DESCRIPTIONS OF WASTE TECHNOLOGIES –

TRANSFER STATIONS AND DROP-OFF FACILITIES

WA Waste Authority - Strategic Waste Infrastructure Planning

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WA WASTE AUTHORITY

STRATEGIC WASTE INFRASTRUCTURE PLANNING

Concise Descriptions of Modern Waste Technologies

Transfer Stations and Drop-off Facilities FINAL REPORT

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1 SUMMARY

Hyder Consulting was commissioned by the Western Australia Department of Environment Regulation (DER) on behalf of the Waste Authority to provide a concise description of best practice transfer stations and drop-off facility technologies, as a means of facilitating modern waste management and resource recovery operations.

This report summarises a number of key parameters relating to this suite of technology, as requested by the DER. It is one of a series of reports reviewing various waste treatment and disposal technologies that may be applied in the Perth Metro and Peel Regions. The information is presented in a concise, standardised table format in Section 7 and Section 8 that, when merged with the information on other waste technologies, will allow a comparison of key parameters across the technology types and inform the development of the *Waste and Recycling infrastructure Plan for the Perth and Metropolitan and Peel Region*.

The purpose of the broader project is to provide sufficient information on each technology type to allow a comparison with other waste technologies and help to assess the potential for each option to play a role in the future Perth and Peel waste infrastructure mix. The project is intended to inform Government planning and strategic decisions.

Transfer stations and drop-off facilities are well-established waste technology systems that can potentially make a significant contribution to resource recovery and landfill diversion objectives, as well providing economic solutions for the transportation of waste materials. They are not a total waste solution in themselves, and will not result in zero waste to landfill.

Transfer stations and drop-off facilities should be considered as part of a broader integrated waste management system, and complementary to other infrastructure. They provide a means to consolidate and manage waste and recyclable materials, and are often a necessary link between collection systems and treatment or disposal facilities.

Drop-off facilities are sites where the public and non-commercial individuals can dispose of household waste and separated recyclable materials, while transfer stations are designed to be used by commercial operators. Although there are different siting and system configurations for transfer stations and drop-off facilities, for the current project Hyder has focussed on a combined transfer station with drop-off facility for detailed analysis.

The information presented in this report is a combination of details gained through consultation with the operators of the identified case study facilities, and information arising from a review of relevant and available literature on the topic. Additional general information has been included based on Hyder's industry knowledge and experience.

On the basis of selection criteria agreed with the DER, Hyder selected the following transfer station and drop-off facilities to use as case studies.

Type	Location
Transfer station and drop-off facility	Sydney, NSW
Transfer station and drop-off facility	Northern Tasmania, TAS

This report presents key details of each reference facility based on information provided by the operators. In some cases, information was not provided due to commercial concerns. The facility information has been summarised in a table as requested by the DER to enable quick comparison with other waste management technologies. Section 8 contains a 'Study Synopsis' table for transfer station and drop-off facility technologies, which summarises the parameters across the technology variations.

2 INTRODUCTION

Following release of the *Western Australian Waste Strategy*, the Western Australian Waste Authority (WAWA) and the Department of Environment Regulation (DER) have established the Strategic Waste Infrastructure Planning Working Group, with the aim of developing a plan for the future waste disposal and recycling infrastructure needs of the Perth metropolitan and Peel regions. The Working Group will guide the development of a *Waste and Recycling infrastructure Plan for the Perth and Metropolitan and Peel Region*.

The WA Waste Strategy sets out challenging recovery targets for each of the major waste streams: municipal solid waste (MSW), commercial and industrial waste (C&I) and construction and demolition waste (C&D), for both the Perth Metro and Peel regions. One of the key objectives of the Waste and Recycling infrastructure Plan for the Perth and Metropolitan and Peel Region is to identify the waste technology options and infrastructure mix that will help Western Australia to achieve those targets.

Hyder Consulting was commissioned by the DER on behalf of the Waste Authority to provide a concise description of best practice transfer station and drop-off facility sites as a system of modern waste management.

