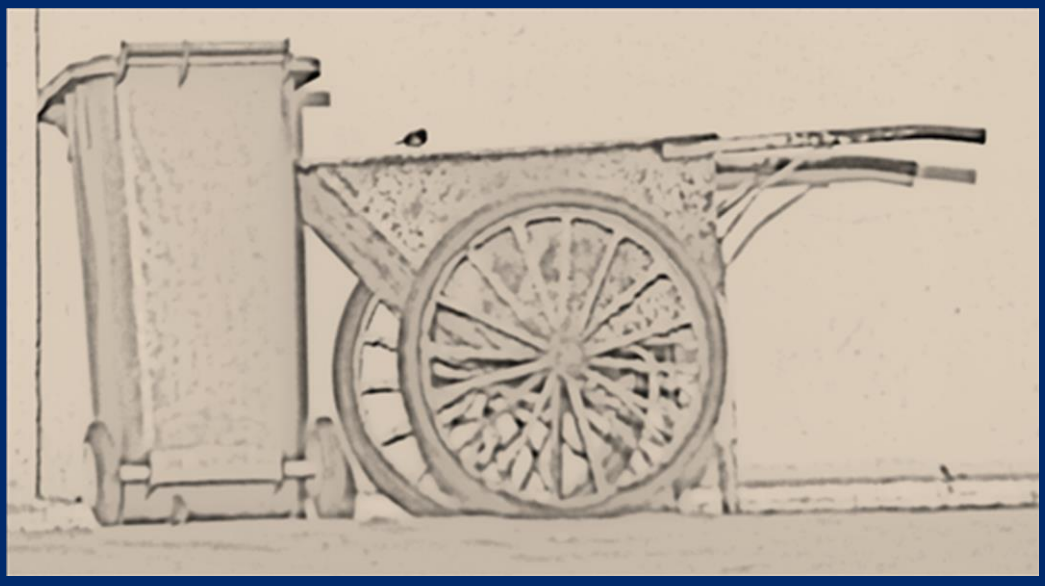
SAMPLE ONLY

Landfill Environmental Monitoring and Management Plan

March 2017



Contents

1. Introduction

The purpose of this Environment Management Plan (EMP) is to outline the methods to be used and actions necessary for the Buon Ma Thuot Solid Waste Management facility to comply with current and future environmental regulations. The EMP should be read in conjunction with the site Operations Manual.

This EMP addresses the various stages of site development including predevelopment of the site, construction, operation and decommissioning and rehabilitation.

Some sections will require updating once decisions are made at the detail design and procurement stages on the need or otherwise for a leachate treatment plant and a mechanised Materials Recovery Facility (MRF) for the long term. However the most critical aspect relating to site success is landfill management in any case, rather than the recycling components.

2. Waste Acceptance Criteria

It is critical to control the types of waste entering the site from an environmental management viewpoint. Some wastes can result in significant impact if for example they result in fires, others may be directly injurious to human health, while others are malodorous.

Further recyclable material needs to be directed to the appropriate recycling area and not automatically diverted to Landfill.

2.1. Reception of Waste

See the operations manual for complete details of waste types and acceptability.

The gatekeeper and the weighbridge are to be located near the entrance and are to be manned at all times. The following data is to be obtained from all vehicles entering the site which carry waste and stored electronically;

- time and date
- vehicle registration details
- name
- weight
- type of waste

The gatekeeper will observe the type of wastes entering the site. If the refuse contains unacceptable material, the gatekeeper will either require the unacceptable material to be removed from the load for dumping elsewhere, or reject the entire load and have the vehicle move off-site.

If the remainder of the load is accepted into the landfill, the gatekeeper will advise the working face staff to closely monitor the remaining contents of the load for off-specification material.

The plant operators and Site Foreman will observe all loads reaching the tipping face. If any off-specification material is observed which was not identified by the Gatekeeper, then the haulage contractor will be required to reload the off-specification material and remove it from the landfill site.

If the off-specification material is believed to have contaminated the remainder of the load, the entire load will be reloaded and removed from site. Advice should be given as to why the load is rejected and where it can be taken.

Any unusual wastes reported to the gatekeeper by operators of waste vehicles or observed by the gatekeeper should be recorded on daily records. Plant operators will observe the compaction and coverage of wastes and any unusual incidents noted.

Special wastes, such as asbestos, will be reported to the Site Foreman. The Foreman will ensure that the procedures for handling of waste are followed or inform the Supervisor if there are no established procedures for the particular type of waste.

The following information should be recorded following receipt of any special wastes:

- quantity
- nature of waste
- date of receipt

- waste disposal site (location and level/lift to be noted on base plan)

2.2. Waste Types

The following ***waste types will be accepted at the Site***:

- domestic solid waste as collected by the City or private vehicles on a regular basis
- acceptable commercial and industrial waste regularly collected by contractors
- garden refuse (i.e. green waste) that is collected separately to municipal waste, and is excess to local recycling demand.
- inert waste i.e. construction and demolition debris including concrete, timber, masonry, etc.
- vehicle tyres

Other wastes that ***may be accepted on site but should be addressed on a case by case basis*** include;

- asbestos
- medical waste, including "sharps" from veterinary services
- dead animals
- pathogenic wastes
- dry sewage sludge
- low level radioactive waste, as determined by the approval conditions for the landfill.
- liquid waste including paints and thinners
- toxic substances, such as acids and biocides
- contaminated soil/dredge spoil

Items unacceptable at the Site will include;

- dangerous goods, such as explosives including UXO's
- hot loads, greater than 50°C
- pressure cylinders e.g. LPG, extinguishers
- large volumes of liquid waste
- radioactive waste, and
- any waste types specified in the Licence or approval conditions.

3. Compaction

Wastes that are poorly compacted can result in many environmental impacts including more litter, vermin and odour, potentially extra leachate, drainage problems and finally unnecessary consumption of valuable airspace.

To achieve optimum compaction, there are a number of essential aspects to consider:

- Each layer of refuse must be less than 0.6m thick. If the layers are thicker, the density will not increase with additional passes.
- Each layer should receive a minimum of three passes; for best results five passes are required. If more than five passes are made, the density increase will not be significant.
- The width of working face should be kept to a minimum, but this will depend on how many vehicles are at the landfill at any one time. There will be a need for separate working faces for both the compactor trucks and the general public. However, the tipping face of either should not be longer than 25m.
- Each lift should be between 2-3metres in height.
- All refuse should be tipped at the bottom of the face and be pushed up.

If a tracked bulldozer is being used to compact waste, the tipping face should be kept at a slope of 1 in 3. This high slope will help the tracks break up and cut the waste as the dozer climbs up the face.

