WasteMINZ Conference, Rotorua, 5th-7th October 2011

The Taming of Mt Tyre

Laurie Gardiner, MWH New Zealand Ltd

1. Introduction

Between 2006 and 2009, an illegal waste tyre stockpile (locally known as Mt Tyre) accumulated on a site at 50, Mersey Street in the Pandora industrial area of Napier (Figure 1 and Photo 1). The unauthorised end-of-life (EOL) tyre dump comprised about 0.5ha of a 5.3ha freehold parcel of Crown land managed by Land Information New Zealand (LINZ).

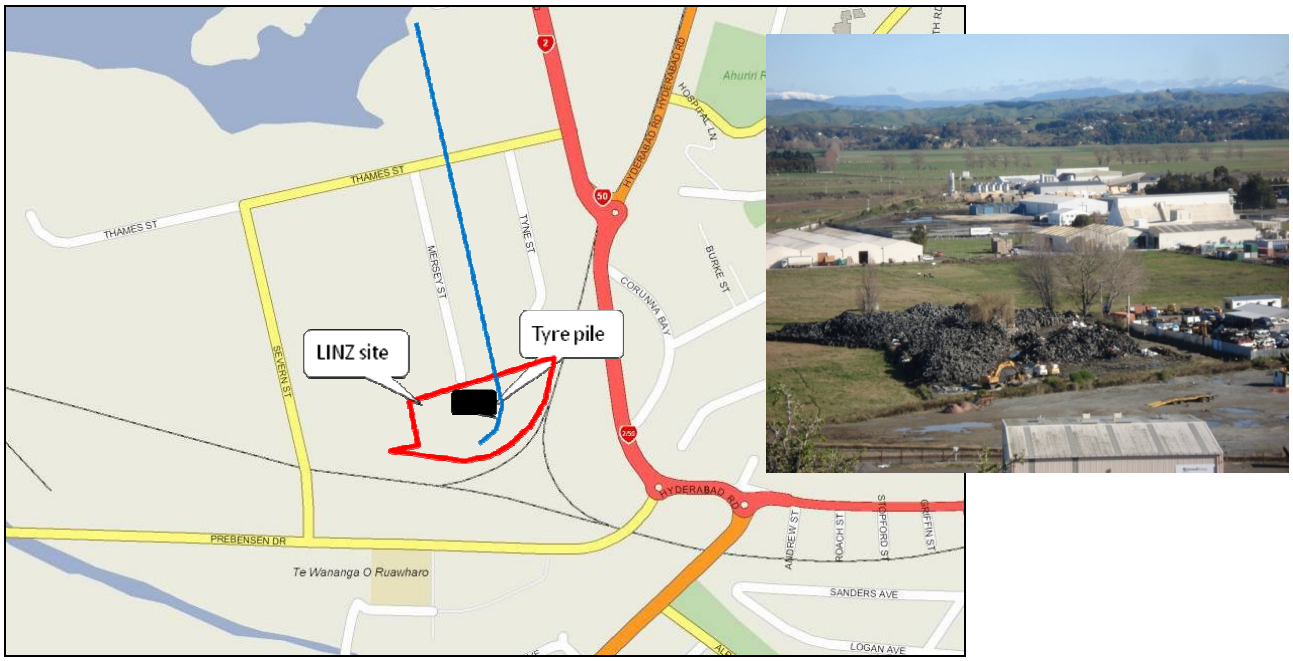

Figure 1: Site location (inset Photo1: view of Mt Tyre from Hospital Hill in July 2008)

With its large size and proximity to residential areas, the illegal pile presented a significant fire risk to the public and the environment. The dump was cleared by a tyre recycling contractor (Waste Tyre Solutions Ltd) between December 2009 and December 2010 under a plan approved by the local Fire Service, Hawke's Bay Regional Council (HBRC) and Napier City Council (NCC).

LINZ appointed MWH as their technical adviser in June 2009 to assist in managing the removal of the dump. This paper describes the planning and waste management procedures followed during removal of the dump, highlighting some technical challenges and how these were resolved.

Environmental Setting

Figure 1 shows the location and boundary of Mt Tyre and its relationship to the LINZ site. The site is flat, low-lying reclaimed land with a shallow water table that is prone to flooding during wet weather. An open intertidal drain on the eastern boundary of the former tyre pile runs north through an industrial estate before discharging to the Ahuriri estuary, a sensitive water body some 0.5km distant. Land adjacent to the west and south of the former tyre pile is open pasture while to the east and north lie industrial premises. The nearest residential suburb (Hospital Hill) lies 2km the east.

The Tyre Pile

The pile comprised an unsorted mix of used car, truck and agricultural tyres (Photos 2 and 3) spread over an area of approximately 0.5ha towards the centre of the land parcel (see enlarged site plan in Figure 2). The overall dimensions of the pile were 73m (west boundary) and 107m (south boundary), with the height varying from 5m on the west side to <1m on the east due to irregular stacking. Running across the pile was a 6m wide track accessed from the south end of Mersey Street. The dump was estimated to have a volume of approximately 15,000m^3, equivalent to about 2000 tonnes of waste tyres.

Photos 2 and 3 (right): Views of Mt Tyre dump from central access track (2009)

2. Risks from Burning Tyre Dumps

Tyre dump fires pose major public health and environmental concerns (NFPA, 2000; Firecone, 2004) from pollutants discharged to air, water and land that may last for weeks or even months. Apart from the health risk from air pollution caused by the dense plume of toxic smoke and ash, the large quantities of oily effluent and run-off generated during a fire can

contaminate nearby water sources and groundwater. Contaminated land under and surrounding a burning dump is also likely to require costly and extensive remediation.

