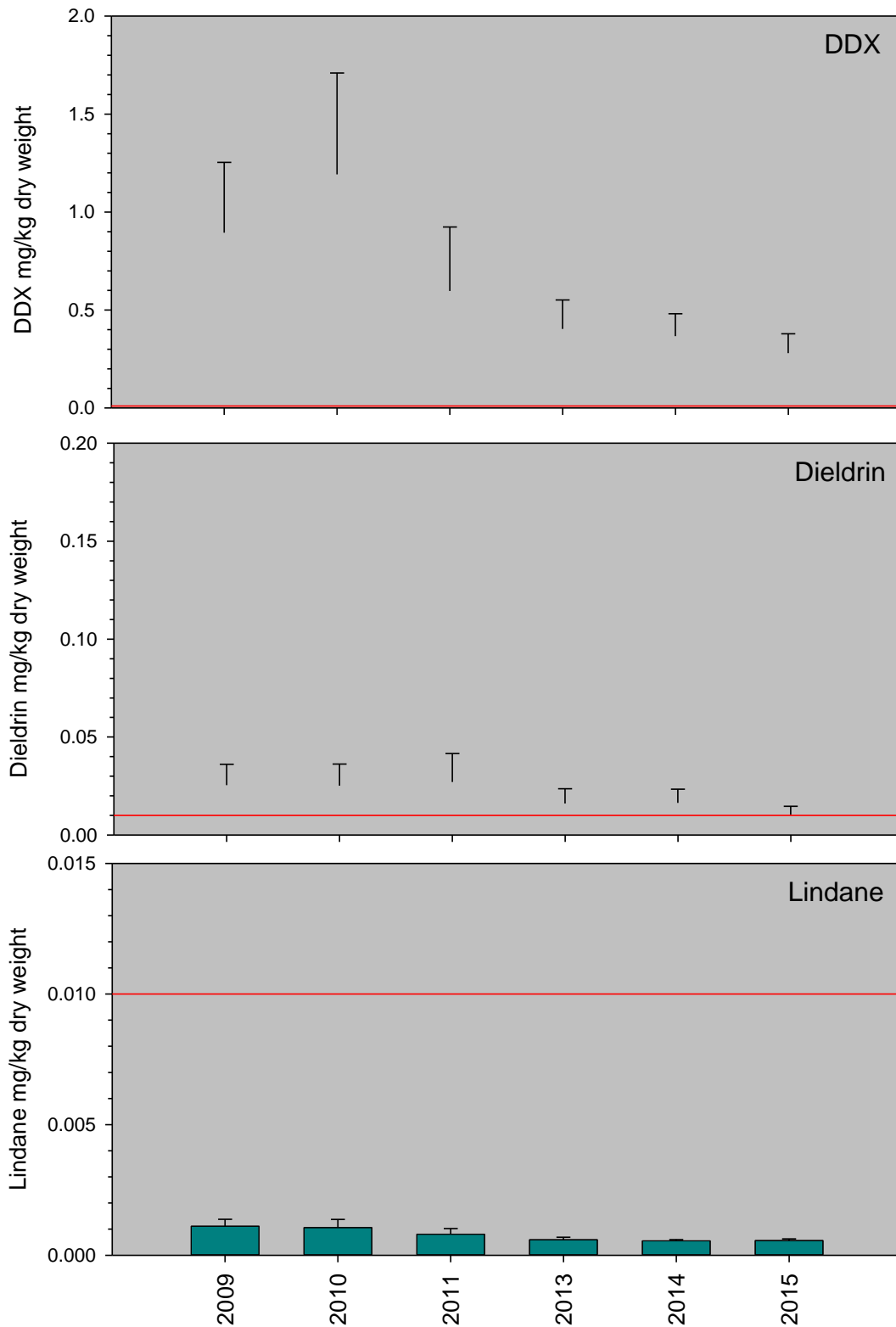


Figure 11. Mean DDX (2,4DDT; 4,4DDT; 2,4DDD; 4,4DDD; 2,4DDE; 4,4DDE), dieldrin and lindane (mg/kg dry weight) pooled from all sites sampled from 2009 onwards. Note: x axis values are variable between graphs. Error bars +/- 1 se. Red lines = SAC

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6.1.2 Mollusc contaminants

Since 2009, a variety of mollusc species have been tested for pesticide contamination from four impact and two control sites. In 2012, 2014 and 2015 the same sites and species have been sampled using the sample sampling protocols (Table 8).

Levels of ADL in cockles sampled at the East FCC impact site was relatively low (0.0033 mg/kg in 1999, 0.0026 mg/kg in 2010, 0.0028 mg/kg in 2011, 0.00075 mg/kg in 2014 and 2015). DDX levels for impact cockles were 0.0087 mg/kg in 2011 and declined to 0.00855 mg/kg in 2015 (Table 8).

At the West FCC shore, mudflat snail ADL and DDX concentrations were sampled from JME 084. In 2011 ADL was 0.45 mg/kg, but declined to 0.03015 mg/kg by 2015. Values did, however, fluctuate between years. DDX also declined at this site over the sample period (11.18 mg/kg in 2011 and 1.3915 mg/kg in 2015) (Table 9). Dieldrin levels at JME 084 also declined over the sample period. Lindane levels were not detectable.

East FCC mudflat snails (*Amphibola*) were collected from a composite sample over a wide area. Contaminants continued to decline with the lowest values recorded in 2015 and were comparable to control values (Table 9).

Topshells (*Diloma*) living on soft substrata were sampled during 2009, 2010 and the present study (Table 8). For the three events, highest values of DDX and Dieldrin were recorded from topshells living on soft substrata in 2011 (Tables 8 and 9). In 2015, contaminants reached the lowest level for the study.

Table 8. Pesticide concentrations in mollusc species sampled from impact and control sites in 2013, 2014 and 2015.

2013							
Location	West	West FCC	East FCC		East FCC	East FCC	East
Site	Control	JME 084	Composite		new2 (south)	JME 090	Control
Species	Amphibola	Amphibola	Amphibola		Amphibola	Cockle	Cockle
Substrata	Soft	Soft	Soft		Soft	Soft	Soft
Pesticides (mg/kg)							
Aldrin	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005
Dieldrin	<0.0005	0.051	0.08		0.145		0.0017
gamma-BHC (Lindane)	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005
2,4-DDD	0.0015	0.0015	0.034		0.038		0.001
4,4 DDD	0.0068	0.0068	0.104		0.18		0.0023
2,4 DDE	<0.005	<0.0005	0.002		0.0013		<0.0005
4,4 DDE	0.039	0.039	0.25		0.31		0.0015
2,4 DDT	<0.005	<0.0005	0.0032		0.0034		<0.0005
4,4 DDT	0.005	0.0055	0.058		0.085		<0.0005
ADL (aldrin, dieldrin, lindane) ¹	<.0005	0.05125	0.0805		0.1455		0.0022
DDX ¹	0.0528	0.0533	0.4512		0.6177		0.00555

2014							
Location	West	West FCC	East FCC		East FCC	East FCC	East
Site	Control	JME 084	Composite		new2 (south)	JME 090	Control
Species	Amphibola	Amphibola	Amphibola		Amphibola	Cockle	Cockle
Substrata	Soft	Soft	Soft		Soft	Soft	Soft
Pesticides (mg/kg)							
Aldrin	<0.0005	<0.0015	<0.0014		<0.0005	<0.0005	<0.0005
Dieldrin	0.0009	0.114	0.22		0.0017	<0.0005	<0.0005
gamma-BHC (Lindane)	<0.0005	<0.0015	<0.0014		<0.0005	<0.0005	<0.0005
2,4-DDD	0.002	0.22	0.076		0.001	<0.0005	<0.0005
4,4 DDD	0.0103	0.67	0.33		0.0081	0.0018	<0.0005
2,4 DDE	<0.0005	<0.0015	<0.0014		<0.0005	<0.0005	<0.0005
4,4 DDE	0.048	3.3	0.48		0.0094	0.0046	<0.0005
2,4 DDT	<0.005	0.0029	0.0119		0.0005	<0.0005	<0.0005
4,4 DDT	0.0067	0.084	0.23		0.003	0.0026	<0.0005
ADL (aldrin, dieldrin, lindane) ¹	0.0014	0.1155	0.2214		0.0022	0.00075	0.00075
DDX ¹	0.06725	4.2777	1.1286		0.02225	0.00975	0.0015

2015							
Location	West	West FCC	East FCC		East FCC	East FCC	East
Site	Control	JME 084	Composite		new2 (south)	New 2	Control
Species	Amphibola	Amphibola	Amphibola		Amphibola	Cockle	Cockle
Substrata	Soft	Soft	Soft		Soft	Soft	Soft
Pesticides (mg/kg)							
Aldrin	<0.0005	<0.0015	<0.0005		<0.0005	<0.0005	<0.0005
Dieldrin	0.0006	0.03	<0.0005		0.0006	<0.0005	<0.0005
gamma-BHC (Lindane)	<0.0005	<0.0005	<0.0005		<0.0005	<0.0005	<0.0005
2,4-DDD	0.001	0.048	<0.0005		<0.0005	<0.0005	<0.0005
4,4 DDD	0.007	0.168	0.0014		0.0072	0.0019	<0.0005
2,4 DDE	<0.0005	0.0052	<0.0005		<0.0005	<0.0005	<0.0005
4,4 DDE	0.035	1.11	0.0012		0.0061	0.0059	<0.0005
2,4 DDT	<0.005	0.0013	<0.0005		0.0005	<0.0005	<0.0005
4,4 DDT	0.0072	0.059	0.0015		0.0021	0.0026	<0.0005
ADL (aldrin, dieldrin, lindane) ¹	0.0011	0.03015	0.00075		0.0011	0.00075	0.00075
DDX ¹	0.05295	1.3915	0.00485		0.0164	0.00855	0.0015

Notes:
¹ For multiple analyte totals, if below the LOR it is assumed to have a concentration of 0.5 the LOR
 ND Not detected above LOR's
 Scale All values presented as mg/kg
 LOR Limit of laboratory reporting

Table 9. Historical pesticide concentrations in mollusc species recorded from impact and control sites sampled by a variety of authors from 2002 to 2015.