If a compactor is being used to compact the waste, the tipping face should be kept relatively flat at 1 in 8 or 1 in 10. The compactor does not need the steep slope to break up and cut the waste. The much heavier weight of the compactor is best at compacting waste if the slope of the face is a fairly flat grade. Compactors should not operate on faces steeper than 1 in 4.

***Refer to the Operations Manual for full details*.**

4. Cover

After refuse has been correctly compacted, it must be covered daily to minimise odours and the ingress of water into waste leading to excessive leachate generation, to contain litter, reduce fire risks and food sources for pests and vermin.

As with compaction, this activity is one of the most critical management components ensuring appropriate environmental management is achieved on site.

There are many materials suitable for daily cover, including;

- material dug from site
- excavation material from building sites
- crushed and broken concrete from building demolition
- road demolition material.

The cover must always contain suitable fines to limit water intrusion and fly breeding.

If the material is to be used for final cover, it must provide a stable, impermeable, permanent barrier to water, odour, pests and vermin and not be easily eroded. The requirements for daily cover are less strict, particularly if the landfill is operating in dry, cool periods.

The best material is a sandy or silty clay, with some gravel to provide reasonable trafficability when wet. Too much sand increases the permeability of the cover (allowing landfill gas out and water in). Too much clay increases the chance of cracking in dry weather and makes the surface slippery in wet periods.

The daily cover on the face should be about150mm thick or as determined by licence approval and must be spread only after the face has been well compacted (3 or 4 passes) and graded to a uniform smooth slope. If the cover layer is too thin, refuse can protrude. If thicker, valuable airspace and cover are being wasted as it does not provide any additional benefits.

On the outside batter and face of each landfill cell, the cover material must be carefully chosen and placed. The final cover layer must keep the waste in, water out and allow plants to grow.

A typical final cover/capping would be:

- 600mm of well compacted, sandy clayey material - to make a waterproof layer to keep out the rainwater. The low permeability of clay or sandy clay soils is essential to minimise percolation of rainwater. Sandy clay is better than a pure clay because it does not develop deep cracks if the layer dries out. This is less important if the cover will be mulched, as is proposed for the City Landfill.
- 300mm to 1800mm of growing medium (top soil or mulch) - to allow grass and plants to grow. If trees are required it will be necessary to provide a thicker

layer of top soil in the immediate area of the tree. When plant roots grow through the capping, the plants are often stunted or killed by the landfill gas collected under the liner. Mulch should be added on top to keep the moisture in and help the grass grow. Chipped or mulched green waste is an ideal medium for mulch and can avoid the need for excessive volumes of topsoil if applied over a number of years to build up an organic, rich surface on the cover material.

5. Vegetation

On completion of the 600mm final cover for each lift, the surface should be adequately prepared by placing mulch or some other growing medium, in accordance with the Licence conditions. Often 600mm of growing medium is required on top of the clay cap.

The first preference should be Vetiver grass to provide rapid stabilisation of the slopes.

Once this grass sward has established, then additional species should be added. It is important not to have a monoculture as some species-specific disease or pest may destroy the grass in the future.

Similar vegetation to that surrounding the Site should be planted as supplements. If certain varieties of trees/shrubs are seen to be not performing then new types should be trialled.

If larger trees are to be planted, then the growing medium should be locally thickened to over 2 metres in depth. This limits the risk of the tree roots going through the clay cap and the tree then suffering from methane poisoning.

It is critical that all exposed batters are revegetated upon completion of earthworks, as the vegetation:

- assists in screening the landfill from external viewing.
- softens the general appearance of the operation
- stabilises the batters against erosion from wind and water
- demonstrates a duty of care by the City towards to operating the facility in an environmental sustainable manner.
- hastens the opportunity to convert the site into the selected end use.

6. Dust Control

6.1. General

Dust is usually caused by vehicles as they drive to and from the tipping face, but large stockpiles of friable cover material can also be a major dust source in dry periods. Dust control is especially needed when dry and windy.

Dust control is achieved by spraying water or leachate and/or mulching access roads, open dirt areas and stockpiles to reduce the amount of dust emitted. generated. While spreading cover in dry weather, water or leachate needs to be sprayed to control the amount of dust generated.

The landfill batters will be progressively mulched and revegetated which eliminates dust from the external previously-worked areas of the site.

The water source to be used for dust control can be stormwater, creek water or leachate.

Other measures can be taken to reduce dust. These include moistening of dust producing substances prior to delivery and prompt covering of any dust producing substances (e.g. fly ash) delivered for landfilling.

Soil admixtures can provide a stable road surface, and reduce dust emissions. These will only be used on an as required basis to supplement watering.

Poor dust control can be dangerous. Consequently, all staff should look for dust problems and report them to the Site Foreman who will arrange for watering or other controls.

6.2. Dust Monitoring Procedure

The following method of determination of dust concentration is extracted from "Criteria for Landfill Management 2003" (Health Department of Western Australia). This method is recommended for monitoring of dust at the Site only in the event of ongoing complaints. This testing would only be undertaken following a series of ongoing complaints and during winds greater than 15 knots:

- The concentration of airborne dust to be determined as the difference in the concentration of dust in air between two samples of 15 minutes duration within a 60 minute period.
- The samples shall be taken at locations within 5 metres of the premise's boundary on opposite sides of the premise.
- One sampling location shall be generally located upwind of the other sampling location.
- The air shall be sampled at a rate of not less than 100 litres per minute.
- The samples shall be taken at a height between 1.5 and 2.0 metres above ground level.

According to the WA criteria, dust emissions monitored on the boundary of the site shall not exceed 1000 μg/m3 averaged over 15 minutes using the dust concentration measurement above. This threshold is considered appropriate for the Site.

7. Mud Control

Mud adhering to vehicle wheels should be removed in wheel washes prior to vehicles leaving the site.

Wheel washes may be classified as static or pressure as described below:

Static

These are shallow drive through basins which remove the dirt from the tyres. The basins are usually made of concrete and can be profiled to enable an excavator or end-loader to clean out the mud. A sealed road before and after the wheel wash is required. This type of wheel wash does not remove mud from the chassis of the truck.

Pressure

The simplest type of pressure wheel wash consists of a concrete drive through area with spray nozzles on low side walls. As the truck moves slowly through, the wheels and chassis are washed. To help remove the mud before the wheel wash a rough section of sealed/concrete road can be built. This must be cleaned regularly. Access roads should be constructed from sandy/gravel material. If mud is noticed on the public roads near the entrance gate it must be immediately cleaned off by either water trucks and/or shovels. The wheel wash will require regular maintenance.

The site operator will select the preferred type of wheel wash at the time of the detailed design of the landfill and associated works, such as weighbridge and gatehouse.

The City may decide that wheel washes are unnecessary as most internal roads will be sealed, limiting the amount of mud on the vehicles.