The literature has numerous case studies of the public and environmental risks from fires at tyre dumps. Three in particular are described below to place Mt Tyre into perspective:

a) *Hagersville, Canada* - the illegal tyre dump comprising approximately 14 million tyres caught fire and caused a large amount of environmental damage. The following extracts (US Solid Waste Magazine, 2000) are of relevance:

   - About 1,700 residents were evacuated from within a 3-kilometre radius;
   - The fire pumped tonnes of pollutants into the air and millions of taxpayer dollars were spent afterward cleaning the site and treating soil and groundwater contaminated by oily runoff from melting tyres;
   - The site's owner had delayed complying with work orders from Ontario's Ministry of the Environment such as segregating the tyres into smaller piles.

b) *Otterwood tyre dump, Canada* – this case study concerns a tyre dump fire involving about 40,000 used tyres (Solid Waste Magazine, 2000):

   - The owners of this illegal urban dump had disregarded notices from the Environment Ministry to get rid of the tires; the first order was issued in October 1997 but the stockpile only grew, eventually peaking at about 40,000 tyres;
   - The site came to public attention in December 1997 when it caught fire; a massive clean-up afterwards saw some 59,000 litres of contaminated water removed from the site.

   By comparison, Mt Tyre had around six times more tyres at risk.

c) *Hamilton illegal tyre dump, New Zealand* - the following is an extract from a report on a fire at this dump that occurred near Hamilton in 2003 (MWH, 2003):

   > *"A large number of mostly truck tyres were dumped in an illegal landfill, caught fire and subsequently burned for a week before being extinguished. In the clean-up operation that ensued, Environment Waikato collected 3m^3 of oil that had accumulated in a waterway beneath the ignited area."*

   According to Firecone (2004), this fire involved around 30,000 tyres and cost over $90,000 (DOC $45,000 to extinguish the fire; Environment Waikato $31,000 to collect and dispose of discharged oil and prosecute the operator; and Waikato District Council $14,000 to deal with community effects including accommodation for 10 households evacuated during the fire).

The Mt Tyre dump, by comparison, had around eight times the number of tyres at risk compared with the Hamilton stockpile.

Following the Hamilton fire, the Hamilton Fire District prepared recommendations for the storage of used vehicle tyres (MfE, 2004). The recovery and re-use of used tyres also received increased attention across New Zealand at this time.

3. Specific Risks from the Mt Pile Tyre Dump

The fire, public health and environmental risks from the illegal Mersey Street tyre dump were significant due to a combination of factors:

- large pile size (equivalent to approximately a quarter of a million passenger tyres);
- lack of compliance with New Zealand best practice fire safety guidelines (MfE, 2004);
- proximity to a large urban population in Napier; and
- potential to impact a sensitive receiving environment (Ahuriri Estuary)

Based on the above case studies, the clean-up costs from a major fire at Mt Tyre could well have exceeded $1 million. This would not include the cost of fire-fighting or external costs such as ill-health caused by smoke inhalation, economic impacts of business disruption or potential long-term environmental damage to the Ahuriri Estuary.

Although the likelihood of a natural or accidental fire at the tyre dump was considered to be low, the consequences of a major fire would have been very severe. Heightened publicity from local and national media at the time also further raised the risk of arson.

Because of its size and proximity to residential areas, the Mersey Street dump presented a Priority 1 emergency fire risk to communities situated downwind of the toxic smoke plume. Accordingly, the Hawke's Bay Fire Service in concert with local emergency services drew up a tactical plan to evacuate Napier's closest residents in the event of a fire (HSTLC, 2009). The plan included contingency measures for the regional council to deal with the pollution threat to water bodies from release of large quantities of oily effluent, including Ahuriri Estuary to the north.

Napier City's public health department was also concerned that the tyre pile was a breeding ground for mosquitoes with potential for exotic species carrying diseases such as dengue fever `jumping ship' from the nearby port area.

The priority driver for managing the dump was clearly to reduce the fire and associated environmental and public health risks in the short term. The ideal solution would eliminate the

risks by complete removal of the pile in a safe, cost-effective manner with the waste tyres going to beneficial end use, preferably in New Zealand.

4. Adopted Waste Management Solution

Options Report

LINZ commissioned MWH in May 2009 to prepare a report outlining the available options for disposal of the tyre pile and assessing them in terms of reducing risk, value for money, sustainability and practicality. MWH considered a number of off-site options including commercial recycling through the waste tyre processing sector, direct sale to end users and, as a last resort, disposal to landfill (MWH, 2009).

At this time, there was intense local and national media interest in Mt Tyre and pressure on the landowner to make the tyre dump safe. The local media suggestion of using bulldozers to break up the dump into smaller piles that were more manageable for the Fire Service offered a `quick fix' but would spread the problem over a larger area and still leave the issue of off-site tyre disposal.

The recommended option, and the one implemented by LINZ, was a competitive tender for the off-site removal using a specialist waste contractor with demonstrated experience in waste recycling/resource recovery. This option provided early reduction in the fire risk, without the need for breaking up the dump into smaller piles over a larger footprint at the site.

It also had clear advantages of complete off-site removal of the pile under controlled conditions and in a timeframe that maximised the opportunity for resource recovery directly from site. The competitive tender process also ensured value for money.