This report summarises a number of key parameters relating to this technology suite, as requested by the DER. It is one of a series of reports reviewing various waste treatment and disposal technologies that may be applied in the Perth Metro and Peel Region. The information is presented in a concise, standardised table format that, when merged with the information on other waste technologies, will allow a comparison of key parameters across the technology types and inform the development of the Waste and Recycling infrastructure Plan for the Perth and Metropolitan and Peel Region.

In the current project, Hyder has focussed on transfer stations and drop-off facilities for detailed analysis.

2.1 PURPOSE

The purpose of the project is to provide sufficient information on each technology type to allow a comparison with other waste technologies and help to assess the potential for each option to play a role in the future Perth and Peel waste infrastructure mix. The project is intended to inform Government planning and strategic decisions.

3 PROJECT METHODOLOGY

The information presented in this report is a combination of

a Details gained through case studies of representative reference facilities identified by Hyder in consultation with DER; and

b Information arising from a review of relevant and available literature on the topic.

Additional general information has been included based on Hyder's industry knowledge and experience.

3.1 CASE STUDIES

For the case studies, information was gathered through direct interviews and consultations with the current operators of the selected existing facilities and Hyder acknowledges their valuable contribution to the project.

To identify appropriate reference sites to use as case studies in the current project, Hyder has focussed on the categories below. These generic criteria have been applied across all waste technologies described by Hyder, including the present study, and applied where appropriate:

- Use proven, mature and best practice technology;
- Have been operational for at least 12 months;
- Have been operating successfully to a high standard with no known major issues or fundamental failures;
- Are generally of a capacity that would be appropriate for the Perth Metro and Peel regions;
- Have established sustainable markets for any outputs and products from the process; and
- The operators have agreed to take part in the project and provide information;

As far as possible, Hyder has selected Australian facilities, so that the costs, regulatory drivers and environmental standards are likely to be consistent with the Western Australian context.

To facilitate the provision of information by operators, the DER wrote an introductory letter to each selected operator to introduce the project, explain Hyder's role, and provide assurance as to the protection of commercially sensitive information.

3.2 LITERATURE REVIEW

To supplement the information obtained through the case studies and provide a broader view of typical facilities, Hyder has conducted a limited review of available literature on transfer stations and drop-off facilities and representative reference facilities and sites. Literature in this case includes:

- Technical Publications;
- Published industry reports;
- Journal articles;
- Company websites; and
- Waste and recycling survey and data reports.

Information obtained from published literature sources has been identified as such and references provided (see Section 9).

3.3 KEY PARAMETERS AND INFORMATION

The table below summarises the key parameters and information specified by the DER. The same list of parameters will be applied to each waste technology category in order to allow information to be presented in a standardised table format and therefore allow comparison across technologies.

Where relevant and representative information was obtained for the case study facilities, this is presented in the summary table (see Sections 7 and 8). Where information was not available or there was a benefit in providing additional background, the table has been supplemented with information obtained through the literature review.

Ref	Information Parameter	Description
1	Process description	A high level description of the process (or technology type) for managing or treating waste including its purpose, conversion processes, stages of treatment and key inputs and outputs (including energy and waste residues)
2	Feedstocks	Types of suitable feedstocks, pre-treatment requirements, broad physical and chemical characteristics, key exclusions
3	Capacity	Processing or disposal capacity (in tonnes per annum) including typical values and ranges
4	Waste Hierarchy	How and where does the technology fit into the established waste hierarchy?
5	Landfill Diversion Potential	Potential to divert waste from landfill (for example, waste recycled/recovered and waste to landfill expressed as a percentage of total waste sent to facility)
6	Products and Residuals	Identify all products, outputs and residuals from the facility / process (including any potentially beneficial outputs and energy)
7	Capital Cost	Expressed as a total cost and $ per tonne of annual capacity
8	Operational Cost	Expressed as $ per tonne of waste processed / disposed
9	Gate fees	Typical gate fees charged to customers. Note gate fees do not necessarily correlate directly with running costs and may include a profit margin and be driven by market forces (i.e., prices of alternatives)
10	Set-up Timeframe	Typical timeframe to establish the technology including planning, approvals, procurement, design, construction and commissioning
11	Lifespan	Typical lifespan of the technology taking into account standard maintenance and replacement practices