Site	Location	Species	Substrata	DDX (mg/kg)										
				2005	2007	2008	2009a	2009b	2010	2010	2011	2013 ³	2014 ³	2015 ³
Control	West	Amphibola	Soft	0.11	-	-	-	0.09575	-	0.0598	0.12665	0.05255	0.067	0.0529
JME 084	West FCC	Amphibola	Soft	6.2	51.14	10.34	3.5	22.09	13.2	4.716	11.183	0.0533	4.277	1.3915
Composite	East FCC	Amphibola	Soft	3.96	-	-	-	1.1399	-	1.1929	0.06755	0.4512	1.129	0.00485
New2 (north)	East FCC	Diloma	Rocky	-	0.543	0.078	0.025	0.1465	-	0.0925	-	-	-	-
New2 (south)	East FCC	Diloma	Soft	-	-	-	-	0.1891	-	0.1218	1.922	0.6177	0.022	0.0164
JME 090	East FCC	Cockle	Soft	-	-	-	-	0.01101	-	0.0149	0.0087	-	0.0098	0.00855
Control	East	Cockle	Soft	<0.01 ¹	-	-	-	0.00279	-	ND	ND	0.00555	0.0015	0.0015

Site	Location	Species	Substrata	Dieldrin (mg/kg)										
				2005	2007	2008	2009a	2009b	2010	2010	2011	2013 ³	2014 ³	2015 ³
Control	West	Amphibola	Soft	0.007	-	-	-	0.002	-	0.0016	0.0029	ND	0.001	0.0006
JME 084	West FCC	Amphibola	Soft	0.364	2.18	0.48	0.22	0.52	0.39 2	0.139	0.45	0.051	0.114	0.03
Composite	East FCC	Amphibola	Soft	1	-	-	-	0.23	-	0.141	0.0126	0.08	0.22	ND
New2 (north)	East FCC	Diloma	Rocky	-	0.027	0.007	0.005	0.0031	-	0.0128	-	-	-	-
New2 (south)	East FCC	Diloma	Soft	-	-	-	-	0.0027	-	0.0121	0.77	0.145	0.0017	0.0006
JME 090	East FCC	Cockle	Soft	-	-	-	-	0.0028	-	0.0021	0.0023	-	ND	ND
Control	East	Cockle	Soft	-	-	-	-	ND	-	ND	<0.0005	0.0017	ND	ND

Site	Location	Species	Substrata	Lindane (mg/kg)										
				2005	2007	2008	2009a	2009b	2010	2011	2013 ³	2014 ³	2015 ³	
Control	West	Amphibola	Soft	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
JME 084	West FCC	Amphibola	Soft	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
Composite	East FCC	Amphibola	Soft	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
New2 (north)	East FCC	Diloma	Rocky	-	0.001	ND	ND	ND	ND	ND	-	-	-	-
New2 (south)	East FCC	Diloma	Soft	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
JME 090	East FCC	Cockle	Soft	-	-	-	-	ND	ND	ND	-	ND	ND	ND
Control	East	Cockle	Soft	-	-	-	-	ND	ND	ND	ND	ND	ND	ND

Note:
1 O'Halloran and Cavanagh (2002)
- No data supplied
2 Easton (2010)
3 Paul Sheldon (TDC)
ND Not detected above LOR's

6.2 Sediment descriptions at sediment sample sites (2011)

A description of sediment was last collected in 2011 (Davidson *et al.*, 2012)

Most OCP sediment sample sites were characterised by a surface layer of silt covering deeper substrata dominated by granule, pebble, silt, fine sand and occasional cobbles (Table 10). Hard substratum (i.e. pebbles, granules and cobbles) were widespread at sites where estuary sediments had been remediated (i.e. silt and clay removed and replaced by fill). The eastern control site located at Hunter-Brown reserve was also characterised by this combination of substrata due to the alluvial origins of this site.

Sample sites located further from the West FCC estuarine edge, away from the remediated flats, were characterised by silt and clay substratum over the entire depth of the core sample (i.e. West FCC new2, new3, JME 082, JME 084, West control).

The three Stream sites were composed of remediated substrata with small cobble, pebble and granule size material being dominant.

Only one impact site had an anaerobic smell (JME 083). This site was in the estuary immediately downstream of where the small stream entered the estuary proper. All other sites did not exhibit any anaerobic odour. Some sites did however, have variable levels of black colouration, usually observed close to the sediment surface (Table 10).



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Table 10. Description of substrata at sediment sampling sites (Davidson *et al.*, 2012).

Area	Site	Deep sample depth	Substratum	Smell colour
Western embayment	Control	8-10 cm	Sand, fine sand	Orange colour below surface, no anaerobic smell
West FCC	JME 083	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Grey-black, anaerobic smell
West FCC	JME 081	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Grey, no anaerobic smell
West FCC	JME 082	8-10 cm	Silt and clay	Grey-black, no anaerobic smell
West FCC	new1 (west)	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Orange colour below surface, no anaerobic smell
West FCC	new2 (middle)	8-10 cm	Silt, clay, fine sand	Grey-black, no anaerobic smell
West FCC	new3 (east)	8-10 cm	Fine sand, sand (silty surface)	Mid grey with patches of orange, no anaerobic smell
West FCC	JME 084	8-10 cm	Fine sand, sand (silty surface)	Mid grey, old vegetation, no anaerobic smell
East FCC	JME 088	6-8 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Light grey, no anaerobic smell
East FCC	JME 087	6-8 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Light grey-brown (some black near surface), no anaerobic smell
East FCC	JME 086	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Light grey, no anaerobic smell
East FCC	new1 (north)	6-8 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Grey-dark brown, some black patches, no anaerobic smell
East FCC	new2 (south)	6-8 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Light grey (some black in top 4 cm), no anaerobic smell
East FCC	JME 090	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Grey-black, no anaerobic smell
Hunter Brown	Control	6-8 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Light grey-grey, patches of orange
West FCC	Stream1 (low)	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Grey-black, no anaerobic smell
West FCC	Stream2 (middle)	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Grey-black, black near surface, no anaerobic smell
West FCC	Stream3 (upper)	8-10 cm	Granules, pebbles, occasional small cobbles, fine sand, silt	Grey-black, black near surface, no anaerobic smell

6.3 Macroalgae cover

Photographs have been previously collected from comparable tidal heights at impact and control sites in October 2009, November 2010 and November 2011. During the present study photos were collected on 11th December 2013 and 21st December 2015.

Macroalgal cover was absent or recorded at low levels at both control sites in all sample years (Plates 1 - 4). At the Hunter-Brown control site, areas of green macroalgae were observed near low water mark, however, little or no macroalgae was observed from the shore at higher tidal levels.

In 2009, macroalgae dominated by *Enteromorpha* sp. was widespread and abundant close to the cobble bank at the West FCC new2 (middle) site (Plate 3, top). In 2010 and in Spring 2011, macroalgae was much reduced compared to Spring 2009. In 2010 and 2011, macroalgae was limited to a relatively narrow band directly adjacent and at the foot of the cobble bank. In 2013 and 2014, a small level of algal cover was observed close to the cobble edge.

At the East FCC shore, macroalgae was present, but never common or abundant. Little difference in the level of macroalgae was observed between 2009 and 2010 (Plate 4). In Spring of 2011, the lowest levels of macroalgae were recorded for the three years of sampling (Photo 7). In 2013 and 2015 macroalgae was restricted to the sediment at the foot of the cobble shore. Most notable was the decline in macroalgae from the middle and lower shore.

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Plate 1. Macroalgae panoramic photos from West control. Order from top is October 2009, November 2010, 2011 and December 2013.



Plate 2. Macroalgae panoramic photos from East control (Hunter-Brown). Order from top is October 2009, November 2010, 2011, December 2013 and December 2015.

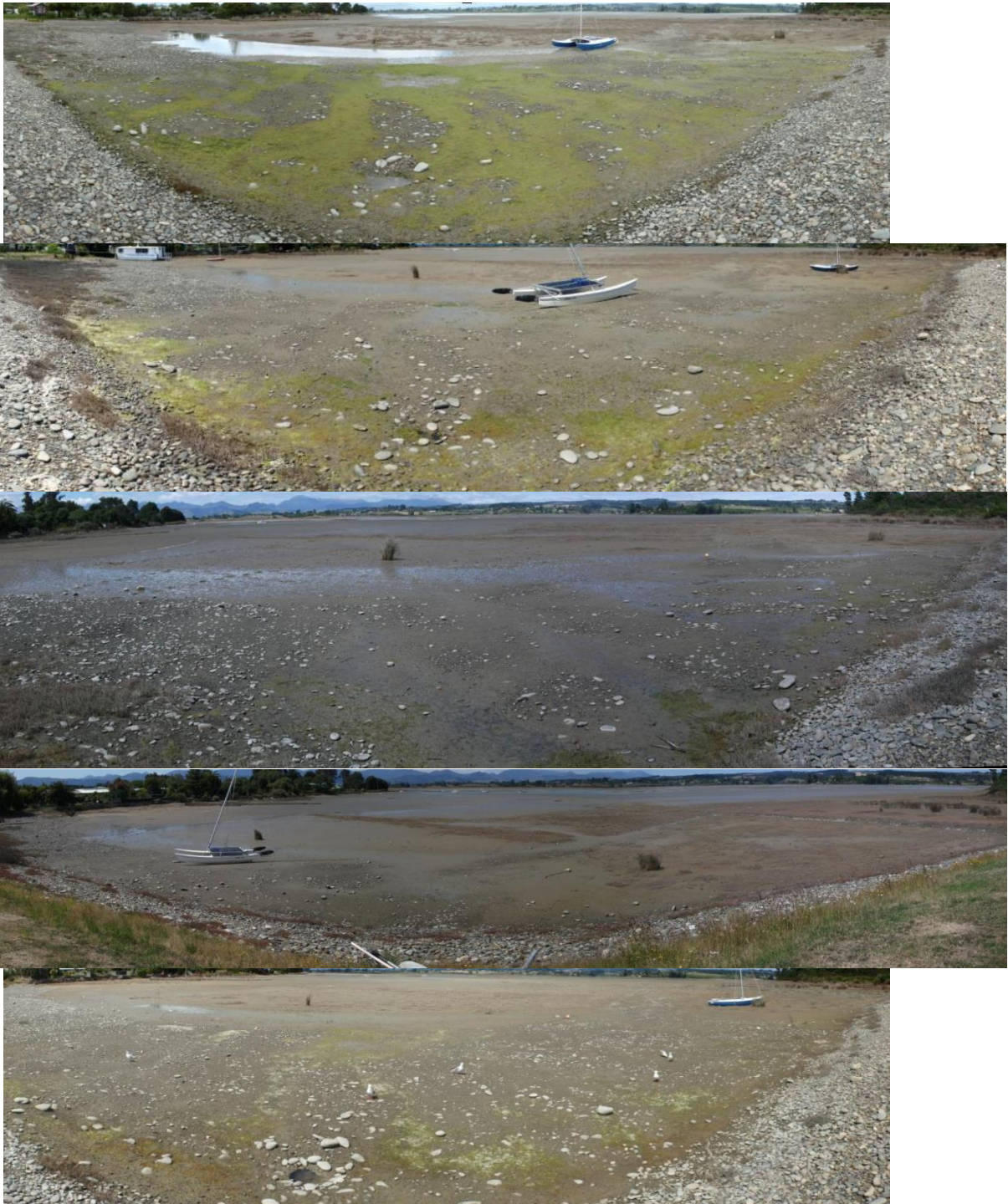


Plate 3. Macroalgae photos from West FCC (middle). Order from top is October 2009, November 2010, 2011, December 2013 and December 2015.