Tender and contract

Following development by MWH of a specification for the preferred option, LINZ's procurement team issued a Request for Proposal on GETS on 2nd June 2009 for removal of the tyre pile. The primary tender requirement was to provide full removal of tyres from the site in accordance with regulatory requirements and industry best practice, and at a price that demonstrated value for money.

A further important consideration in the award of contract was for tenderers to demonstrate that they operated an environmentally-responsible business for disposal of EOL tyres that promotes resource recovery (reuse or recycling) while minimising disposal to landfill, in accordance with government waste management policy.

Following tender evaluation and contract negotiations, LINZ appointed Waste Tyre Solutions Ltd as the contractor for the tyre clearance works. Discussions were then held with the

appointed contractor to develop a practical programme and documented site procedures that met the specification and other tender requirements, and a staged contract for the works.

Subject to meeting the core tender requirements, the contract conditions and programme were structured to allow the waste tyre contractor to add value to the waste tyres (e.g. shredding or baling on site), and to take commercial advantage of market opportunities in the reuse/recycling sector during tyre clearance (e.g. direct sale to end users).

Tyre clearance was planned, budgeted and progressively completed in three stages (see Section 5) with clearly defined end points for each stage. Progressing to the next stage required satisfactory completion of the proceeding one, including provision of reporting and waste documentation

Design of tyre clearance for early reduction in fire risk

A crucial design factor in the tyre clearance process was to ensure early and effective reduction in the fire risk. Tyre removal was also required to meet the Fire Service recommendations for pile segregation that included a firebreak grid and minimum 15m wide firebreak between piles to allow fire-fighting access.

An *in situ* disaggregation method was proposed by MWH to achieve this goal by initially removing tyres so that the cleared areas created a firebreak grid within the original pile. The method is illustrated in Figure 2. The hatched envelope represents the surface area of the original tyre pile. The contractor initially removes tyres from the yellow hatched area of the dump (Phase 1), so creating the 15m wide firebreak grid within the original tyre pile. The resultant smaller tyre piles (red hatched squares), now with easier fire-fighting access and a much reduced fire risk, are subsequently removed in Phase 2.

The disaggregation plan avoided double handling and damage to the tyres, so maximising the potential for beneficial reuse or recycling. Other than temporary storage areas for sorted tyres, the plan avoided the need to create new tyre piles outside of the existing footprint.

The *in situ* disaggregation method was approved by the Fire Service for breaking up the pile, and written into the resource consent and tyre clearance contract.

Retrospective resource consent

In parallel to the tender process, MWH obtained retrospective resource consent to enable LINZ to operate the tyre dump (classified as a landfill) as a temporary waste transfer station during clearance operations. This was necessary to satisfy regional council requirements as the activity would not meet the permitted activity standards of the Regional Plan.

The application was processed as non-notified and a resource consent comprising discharge permits to air and to land was granted by HBRC on 17th December 2009 (HBRC, 2009). Conditions attached included the requirement for an approved Site Management Plan to minimise the risk of a fire and to avoid polluting the surface water courses during the works.