Ref	Information Parameter	Description
12	Footprint	Typical land footprint for a facility including for the core technology and any surrounding ancillary requirements (access roads, waste and product storage, buffers, etc.)
13	Buffer zones	Extent of buffers required around the plant, including typical existing facilities and any requirements in regulation
14	Emissions Performance	Typical pollutants arising from the process (solid, liquid and gaseous) – key substances and approximate quantities / concentrations. Also high level estimates of carbon impact including direct carbon emissions and indirect emissions from electricity use.
15	Environmental Performance	Compliance with regulations / permits, key environmental impacts including air, water, groundwater, noise, odour, dust, and waste arisings.
16	Social impacts / costs	Impacts on local community and neighbours, employment, local economy impacts,
17	Compatibility with existing systems / technologies and supporting systems	To what extent is the technology compatible with the existing waste management system and facilities (sorting, collection, processing, disposal), what broad changes would be required and which other technologies are required to complement the technology
18	Risks	Identification of potential risks including technical, commercial, environmental, operational and market risks
19	Local Application	Most appropriate application of the technology to the local context (metro or non-metro, medium to high density)
20	Maturity of the technology	How long has the technology been in operation, it considered proven and how many reference facilities exist in Australia and overseas
21	Availability	Typical annual maintenance shutdown requirements, plant availability as a proportion of the name-plate capacity
22	Penetration	Extent of existing penetration of the technology in the Perth Metro and Peel regions and within Australia (such as number / total capacities of existing facilities)
23	Benefits	Benefits of the technology (financial, environmental, social) compared with alternatives including landfill diversion performance, flexibility, future-proofing, etc
24	Barriers / constraints	Barriers to implementation including markets for outputs, policy and regulatory constraints, availability of technology and support in Australia, etc
25	Other relevant information	Any other relevant information which becomes apparent during investigations

4 BACKGROUND

For the purpose of this report, the term ‘transfer station’ is defined (consistent with the Strategic Waste Infrastructure Group Working Report) as an aggregation point for bulk quantities of waste prior to recycling or disposal, which is only accessed by commercial vehicles. ‘Drop-off facilities’, meanwhile, are operated by local governments and allow residents to deliver small loads of materials; unlike transfer stations, drop-off facilities are not designed for access and use by commercial collection vehicles.

Transfer stations can play an important function in a waste management system. Transfer stations provide a means of consolidating and managing waste and recyclable materials and form a link between collection systems, and treatment or disposal facilities.

The basic operations at a transfer station can include:

- Consolidation of waste from multiple sources for more economical transport to disposal sites; and
- Recovery of recyclable materials and resources.

A transfer station, in its simplest form, will encompass a designated receiving area where vehicles can discharge waste. This waste is then aggregated and loaded into a larger or otherwise more efficient vehicle for hauling to an appropriate treatment or disposal facility.

A transfer station receiving recyclables will have designated areas for discharging recycled materials, or an area to temporarily store any recyclables that are picked or sorted from mixed waste. The materials received at transfer stations may include municipal solid waste (MSW), commercial and industrial (C&I) waste, and construction and demolition (C&D) waste.

Drop-off facilities are sites where residents can dispose of excess household waste and separated recyclable materials. Drop-off facilities can range from single material collection points (bottle banks, or igloo recycling containers), to staffed multi-material drop-off centres. The waste materials received at drop-off facilities are MSW and household separated recyclables.

4.1 PURPOSE OF TRANSFER STATION AND DROP-OFF FACILITIES

Transfer station

Transfer stations are designed to be a short term transfer depot that operates efficiently to reduce the overall costs of hauling, and to provide resource recovery opportunities. They are not designed with the capacity to store waste long-term.

Transfer station operations involve the consolidation of smaller loads of waste collected by collection vehicles with loads discharged by self-haul vehicles, into large transfer vehicles. This reduces the haulage costs associated with the transfer of waste to the disposal or reprocessing facilities.

The use of transfer stations can mean haulage vehicle maintenance costs are reduced, and waste collection crews are able to spend more time collecting waste from households, and less time hauling to waste facilities, thereby increasing the efficiency of the collection operations.

Transfer stations can also allow for waste to be screened prior to disposal to retrieve recyclables and identify wastes that are inappropriate for landfill disposal (including batteries, hazardous waste, tyres etc.). Compared to landfills, transfer stations can be a more pleasant facility to use and visit.