Photo 4. Macroalgae panoramic photos from East FCC (south). Order from top is October 2009, November 2010, 2011, December 2013 and December 2015.

7.0 Discussion

7.1 Organism and sediment contaminant sampling

7.1.1 Surface sediment contaminant levels

As with previous studies, DDX and ADL in surface sediments varied depending on location and sample year.

In 2009, SAC levels for ADL were exceeded at three of the seven West estuarine FCC sites. In 2010 and 2011, the SAC for ADL was exceeded at only one of the seven of the West FCC sample sites. By 2015, the SAC for shallow sediments was exceeded at only two sites (Stream middle and upper).

The SAC for DDX in both 2009 and 2010 was exceeded at all West FCC sites. In 2011, one of the West FCC site met the DDX SAC for the first time (West FCC new3). Three sites showed declines between 2009 and 2010, with DDX declines recorded at all but one site between 2010 and 2011. The one increase in DDX between 2010 and 2011 was recorded in the estuarine ditch draining the west stream. In 2015, the SAC was exceeded at 13 of the 15 samples. Overall, contaminant levels were lower compare to 2009 and 2010.

For the West FCC tidal freshwater stream, all surface sediments sampled exceeded DDX and ADL SAC criteria for all years. The West FCC (stream1 low) site showed a decline for both contaminant groups since 2009. However, the middle and upper stream sites, retained ADL and DDX at elevated levels recorded in earlier years.

Davidson (2012) stated “based on results from 2009, 2010 and 2011 study, it is probable that DDX in stream surface sediments are elevated due to seepage containing contaminants from adjacent terrestrial sediments”. In the Auditor’s report, a contaminant “hotspot” buried close to the stream edge was suspected (see Auditor’s report, section 6.7.3.2). The auditor stated that such “hotspots” could be remediated, however, he stated that this was not warranted as they presented no particular risk as creek-bed gravel and vegetative cover prevents sediment mobilisation and hence the pathway to potential receptors. The auditor recommended that the Site Management Plan ensure measures be established to control excavation in the area and to prevent the creek from being eroded.

At the East FCC site, SAC criterion in surface sediments for ADL was exceeded at one of the six sites in 2009 and two in 2010 and one site in 2011. In 2015 there were no exceedances for ADL at shallow East FCC sites.



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7.1.2 Deep sediment contaminant levels

Deep sediment at West FCC sites had an ADL SAC exceedance at one estuarine site in 2015. All three deep stream sites, however, had ADL levels above the SAC. In 2015, deep DDX levels in the western FCC sites exceeded the SAC at four of the seven sites as well as all stream sites. Davidson *et al.* (2012) recorded elevated ADL levels in the western estuarine ditch that drained the West FCC stream. The author suggested this may be due to contaminants travelling from the stream sites located upstream. In 2015, ADL and DDX levels in deep sediment samples at West FCC stream sites remained at comparable levels to 2010. Highest values were again recorded from the middle site followed by the upper site. Lowest values were recorded from the bottom stream site in 2015. The deep sediment is relatively stable; however, shallow levels have declined in recent years.

DDX levels at all deep East FCC sites showed a relatively large increase in 2010. Since 2014, however, levels have declined. The exception was a spike at an FCC East site in 2013. Since 2013, DDX and ADL levels have returned to normal level and have continued to decline.

Davidson *et al.* (2011) suggested that water seepage channels arising from the foot of the East FCC rock wall could be carrying contaminated water from the adjacent FCC site onto the mudflats. The declines for 2014 and 2015 suggests that this phenomenon has probably slowed or stopped.

7.1.3 Overall patterns of contamination

Apart from shallow and deep sediments at the West FCC freshwater tidal stream, most sites showed some improvement for ADL and DDX levels by 2015.

In the 2009 auditor's report, it was stated that the SAC for DDX and ADL in estuarine sediments was not met (Pattle Delamore, 2009). By 2015 most of the shallow and deep sediments (excluding the West FCC stream) meet the SAC for ADL. DDX levels, however, remain above the SAC at most sites, but levels are dramatically lower compared to pre-2008.

Based on results and trends, there remains one area of concern (i.e. West FCC stream middle and upper sites). At these sites, sediment recontamination has occurred and has probably come from a "hot spot" in the adjacent land. Some comfort is provided by a small decline in surface sediment levels and no further increase in deeper sediments. This suggests the introduction of new contaminants has ceased and the "hotspot" source may have stabilized as the auditor suggested (Pattle Delamore, 2011).

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7.1.4 Shellfish and snail contaminant levels

ADL in cockles at the East FCC shore achieved ND (not detectable levels) for 2014 and 2015. DDX levels in cockles were elevated above the control values, but were at lower levels in 2015 compared to cockles located close to contaminant sources such as the Avon Heathcote (Thomson and Davies, 1993) and Manukau Harbour (Hickey *et al.*, 1995).

ADL in mudflat snails at the West FCC site, were low in 2015, but remained above controls levels. DDX in mudflat snails were below the control site at the East FCC sample, but remained elevated for snails at the West FCC site. DDX levels did, however, decline at the west FCC site over the duration of the study. Results confirm the conclusion by O'Halloran and Cavanagh (2002) that mudflat snails represent the best mollusc to monitor contaminants. Davidson *et al.* (2010) noted an increase in DDX and dieldrin in mudflat snails at the West FCC site between February 2009 and October 2009. The authors recorded DDX in October 2009 (JME 084 at 22.09 mg/kg), representing the second highest value since 2007 (51.15 mg/kg), while dieldrin was also relatively high (0.52 mg/kg) compared to previous samples. In the 2015 sample, ADL and DDX declined well below the 2009 levels for cockles and topshells.

For mudflat snails, ADL and DDX values have historically been very high. For example, at JME084 (western FCC), DDX values declined from 51.14 mg/kg in 2007 to 1.39 mg/kg in 2015. As these are mostly juvenile snails, it is unlikely they have migrated into this area from elsewhere, therefore the OCP concentrations in the flesh will have come from the surface layer of estuarine sediment.

DDX and Dieldrin levels from topshells living on East FCC soft sediment have declined to levels comparable to the control site. This correlates with the decline in cockle contamination at the East FCC site over the same period.

7.2 Macroalgae cover

Macroalgae blooms are traditionally indicative of nutrient enrichment. Davidson *et al.* (2010) recorded a localised macroalgae bloom from the West FCC site with relatively minor levels of macroalgae being recorded from the East FCC shore. This was also noted by Davidson *et al.* (2011) in the spring of 2010, however, levels of macroalgae were reduced in the latter sample. Davidson *et al.* (2011) stated that the reduction also occurred at control sites and may have been due to the very dry and hot conditions. The authors reported that macroalgae present in the West FCC shore was dominated by *Enteromorpha* sp., a species usually associated with freshwater flows into a marine environment. In the present study, relatively little macroalgae was observed at impact sites compared to 2009 photographs. The decline of macroalgae recorded in the present study is therefore most likely due to a decline in nutrients seeping from the adjacent land area.

7.3 Recommendations for future monitoring

Since Spring 2009, a total of six sample events have occurred in relation to the post-remediation contamination monitoring. Results from those sampling events combined with previous sampling have been used as a basis for the following monitoring recommendations.

It is recommended that the site auditor make a final decision on any changes to the monitoring regime.

- Many of the sites have exhibited a reduction in contamination over the duration of the study. DDX remains widespread and represents the dominant contaminant in sediment and shellfish. Previously, collection of deep and shallow contaminant data has indicated considerable fluctuation between years, however, variability appears to have declined. **Apart from FCC stream sites (see below), sampling every second year may be sufficient to monitor the further decline in contaminants.**
- An area of concern remains at the West FCC stream and an occasional contaminant spike at an East FCC site. At the FCC Stream sites, there is evidence that new contamination historically entered the estuary after remediation. Most recent data suggest this area may have stabilized. **It is therefore recommended that annual monitoring of contaminants from the middle and upper shallow and deep FCC stream sites be continued. A periodic review of any new data is suggested to assess the need for ongoing monitoring.**
- Based on the variability of sediment and shellfish contaminants and the elevated contamination in some estuarine and stream sediments, **it is recommended that mudflat snail and cockle and sampling be continued. It is also recommended that soft sediment-dwelling *Diloma* (topshells) only be sampled if insufficient mudflat snails are available at the East FCC site.**
- Nutrient input into the estuary originating from the remediation event has declined and now appears stable. **There is no longer a need to monitor macroalgae cover.**

Acknowledgements

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Appendix 1. Hill Laboratories (11th December 2013).