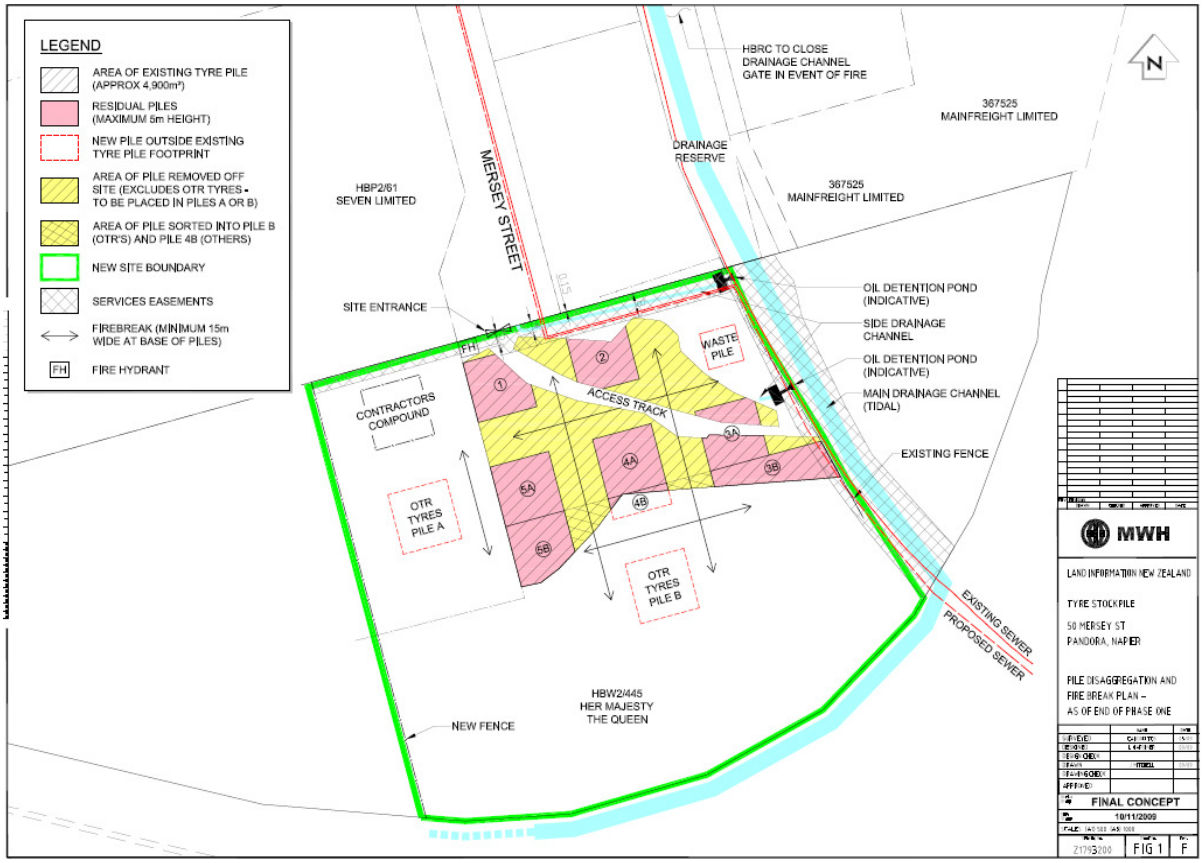

Figure 2: *In-Situ* Pile disaggregation and firebreak plan (end of Phase 1)

5. Tyre Clearance

Tyre clearance occurred in three phases to ensure progressive reduction in the fire risk:

- *Phase One* (December 2009 to April 2010)*:* sorting, processing and off-site removal of approximately 50% of the tyres, leaving 5 smaller piles each separated by a 15m wide firebreak (Figure 2 and Photo 4) and two sorted off-the-road (OTR) tyre piles;
- *Phase Two* (July to September 2010)*:* sorting, processing and off-site removal of the 5 smaller tyre piles leaving two OTR piles outside the original tyre footprint (Photo 5);
- *Phase Three* (October to December 2010)*:* off-site removal of the remaining two OTR tyre piles leaving a fully cleared site (Photo 6).

Photo 4: *In-situ* pile disaggregation creating the fire break grid and smaller piles

Aerial photos (provided by NCC) were used to indicate overall progress in tyre clearance in combination with observations and measurements on the ground. Photo 4 shows the disaggregated dump and firebreak grid in March 2010 during Phase 1 with about 40% tyres cleared. The red overlay shows the pile configuration required to meet the planned Phase 1 end point (see Figure 2). Piles needing further clearance are shown by the purple lines.

Photo 5: (left) End of Phase 2 with two OTR tyre piles remaining
Photo 6: (right) End of Phase 3 with site fully cleared (January 2011)

Site clearance involved the contractor sorting the tyres into passenger, commercial, OTR (off-the-road, mainly tractor and grader tyres) and a scrap category that could not be recycled (including damaged or soil-contaminated tyres, tubes and tyre pieces). Passenger

and commercial tyres were generally baled on site (Photo 7) and stored near the site entrance (Photo 8), before being removed by truck to their end destination. The OTR tyres were removed whole in trucks to their end destination.

Photo 7: Baling selected tyres on site

Photo 8: Tyre bales awaiting despatch

As far as practicable, the EOL tyres (either whole or baled) were reused or recycled by direct shipping from the site to the end user. Applications included racetrack crash barriers, civil engineering retaining walls and farm silage structures. A proportion of the site tyres was removed to the contractor's Waikato depot for temporary storage pending reprocessing and on-sale e.g. OTR tyres and tyres with attached rims. Scrap tyres were chopped on site and taken by the contractor to a landfill consented to accept such waste. Further details on waste streams and end use are given in Section 6.

6. Site Management, Monitoring and Waste Tracking

The site management and monitoring procedures during tyre clearance (including tracking of waste tyres leaving the site) are outlined below.

Site Management and Monitoring

The clearance works were conducted in accordance with a contract between LINZ and the tyre contractor. LINZ appointed an internal project manager to oversee the contract. The contract provisions included meeting the resource consent conditions and the approved Site Management Plan (that addressed health, safety and environmental aspects), and fortnightly reporting on progress.

The progress reports to LINZ included the status of tyre clearance, any identified operational issues in the current period (or anticipated in the next period), and a record of waste tyre consignments leaving the site in the format prescribed under the contract.

MWH conducted fortnightly site inspections, using staff from their Hasting office, to check the contractor's compliance with consent conditions and the SMP, and to provide independent monitoring of progress to LINZ. Darroch Ltd provided advice to LINZ on property management, security and provision of contractors (e.g. for mosquito dosing).

Monthly video conferences to review progress were held between LINZ and MWH (in Wellington) and representatives from Hawke's Bay Area Fire Service, HBRC and NCC (based at Napier Fire Station). The conferences took place in the afternoon after a combined site visit earlier that day by these representatives to take stock of the current situation. Actions agreed from these conferences were minuted and fed back to the contractor and other parties, and reviewed at the following meeting. The meetings were held every other month towards the end of the project, after the majority of tyres had been removed and the fire and related risks were substantially abated.

The site visit/video conference combination was a valuable tool in coordinating discussions by the respective parties and in assisting LINZ in managing site issues as they arose during the course of the project. These included a wide range of aspects such as disposal of waste gas cylinders, site security, mosquito surveillance, managing contaminated spoil, work during adverse weather conditions, monitoring fire risks (e.g. from long grass) and co-ordination with NCC on proposed sewer works at the site.

Waste tyre reporting and tracking

A waste tracking mechanism was used to assist in verifying that the contractor removed and disposed of the tyres in an environmentally responsible manner, according to the contract, and therefore provide assurance that removal of tyres from Mt Tyre did not create a waste tyre problem elsewhere.

The waste tyre contractor was required to collect and report details of all waste tyre truck loads leaving the site, including their end destination and use, and to provide LINZ with documented validation from end users.