Transfer stations may accept MSW and C&I

Transfer stations may include a drop-off facility, where a safe and accessible site is provided for small vehicles to enter and discharge waste. In Perth and Peel, however, transfer stations are privately owned and operated and cannot be accessed by the public.

Drop-off facility

Drop-off facilities are operated by local governments, or by private operators on behalf of local governments, to provide the householder access to dispose of excess waste materials or separated recyclable materials.

Some transfer stations will include a drop-off facility to provide public access to a section of the facility. The public unloading areas and traffic pathways are usually kept separate from commercial vehicles for safety and efficiency.

Drop-off facilities can also be found as stand-alone facilities and have operations set up to transfer all the waste dropped at the facility to either a transfer station or directly to a recycling reprocessor or waste facility.

In Perth and Peel, most drop-off facilities are operated by local governments and can be accessed by the public.

5 CASE STUDY DETAILS

On the basis of the selection criteria set out in 3.1 above, Hyder selected the following transfer stations and drop-off facility sites to use as case studies.

Type	Site Name	Location
Transfer station & drop-off facility	Site A	Sydney, NSW
Transfer station & drop-off facility	Site B	Northern Tasmania, TAS

This section provides a brief description each facility including the key features that make them representative case studies of best practice transfer station and drop-off facility sites, and how they satisfy the criteria set out in section 3.1.

Case Study 1 – Transfer station & drop-off facility A, NSW

The combined transfer station and drop-off facility is sited in an industrial zone of the Sydney metropolitan area, close to other waste management facilities including a materials recovery facility. The privately owned and operated facility accepts local government collected municipal solid waste (MSW) as its core operation, as well as other putrescible and non-putrescible waste streams from commercial businesses and the general public. The drop-off facility includes a series of large receptacles where recyclables can be deposited by the general public.

The facility has a licence to accept 150,000 tonnes of waste per annum, and does not have a defined operating life. The facility began operating in 1996, following a five year period of approvals, design and construction. The buffer zone is the immediate boundary of the site. The gate fees charged at the facility are contained in Table 5-1.

Table 5-1 Transfer station and drop-off facility gate fees

Waste Type	Dollars per tonne for loads over or equal to 500kg	Dollars per tonne for loads under 500kg	Minimum charges
Wet material (e.g. mixed waste containing food)	$295.00	$320.00	$55.00
Dry material	$275.00	$290.00	$55.00
Garden organics	$195.00	$209.00	$45.00
Untreated timber	$189.00	$203.00	n/a
Palm trees and fronds	$256.00	$265.00	n/a
Expanded plastics (e.g. polystyrene) when load has< 25% by volume	$600.00	n/a	n/a
Expanded plastics (e.g. polystyrene) when load has> 25% – 50% by volume	$1,200.00	n/a	n/a
Paper and cardboard (Clean newspapers, writing papers, books and cardboard boxes)	Free	Free	Free
Cans (Aluminium and steel cans)	Free	Free	Free

Waste Type	Dollars per tonne for loads over or equal to 500kg	Dollars per tonne for loads under 500kg	Minimum charges
Glass bottles and jars (Separated green, brown and clear glass)	Free	Free	Free
Plastic bottles and containers	Free	Free	Free
Scrap metals (Ferrous (e.g. steel) and non-ferrous (e.g. aluminium, brass, copper, stainless steel) including metal car body parts.	Free	Free	Free
Fire extinguishers	Free	Free	Free
Sump oil	Free	Free	Free
Vehicle batteries	Free	Free	Free
Gas Cylinders	$2.50 per 1kg of total container capacity.		

Case Study 2 – Transfer station & drop-off facility B, TAS

The combined transfer station and drop-off facility is located on the site of a former landfill, which has ceased operation and been partially rehabilitated. The facility is located at the edge of a rural town in Northern Tasmania, and accepts local government collected MSW as well as privately collected C&I waste as its core operation. Recyclable and recoverable materials from the public and commercial businesses are also accepted at the drop-off facility.

The facility can accept up to 30,000 tonnes of waste per annum and has an operating life of 80 years. Part of the transfer station area has recently been redesigned and constructed as shown in Figure 5-1. The new part of the facility began operating in 2012, following a three year period of undertaking feasibility studies, design and construction.