8. Pest Control

It is anticipated that pests such as insects, rodents and other vermin will be effectively controlled by the compaction and covering techniques which will be used on site. By limiting the exposed working area through compaction and daily coverage of wastes, the availability of food and protection for birds and rodents is severely restricted.

If fly numbers become a problem, the Site Foreman will arrange for extra pest control by spraying. This will be discontinued once the fly numbers have stabilised. Experience at many engineered landfills indicates that daily fly spraying is generally unnecessary. Non persistent sprays would be used.

Similarly, if vermin numbers increase, a baiting program will be instituted. Again if the waste is properly compacted and covered, then rodents are rarely a problem.

9. Litter Control

Litter control is to ensure that the site is clean and tidy. Litter on a landfill site is defined as any material uncovered or incorrectly located. The public is very aware of litter on or near a landfill and if the site is not always kept clean and tidy, unfavourable public opinion will affect the operation.

Litter on the main roads to the site could also be a traffic danger.

A moveable litter fence 1.8m high should be positioned immediately adjacent to the tipping face. The length of the fence depends on the size of the tipping face but should be long enough to accommodate for any changes in wind direction. The fence should be cleaned when necessary to ensure it operates properly. This may be daily during windy periods. The fence should have 'returns' to prevent litter escaping around the end of the fence.

The boundary fence is to stop trespassers and also to help keep litter within the site. This fence should be cleaned every second day.

A weather station may be provided on site to help the control of litter, by confirming wind directions and strength.

Any litter found outside the site should be removed. General surveillance of the site and surroundings for illegal dumpers is recommended.

Litter control will cease once the landfill operations cease.

10. Fire Control

Open fires should never be deliberately started on site, as fires result in health risks associated with incomplete combustion of plastics and other combustible wastes, explosion risks and as well as causing obvious visual pollution.

Access by the general public is limited and the site is to be fenced so the general public should be prevented from lighting fires. Staff will need to enforce the No Smoking policy to minimise the risk of accidental fires.

In the event of a fire, onsite equipment with a minimum 2 000 litre capacity and pressurised will be available. Larger surface fires will require assistance from local fire brigades.

Any subsurface fires within the refuse mound will require excavation to expose the combustion as per the normal response to these fires.

It is proposed that a fire management plan be developed after agency conditions are applied for the landfill including:

- a description of the site and fire hazards
- a description of fire systems
- a description of fire control procedures.

The only open burning which may be allowed is in a controlled system, such as a Pit Burner.

11. Noise Control

Noise from the landfill is not anticipated to be a concern. Through the strategic placement of bunds, natural topography and adequate buffers, suitable limits will be achieved during the normal operation of the landfill.

The bulk of the landfill equipment such as dozers and compactors will normally operate after 6.00am. This is into the less sensitive time of the day for noise limits and environmental targets.

Prior to the new areas of the Landfill being used, significant earthworks will be required. When a short period (e.g., a few weeks) of this intense activity is to occur, it is likely that the target noise limits will be exceeded during some part of the works. The appropriate action will be to inform affected residents prior to commencement of the operation, and limit the working hours as appropriate.

This intense activity will also be required during certain stages of the operating landfill, when a similar approach should be adopted. It will be impractical to meet the noise criteria during these isolated periods.

Any required noise monitoring would be discontinued once operations at the landfill cease.

12. Visual Control

The general public will be shielded from seeing the landfill operation to the greatest possible extent. Existing topography, earthen mounds, sight barriers, bunds and trees all serve to act as visual barriers.

Landfilling will always take place within the confines of a mounded or bunded area. This mound provides both a visual screen and noise barrier. The mounds will be progressively revegetated such that the limited numbers of the public will usually only see an increasing treed 'hill', behind which the operating face and completed lifts will be shielded.

13. Odour Control

13.1. General

Odour can occur from four main sources at a Landfill:

- landfill gas.
- putrescent waste, such as partly decomposed food scraps.
- the working face, particularly following wet weather
- impounded leachate ponds

Landfill gas is addressed later in the EMP.

Putrescent waste will not be allowed on site unless appropriate controls have been instituted at the generation source of the waste. These would include spray systems and more frequent collection of the waste.

The working face odours can only be limited by minimising the area of exposed refuse, and covering as quickly as practicable. Condemned foodstuffs and other highly biodegradable material should be buried and covered immediately.

Leachate ponding should be avoided by correct profiling of the site.

13.2. Optional Detailed Study Procedure

If ongoing odour complaints are still received, then a detailed odour study will be required. This study is described below.

The perception of odour and the degree of olfactory offence and level of acceptability are obviously very subjective. This would be expected given the small buffer between the existing landfill and nearest residences.

Odours will be minimised by ensuring that only the smallest practicable working face is used (to minimise the volume of exposed refuse), and that the site is well profiled to avoid water ponding. Refuse will be covered daily in accordance with good practice, to further lessen odour generation potential. Any obnoxious wastes, such as vegetable wastes, would be buried immediately upon receival at the working face.

Fugitive emission sources of odours from land disposal can, like the more traditional point sources, be measured or estimated and controlled. The assessment technologies can be used to assess emissions, evaluate control techniques including separation distances and help maintain acceptable emissions from disposal areas.

An objective, scientifically valid investigation could ultimately be undertaken to understand the generation of odour at the Landfill if subsequently determined to be necessary.

The odour study would have three main components including;

- a site inspection
- 12 months of continuous monitoring of local meteorological conditions
- odour dispersion modelling and determination of separation distances and/or additional odour controls.

A campaign of air sampling and olfactometric testing of odour emissions from various sections of the existing landfill would also be proposed.

A site inspection would be undertaken at the outset of the study and be aimed at obtaining details of the operation and the surrounding topography and land use as well as information concerning existing odour controls and current air quality in the surrounding area in terms of nuisance odours.

A location for the proposed meteorological monitoring station would be selected at the same time in consultation with Council's staff and arrangements would be made for the subsequent installation and operation of the equipment.

The scope of an odour study for the Landfill extension would include;

- obtain continuous records of local meteorology governing the dispersal of ambient odours
- identify sources of ambient odours from the operation including both covered and open sections
- quantify the strength and odour emissions by references to available data or by sampling and analysing the air by dynamic olfactometry (optional)
- use the so determined emission rates together with the recorded meteorological data to execute a computer model of odour propagation and dispersal around the landfill site and thereby
- obtain estimates of the maximum odour nuisance levels at various distances from the site under a variety of meteorological conditions, then
- relate the predicted levels to the available assessment criteria to determine impacts
- review a need for any upgrading or modification of odour controls to aid the creation of a buffer, and finally
- prepare a technical report summarising the main findings and recommendations.