Details were recorded in a prescribed format on an Excel spreadsheet provided to the contractor by LINZ at the start of each phase. Each row in the spreadsheet represents a separate truck load leaving the site and has a unique reference number. Information included the date of departure, volume and tonnage, tyre type, temporary storage destination (if applicable), on-site processing (e.g. baling), end destination and user, and a validation record. The spreadsheet provided a rolling summary of each truck load of waste tyres under each stage with cumulative tonnage and volume. An extract is shown in Figure 3.

	TABLE 1: WASTE LEAVING THE SITE (50 MERSEY STREET, PANDORA, NAPIER)								
								Individual Waste Stream Details	
Ref No (Note 2)	Date taken from site	Volume (m3) (Notes 1, 4)	Mass (t)	Tyre Type	Storage destination (Note 3)	WTS process	Purchaser / End destination	End use	Receiver Date WTS sent to LINZ
99	28/06/10	186	24	mixed	N/A	Baled on site	PNCC	Civil Eng	6/08/2010
100	29/06/10	130	11.93	truck	N/A	SWC	CHB LandFill	Landfill	23/07/2010
101	29/06/10	130	12.1	truck	N/A	SWC	CHB LandFill	Landfill	23/07/2010
102	29/06/10	168	24	mixed	N/A	Baled on site	PNCC	Civil Eng	6/08/2010
103	29/06/10	80	11	scrap truck	WTS Waikato	N/A	WTS Waikato	Temp storage	N/A
104	30/06/10	130	12.1	truck	N/A	SWC	CHB LandFill	Landfill	23/07/2010
105	01/07/10	65	5.58	truck	N/A	SWC	CHB LandFill	Landfill	6/09/2010
106	01/07/10	112	16	mixed	N/A	Baled on site	PNCC	Civil Eng	6/08/2010
107	01/07/10	112	16	mixed	N/A	Baled on site	PNCC	Civil Eng	6/08/2010
108	02/07/10	168	24	Truck	N/A	Baled on site	K&M Contractors	Civil Eng	6/09/2010
	Subtotal	1,281	157						

Figure 3: Extract from waste tracking spreadsheet for waste tyres leaving site

The contractor updated the master spreadsheet each fortnight with new data for that period and provided a copy to LINZ with each progress report. The spreadsheet was checked by MWH and any identified inconsistencies or queries noted in a report to LINZ that was passed back to the contractor for comment and/or action. New information included in an earlier fortnightly reporting period (e.g. incoming validation data from end users) was marked in red by the contractor to identify new data entries.

End user validation

A key requirement for the contractor under the waste reporting system was to provide end user validation i.e. evidence confirming that the end user had indeed received the stated waste consignments from the site. Each validation was cross-referenced with the relevant row in the spreadsheet to confirm the details matched and the date the validation was received by LINZ was entered as a record in the spreadsheet.

Validation included written confirmation of delivery or copy of invoices referencing the waste loads from the end user, marked up by the contractor with their spreadsheet waste reference number. A copy of the landfill weighbridge docket was used to validate tyres sent to authorised landfills by the contractor (this also provided a tonnage that was combined with the volume estimate to provide an average density as a check on the type of tyre waste).

Waste tyres that were taken by the contractor for storage and/or processing to their Waikato depot were noted in the spreadsheet but not validated. Confirmation was received by LINZ prior to commencement of the contract that the waste tyre contractor's Waikato waste tyre

storage/processing facility was approved for this purpose by the local authority and had adequate storage capacity to manage the volume of tyres expected to be sent to this facility.

Waste statistics and recycling

The waste spreadsheet provided an overall summary of the approximate volume and tonnage of waste tyres in Mt Tyre (Table 1).

Table 1: Summary of approximate waste tyre volume and tonnage in Mt Tyre

Phase	Volume		Weight		Tyre type
	m^3	%	Tonnes	%	
Phase 1	6,924	45	915	42	Passenger & truck
Phase 2	7,158	47	933	43	Passenger & truck
Phase 3	1,202	8	313	14	Off-the-Road (OTRs)
Total	15,284	100	2,161	100	

The end use (volume %) for passenger and truck waste tyres (i.e. excluding OTR tyres processed separately in Phase 3) is shown in Figure 4.

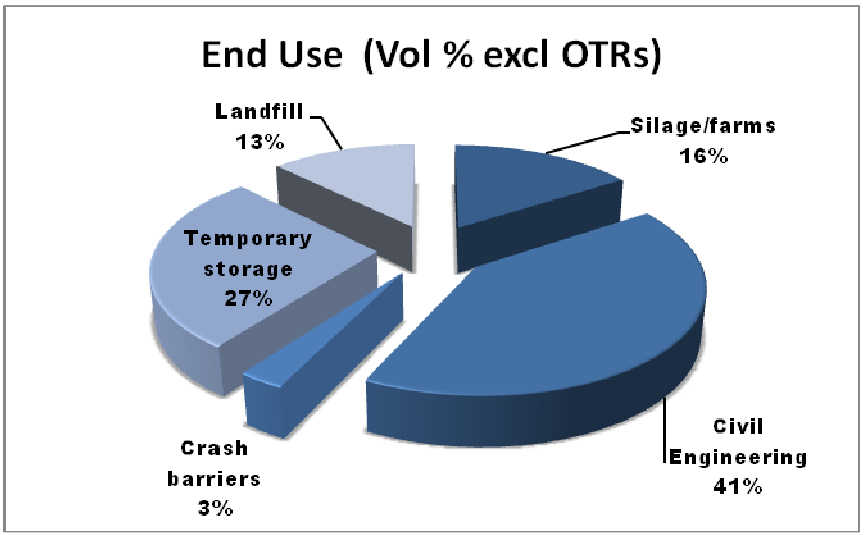

Figure 4: End use of Mt Tyre waste stream (excluding OTR tyres)

Excluding OTRs, 60% of the tyres were trucked directly to end users during tyre clearance. A further 27% was sent to the contractor's Waikato processing facility for resource recovery (e.g. crumb rubber and scrap steel) with waste disposed to Leaches Landfill, Tirohia. The remainder (13%) of tyres from the site (i.e. damaged, poor quality or scrap waste) was sent directly to Central Hawke's Bay Landfill.