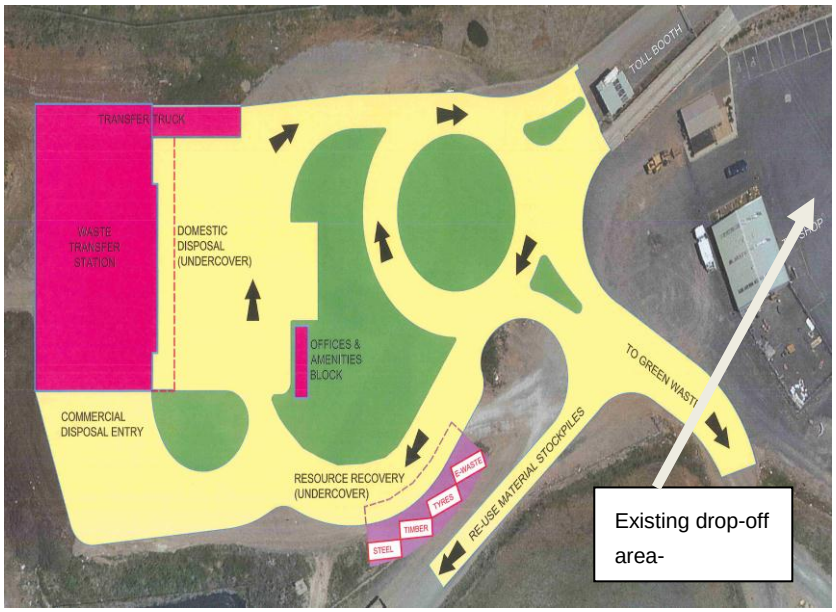

Figure 5-1 **Transfer station and drop-off facility**
This drawing shows the recently constructed area of the transfer station and drop-off facility. A further resource recovery area is present to the right of the tip shop shown on the image.

The buffer zone at the facility is 140m, in accordance with the previous buffer distance for the landfill. The footprint of the site is 20,600m^2. The gate fees charged at the facility are contained in Table 5-2 and Table 5-3.

Table 5-2 Transfer station and drop-off facility entry fees

Entry Fee for disposing Residual Waste	Cost ($)
Cars/Station Wagons	$ 7.00
Twin Cab Utes	$14.00
Vans, Utes, Small Trailers	$16.00
Dual Axle, Large Single Axle Trailers.	$41.00

Table 5-3 Transfer station and drop-off facility gate fees

Waste	Cost
Residual Waste (destined for landfill) (t)	$115.00
Low Level Controlled Waste (t) – (for direct landfilling) Asbestos, Soil, Sanitary (Hazardous Waste Level 1& 2)	$137.00 minimum charge $30.00
Separated non landfill waste (t) (timber, concrete, mixed inert fill)	$35.00
Clean soil (t)	$20.00
Green Waste (m^3) (separated loads greater than 3m^3)	$ 7.00
Tyres - Car & Motorcycle (each)	$ 6.00
Tyres - Light Truck & 4WD (each)	$15.00
Tyres - Truck (each)	$20.00
Additional Fees for Tyres on Rims	$ 3.00
Electronic Waste - Domestic	Limit 1 item per visit, with a paid waste load. ($5.00 per additional item)
Electronic Waste - Commercial (kg)	$ 3.60
Recyclables	Free
Car Bodies (Whole)	Free

6 LITERATURE REVIEW

6.1 PROCESS DESCRIPTION

Transfer station

The function of the transfer station is to provide the means or facilities for the transfer or transport of wastes from one location to another, usually a more distant location. Typically the contents of a smaller waste collection vehicle are transferred to larger vehicles, which are used to more efficiently transport waste over larger distances. Transported waste may be directed to waste facilities for sorting, reprocessing, treatment or disposal as appropriate.

Transfer stations may also be used to improve safety outcomes, even where long-haul transport of material is not required. Whereas historically waste was often directly hauled to a landfill tipping face, as a result of safety concerns and restrictions on landfill operations within some jurisdictions, many landfill operators have constructed transfer stations directly on their sites in order to restrict access to tip-face operations.