A program of sampling and odour testing of air emissions from both the covered and open surfaces of the existing landfill would also be proposed. The sampling would be undertaken using a flux chamber (wind tunnel) to collect odorous air for subsequent testing by dynamic olfactometry. This part of the study could be carried out as one intensive campaign of measurements over two days of sampling (possibly during the hottest part of the year when the odour emission may be at its peak).

The measurements could, however, be divided into two separate campaigns should the experience with the existing operation indicate that significant variations in odour emissions occur in response to seasonal variations in prevailing weather conditions.

The first campaign of measurements may then take place in late winter/early spring and be followed by a second campaign in mid- to late summer.

An interim report would be prepared after the completion of the first campaign should this option be exercised. The interim report would summarise the results of both the odour emission sampling and meteorological monitoring programs after about 6 months of work. In addition, the report would recommend any remedial action to be taken, if required.

14. Complaints Register

Most complaints about a Solid Waste Management facility relate to environmental issues. Therefore site staff are required to keep a record of all complaints made about the landfill.

The complaints register applies to many of the aspects addressed in the EMP, such as noise, odour, dust, mud, visual impacts, litter, water quality and so on.

Generally it will be the gatekeeper who receives the initial complaint, if it is given by phone direct to the landfill or the Site Foreman if a written complaint. Telephone complaints direct to the City offices will be recorded and passed on to the Site Foreman immediately.

The Site Foreman is responsible for dealing with all complaints and organising the appropriate action to be taken, assess the level of urgency and check if the complaint is valid. This person is also responsible for informing the party who complains by letter of the outcome of their complaint, with a copy to the Supervisor for inclusion in his report to the Client.

The complaints register serves two purposes:

1) It identifies problems unseen or neglected by the landfill staff and will ensure that this problem is recognised and action is taken if appropriate.
2) It enables the public to maintain an ongoing relationship with the landfill operation and to enable them to have their concerns formally documented and recorded

The weather station, if required by Licence conditions, can be used to verify odour, dust, and even noise complaints to some extent by interpreting the wind direction recorded at the time of complaint.

15. Landfill Gas Control

Gases at landfills are composed mainly of carbon dioxide and methane but can include minor amounts of ammonia, carbon monoxide, hydrogen, hydrogen sulphide, nitrogen and oxygen as well as many other trace elements. The gas can be explosive in certain dilutions with air.

The expected waste tonnage to the site, together with the plans to recycle as much organic waste as possible, means that the Site will not produce large quantities of landfill gas, such as that required commercially for on-site power generation. Therefore it is proposed to install a gas collection blanket immediately under the final cap in the upper one third of the final mound profile, and connect this blanket to 6m high passive vents.

If required by legislation, these vents can be fitted with flares to convert the methane to carbon dioxide. Alternatively the gas could be piped to the adjacent industrial area for use a heat source. However if any off-site use is contemplate din the future, then vertical gas wells on a 50 metre grid should be retrofitted over the site after final cover is applied to maximise gas recovery.

The gas collection system is to be progressively installed in parallel with the landfill development.

Monitoring of the gas should commence five years after the commencement of the landfill.

The cover vegetation can be affected by gas, if the roots of the vegetation enter the deeper layers of the cover profile. This will result in stunted growth or death of the tree. Either the cover has to be locally thickened or a shallow-rooted species used to replace the affected tree.

After completion of the landfill, the gas system is to be maintained until all landfill gas resources within the site have been removed or until residual gas is reduced to a level where it poses little or no public risk or hazard. At this point, above surface gas collection infrastructure should be removed.

16. Stormwater Management

16.1. Background

Keeping stormwater separate from leachate is the most critical environmental issue on any Site.

If storm water is not carefully controlled, many environmental problems will arise, including the following;

- extra leachate will be formed,
- pollution can be carried off Site,
- the Site will be hard to operate due to bogged vehicles, and
- the operator of the Site can be fined for breach of the Site Licence.

The storm water on a Site can be classified as either clean or dirty. The clean storm water falls on undisturbed land and is not polluted. This water usually drains onto the Site from the adjacent catchment. To ***stop the clean water from being polluted, diversion drains will be constructed around the Site to divert clean storm water runoff from entering the working areas and disturbed areas of the Site***. All storm-water channels and the entrances into local canals and natural creeks should be checked regularly for signs of erosion and/or instability such as after each major storm event.

Internal stormwater runoff contaminated by cover stockpiles and disturbed areas is classified as dirty. This dirty water volume can be minimised by implementing progressive revegetation of completed areas.

At present there is no requirement to treat dirty stormwater before discharge. If treatment is required in the future, a hay bale/geotextile barrier can be constructed across the runoff points within the Site to minimise escape of silt or a settling pond constructed, if required by the Site Licence or Permit. The barrier should be inspected after each major storm event. Trapped sediment will be removed, and the silt barrier inspected for any damage.

Where storm water is to cross an access track, a piped crossing must be provided.

Any water that ponds against the waste face for a lengthy period, or even litter, must be treated as leachate, and must not be directed to the storm water systems.

16.2. Stormwater Controls

The ***cells will be filled with waste from higher areas to lower areas to avoid stormwater ponding at the base of the working face or previously worked areas***.

The base of the Site is sloped to allow stormwater runoff to flow by gravity to a central location from ***where it will be pumped outside the cell.*** If the drain is lower than the lowest point of the cell, then it will be able to drain into the local external stormwater drain. ***The pipe will be sealed immediately before covering with waste to prevent leachate flowing directly into the stormwater drain.***

The drainage water will flow in open channels on both sides of the central access road toward the Site entrance area. A pipe under the road near the entrance will allow the water to meet at a common outlet offsite.

Any stormwater runoff from higher areas or previously worked areas will be diverted away from the active face through small drains or bunds as necessary during new cell development.

16.3. Surface Water Monitoring

Visual inspection of the water leaving the Site should usually suffice. If obviously turbid or dirty, then treatment will be required, such as silt barriers or settling ponds.

The aim is to have runoff water leaving the site at the same quality as entering the site. Therefore monitoring will always be relative to upstream water quality, rather than some arbitrary standard. This also applies to groundwater flows.

If required by the Site Licence in the future, monitoring of surface water as it enters and leaves the Site may be specified on a regular basis, such as during major runoff events to determine the level of any contamination. Parameters analysed could include the following but will be stipulated in the Site Licence if required: electrical conductivity, pH, redox potential, temperature, total dissolved solids, suspended solids, turbidity, nitrogen scan, bicarbonate, chemical oxygen demand, standard water analysis, iron total, zinc, chromium, lead and copper. Similar monitoring of the internal storm water above and below the working face should also be carried out.