OTR tyres comprised 8% of the total tyre volume (and 14% of the total weight due to their large size). Approximately 50% of the volume of OTR tyres (mainly old tractor tyres) were chopped on site and taken to Central Hawkes Bay Landfill in Waipukarau. The remainder

(all earthmover tyres) were reused, mainly for civil engineering applications e.g. retaining walls for storage bunkers at Leaches Landfill (Tirohia).

On the conservative assumption that at least half the tyres returned by the waste tyre contractor to their processing facility were recycled, the overall resource recovery figure achieved for the Mt Tyre dump was around 75% (i.e. about 25% landfilled). This was a good outcome for the project despite the generally poor quality of many of the tyres.

7. Technical Challenges

The project raised a number of technical challenges in the course of both planning the works and during tyre clearance, as described below.

Oil detention ponds

Environmental control measures at the site included the installation of two simple oil detention ponds to intercept and prevent the majority of oily effluent entering the drainage reserve in the event of a fire at the tyre pile during the works (Photo 9).

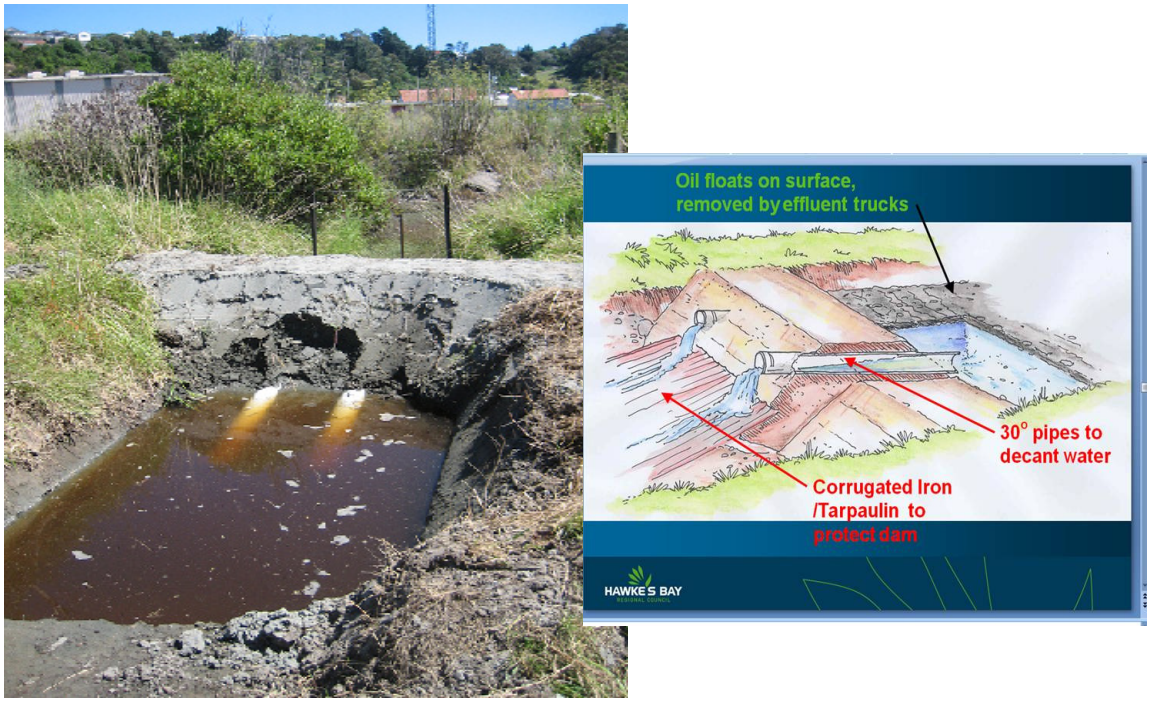

Photo 9: Installed oil detention pond and insert schematic diagram (source: HBRC)

Each device comprised an excavated pit on the side closest to the tyre pile that is connected to the drainage channel by an inclined culvert pipe. In a fire, the oil fraction collects on the pond surface and is prevented from entering the drainage channel through the submerged

culvert. Each pond was nominally 4m x 2m x 1m with a capacity of about 8m3, and positioned at the lowest point where the side drains intercept the main channel.

Normal site drainage and tidal flows are not impeded by this device which has been successfully used by HBRC to contain discharges from other emergency spills. The detention ponds worked well but required periodic maintenance to ensure they did not silt up following heavy rain.

Adverse weather conditions

The site works were spread over one year and the weather was at times challenging and occasionally curtailed operations. As the area is reclaimed land, prolonged heavy rains combined with plant movements turned parts of the site's surface into a slurry with extensive water ponding (Photo 10). Additional site drainage measures agreed in consultation with HBRC (i.e. a surface trench leading to a settlement pond and Supersilt fencing at the point of discharge to the site's drainage channel) were later introduced to remedy the situation.