Transfer stations can play a key role in an integrated waste management system, providing benefits through improvements in the economics of medium and long distance waste haulage, and also through a reduction in the number of vehicle movements.

Transfer stations may also enhance resource recovery operations, and for example may be used to transport recovered materials to a material recycling facility (MRF) or an energy from waste facility.[i]

Drop-off facilities

Drop-off facilities are an outlet for the public to deposit waste materials that cannot be readily accommodated through the local government kerbside collection system.

A drop-off facility generally consists of an area containing a series of large receptacles (skips, bins, or enclosed bays) for different categories of waste, where the public can dispose of materials. A drop-off facility will have a series of parking spaces aligned with the separate waste depositing areas, designed to meet health and safety requirements at the site. Members of the public will drive to a drop-off facility, park their car nearby to the correct receptacle, and physically deposit the waste from their vehicle into the appropriate receptacle.

Whereas historically waste was often directly hauled to a landfill tipping face, as a result of safety concerns and restrictions on landfill operations within some jurisdictions, many landfill operators have constructed drop-off facilities on their sites in order to keep the general public away from tip-face operations.

The collection of waste deposited at a drop-off facility will be operated in a similar fashion to a transfer station, where waste would be bulked up for onwards transfer by a larger vehicle to either a reprocessing facility for recyclables, or to a waste treatment or disposal facility for residual waste.

Drop-off facilities in Australia are commonly found as a component of a transfer station or landfill, but can also be designed as stand-alone facilities.

6.1.1 DESIGN OF TRANSFER STATIONS AND DROP -OFF FACILITIES

In the design of transfer stations and/or drop-off facilities, a number of important factors that must be considered including:

1. The type of transfer operation to be used
2. Capacity requirements;
3. Equipment requirements; and
4. Environmental requirements.

Operation Type

Transfer stations can be classified into three types of operation[vii]:

1. Direct discharge;
2. Storage discharge; and
3. Combined direct and storage discharge.

Direct Discharge Operation

At a direct discharge operation transfer station, waste from the collection vehicle is emptied directly into the larger vehicle that will be used transport the waste material to an appropriate treatment or disposal facility. These transfer stations are usually constructed on a two level arrangement. Either the unloading dock or platform is elevated, or the transport trailers are located in a depressed ramp, in order to enable collection vehicles to discharge directly into the trailers that will transport the waste.

Larger direct discharge transfer stations often have compaction equipment to compress the waste into transfer trailers, or into bales, to enable a higher volume of waste to be hauled.

Storage Discharge

At the storage discharge transfer station, waste is emptied into a storage pit or onto a platform, from which it can then be loaded into the larger vehicle by various types of auxiliary equipment. These transfer stations typically have capacity to hold between one and three day's volume of waste.

Combined Direct and Storage Discharge

Transfer stations with combined direct and storage operations are commonly designed as multipurpose facilities with large waste holding capacities. They can serve a broader range of users, and are able to also house a drop-off facility to foster materials recovery[vii].

In combined direct and storage transfer stations, the operations generally follow a similar format to the description below:

1. All waste haulers (public and/or commercial) check in at the gate;
2. Waste haulers (either all haulers or a subset of waste haulers, for example only commercial haulers) have their vehicles weighed using the weighbridge;
3. A ticket/stamp is given to the vehicle driver;
4. The driver proceeds to the unloading platform/area and unloads the waste directly into the correct receptacle, depending on the waste type;
5. After unloading the vehicle is re-weighted prior to leaving and returns the ticket; and

6 The weight of the vehicle is recorded and the fee for the discharge is calculated (based on the weight of the waste discharged).

Vehicles may sometimes not be weighed, and instead have a fixed discharge fee may be applied based on an estimate of volume and/or material type.

Recyclable materials can commonly be discharged at transfer stations or drop-off facilities without a disposal fee, so long as they are sufficiently free of contamination and are deposited into nominated areas or skips. Householders and smaller independent non-commercial haulers will often haul significant quantities of garden waste and bulky wastes to drop-off facilities, given the nature of this material may make it hard to dispose of through kerbside collection services.