All staff are responsible for checking that the storm water systems are operating properly. Any problems are to be reported to the Site Foreman.

16.4. External Runoff Management

The stormwater diversion system should be constructed ahead of landfilling within the existing creek area to ensure that external runoff remains separate from all disturbed areas. All external runoff diversion channels should be checked regularly for signs of erosion and/or instability.

Scour protection may be required for the proposed major diversion channels where the channel is excavated through erodible material, such as the surface silty clay. This may be achieved by placing some of the excavated rock from the deeper part of the excavation channel over the invert of the channel. This protection will only be required for the entry and exit lengths of the channel as the majority is expected to be in bedrock.

16.5. Internal Runoff Management

Internal runoff contamination from cover stockpiles and disturbed areas should be minimised by implementing progressive revegetation of completed areas. The stability of local and internal diversion channels should also be checked regularly and maintained to prevent contamination of runoff.

Monitoring of stormwater quality within the site above and below the working area may be required as part of the site operating Licence, which would then be undertaken in association any required external catchment monitoring program and using the same water quality parameters.

If elevated turbidity levels are monitored in the site runoff, then geotextile curtains will be incorporated to further reduce sediment runoff.

Diligent litter management by landfill operators will also ensure refuse does not enter the surface water stream.

16.6. Internal Runoff Management - Post-Closure

Internal runoff should continue to be monitored quarterly during major runoff events at the downstream limit of the internal drainage system. Monitoring will continue until the landfill becomes inert i.e. until the leachate quality is essentially the same as that of the external stormwater runoff. This is expected to take at least 5 to 10 years. The sampling parameters would be as for the operation phase.

Batters should regularly be checked for erosion, especially where refuse may become exposed.

17. Leachate Control

17.1. Background

There is a trend to focus more on minimizing leachate volumes and disposing of these within the landfill site, as opposed to providing complex leachate treatment systems that are rarely operated correctly on a sustainable basis. In fact numerous landfills fail not because of design intent but because of ongoing operational costs for complex treatment systems and lack of suitably trained operators in the medium to long term.

There are few if any landfill in a developing country within Asia or the Pacific which operate a full leachate treatment system effectively. Once external funding, such as from ADB or World bank, is no longer available, the cost of chemicals and energy for powering aeration equipment, as well as ongoing maintenance of these mechanical items, traditionally becomes economically or politically unacceptable. This is even more so the case for relatively small landfills such as the one under consideration here.

Leachate developing within the proposed deep and extensive waste fill will tend to collect at the waste fill/ liner interface and seep by gravity through the gravel bed to the lowest adjoining area. Central and lateral interceptor drains beneath the fill will then allow adequate interception at the downstream and central areas of the fill areas.

By continuously withdrawing leachate from beneath the fill, large volumes of leachate will be most unlikely to penetrate the underlying rock mass.

Shaping of the base of the waste fill areas, promotion of leachate flow along the fill/ liner interface to low spots and the automatic pumping of leachate from deleaching wells will maintain a low head of leachate. By this means potential seepage flow of leachate into the base of the fill areas may be reduced to negligible levels.

17.2. Approach to Leachate Management

Therefore the environmental management approach focuses more on ensuring good operation is provided to minimize the leachate volume generated rather than incorporating large treatment plants to manage an excessive leachate volume.

The aim is to absolutely minimize the area of exposed solid waste to limit contact with and infiltration of rainfall. Other operational criteria will assist in reducing leachate generation as follows;

- Previously worked areas of the site will have a minimum slope of 5% to maximize stormwater runoff rather than infiltration through this upper soil cover and then into the waste mound. The final slopes will be the traditional 1 vertical to 3 horizontal post settlement from the initial 1V:2.5H. This will further decrease the amount of rainfall infiltration into the refuse mount resulting in leachate.
- Another key component of the leachate minimization strategy is to ensure good compaction of the deposited waste. This not only reduces the permeability of the waste mound but also reduces the potential for differential settlement. Reduced differential settlement means there is less chance of surface ponding and therefore excessive storm water infiltration occurring.
- The base of the active working cell will slope the way from the working face to eliminate stormwater ponding against exposed solid waste. Also at certain stages of cell development, it will be necessary to construct small diversion bunds or

drains above the active face to prevent stormwater runoff going over the face, but rather it will be directed down the side of previously worked areas.

- Earthen bunds will prevent direct contact of any impounded stormwater against exposed solid waste. This is traditionally the greatest contributor towards excessive leachate volumes but will not occur at this site.

17.3. Leachate Minimisation Measures

The ***principal means of minimising leachate formation by good site management techniques*** include:

- use of low permeability material as cover
- good compaction and coverage of wastes which acts to limit infiltration into the landfill
- maintain minimal working face particularly during wet weather periods
- grading of the site (particularly exposed areas) to not less than five in 100 which helps run-off from the site and limits infiltration
- revegetation of areas which are filled to design levels. The increased evapotranspiration from these areas limits infiltration and therefore production of leachate
- diversion of major upstream catchment water around the fill areas by means of rock-lined diversion channels. Local diversion ditches will remove rainfall runoff in small, local catchments.
- It is estimated that at least 25% of the waste stream is composed of leaves, grass cuttings, shrub prunings and tree loppings. Removal of some of this organic matter from the waste stream will significantly reduce the production of leachate.
- The filling sequence will be from "upstream" to "downstream", intercepting and diverting clean water around the progressively completed waste areas and out via the undisturbed open end of the valleys.

Leachate quantities will be monitored at the final deleaching well. Regular inspections of the toe of the landfill mound will also allow detection of excess leachate being generated. Leachate will be automatically pumped back into the mound via dry well injection points. In the event of excessive volumes being generated, leachate could be irrigated on completed areas or open grasslands, or as the last option leachate could be treated prior to discharge.

This re-pumping also allows leachate to volatilise with the landfill gas. Landfill gas escapes at elevated temperatures, carrying significant quantities of leachate as vapour with it.

The leachate collection system will consist of slotted pipes and gravel drains located under the landfill stages, which then connect into a central solid wall pipe conveying the leachate to the primary leachate pump station. Even though the life of the landfill is so short, the unused stages will not be hydraulically connected into the central leachate pipe until immediately prior to waste placement within that stage. This prevents uncontaminated stormwater directly entering the leachate collection system

and resulting in excessive leachate volumes. This premature exposure of the leachate interception system has resulted in many landfill operational failures due to excessive volumes of dilute leachate being formed.

Once the untreated leachate has reached the primary leachate pumping station, there will be three options for leachate management.

17.4. Recirculation.

Solid waste often has a moisture content of 20% to 40% at landfilling. Leachate does not begin to flow through the waste mound until this moisture content exceeds approximately 70%. Therefore it is intended to recirculate untreated leachate from the primary leachate pumping station back through both the existing mounds of the Landfill. This recirculated leachate will be initially absorbed by the dryer solid waste in the upper levels of the mound.