Photo 10: Ponding due to poor drainage **Photo 11: Dusty site conditions in summer**

During persistent dry and windy conditions in summer, vehicles traversing the powdery surface near the site entrance and the truck haul route along the fire breaks (Photo 11) raised dust clouds which could potentially cause nuisance at the adjoining premises in Mersey Street. To meet the air permit condition limiting airborne discharges beyond the site boundary, contingency measures were included in the Site Health, Safety and Environmental Management Plan to prevent this occurring.

The measures included provision for the contractor to use a hose connected to the fire hydrant at the site entrance to dampen down surfaces, and limiting vehicle movements along the central firebreak area during dry windy weather. No off-site complaints from dust were recorded during the works.

Mosquitoes

Tyre stockpiles can be a breeding ground for mosquitoes. In New Zealand, diseases associated with mosquitoes include dengue fever and Ross River virus. New Zealand currently has very few mosquitoes capable of carrying serious diseases, and those that exist do not appear to breed in tyres.

However, mosquitoes capable of carrying serious diseases that are known to breed in tyres are discovered on occasion by MAF on entry to New Zealand. For this reason, the Public Health Unit of Napier City Council was concerned that Mt Tyre could be an ideal breeding ground for any invasive species carrying harmful diseases if they were accidentally introduced through the Port of Napier.

This aspect was managed by a mosquito plan agreed with the City's Public Health Unit and implemented by a specialist contractor (NZBiosecure). The plan included periodic dosing of the tyre pile to prevent larvae developing to the adult stage. Surveillance comprised larval checks in tyres and trapping adult mosquitoes light traps (Photo 12) to check the effectiveness of dosing measures on site.

Photo 12: Light trap for mosquito surveillance (inset: mosquito larvae in tyre on site)

Monitoring by examination of trapped specimens at the entomology laboratory confirmed the absence of exotic species at the site. The risk of mosquitoes from the Mt Tyre pile was principally a public nuisance concern with the critical period restricted to the warmer summer months. This was exacerbated during tyre clearance by the exceptionally warm and humid weather Napier experienced in 2010.

Mosquitoes were a recurrent nuisance for site workers during the works, but this was mitigated by periodic dosing. Over time, as the pile was disaggregated and the tyres were removed from the site, the risk from mosquitoes was eliminated.

Non-tyre waste and contaminated spoil

In common with many illegal waste dumps, the Mt Tyre dump also contained a quantity of non-tyre waste and general rubbish (wood, plastic and scrap metal) that had been dumped by the public or other parties (Photo 13). During the course of tyre clearance, more non-tyre waste was uncovered, including plastic and metal car parts, wire, scrap metal, masonry and empty gas cylinders (Photo 14).

Photo 13: Rubbish dumped on site

Photo 14: Dumped empty gas cylinders

Any such non-tyre waste that was required to be moved as part of tyre clearance services (e.g. to gain access to the tyres or to create a clear firebreak with unrestricted fire vehicle access) was to be placed in a designated waste storage area. In practice, and to avoid double handling, a number of skips (metal, wood) were provided by LINZ for the contractor for this purpose. The filled skips were periodically taken to the local landfill (Omaranui Landfill) for recycling and/or disposal.

Two grassed stockpiles of spoil near the site entrance were required to be moved in order to meet the consent condition requiring the 10m zone adjacent to site drains to be kept clear of waste (Photo 15).

Tests showed the spoil heaps contained minor hydrocarbons and metal contamination (mainly copper, zinc and lead). Following confirmation that this material met the screening criteria for a Class A landfill, the spoil heaps were broken up by an excavator, sorted to

remove unacceptable waste (e.g. wire and masonry blocks) and the soil taken in sheeted trucks to Omaranui Landfill.