Capacity Requirements

Transfer stations must have operational capacities that ensure delays in the unloading of collection vehicles are prevented. They are frequently designed to accommodate future expansion. Often, this is accomplished by siting the facility on a larger parcel of land than would otherwise be necessary.[ii]

Equipment Requirements

The equipment requirements at transfer stations vary, and depend on factors such as the operation type, capacity, and function in the waste management system. Generally, equipment such as front-end loaders, skid-steers and/or grappling cranes are used to move bulk quantities of waste within the facility. Storage receptacles will be required. Compaction units can be used to load transfer vehicles as well as balers to consolidate separated materials such as paper/cardboard. Weighing equipment and data capture systems are generally necessary to monitor the use of a transfer station.

Environmental Requirements

Most modern transfer stations are designed to be enclosed and be easy to maintain and clean. For direct discharge facilities, attention must be given to windblown litter and odour. Equipment and barriers to prevent windblown litter are commonly applied at transfer stations. Misting systems may be employed for dust and/or odour suppression at some facilities.

6.2 CAPACITY AND FOOTPRINT

The footprint and capacity of a transfer station and/or drop-off facility is limited by the available land space and the development approval held. Transfer stations can be as large or as small as required. The actual throughput will be dependent on the licence, the operational logistics in place at the site, and commercial factors such as demand for use.

For example, information gathered from consultation with the operators of the two facilities described in the case studies revealed the transfer station in Case Study 1 had a footprint of 6,000m^2 for the shorting shed and 120m^2 dedicated to the drop-off facility area. The facility in Case Study 2 had an overall site footprint of 20,600m^2 with a sorting shed footprint of 1,485m^2. The annual throughput varied between the two sites from 25,000 tonnes to 150,000 tonnes.

6.2.1 DETERMINING TRANSFER STATION SIZE AND CAPACITY

The physical size of a transfer station is typically determined based on the following factors:

- The catchment area for waste serviced, such as all waste generated within a particular local government area, or all waste collected by a specific company;

- The volume of waste generated within the service area, including projected changes such as population growth and recycling targets and programs;
- Expected increases in tonnage delivered during the life of the facility;
- The types of vehicles delivering waste to the transfer station;
- The types of materials to be transferred (for example compacted or uncompacted MSW, garden waste, C&D waste) and seasonal variations effects to volumes;
- Daily and hourly arrival patterns of customers delivering waste, with peak hourly arrivals tending to dictate a facility's design more than average daily arrivals;
- The availability of complementary systems such as transfer trailers, intermodal containers, barges, or railcars; and
- The relationship to other existing and proposed waste management facilities.

6.2.2 FEEDSTOCK

The following types of waste are commonly handled at transfer stations:

- Municipal solid waste (MSW) generated by households. MSW typically contains a wide variety of materials including discarded containers, packaging, food wastes, and paper products. MSW includes a mixture of putrescible (easily degradable) and non-putrescible (inert) materials.
- Garden waste (green waste). This includes leaves, grass clippings, tree trimmings, and brush. Garden waste is often recycled through composting or mulching instead of being disposed to landfill.
- Hazardous waste generated by households. Items such as batteries, cleaning products; pesticides; herbicides; brake fluid, and paint.
- Recyclable materials that can be reprocessed for manufacture into new products. Common recyclables include paper, metals, plastic, glass, used motor oil, and tyres.
- Construction and demolition (C&D) waste from construction operations. This consists of concrete, brick, wood, masonry, tiles, plasterboard, and metals.

Certain wastes will be unacceptable at a transfer station for a variety of reasons, including:

- They are prohibited by the regulatory framework within the jurisdiction;
- They are difficult or costly to process;
- They might pose a health or fire hazard;
- They might be prohibited at the disposal facility to which the transfer station delivers; and
- They might be so large that they could damage trucks or equipment during waste loading operations.

Drop-off facilities commonly accept recyclable materials, MSW, and other specified materials such as E-waste and gas bottles.

6.3 COSTS

The capital cost for the construction of a transfer station and associated drop-off facility can vary. The facilities contacted provided capital cost information varying from $10 million for land acquisition, development approval and construction of a combined transfer station and drop-off facility, to $1.5 million for upgrading an existing facility (construction of a shed and ancillary

works). Similarly, operating costs will vary depending on local conditions and transfer facility design, however specific information was not available.