Hill Laboratories
 BETTER TESTING BETTER RESULTS

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 Fax +64 7 858 2001
 Email mail@hill-labs.co.nz
 Web www.hill-labs.co.nz

ANALYSIS REPORT Page 1 of 7

Client: Tasman District Council ENVIRONMENTAL	Lab No: 1215523	SPV1
Contact: P Sheldon	Date Registered: 14-Dec-2013	
C/- Tasman District Council ENVIRONMENTAL	Date Reported: 14-Jan-2014	
Private Bag 4	Quote No: 58528	
RICHMOND 7050	Order No: 305330	
	Client Reference: Mapua samples	
	Submitted By: P Sheldon	

Sample Type: Soil

Sample Name:	JME 080 Shallow 11-Dec-2013 12:00 pm	JME 080 Deep 11-Dec-2013 12:00 pm	JME 083 Shallow 11-Dec-2013 10:30 am	JME 083 Deep 11-Dec-2013 10:30 am	JME 082 Shallow 11-Dec-2013 10:30 am
Lab Number:	1215523.1	1215523.2	1215523.3	1215523.4	1215523.5

Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	0.0011	0.0054	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0019	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	0.042	0.37	0.0040
4,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	0.156	1.16	0.0104
2,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	0.0098	0.056	0.0011
4,4'-DDE	mg/kg dry wt	0.0011	< 0.0010	0.114	0.50	0.0136
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	0.0054	0.29	0.0019
4,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	0.059	4.0	0.026
Dieldrin	mg/kg dry wt	< 0.0010	< 0.0010	0.0082	0.029	< 0.0010
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin Aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0021	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Sample Name:	JME 082 Deep 11-Dec-2013 10:30 am	WFCC New 1 Shallow 11-Dec-2013 11:00 am	WFCC New 1 Deep 11-Dec-2013 11:00 am	WFCC New 2 Shallow 11-Dec-2013 11:00 am	WFCC New 2 Deep 11-Dec-2013 11:00 am
Lab Number:	1215523.6	1215523.7	1215523.8	1215523.9	1215523.10

Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0022	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010



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Sample Type: Soil						
Sample Name:	JME 082 Deep 11-Dec-2013 10:30 am	WFCC New 1 Shallow 11-Dec-2013 11:00 am	WFCC New 1 Deep 11-Dec-2013 11:00 am	WFCC New 2 Shallow 11-Dec-2013 11:00 am	WFCC New 2 Deep 11-Dec-2013 11:00 am	WFCC New 2 Deep 11-Dec-2013 11:00 am
Lab Number:	1215523.6	1215523.7	1215523.8	1215523.9	1215523.10	
Organochlorine Pesticides Trace in Soil						
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	< 0.0010	0.0127	< 0.0010	0.166	0.0032
4,4'-DDD	mg/kg dry wt	< 0.0010	0.022	< 0.0010	0.30	0.0096
2,4'-DDE	mg/kg dry wt	< 0.0010	0.0040	< 0.0010	0.024	< 0.0010
4,4'-DDE	mg/kg dry wt	0.0022	0.067	0.0025	0.34	0.0100
2,4'-DDT	mg/kg dry wt	< 0.0010	0.0012	< 0.0010	0.0022	< 0.0010
4,4'-DDT	mg/kg dry wt	0.0023	0.021	0.0025	0.0114	0.0049
Dieldrin	mg/kg dry wt	< 0.0010	0.0020	< 0.0010	0.0192	0.0028
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin Aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	WFCC New 3 Shallow 11-Dec-2013 11:00 am	WFCC New 3 Deep 11-Dec-2013 11:00 am	JME 081 Shallow 11-Dec-2013 10:30 am	JME 081 Deep 11-Dec-2013 10:30 am	JME 084 Shallow 11-Dec-2013 11:00 am	
Lab Number:	1215523.11	1215523.12	1215523.13	1215523.14	1215523.15	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	0.0014	0.0020	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.0041	0.0011	0.024	0.090	0.0092
4,4'-DDD	mg/kg dry wt	0.0083	0.0034	0.063	0.25	0.033
2,4'-DDE	mg/kg dry wt	0.0013	< 0.0010	0.0096	0.035	0.0020
4,4'-DDE	mg/kg dry wt	0.0178	0.0048	0.090	0.23	0.035
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	0.0035	0.0078	< 0.0010
4,4'-DDT	mg/kg dry wt	0.0037	0.0048	0.0159	0.052	0.0053
Dieldrin	mg/kg dry wt	0.0015	< 0.0010	0.0063	0.025	0.0027
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin Aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

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Sample Type: Soil						
Sample Name:	JME 084 Deep 11-Dec-2013 11:00 am	STRM Lower Shallow 11-Dec-2013 9:45 am	STRM Lower Deep 11-Dec-2013 9:45 am	STRM 1 Mid Shallow 11-Dec-2013 9:30 am	STRM Mid Deep 11-Dec-2013 9:30 am	
Lab Number:	1215523.16	1215523.17	1215523.18	1215523.19	1215523.20	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	0.0010	0.0015	< 0.0010	0.0058	0.0120
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0020	0.0047
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.034	0.035	< 0.0010	0.25	0.84
4,4'-DDD	mg/kg dry wt	0.065	0.092	0.0017	0.70	2.2
2,4'-DDE	mg/kg dry wt	0.0073	0.0121	< 0.0010	0.105	0.44
4,4'-DDE	mg/kg dry wt	0.086	0.168	0.0058	1.06	2.3
2,4'-DDT	mg/kg dry wt	0.0021	0.0082	< 0.0010	0.030	0.062
4,4'-DDT	mg/kg dry wt	0.0109	0.030	0.0016	0.22	0.37
Dieldrin	mg/kg dry wt	0.0105	0.025	0.0011	0.114	0.29
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin Aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	Stream Upper Shallow 11-Dec-2013 9:03 am	STRM 1 Upper Deep 11-Dec-2013 9:03 am	JME 088 Shallow 11-Dec-2013 1:00 pm	JME 088 Deep 11-Dec-2013 1:00 pm	JME 087 Shallow 11-Dec-2013 1:00 pm	
Lab Number:	1215523.21	1215523.22	1215523.23	1215523.24	1215523.25	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	0.0093	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	0.0085	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.122	1.23	0.0149	0.0168	0.0028
4,4'-DDD	mg/kg dry wt	0.31	3.1	0.084	0.073	0.0168
2,4'-DDE	mg/kg dry wt	0.042	0.72	< 0.0010	0.0018	< 0.0010
4,4'-DDE	mg/kg dry wt	0.35	3.1	0.025	0.044	0.0075
2,4'-DDT	mg/kg dry wt	0.0146	0.124	0.0154	0.023	0.0080
4,4'-DDT	mg/kg dry wt	0.046	0.42	0.141	0.148	0.040
Dieldrin	mg/kg dry wt	0.056	0.34	0.0037	0.0077	< 0.0010
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin Aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

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Sample Type: Soil						
Sample Name:	Stream Upper Shallow 11-Dec-2013 9:03 am	STRM 1 Upper Deep 11-Dec-2013 9:03 am	JME 088 Shallow 11-Dec-2013 1:00 pm	JME 088 Deep 11-Dec-2013 1:00 pm	JME 087 Shallow 11-Dec-2013 1:00 pm	
Lab Number:	1215523.21	1215523.22	1215523.23	1215523.24	1215523.25	
Organochlorine Pesticides Trace in Soil						
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	JME 087 Deep 11-Dec-2013 1:00 pm	JME 086 Shallow 11-Dec-2013 1:00 pm	JME 086 Deep 11-Dec-2013 1:00 pm	EFCC New 1 Shallow 11-Dec-2013 1:00 pm	EFCC New 1 Deep 11-Dec-2013 1:30 pm	
Lab Number:	1215523.26	1215523.27	1215523.28	1215523.29	1215523.30	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	0.0015	< 0.0010	0.0153	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.022	0.0042	0.135	0.0144	0.0063
4,4'-DDD	mg/kg dry wt	0.076	0.022	0.59	0.037	0.0195
2,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
4,4'-DDE	mg/kg dry wt	0.032	0.0067	0.091	0.025	0.0186
2,4'-DDT	mg/kg dry wt	0.0012	0.023	0.036	0.0066	0.028
4,4'-DDT	mg/kg dry wt	0.0067	0.065	0.189	0.036	0.076
Dieldrin	mg/kg dry wt	0.0067	0.0024	0.091	0.0040	0.0018
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin Aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	EFCC New 2 Shallow 11-Dec-2013 1:30 pm	EFCC New 2 Deep 11-Dec-2013 1:30 pm	JME 090 Shallow 11-Dec-2013 1:00 pm	JME 090 Deep 11-Dec-2013 1:30 pm	Hunter Brown Shallow 11-Dec-2013 3:00 pm	
Lab Number:	1215523.31	1215523.32	1215523.33	1215523.34	1215523.35	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	0.0022	0.165	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	0.029	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	0.0032	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	0.053	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.030	1.84	0.0104	0.0095	< 0.0010
4,4'-DDD	mg/kg dry wt	0.119	6.8	0.038	0.030	0.0023
2,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
4,4'-DDE	mg/kg dry wt	0.034	1.12	0.0179	0.044	0.0013
2,4'-DDT	mg/kg dry wt	0.064	3.2	0.0128	0.0179	< 0.0010
4,4'-DDT	mg/kg dry wt	0.40	21	0.086	0.111	0.0033

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Sample Type: Soil						
Sample Name:	EFCC New 2 Shallow 11-Dec-2013 1:30 pm	EFCC New 2 Deep 11-Dec-2013 1:30 pm	JME 090 Shallow 11-Dec-2013 1:00 pm	JME 090 Deep 11-Dec-2013 1:30 pm	Hunter Brown Shallow 11-Dec-2013 3:00 pm	
Lab Number:	1215523.31	1215523.32	1215523.33	1215523.34	1215523.35	
Organochlorine Pesticides Trace in Soil						
Dieldrin	mg/kg dry wt	0.031	1.10	0.0048	0.0026	< 0.0010
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	0.041	< 0.0010	< 0.0010	< 0.0010
Endrin Aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	0.025	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	Hunter Brown Deep 11-Dec-2013 3:00 pm					
Lab Number:	1215523.36					
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.0010	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.0010	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.0010	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.0010	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.0010	-	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.0010	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.0010	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.0010	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.0010	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.0010	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.0010	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.0010	-	-	-	-
Endrin	mg/kg dry wt	< 0.0010	-	-	-	-
Endrin Aldehyde	mg/kg dry wt	< 0.0010	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.0010	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.0010	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.0010	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.0010	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.0010	-	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	-	-	-	-
Sample Type: Shellfish						
Sample Name:	Hunter Brown 11-Dec-2013 3:00 pm					
Lab Number:	1215523.41					
Individual Tests						
Dry Matter	g/100g as recd	8.8	-	-	-	-
Organochlorine Pesticides in Biomatter						
Aldrin*	mg/kg	< 0.0005	-	-	-	-