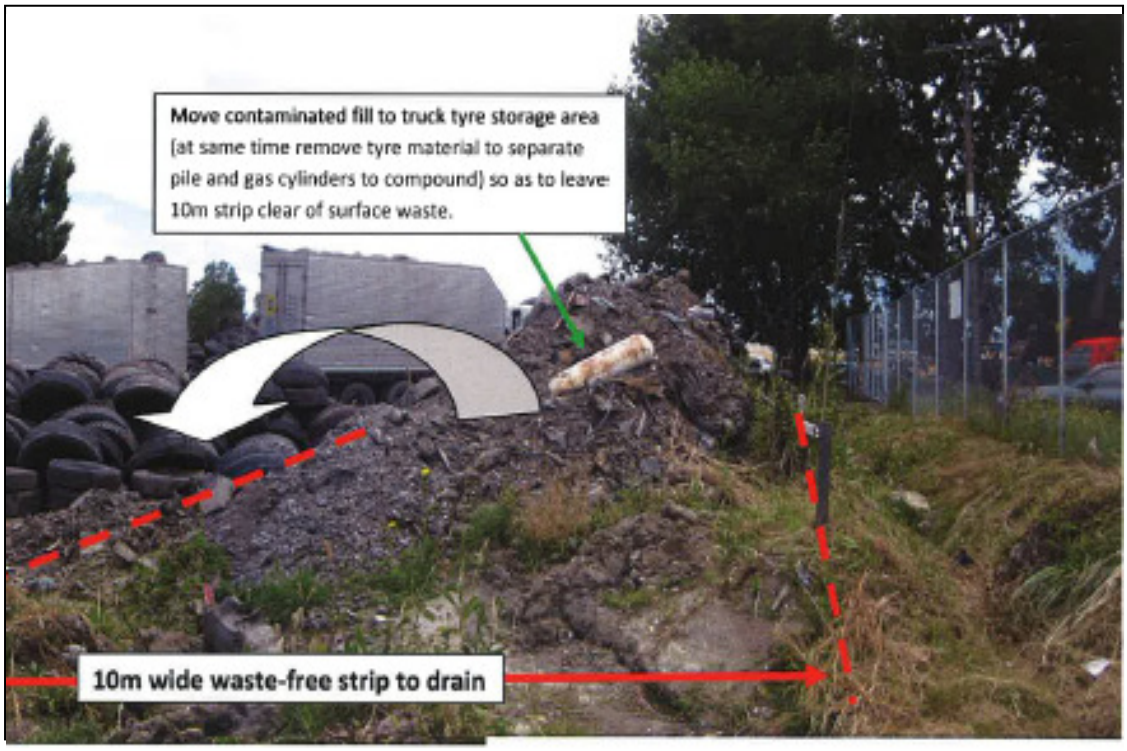

Photo 15: Contaminated spoil heap within 10m waste-free strip adjacent to drain

8. Concluding Comments

The safe removal of Mt Tyre represented a unique tyre clearance project and a satisfactory conclusion to the largest illegal tyre dump in New Zealand.

The goals of the project were successfully achieved with the removal of a significant fire, environmental and public health risk, and an environmentally responsible outcome in terms of resource recovery with about 75% of the tyres reused or recycled.

The project also showed that technical challenges could be satisfactorily overcome by a planning, collaboration and ongoing dialogue between the client, consultant, contractor, local authorities and fire service.

On a wider note, while Mt Tyre's unique characteristics of size, economy of scale and urgency attracted commercial interest, it raises the question of how best to promote a higher uptake in resource recovery for the mainstream EOL tyre sector in New Zealand.

Management of EOL tyres is a world-wide issue and many sustainable solutions have been identified (e.g. WBCSD, 2008). Putting the responsibility back up the chain to the producer

through the product stewardship mechanism is increasingly being used overseas to drive resource efficiency for this and other waste streams.

However, the success of such a scheme depends on finding a commercially attractive solution for the local market. URS (2006) noted that despite the attraction of value-added products from EOL tyres, none of these markets had been developed in New Zealand. Likely reasons cited were uncertainty in security of supply of tyres, long transport distances (source to processor) and low uptake locally of overseas tyre processing technology.

New Zealand's Waste Minimisation Act 2008 provides a regulatory framework, administered by the Ministry for the Environment, for the establishment of product stewardship for certain end-of-life products. Waste tyres are currently a non-priority product and therefore are not regulated to ensure producers and others in the supply chain share responsibility.

Recent indications, however, show that there is collective support from the major tyre companies, the waste recycling sector and Local Government New Zealand to develop a priority product stewardship scheme for EOL tyres (Product Stewardship Foundation, 2011).

The case for central government assisting the waste industry develop such a scheme to promote resource efficiency for EOL tyres in an economically attractive way would appear to be nearing fruition. If achieved, this initiative would invigorate the local tyre recycling market, divert waste tyres from landfills and herald the demise of legacy tyre dumps such as Mt Tyre.

Acknowledgements

The author would like to acknowledge LINZ for permission to publish this paper and, in particular, Lynda Pryde and Bibby Ronberg for their professional association during the project. Opinions are those of the author and do not necessarily represent LINZ policy.

9. References

Firecone, 2004. Management of End-of-Life Tyres. Report reference TR136 prepared in January 2004 for Ministry of Environment, Wellington (see www.mfe.govt.nz/publications/waste/management-end-of-life-tyres).

HBRC, 2009. Resource Consent (Reference Nos DP090618L and DP090619A) in respect of Lot 1 DP 26621, 50 Mersey Street, Napier, Hawke's Bay Regional Council.

HSTLC, 2009. Meeting of Hazardous Substance Technical Liaison Committee on 5th May 2009 to discuss emergency response/ contingency planning for a potential fire at the Mersey Street tyre pile: Chair: Chris Nicholl, New Zealand Fire Service Area Manager.

MfE, 2004. Appendix 1: Hamilton Fire District Recommendations for the Storage of Used Vehicle Tyres. http://www.mfe.govt.nz/publications/waste/tyre-storage-enforcement-action-jul04/html/page14.html.

MWH, 2003. Development of a Regional Waste Recovery/Processing Sector. A report prepared for Wellington City Council, Ministry for the Environment and Ministry of Economic Development, Wellington, New Zealand.

MWH, 2004. End-of-Life Tyre Management: Storage Options. A report prepared for the Ministry for the Environment, Wellington, New Zealand.

MWH, 2009. Tyre Pile at 50 Mersey Street, Napier: Options Report. A report prepared for Land Information New Zealand, Wellington, New Zealand.

NFPA, 2004. The Prevention & Management of Scrap Tire Fires, The National Fire Protections Association, www.rma.org/scrap_tires/scrap_tires...environment/fire_prevention.pdf.

Product Stewardship Foundation, 2011. Article "End of life tyre scheme for industry", 11th August 2011.

Solid Waste Magazine, 2000. Canada's solid waste and recycling magazine, December 1999/January 2000. solidwastemag.com.

URS, 2006. Product Stewardship Case Study for End-of-Life Tyres. Report prepared for Ministry for the Environment, Wellington, New Zealand.

WBCSD, 2008. Managing End-of-Life Tires. World Business Council for Sustainable Development, November 2008.