As the upper levels eventually become saturated, the leachate will start to trickle down towards the leachate collection system. This also has the advantage of accelerating the maturation of the landfill from the acidic phase to the methane phase, which then reduces metals mobility. It also makes the leachate more available for evapo-transpiration losses by the vegetation on the completed areas of the mound.

17.5. Leachate Irrigation.

Previously worked areas of the site will be protected with a 600mm clay cover with growing medium on top of this. Grasses and small shrubs will be planted on the growing medium. This vegetation serves a number of purposes but primarily it will substantially limit erosion as well as maximising evapo-transpiration from the completed areas of the landfill and the also the associated Landfill. These areas will be irrigated with untreated leachate which will both provide the necessary water source for keeping the vegetation alive in the dry season, as well as making maximum use of this evapo-transpiration capability.

This system of leachate recirculation and irrigation has been used to manage landfills in wet areas successfully.

Given the predominantly domestic and commercial nature of the incoming solid waste, it is expected that the resulting leachate will be suitable for irrigation without any dilution. This has been the experience in other landfills receiving predominantly domestic waste. Irrigation will not be restricted just to the dry season. During the wet season, there are always extended periods of little or no rainfall when the evapo-transpiration capacity can still be utilized by leachate irrigation.

17.6. Leachate Treatment and Discharge.

This will not be provided as an option unless mandated by the approving authority.

In this case, a passive lagoon series will be constructed to which leachate will be pumped for treatment prior to discharge outside the Site. This will be the least preferred option because of much greater running costs and the need for some treatment process understanding by the landfill operator. It is expected that once the first landfill stage is completed and both irrigation and re-injection systems are operating, the treatment plant will not be used.

17.7. Summary

In summary, the first priority will be irrigation (to maintain vegetation vitality), followed by re-injection. It is expected that the leachate treatment plant will only be used during wet weather periods during the first few months, and then only if the landfill mound and existing Landfill becomes too saturated to accept additional leachate for re-injection. However this last situation is extremely unlikely given the operational procedures planned for the site, which will minimise leachate formation in the first place.

Leachate will only be treated if it is going to be discharged.

17.8. Leachate Management - Operation

Sampling piezometers will be installed in these bores hydraulically downstream of the proposed landfill stage. Groundwater quality will be monitored in the bores to confirm that groundwater is not being contaminated.

If contaminated, a series of deep wells will be installed to intercept the contaminated groundwater. These high volume bores will lower the local watertable and intercept any leachate contaminated groundwater prior to it exiting the site. The groundwater would be pumped back into the landfill mound if the quantity is small, or treated and discharged if the flow is high.

A different leachate management system would then be implemented for further stages, such as additional lining and leachate interception drains and blankets.

Any leachate collected in the deleaching wells will be tested regularly to assess its quality. Groundwater will also be tested to see if this is being affected by leachate. The testing would be required to appreciate landfill operation and leaching aspects, and also determine if the liquid is suitable for irrigation.

It is proposed that the groundwater bores and leachate wells will be monitored on a quarterly basis or in accordance with the approvals, regulations or guidelines of the time. After 2 years of monitoring, the parameter list may be amended to include other indicator parameters, provided that the recorded levels of parameters are acceptable. A full scan of parameters would still be completed annually.

17.9. Leachate Management - Post-Closure

Following closure of the landfill, the leachate collection system will remain in place and functioning. The sampling parameters for groundwater would be as for the operation phase. Sampling frequency would decrease from the proposed quarterly program only after consultation with advisory agencies such as DONRE.

When the leachate becomes benign or inert, any water collected in the pervious blankets would be directed into local waterways.

18. Post Closure Management Plan

The post closure management plan has been incorporated into appropriate sections of the EMP as it is a progressive process.

The ultimate landform and use of the site has not been finalised, however the proposed rolling/hilly topography will be compatible with the existing area.

With simple gas control measures, the following uses are possible;

- walkways, playgrounds, cycle paths
- re-pasture and return to grazing
- sports fields
- grass and tree planting
- par 3 golf course.

19. Environmental Management Plan - Summary Table

Element	Policy	Performance Objective	Monitoring	Corrective Action
1. Compaction	To ensure that waste is properly compacted.	To achieve maximum airspace for the operation and to minimise the environmental impact.	1. Daily inspections by the Site Foreman 2. Weekly unannounced visual checks by the Manager. 3. Audit of the airspace used (based on a half metre contour survey). Compare the actual airspace used with the theoretical airspace required (at the target compaction rate for the recorded mass of waste accepted into the operation during the previous audit period) 4. Inspection of intermediate and final cover for ponding due to differential settlement	1. Ensure that subsequent lifts are properly compacted. 2. Check maintenance and operation of compacting equipment e.g. that three to five passes of the bulldozer are being completed over a waste layer less than 0.6 metres thick, with a lift height of less than 2 metres. 3. Compact with heavier roller (e.g. 40T proof roller) with 20 passes in each direction. This should only be done as a final option.

Element	Policy	Performance Objective	Monitoring	Corrective Action
2. Daily Cover	To ensure adequate daily cover	1. To provide at least 150mm of suitable cover on a daily basis 2. To prevent waste being blown from the working face. 3. To keep water, pests and vermin out of the waste.	1. Daily inspection of cover thickness by Site Foreman, grading/structure and frequency of placement. 2. Daily appraisal of litter, pests and odours to check if the thickness and frequency of the daily cover is adequate.	1. If cover is not being applied daily, Site Foreman to notify operator of required frequency. 2. If pest numbers are increasing due to poor cover, increase the thickness or the quality and compaction of the cover. 3. If water is obviously leaching into the waste, the clay content or thickness should be increased. 4. If trafficability is poor in wet weather, increase the gravel content of the cover. 5. Ensure cover has been well compacted and graded to at least a 5% slope.

Element	Policy	Performance Objective	Monitoring	Corrective Action
3. Intermediate Cover	To ensure placement of adequate intermediate cover	To provide at least 300mm of suitable cover on areas which will not be used again for waste placement for at least 6 months to minimise environmental impacts	1. The Site Foreman is to monitor the intermediate cover during placement. 2. Monthly inspection of the intermediate sections of the landfill mound to check cover integrity, during the life of the operation on the site.	1. Increase quantity and quality of cover as necessary. 2. Supplement with topsoil or mulch, and revegetate to enhance cover stability in the interim if essential. 3. If water is leaching into the waste, the clay content or thickness should be increased. 4. If trafficability is poor in wet weather, increase the gravel content of the cover. 5. Ensure cover has been well compacted and graded to at least a 5% slope.