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Sample Type: Shellfish						
Sample Name:	Hunter Brown 11-Dec-2013 3:00 pm					
Lab Number:	1215523.41					
Organochlorine Pesticides in Biomatter						
alpha-BHC*	mg/kg	< 0.0005	-	-	-	-
beta-BHC*	mg/kg	< 0.0005	-	-	-	-
delta-BHC*	mg/kg	< 0.0005	-	-	-	-
gamma-BHC (Lindane)*	mg/kg	< 0.0005	-	-	-	-
cis-Chlordane*	mg/kg	< 0.0005	-	-	-	-
trans-chlordane*	mg/kg	< 0.0005	-	-	-	-
2,4'-DDD*	mg/kg	0.0010	-	-	-	-
4,4'-DDD*	mg/kg	0.0023	-	-	-	-
2,4'-DDE*	mg/kg	< 0.0005	-	-	-	-
4,4'-DDE*	mg/kg	0.0015	-	-	-	-
2,4'-DDT*	mg/kg	< 0.0005	-	-	-	-
4,4'-DDT*	mg/kg	< 0.0005	-	-	-	-
Dieldrin*	mg/kg	0.0017	-	-	-	-
Endosulfan I*	mg/kg	< 0.0005	-	-	-	-
Endosulfan II*	mg/kg	< 0.0005	-	-	-	-
Endosulfan sulfate*	mg/kg	< 0.0005	-	-	-	-
Endrin*	mg/kg	< 0.0005	-	-	-	-
Endrin Aldehyde*	mg/kg	< 0.0005	-	-	-	-
Endrin ketone*	mg/kg	< 0.0005	-	-	-	-
Heptachlor*	mg/kg	< 0.0005	-	-	-	-
Heptachlor epoxide*	mg/kg	< 0.0005	-	-	-	-
Hexachlorobenzene*	mg/kg	< 0.0005	-	-	-	-
Methoxychlor*	mg/kg	< 0.0005	-	-	-	-
Total Chlordane [(cis+trans)*100/42]*	mg/kg	< 0.002	-	-	-	-
Sample Type: Snails						
Sample Name:	JME 080 11-Dec-2013 12:00 pm	JME 084 11-Dec-2013 11:00 am	East FCC New 2 11-Dec-2013 1:30 pm	East FCC Composite 11-Dec-2013 1:30 pm		
Lab Number:	1215523.37	1215523.38	1215523.39	1215523.40		
Individual Tests						
Dry Matter	g/100g as rcvd	12.5	11.4	12.2	11.9	-
Organochlorine Pesticides in Biomatter						
Aldrin*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
alpha-BHC*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
beta-BHC*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
delta-BHC*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
gamma-BHC (Lindane)*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
cis-Chlordane*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
trans-chlordane*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
2,4'-DDD*	mg/kg	0.0015	0.090	0.038	0.034	-
4,4'-DDD*	mg/kg	0.0068	0.32	0.180	0.104	-
2,4'-DDE*	mg/kg	< 0.0005	0.0136	0.0013	0.0020	-
4,4'-DDE*	mg/kg	0.039	1.34	0.31	0.25	-
2,4'-DDT*	mg/kg	< 0.0005	0.0027	0.0034	0.0032	-
4,4'-DDT*	mg/kg	0.0055	0.053	0.085	0.058	-
Dieldrin*	mg/kg	< 0.0005	0.051	0.145	0.080	-
Endosulfan I*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endosulfan II*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endosulfan sulfate*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endrin*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endrin Aldehyde*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endrin ketone*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Heptachlor*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-

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Sample Type: Snails					
Sample Name:	JME 080 11-Dec-2013 12:00 pm	JME 084 11-Dec-2013 11:00 am	East FCC New 2 11-Dec-2013 1:30 pm	East FCC Composite 11-Dec-2013 1:30 pm	
Lab Number:	1215523.37	1215523.38	1215523.39	1215523.40	
Organochlorine Pesticides in Biomatter					
Heptachlor epoxide*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Hexachlorobenzene*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Methoxychlor*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Total Chlordane [(cis+trans)*100/42]*	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002

Analyst's Comments
 It has been noted that the spikes for OCP on sample 1215523.41, were run as part of our in-house QC procedure, had lower than expected recoveries for Endrin aldehyde. Therefore the result maybe underestimated.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Organochlorine Pesticides Trace in Soil	Sonication extraction, SPE cleanup, GPC cleanup (if required), dual column GC-ECD analysis. Tested on dried sample	-	1-36

Sample Type: Snails			
Test	Method Description	Default Detection Limit	Sample No
Homogenisation of Biological samples for Organics Tests*	Mincing, chopping, or blending of sample to form homogenous sample fraction.	-	37-41
Shucking of Shellfish*	Removal of tissue from shell. Analysis performed at Hill Laboratories - Food & Bioanalytical Division, Waikato Innovation Park, Ruakura Lane, Hamilton.	-	37-41
Organochlorine Pesticides in Biomatter*	Sonication extraction, alumina cleanup, GPC cleanup, dual column GC-ECD analysis	-	37-41
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) - gravimetry, US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	37-41

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.


 Ara Heron BSc (Tech)
 Client Services Manager - Environmental Division

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Appendix 2. Hill Laboratories (11th December 2014).



Hill Laboratories
 BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
 1 Clyde Street
 Private Bag 3205
 Hamilton 3240, New Zealand
 Tel +64 7 858 2000
 Fax +64 7 858 2001
 Email mal@hill-labs.co.nz
 Web www.hill-labs.co.nz

ANALYSIS REPORT

Page 1 of 7

Client: Tasman District Council ENVIRONMENTAL	Lab No: 1364305	SPV1
Contact: P Sheldon	Date Registered: 16-Dec-2014	
C/- Tasman District Council ENVIRONMENTAL	Date Reported: 06-Jan-2015	
Private Bag 4	Quote No: 58528	
RICHMOND 7050	Order No: 314886	
	Client Reference: Mapua samples	
	Submitted By: P Sheldon	

Sample Type: Sediment

Sample Name:	JME 083 S 11-Dec-2014 8:45 am	JME 083 D 11-Dec-2014 8:45 am	JME 081 S 11-Dec-2014 8:15 am	JME 081 D 11-Dec-2014 8:15 am	West FCC New 1 S 11-Dec-2014 8:15 am
Lab Number:	1364305.1	1364305.2	1364305.3	1364305.4	1364305.5

Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	0.0024	< 0.0010	0.0014	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.031	0.037	0.021	0.037	0.0042
4,4'-DDD	mg/kg dry wt	0.065	0.038	0.053	0.103	0.0078
2,4'-DDE	mg/kg dry wt	0.0131	0.024	0.0083	0.0161	0.0015
4,4'-DDE	mg/kg dry wt	0.166	0.36	0.063	0.096	0.021
2,4'-DDT	mg/kg dry wt	0.0060	0.069	0.0016	0.0029	0.0050
4,4'-DDT	mg/kg dry wt	0.040	0.31	0.020	0.0181	0.128
Dieldrin	mg/kg dry wt	0.0076	0.0111	0.0038	0.0046	< 0.0010
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Sample Name:	West FCC New 1 D 11-Dec-2014 8:15 am	JME 082 S 11-Dec-2014 8:15 am	JME 082 D 11-Dec-2014 8:15 am	West FCC New 2 S 11-Dec-2014 8:15 am	West FCC New 2 D 11-Dec-2014 8:15 am
Lab Number:	1364305.6	1364305.7	1364305.8	1364305.9	1364305.10

Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0011	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

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Sample Type: Sediment						
Sample Name:	West FCC New 1 D 11-Dec-2014 8:15 am	JME 082 S 11-Dec-2014 8:15 am	JME 082 D 11-Dec-2014 8:15 am	West FCC New 2 S 11-Dec-2014 8:15 am	West FCC New 2 D 11-Dec-2014 8:15 am	
Lab Number:	1364305.6	1364305.7	1364305.8	1364305.9	1364305.10	
Organochlorine Pesticides Trace in Soil						
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.111	0.0037
4,4'-DDD	mg/kg dry wt	0.0010	0.0018	< 0.0010	0.154	0.0092
2,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0188	< 0.0010
4,4'-DDE	mg/kg dry wt	0.0048	0.0088	0.0047	0.21	0.0114
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0019	< 0.0010
4,4'-DDT	mg/kg dry wt	0.0034	0.0059	0.0019	0.0130	0.0018
Dieldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0119	0.0016
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	0.0037	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	JME 084 S 11-Dec-2014 8:15 am	JME 084 D 11-Dec-2014 8:15 am	West FCC New 3 S 11-Dec-2014 8:15 am	West FCC New 3 D 11-Dec-2014 8:15 am	Hunter Brown S 11-Dec-2014 7:00 am	
Lab Number:	1364305.11	1364305.12	1364305.13	1364305.14	1364305.15	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.0130	0.029	0.0047	0.0016	< 0.0010
4,4'-DDD	mg/kg dry wt	0.047	0.064	0.0117	0.0075	< 0.0010
2,4'-DDE	mg/kg dry wt	< 0.0010	0.0103	0.0020	< 0.0010	< 0.0010
4,4'-DDE	mg/kg dry wt	0.049	0.115	0.027	0.0075	< 0.0010
2,4'-DDT	mg/kg dry wt	0.0017	0.0015	0.020	< 0.0010	< 0.0010
4,4'-DDT	mg/kg dry wt	0.0076	0.0080	0.31	0.023	< 0.0010
Dieldrin	mg/kg dry wt	0.0042	0.0131	< 0.0010	< 0.0010	< 0.0010
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	Hunter Brown D 11-Dec-2014 7:00 am	JMS 080 S 11-Dec-2014 9:30 am	JMS 080 D 11-Dec-2014 9:30 am	W FCC STM 1 S 11-Dec-2014 10:00 am	W FCC STM 1 D 11-Dec-2014 10:00 am	
Lab Number:	1364305.16	1364305.17	1364305.18	1364305.19	1364305.20	

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Sample Type: Sediment						
Sample Name:	Hunter Brown D 11-Dec-2014 7:00 am	JMS 080 S 11-Dec-2014 9:30 am	JMS 080 D 11-Dec-2014 9:30 am	W FCC STM 1 S 11-Dec-2014 10:00 am	W FCC STM 1 D 11-Dec-2014 10:00 am	
Lab Number:	1364305.16	1364305.17	1364305.18	1364305.19	1364305.20	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.049	0.038
4,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	0.0011	0.109	0.089
2,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0176	0.0186
4,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	0.0014	0.182	0.194
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0063	0.0065
4,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.034	0.028
Dieldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.020	0.0132
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	0.0014	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	W FCC STM 2 S 11-Dec-2014 10:00 am	W FCC STM 2 D 11-Dec-2014 10:00 am	W FCC STM 3 S 11-Dec-2014 10:00 am	W FCC STM 3 D 11-Dec-2014 10:00 am	JME 090 S 11-Dec-2014 11:00 am	
Lab Number:	1364305.21	1364305.22	1364305.23	1364305.24	1364305.25	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	0.0025	0.0050	< 0.0010	0.0079	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	0.0013	0.0022	< 0.0010	0.0018	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.28	0.32	0.116	0.33	0.035
4,4'-DDD	mg/kg dry wt	0.60	0.48	0.29	0.45	0.106
2,4'-DDE	mg/kg dry wt	0.121	0.171	0.049	0.116	< 0.0010
4,4'-DDE	mg/kg dry wt	0.75	0.58	0.33	0.36	0.047
2,4'-DDT	mg/kg dry wt	0.0197	0.027	0.0068	0.0101	0.0078
4,4'-DDT	mg/kg dry wt	0.110	0.128	0.029	0.067	0.065
Dieldrin	mg/kg dry wt	0.089	0.081	0.084	0.096	0.020
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

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Sample Type: Sediment					
Sample Name:	W FCC STM 2 S 11-Dec-2014 10:00 am	W FCC STM 2 D 11-Dec-2014 10:00 am	W FCC STM 3 S 11-Dec-2014 10:00 am	W FCC STM 3 D 11-Dec-2014 10:00 am	JME 090 S 11-Dec-2014 11:00 am
Lab Number:	1364305.21	1364305.22	1364305.23	1364305.24	1364305.25
Organochlorine Pesticides Trace in Soil					
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	JME 090 D 11-Dec-2014 11:00 am	East FCC New 1 S 11-Dec-2014 11:00 am	East FCC New 1 D 11-Dec-2014 11:00 am	East FCC New 2 S 11-Dec-2014 11:00 am	East FCC New 2 D 11-Dec-2014 11:00 am
Lab Number:	1364305.26	1364305.27	1364305.28	1364305.29	1364305.30
Organochlorine Pesticides Trace in Soil					
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.0125	0.041	0.022	0.0186
4,4'-DDD	mg/kg dry wt	0.036	0.128	0.080	0.057
2,4'-DDE	mg/kg dry wt	0.0013	0.0035	0.0028	< 0.0010
4,4'-DDE	mg/kg dry wt	0.022	0.074	0.047	0.039
2,4'-DDT	mg/kg dry wt	0.0068	0.031	0.110	0.041
4,4'-DDT	mg/kg dry wt	0.055	0.38	0.33	0.119
Dieldrin	mg/kg dry wt	0.0072	0.0033	< 0.0010	0.0106
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	JME 086 S 12-Dec-2014 8:30 am	JME 086 D 12-Dec-2014 8:30 am	JME 087 S 12-Dec-2014 8:30 am	JME 087 D 12-Dec-2014 8:30 am	JME 088 S 12-Dec-2014 8:30 am
Lab Number:	1364305.31	1364305.32	1364305.33	1364305.34	1364305.35
Organochlorine Pesticides Trace in Soil					
Aldrin	mg/kg dry wt	< 0.0010	0.0034	< 0.0010	0.0017
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.0014	0.0181	0.0028	0.0106
4,4'-DDD	mg/kg dry wt	0.0035	0.050	0.0090	0.028
2,4'-DDE	mg/kg dry wt	< 0.0010	0.0047	< 0.0010	< 0.0010
4,4'-DDE	mg/kg dry wt	0.0019	0.023	0.0068	0.0121
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	0.0025	0.0018
4,4'-DDT	mg/kg dry wt	0.0038	0.0059	0.024	0.0112
Dieldrin	mg/kg dry wt	0.0053	0.048	0.0016	0.0041
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010

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Sample Type: Sediment						
Sample Name:	JME 086 S 12-Dec-2014 8:30 am	JME 086 D 12-Dec-2014 8:30 am	JME 087 S 12-Dec-2014 8:30 am	JME 087 D 12-Dec-2014 8:30 am	JME 088 S 12-Dec-2014 8:30 am	
Lab Number:	1364305.31	1364305.32	1364305.33	1364305.34	1364305.35	
Organochlorine Pesticides Trace in Soil						
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	JME 088 D 12-Dec-2014 8:30 am					
Lab Number:	1364305.36					
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.0010	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.0010	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.0010	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.0010	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.0010	-	-	-	-
2,4'-DDD	mg/kg dry wt	0.0194	-	-	-	-
4,4'-DDD	mg/kg dry wt	0.050	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.0010	-	-	-	-
4,4'-DDE	mg/kg dry wt	0.033	-	-	-	-
2,4'-DDT	mg/kg dry wt	0.0059	-	-	-	-
4,4'-DDT	mg/kg dry wt	0.034	-	-	-	-
Dieldrin	mg/kg dry wt	0.0086	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.0010	-	-	-	-
Endrin	mg/kg dry wt	< 0.0010	-	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.0010	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.0010	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.0010	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.0010	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.0010	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.0010	-	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	-	-	-	-
Sample Type: Shellfish						
Sample Name:	JME 090 11-Dec-2014 11:00 am	Hunter Brown 11-Dec-2014 7:00 am				
Lab Number:	1364305.38	1364305.39				
Individual Tests						
Dry Matter	g/100g as rcvd	14.3	17.9	-	-	-
Organochlorine Pesticides in Biomatter						
Aldrin*	mg/kg	< 0.0005	< 0.0005	-	-	-
alpha-BHC*	mg/kg	< 0.0005	< 0.0005	-	-	-
beta-BHC*	mg/kg	< 0.0005	< 0.0005	-	-	-
delta-BHC*	mg/kg	< 0.0005	< 0.0005	-	-	-
gamma-BHC (Lindane)*	mg/kg	< 0.0005	< 0.0005	-	-	-
cis-Chlordane*	mg/kg	< 0.0005	< 0.0005	-	-	-
trans-Chlordane*	mg/kg	< 0.0005	< 0.0005	-	-	-

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Sample Type: Shellfish					
Sample Name:	JME 090 11-Dec-2014 11:00 am	Hunter Brown 11-Dec-2014 7:00 am			
Lab Number:	1364305.38	1364305.39			
Organochlorine Pesticides in Biomatter					
2,4'-DDD*	mg/kg	< 0.0005	< 0.0005	-	-
4,4'-DDD*	mg/kg	0.0018	< 0.0005	-	-
2,4'-DDE*	mg/kg	< 0.0005	< 0.0005	-	-
4,4'-DDE*	mg/kg	0.0046	< 0.0005	-	-
2,4'-DDT*	mg/kg	< 0.0005	< 0.0005	-	-
4,4'-DDT*	mg/kg	0.0026	< 0.0005	-	-
Dieldrin*	mg/kg	0.0005	< 0.0005	-	-
Endosulfan I*	mg/kg	< 0.0005	< 0.0005	-	-
Endosulfan II*	mg/kg	< 0.0005	< 0.0005	-	-
Endosulfan sulfate*	mg/kg	< 0.0005	< 0.0005	-	-
Endrin*	mg/kg	< 0.0005	< 0.0005	-	-
Endrin aldehyde*	mg/kg	< 0.0005	< 0.0005	-	-
Endrin ketone*	mg/kg	< 0.0005	< 0.0005	-	-
Heptachlor*	mg/kg	< 0.0005	< 0.0005	-	-
Heptachlor epoxide*	mg/kg	< 0.0005	< 0.0005	-	-
Hexachlorobenzene*	mg/kg	< 0.0005	< 0.0005	-	-
Methoxychlor*	mg/kg	< 0.0005	< 0.0005	-	-
Total Chlordane [(cis+trans)*100/42]*	mg/kg	< 0.002	< 0.002	-	-
Sample Type: Snails					
Sample Name:	JME 084 11-Dec-2014 8:15 am	JME 080 11-Dec-2014 9:20 am	East FCC New 2 12-Dec-2014 9:00 am	East FCC Composite 12-Dec-2014 9:00 am	
Lab Number:	1364305.37	1364305.40	1364305.41	1364305.42	
Individual Tests					
Dry Matter	g/100g as rcvd	28	36	36	32
Organochlorine Pesticides in Biomatter					
Aldrin*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
alpha-BHC*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
beta-BHC*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
delta-BHC*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
gamma-BHC (Lindane)*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
cis-Chlordane*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
trans-Chlordane*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
2,4'-DDD*	mg/kg	0.22	0.0020	0.0010	0.076
4,4'-DDD*	mg/kg	0.67	0.103	0.0081	0.33
2,4'-DDE*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
4,4'-DDE*	mg/kg	3.3	0.048	0.0094	0.48
2,4'-DDT*	mg/kg	0.0029	< 0.0005	< 0.0005	0.0119
4,4'-DDT*	mg/kg	0.084	0.0067	0.0030	0.23
Dieldrin*	mg/kg	0.114	0.0009	0.0017	0.22
Endosulfan I*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Endosulfan II*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Endosulfan sulfate*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Endrin*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Endrin aldehyde*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Endrin ketone*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Heptachlor*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Heptachlor epoxide*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Hexachlorobenzene*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Methoxychlor*	mg/kg	< 0.0015	< 0.0005	< 0.0005	< 0.0014
Total Chlordane [(cis+trans)*100/42]*	mg/kg	< 0.003	< 0.002	< 0.002	< 0.002

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SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment			
Test	Method Description	Default Detection Limit	Sample No
Organochlorine Pesticides Trace in Soil	Sonication extraction, SPE cleanup, GPC cleanup (if required), dual column GC-ECD analysis. Tested on dried sample	0.0010 - 0.002 mg/kg dry wt	1-36
Sample Type: Snails			
Test	Method Description	Default Detection Limit	Sample No
Homogenisation of Biological samples for Organics Tests*	Mincing, chopping, or blending of sample to form homogenous sample fraction.	-	37-42
Shucking of Shellfish*	Removal of tissue from shell. Analysis performed at Hill Laboratories - Food & Bioanalytical Division, Waikato Innovation Park, Ruakura Lane, Hamilton.	-	37-42
Organochlorine Pesticides in Biomatter*	Sonication extraction, alumina cleanup, GPC cleanup, dual column GC-ECD analysis	0.0005 - 0.002 mg/kg	37-42
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) - gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	37-42

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Peter Robinson MSc (Hons), PhD, FNZIC
 Client Services Manager - Environmental Division

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Appendix 3. Hill Laboratories (21st December 2015).