Element	Policy	Performance Objective	Monitoring	Corrective Action
4. Final Cover	To apply a final cover that will prevent air and water pollution and support vegetation.	To ensure a minimum thickness of 600mm of continuous and impermeable final cover at all times, and supplement with an appropriate growing medium to the depth required.	1. The Site Foreman is to monitor the final cover during placement. 2. Monthly inspection by the Consultant of the completed sections of the waste mound to check cover integrity, during the life of the operation on the site. 3. Annual inspections of the cover integrity post-closure e.g. ensure rainwater runoff is still being managed to avoid cover erosion.	1. Increase quantity and quality of cover as necessary, such as if excessive leachate volumes are still generated. 2. Supplement with topsoil or mulch and revegetate to enhance cover stability in the long-term, and to avoid any surface ponding due to differential settlement. 3. Maintain stormwater runoff systems.

Element	Policy	Performance Objective	Monitoring	Corrective Action
5. Vegetation	To ensure that the site is sufficiently vegetated to satisfy environmental requirements and end use plans.	To revegetate the final landform with native plants and trees, in accordance with the end use plans.	1. Monthly monitoring by Site Foreman to check the progress of planted trees, shrubs and grasses during the operating life of the site. 2. If irrigating with leachate, confirm that the leachate quality is suitable for the planted species. 3. Annual post-closure inspections by a City nominee, with additional inspections following identification of vegetation stress, such as after bushfires.	1. Plant more tolerant trees and shrubs. 2. Increase amount of mulch cover. 3. Increase amount of top- soil cover. 4. Increase watering on new plantings. 5. Cease irrigating leachate if plant stress is resulting. 6. If the vegetation continues to suffer stunted growth or die-off, the species selection is to be re-assessed. 7. If vegetation continues to fail, undertake an agronomic assessment of the vegetation and soil to determine the required management elements, such as fertilisation rates or soil ameliorants.

Element	Policy	Performance Objective	Monitoring	Corrective Action
6. Dust Control	To prevent excessive dust from being generated on site.	1. Dust levels are not to be excessive (compared with neighbouring site activities) at the boundary of the site. 2. Dust levels within the site will satisfy the required safety and health levels.	1. Daily visual appraisal of dust generation via inspection by Site Foreman.	1. Water the source of the dust such as internal unsealed roads or dry compost piles. 2. Moisten any dust producing substances (e.g. fly ash, builders rubble) prior to delivery 3. Minimise the disturbed areas, by only clearing vegetation when required 4. Accelerate revegetation of completed batters

Element	Policy	Performance Objective	Monitoring	Corrective Action
7. Pest Control	To manage pest numbers.	To limit pests, such as flies, vermin, birds and rodents to acceptable environmental numbers.	All operational staff to actively observe if pest numbers are increasing.	1. Improve cleanliness of MRF/recycling sheds after residual waste has been transferred to the Landfill. 2. Undertake fly control spraying as necessary. 3. Commence rat baiting and other poison programs if required. 4. Improve compaction of the waste and cover at the Landfill area. 5. Place additional cover as required at the Landfill area. 6. Ensure prompt covering of waste at the Landfill area.

Element	Policy	Performance Objective	Monitoring	Corrective Action
8. Litter Control	To keep site and surrounding areas clean, tidy and free of litter.	Minimise litter formation and prevent litter from leaving the site.	1. Daily appraisal of amount of litter on site, in buffer areas and along access roads by Site Foreman. 2. Random inspections by the City staff.	1. Increase the frequency of general litter patrols. 2. Minimise internal litter sources, such as residual waste and storage areas associated with recycling activities. 3. Keep recyclables suitably packaged to prevent wind disturbance 4. Minimise external litter sources, such as from uncovered incoming or outgoing waste loads 5. If site litter is still excessive, then install litter fence panels in the MRF and/or Landfill, especially around the tipping areas. 6. Litter fences are to be cleaned on a daily basis, with boundary fences/tree screens every second day 7. Increase soil covering activities

Element	Policy	Performance Objective	Monitoring	Corrective Action
9. Fire Control	No open fires of any sort to be allowed on any part of the site, including a No Smoking policy.	Minimise the risk of fires on site.	1. All staff to be continuously on the alert for fires, or signs of fire. 2. Staff to advise patrons of the No Smoking policy.	1. For small above ground fires, use the on-site equipment. 2. For larger fires, call the local fire brigade for assistance. 3. Subsurface fires within the waste mound will require excavation to expose the combustion source for subsequent extinguishing. 4. Extinguished waste must be completely cooled before being placed back with other residuals for hauling off-site

Element	Policy	Performance Objective	Monitoring	Corrective Action
10. Noise Control	To prevent excessive noise at the site.	No noise complaints as logged in the Complaints Register	Site Foreman to review Complaints register weekly	1. Check maintenance of all delivery and onsite vehicles, including silencers. 2. Reduce number of vehicles operating simultaneously, or their operating times. 3. Reduce operating hours of the vehicles onsite 4. Limit the facilities hours for receiving waste 5. Only operate any MRF equipment, such as the chipper, during the middle of the day

Element	Policy	Performance Objective	Monitoring	Corrective Action
11. Visual Barriers	To isolate the site from public viewing to the greatest practicable extent.	To ensure that perimeter fences and/or tree screen are installed and maintained	1. Monthly inspection of the mound/fence/barrier and vegetation by Site Foreman, as appropriate. 2. Inspections of buffer and barrier vegetation following bushfires other extreme weather events.	1. Fencing/screening and bunds to be maintained in accordance with the development plan for the site 2. Additional vegetation to be planted in buffers and on any mounds when necessary. 3. Increase the height of the sight barriers/tree screen if practicable to shield the public's view. 4. Revegetate the waste mound to shield waste from view

Element	Policy	Performance Objective	Monitoring	Corrective Action
12. Odour Control (Landfill)	To prevent offensive odour emissions at the site.	No offensive odour to be detectable at the perimeter boundary.	1. Daily appraisal of odour at the site boundary. ('Smell' test by the Site Foreman prior to entering the site proper, and particularly at the working face.) 2. The Site Foreman is to ensure that the width of the working face is kept to a minimum. 3. Operators are to ensure that waste is deposited in the correct location and the appropriate action is taken, e.g. immediate burial of putrescibles such as animal wastes from the wet market. 4. Monitor the site to ensure that leachate ponding does not occur, by daily inspections by the Site Foreman.	1. Locate the source of the odour and cover as soon as possible. If it is a previously worked area of the site, then additional cover may be required to limit odour escape. 2. A truck carrying suspected odorous waste is to be directed to that part of the site where the waste can be buried immediately. 3. Reprofile the site to avoid ponding. 4. If waste gas is the odour source, flare or reuse the collected gas prior to venting to atmosphere.

Element	Policy	Performance Objective	Monitoring	Corrective Action
13. Odour Control (Any Recycling Sheds/MRF)	To prevent offensive odour emissions at the site.	No offensive odour to be detectable at the perimeter boundary.	Daily appraisal of odour at the site boundary. (`Smell' test by the Site Foreman prior to entering the site proper)	1. Increase cleaning activities in the MRF/recycling sheds to ensure that all residual biological waste is being removed to the Landfill on a daily basis. 2. If odour is resulting from compost processing problems, add more enzyme or other additives such as lime, or drying agents such as paper to stabilise the process 3. If odour is from off-specification products on site or excess product stockpiled for too long, adjust production schedules and/or the blend to suit the market, plus increase marketing development efforts to sell the compost

Element	Policy	Performance Objective	Monitoring	Corrective Action
14. Site Flooding	To minimise site flooding.	1. Ensure that the site is adequately bunded and fenced to prevent inundation of the site 2. Ensure that any minor inundation is kept separate from uncovered waste in the mound	Monthly monitoring of the perimeter bund and drains by Site Foreman	1. Repair and maintain the perimeter bund and drains 2. Maintain and advance the internal stormwater bunding system

Element	Policy	Performance Objective	Monitoring	Corrective Action
15. Internal Stormwater Runoff Management	Minimise contamination of internal runoff.	Ensure best practice approach to maintaining water quality of internal runoff.	Weekly inspections by Site Foreman to check that the extent of any disturbed areas is minimised, such as cleared site for construction of ramps, litter or waste in drain system	1. Clean all internal drains to remove any residual waste and any litter 2. Check litter fences (if installed) are suitably located and closed to prevent litter entering runoff flows. 3. Minimise disturbed areas e.g. accelerate the revegetation process of disturbed areas such as future bund construction.

Element	Policy	Performance Objective	Monitoring	Corrective Action
16. External Stormwater Runoff Management	To minimise contamination of external runoff.	Ensure clean runoff water remains separate from the disturbed areas on the site.	The Site Foreman shall ensure that the stormwater diversion system is suitably advanced in relation to landfilling activities, on a weekly basis by.	1. Accelerate diversion works. 2. Maintain erosion stability of all diversion works by revegetation or installing rip-rap. 3. Undertake a detailed site inspection to determine the source of the pollutants, and prevent further emissions of this pollutant.

Element	Policy	Performance Objective	Monitoring	Corrective Action
17. Landfill Gas Control	To responsibly manage gas in accordance with the environmental requirements of the time.	To manage the gas to avoid explosion risk, vegetation impacts and odour complaints.	1. Site Foreman to monitor the health of the revegetation on a monthly basis. 2. Site Foreman to monitor site gas odours, as per Odour above	1. If the flora is stunted or dying, replant smaller species or thicken the local growing media. (See Vegetation.) 2. If landfill gas is the source of ongoing odour complaints (rather than an explosive risk), upgrade the gas system to flare gas. 3. If gas is still causing odour complaints, upgrade the gas collection system by installing vertical wells and collection manifolds prior to productive reuse (if sufficient quantities available) or flare 4. If the gas concentration is within the explosive range, notify the Site Safety Officer. 5. Prevent access to the affected part of the site if it cannot be safely vented.

Element	Policy	Performance Objective	Monitoring	Corrective Action
18. Leachate Minimisation Overall	To minimise amount of leachate produced.	No leachate leaving the site.	Site Foreman to inspect downstream of waste mounds for leachate seepage on a weekly basis, and following wet weather.	1. Ensure good compaction and coverage of waste 2. Ensure minimum final grade of 5%. 3. Accelerate revegetation of completed areas thus limiting net infiltration. 4. Divert more organic such as wet market or green waste from waste stream to the compost trials/vermiculture. 5. Install additional collection and/or treatment systems for management of excess leachate, such as ponds, to allow more complete re-injection or irrigation.

19. Leachate Management Infrastructure	To ensure interception and collection of leachate and prevent contamination of groundwater.	1. Ensure that the appropriate leachate collection infrastructure is in place and functioning. 2. To ensure groundwater quality under the waste mound, and downstream of the site, is similar to the quality of upstream groundwater.	1. Site Foreman to ensure that the liner is continuous under the new cells as the site is developed. 2. Site Foreman to ensure that the liner and drainage layer above is correctly sloped toward the leachate extraction pipes and leachate pump station 3. Site Foreman to inspect on-site drains and water wells for possible leachate contamination 4. Site Foreman to check operation of any leachate drains from the MRF/recycling areas and truck wash, pumps and injection/spray systems on a daily basis. 5. Monitor groundwater quality in sampling wells for parameters specified in the DONRE site permit using DONRE sampling protocols, or other approvals and operational requirements. Monitoring is expected to include the basic indicator parameters such as the following on a quarterly basis; □ Biochemical oxygen demand (BOD), □ Chemical oxygen demand (COD),	1. Review or implement a revised leachate control system for the next stage of site development if leachate is causing contamination. (For example, it may require a new deleaching system) 2. Ensure maintenance of all leachate infrastructure, including any leachate pumps and injection/spray systems. 3. If parameter exceedences are observed from the monitoring program, resample more frequently and possibly for additional parameters such as heavy metals and biocides. 4. If groundwater quality is still poor, install downstream pumpout wells to intercept the contaminated groundwater plume prior to exiting the site.

			☐ Suspended Solids ☐ PH ☐ Conductivity, and ☐ Faecal coliforms *If more tests are required, whether by loal agencies or by public pressure, then the tests listed in Schedule A and even Schedule B below would be appropriate.*	

Schedule A

Electrical conductivity, pH, Redox potential, temperature, total dissolved solids, nitrogen scan, bicarbonate, oil (TPH), chemical oxygen demand, standard water analysis, iron total, zinc, chromium, cadmium, lead, nickel and copper.

If exceedences are observed in the wells, the wells would be resampled more frequently and for an extended range of parameters as listed in Schedule B below.

Schedule B

Schedule A as above, plus aluminium, MBAS, PAH, BTEX, cadmium, mercury, selenium, phosphorus scan, chlorinated hydrocarbons, cyanide, phenolic substances.

Element	Policy	Performance Objective	Monitoring	Corrective Action
20. Leachate Management Post Closure	To ensure interception and collection of all leachate.	Ensure a suitable leachate collection system is installed and functioning.	1. City Nominee to continue inspections of batter integrity on an annual basis even after leachate testing has been discontinued.	1. Repair any eroded batters and reprofile to avoid ponding. 2. Continue to return any remaining leachate flow to injection wells, irrigate or treat and discharge until monitoring indicates that the leachate is benign.