Hill Laboratories
 BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
 1 Clyde Street
 Private Bag 3205
 Hamilton 3240, New Zealand

Tel +64 7 858 2000
 Fax +64 7 858 2001
 Email mail@hill-labs.co.nz
 Web www.hill-labs.co.nz

ANALYSIS REPORT Page 1 of 7

Client: Tasman District Council ENVIRONMENTAL	Lab No: 1519509 SPV1
Contact: P Sheldon	Date Registered: 23-Dec-2015
C/- Tasman District Council ENVIRONMENTAL	Date Reported: 24-Feb-2016
Private Bag 4	Quote No: 58528
Richmond 7050	Order No: 324364
	Client Reference: Mapua samples
	Submitted By: P Sheldon

Sample Type: Sediment

Sample Name:	JME 080 Shallow 21-Dec-2015 11:30 am	JME 080 Deep 21-Dec-2015 11:30 am	JME 083 Shallow 21-Dec-2015 10:30 am	JME 083 Deep 21-Dec-2015 10:30 am	JME 082 Shallow 21-Dec-2015 10:30 am
Lab Number:	1519509.1	1519509.2	1519509.3	1519509.4	1519509.5

Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	0.0011	0.0023	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0023	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	0.049	0.140	0.0024
4,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	0.134	0.33	0.0078
2,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	0.020	0.067	< 0.0010
4,4'-DDE	mg/kg dry wt	< 0.0010	0.0012	0.156	0.45	0.0085
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	0.0130	0.021	0.0022
4,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	0.048	0.128	0.0154
Total DDT Isomers	mg/kg dry wt	< 0.006	< 0.006	0.42	1.13	0.036
Dieldrin	mg/kg dry wt	0.0033	< 0.0010	0.0078	0.028	< 0.0010
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Sample Name:	JME 082 Deep 21-Dec-2015 10:30 am	WFCC New 1 Shallow 21-Dec-2015 10:30 am	WFCC New 1 Deep 21-Dec-2015 10:30 am	WFCC New 2 Shallow 21-Dec-2015 10:30 am	WFCC New 2 Deep 21-Dec-2015 10:30 am
Lab Number:	1519509.6	1519509.7	1519509.8	1519509.9	1519509.10

Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010



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Sample Type: Sediment					
Sample Name:	JME 082 Deep 21-Dec-2015 10:30 am	WFCC New 1 Shallow 21-Dec-2015 10:30 am	WFCC New 1 Deep 21-Dec-2015 10:30 am	WFCC New 2 Shallow 21-Dec-2015 10:30 am	WFCC New 2 Deep 21-Dec-2015 10:30 am
Lab Number:	1519509.6	1519509.7	1519509.8	1519509.9	1519509.10
Organochlorine Pesticides Trace in Soil					
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	< 0.0010	0.0032	< 0.0010	0.106
4,4'-DDD	mg/kg dry wt	0.0013	0.0052	< 0.0010	0.124
2,4'-DDE	mg/kg dry wt	< 0.0010	0.0014	< 0.0010	0.0105
4,4'-DDE	mg/kg dry wt	0.0023	0.021	0.0039	0.21
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0024
4,4'-DDT	mg/kg dry wt	< 0.0010	0.0078	0.0029	0.0090
Total DDT Isomers	mg/kg dry wt	< 0.006	0.039	0.007	0.46
Dieldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0081
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	WFCC New 3 Shallow 21-Dec-2015 10:30 am	WFCC New 3 Deep 21-Dec-2015 10:30 am	JME 081 Shallow 21-Dec-2015 10:30 am	JME 081 Deep 21-Dec-2015 10:30 am	JME 084 Shallows 21-Dec-2015 10:30 am
Lab Number:	1519509.11	1519509.12	1519509.13	1519509.14	1519509.15
Organochlorine Pesticides Trace in Soil					
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0013
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.0070	< 0.0010	0.0145	0.041
4,4'-DDD	mg/kg dry wt	0.0133	0.0014	0.033	0.093
2,4'-DDE	mg/kg dry wt	0.0034	< 0.0010	0.0066	0.0181
4,4'-DDE	mg/kg dry wt	0.031	0.0022	0.052	0.134
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	0.0021	0.0040
4,4'-DDT	mg/kg dry wt	0.0028	< 0.0010	0.0105	0.021
Total DDT Isomers	mg/kg dry wt	0.057	< 0.006	0.120	0.31
Dieldrin	mg/kg dry wt	< 0.0010	< 0.0010	0.0024	0.0082
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010

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Sample Type: Sediment						
Sample Name:	WFCC New 3 Shallow 21-Dec-2015 10:30 am	WFCC New 3 Deep 21-Dec-2015 10:30 am	JME 081 Shallow 21-Dec-2015 10:30 am	JME 081 Deep 21-Dec-2015 10:30 am	JME 084 Shallows 21-Dec-2015 10:30 am	
Lab Number:	1519509.11	1519509.12	1519509.13	1519509.14	1519509.15	
Organochlorine Pesticides Trace in Soil						
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	JME 084 Deep 21-Dec-2015 10:30 am	STRM Lower Shallow 21-Dec-2015 10:00 am	STRM Lower Deep 21-Dec-2015 10:00 am	STRM Mid Shallow 21-Dec-2015 10:00 am	STRM Mid Deep 21-Dec-2015 10:00 am	
Lab Number:	1519509.16	1519509.17	1519509.18	1519509.19	1519509.20	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0019	0.0025
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	0.0015	0.0033
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.041	0.034	0.041	0.183	0.48
4,4'-DDD	mg/kg dry wt	0.063	0.069	0.102	0.46	2.6
2,4'-DDE	mg/kg dry wt	0.0066	0.0174	0.0175	0.093	0.28
4,4'-DDE	mg/kg dry wt	0.124	0.178	0.188	0.61	2.2
2,4'-DDT	mg/kg dry wt	< 0.0010	0.0043	0.0047	0.038	0.036
4,4'-DDT	mg/kg dry wt	0.0023	0.0167	0.022	0.159	0.148
Total DDT Isomers	mg/kg dry wt	0.24	0.32	0.37	1.54	5.7
Dieldrin	mg/kg dry wt	0.0085	0.0134	0.0158	0.066	0.143
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	STRM Upper Shallow 21-Dec-2015 10:00 am	STRM Upper Deep 21-Dec-2015 10:00 am	JME 088 Shallow 21-Dec-2015 1:00 pm	JME 088 Deep 21-Dec-2015 1:00 pm	JME 087 Shallow 21-Dec-2015 1:00 pm	
Lab Number:	1519509.21	1519509.22	1519509.23	1519509.24	1519509.25	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	0.0060	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	0.0063	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.073	0.40	0.0067	0.041	0.0046
4,4'-DDD	mg/kg dry wt	0.185	0.92	0.0180	0.133	0.0105
2,4'-DDE	mg/kg dry wt	0.041	0.22	< 0.0010	0.0031	< 0.0010
4,4'-DDE	mg/kg dry wt	0.26	1.21	0.0122	0.068	0.0076
2,4'-DDT	mg/kg dry wt	0.0168	0.060	0.0148	0.078	0.0074
4,4'-DDT	mg/kg dry wt	0.040	0.136	0.103	1.04	0.041
Total DDT Isomers	mg/kg dry wt	0.61	2.9	0.155	1.37	0.071

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Sample Type: Sediment						
Sample Name:	STRM Upper Shallow 21-Dec-2015 10:00 am	STRM Upper Deep 21-Dec-2015 10:00 am	JME 088 Shallow 21-Dec-2015 1:00 pm	JME 088 Deep 21-Dec-2015 1:00 pm	JME 087 Shallow 21-Dec-2015 1:00 pm	
Lab Number:	1519509.21	1519509.22	1519509.23	1519509.24	1519509.25	
Organochlorine Pesticides Trace in Soil						
Dieldrin	mg/kg dry wt	0.036	0.23	0.0018	0.0144	0.0143
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	JME 087 Deep 21-Dec-2015 1:00 pm	JME 086 Shallow 21-Dec-2015 1:00 pm	JME 086 Deep 21-Dec-2015 1:00 pm	EFCC New 1 Shallow 21-Dec-2015 1:00 pm	EFCC New 1 Deep 21-Dec-2015 1:00 pm	
Lab Number:	1519509.26	1519509.27	1519509.28	1519509.29	1519509.30	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	0.0014	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD	mg/kg dry wt	0.0067	0.0011	0.0171	0.042	0.029
4,4'-DDD	mg/kg dry wt	0.0189	0.0029	0.056	0.100	0.088
2,4'-DDE	mg/kg dry wt	0.0015	< 0.0010	0.0079	0.0087	0.0026
4,4'-DDE	mg/kg dry wt	0.0103	0.0029	0.037	0.141	0.052
2,4'-DDT	mg/kg dry wt	0.0021	0.0018	0.0021	0.094	0.057
4,4'-DDT	mg/kg dry wt	0.0084	0.0055	0.030	0.24	0.31
Total DDT Isomers	mg/kg dry wt	0.048	0.014	0.150	0.63	0.54
Dieldrin	mg/kg dry wt	0.0029	< 0.0010	0.0038	0.0125	0.0031
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	EFCC New 2 Shallow 21-Dec-2015 1:00 pm	EFCC New 2 Deep 21-Dec-2015 1:00 pm	JME 090 Shallow 21-Dec-2015 1:00 pm	JME 090 Deep 21-Dec-2015 1:00 pm	Hunter Brown Shallow 21-Dec-2015 3:30 pm	
Lab Number:	1519509.31	1519509.32	1519509.33	1519509.34	1519509.35	
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	0.0041	< 0.0010	< 0.0010	< 0.0010
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

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Sample Type: Sediment					
Sample Name:	EFCC New 2 Shallow 21-Dec-2015 1:00 pm	EFCC New 2 Deep 21-Dec-2015 1:00 pm	JME 090 Shallow 21-Dec-2015 1:00 pm	JME 090 Deep 21-Dec-2015 1:00 pm	Hunter Brown Shallow 21-Dec-2015 3:30 pm
Lab Number:	1519509.31	1519509.32	1519509.33	1519509.34	1519509.35
Organochlorine Pesticides Trace in Soil					
delta-BHC mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
gamma-BHC (Lindane) mg/kg dry wt	< 0.0010	0.0017	< 0.0010	< 0.0010	< 0.0010
cis-Chlordane mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
trans-Chlordane mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4'-DDD mg/kg dry wt	0.0048	0.34	0.0087	0.0072	< 0.0010
4,4'-DDD mg/kg dry wt	0.0122	1.44	0.023	0.0159	< 0.0010
2,4'-DDE mg/kg dry wt	< 0.0010	0.0159	< 0.0010	0.0049	< 0.0010
4,4'-DDE mg/kg dry wt	0.0072	0.31	0.0173	0.057	< 0.0010
2,4'-DDT mg/kg dry wt	0.0050	0.22	0.0159	0.0173	< 0.0010
4,4'-DDT mg/kg dry wt	0.031	1.63	0.081	0.080	< 0.0010
Total DDT Isomers mg/kg dry wt	0.060	4.0	0.145	0.182	< 0.006
Dieldrin mg/kg dry wt	0.0016	0.128	0.0017	0.0030	< 0.0010
Endosulfan I mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulphate mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin aldehyde mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor epoxide mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachlorobenzene mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Methoxychlor mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Chlordane [(cis+trans)* 100/42] mg/kg dry wt	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Sample Name:	Hunter Brown Deep 21-Dec-2015 3:30 pm				
Lab Number:	1519509.36				
Organochlorine Pesticides Trace in Soil					
Aldrin mg/kg dry wt	< 0.0010	-	-	-	-
alpha-BHC mg/kg dry wt	< 0.0010	-	-	-	-
beta-BHC mg/kg dry wt	< 0.0010	-	-	-	-
delta-BHC mg/kg dry wt	< 0.0010	-	-	-	-
gamma-BHC (Lindane) mg/kg dry wt	< 0.0010	-	-	-	-
cis-Chlordane mg/kg dry wt	< 0.0010	-	-	-	-
trans-Chlordane mg/kg dry wt	< 0.0010	-	-	-	-
2,4'-DDD mg/kg dry wt	< 0.0010	-	-	-	-
4,4'-DDD mg/kg dry wt	< 0.0010	-	-	-	-
2,4'-DDE mg/kg dry wt	< 0.0010	-	-	-	-
4,4'-DDE mg/kg dry wt	< 0.0010	-	-	-	-
2,4'-DDT mg/kg dry wt	< 0.0010	-	-	-	-
4,4'-DDT mg/kg dry wt	< 0.0010	-	-	-	-
Total DDT Isomers mg/kg dry wt	< 0.006	-	-	-	-
Dieldrin mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan I mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan II mg/kg dry wt	< 0.0010	-	-	-	-
Endosulfan sulphate mg/kg dry wt	< 0.0010	-	-	-	-
Endrin mg/kg dry wt	< 0.0010	-	-	-	-
Endrin aldehyde mg/kg dry wt	< 0.0010	-	-	-	-
Endrin ketone mg/kg dry wt	< 0.0010	-	-	-	-
Heptachlor mg/kg dry wt	< 0.0010	-	-	-	-
Heptachlor epoxide mg/kg dry wt	< 0.0010	-	-	-	-
Hexachlorobenzene mg/kg dry wt	< 0.0010	-	-	-	-

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Sample Type: Sediment					
Sample Name:	Hunter Brown Deep				
	21-Dec-2015 3:30 pm				
Lab Number:	1519509.36				
Organochlorine Pesticides Trace in Soil					
Methoxychlor	mg/kg dry wt	< 0.0010	-	-	-
Total Chlordane [(cis+trans)*100/42]	mg/kg dry wt	< 0.002	-	-	-
Sample Type: Shellfish					
Sample Name:	EFCC New 2 Cockles	Hunter Brown Cockles			
	21-Dec-2015 2:00 pm	21-Dec-2015 3:30 pm			
Lab Number:	1519509.39	1519509.42			
Individual Tests					
Dry Matter	g/100g as rcvd	8.6	7.8	-	-
Organochlorine Pesticides in Biomatter					
Aldrin*	mg/kg	< 0.0005	< 0.0005	-	-
alpha-BHC*	mg/kg	< 0.0005	< 0.0005	-	-
beta-BHC*	mg/kg	< 0.0005	< 0.0005	-	-
delta-BHC*	mg/kg	< 0.0005	< 0.0005	-	-
gamma-BHC (Lindane)*	mg/kg	< 0.0005	< 0.0005	-	-
cis-Chlordane*	mg/kg	< 0.0005	< 0.0005	-	-
trans-Chlordane*	mg/kg	< 0.0005	< 0.0005	-	-
2,4'-DDD*	mg/kg	< 0.0005	< 0.0005	-	-
4,4'-DDD*	mg/kg	0.0019	< 0.0005	-	-
2,4'-DDE*	mg/kg	< 0.0005	< 0.0005	-	-
4,4'-DDE*	mg/kg	0.0059	< 0.0005	-	-
2,4'-DDT*	mg/kg	< 0.0005	< 0.0005	-	-
4,4'-DDT*	mg/kg	0.0026	< 0.0005	-	-
Dieldrin*	mg/kg	< 0.0005	< 0.0005	-	-
Endosulfan I*	mg/kg	< 0.0005	< 0.0005	-	-
Endosulfan II*	mg/kg	< 0.0005	< 0.0005	-	-
Endosulfan sulfate*	mg/kg	< 0.0005	< 0.0005	-	-
Endrin*	mg/kg	< 0.0005	< 0.0005	-	-
Endrin aldehyde*	mg/kg	< 0.0005	< 0.0005	-	-
Endrin ketone*	mg/kg	< 0.0005	< 0.0005	-	-
Heptachlor*	mg/kg	< 0.0005	< 0.0005	-	-
Heptachlor epoxide*	mg/kg	< 0.0005	< 0.0005	-	-
Hexachlorobenzene*	mg/kg	< 0.0005	< 0.0005	-	-
Methoxychlor*	mg/kg	< 0.0005	< 0.0005	-	-
Total Chlordane [(cis+trans)*100/42]*	mg/kg	< 0.002	< 0.002	-	-
Sample Type: Snails					
Sample Name:	JME 080 Snail	JME 084 Snail	EFCC New 2 Snail	EFCC Composite	
	21-Dec-2015 11:30 am	21-Dec-2015 10:30 am	21-Dec-2015 2:00 pm	21-Dec-2015 2:00 pm	
Lab Number:	1519509.37	1519509.38	1519509.40	1519509.41	
Individual Tests					
Dry Matter	g/100g as rcvd	13.8	11.8	67	8.4
Organochlorine Pesticides in Biomatter					
Aldrin*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
alpha-BHC*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
beta-BHC*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
delta-BHC*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
gamma-BHC (Lindane)*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
cis-Chlordane*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
trans-Chlordane*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,4'-DDD*	mg/kg	0.0010	0.048	< 0.0005	< 0.0005

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Sample Type: Snails						
Sample Name:	JME 080 Snail 21-Dec-2015 11:30 am	JME 084 Snail 21-Dec-2015 10:30 am	EFCC New 2 Snail 21-Dec-2015 2:00 pm	EFCC Composite 21-Dec-2015 2:00 pm		
Lab Number:	1519509.37	1519509.38	1519509.40	1519509.41		
Organochlorine Pesticides in Biomatter						
4,4'-DDD*	mg/kg	0.0070	0.168	0.0072	0.0014	-
2,4'-DDE*	mg/kg	< 0.0005	0.0052	< 0.0005	< 0.0005	-
4,4'-DDE*	mg/kg	0.035	1.11	0.0061	0.0012	-
2,4'-DDT*	mg/kg	< 0.0005	0.0013	< 0.0005	< 0.0005	-
4,4'-DDT*	mg/kg	0.0072	0.059	0.0021	0.0015	-
Dieldrin*	mg/kg	0.0006	0.030	0.0006	< 0.0005	-
Endosulfan I*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endosulfan II*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endosulfan sulfate*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endrin*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endrin aldehyde*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Endrin ketone*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Heptachlor*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Heptachlor epoxide*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Hexachlorobenzene*	mg/kg	< 0.0005	0.0007	< 0.0005	< 0.0005	-
Methoxychlor*	mg/kg	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Total Chlordane [(cis+trans)*100/42]*	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-

Analyst's Comments

The snails on sample 1519509.40 were very small so they were crushed and not shucked at the client's request.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment			
Test	Method Description	Default Detection Limit	Sample No
Organochlorine Pesticides Trace in Soil	Sonication extraction, SPE cleanup, GPC cleanup (if required), dual column GC-ECD analysis. Tested on dried sample	0.0010 - 0.006 mg/kg dry wt	1-36
Sample Type: Snails			
Test	Method Description	Default Detection Limit	Sample No
Homogenisation of Biological samples for Organics Tests*	Mincing, chopping, or blending of sample to form homogenous sample fraction.	-	37-42
Shucking of Shellfish*	Removal of tissue from shell. Analysis performed at Hill Laboratories - Food & Bioanalytical Division, Waikato Innovation Park, Ruakura Lane, Hamilton.	-	37-42
Organochlorine Pesticides in Biomatter*	Sonication extraction, alumina cleanup, GPC cleanup, dual column GC-ECD analysis	0.0005 - 0.002 mg/kg	37-42
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	37-42

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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