The gate fee for receiving materials at a transfer station varies from operator to operator. It should be noted that, while gate fees will be related to operating costs, commercial factors may also dictate significant differences between what it actually costs to operate a facility, and what a user is charged. Charges are generally based on types and/or volumes of materials.

The capital cost for the construction of a simple household community drop-off facility is estimated to be in the order of $230,000[iii] (excluding land purchase).

Some local governments provide householders with a limited number of disposal opportunities without charging a fee. Typically the disposal of recyclable materials at a drop-off centre does not attract a fee, although this is dependent on the individual local government.

6.4 RISKS

The concept of a transfer stations or drop-off facility that serves to receive and temporarily store waste in a designated area is not new; these systems have been operating as part of the waste management system in many countries for many years.

Resource recovery operations at the facilities are a newer concept, driven by policy and commodity markets, and some relatively new technologies have been developed in order to enable and enhance recovery of materials from the waste stream.

There will be a higher degree of technical risk associated with facilities that employ more complex systems (including those to support resource recovery activities), although the risks are generally not high and can be mitigated through appropriate selection and ongoing maintenance of the specialist equipment used.

Transfer stations are often necessary in providing an economical approach to haul waste, whilst also providing opportunities for additional resource recovery. Commercial risks, for operators, are largely associated with securing sufficient volume of throughput – at sufficient gate fee – to support development and ongoing operation of the facility. Commercial risks will increase where there are multiple transfer stations in operation, and/or where there is strong competition for waste volumes within the catchment area.

Commercial risks are generally managed by operators seeking to secure long-term agreements for use of the facility before it is constructed, for example securing a 10 year commitment from a local government to use the facility for all its MSW at a specified gate fee. Upon securing sufficient volume to justify establishment of a facility, operators may be willing to accept a larger degree of commercial risk in terms of over-designing capacity to enable use by some additional customers (such as commercial users).

Transfer stations would not generally be considered to have a particularly high commercial risk, so long as the operator has sufficient volumes contracted to justify development and operation of the transfer station.

Environmental risks include issues associated with dust, odour, noise, littering and risks to water quality, although many standard and proven management measures exist that can minimise the risks considerably, if implemented correctly (see Section 6.5 for more).

Occupational health and safety risks can be significant, but may be minimised through best practice facility design and by providing sufficient oversight of users. Risks may include fall-from-height risks when unloading materials, and risks associated with traffic movements on the site. Risks are greatly increased at unmanned sites.

Drop-off facilities are often co-located with transfer stations, in order to leverage advantages of existing development approvals, site staffing, and the transport and material handling logistics associated with handling waste materials.

Drop-off facilities can be constructed as standalone facilities. Where there is insufficient waste volumes and customer usage to support staffing of the drop-off facilities, surveillance equipment (such as CCTV systems) can be deployed in order to help reduce some of the risks associated with unmanned facilities. Other techniques to reduce risks, especially at unmanned sites, include ensuring there is clear signage so that users can readily understand how they should use the facility. General maintenance, including regular collection of materials to avoid overflowing receptacles, can help to reduce the instance of misuse such as illegal dumping.

6.5 ENVIRONMENTAL CONSIDERATIONS

When siting transfer stations, many environmental issues need to be taken into account, as described in Table 6-4. These same environmental considerations remain when the site is operational, however design measures would have been implemented to mitigate any impacts. The main environmental issues are discussed.

Aesthetics

The aesthetic appearance of transfer stations and drop-off facilities are important to promote better customer behaviour, efficient operations and good use of the facility. Measures to promote the maintenance of aesthetic include regular cleaning and litter patrols, clear and efficient signage, and landscaping of the area.

Traffic

Traffic management measures should incorporate traffic entering and leaving the site as well as flows within the facility. The key focus is promoting an efficient and safe movement of vehicles within the site, including minimising cross-over between household and commercial customers wherever possible.

Litter

Minimising the generation of litter from the transfer station operations is necessary. During operations, it is likely that stray pieces of waste may become litter in and around the waste transfer station.[viii]

The design of the transfer station should take into account the direction of prevailing winds. Control methods can be utilised for litter including, mobile litter fences, using covered and bunded areas to undertake resource recovery activities, and ensuring operations maintain a small active area. The regular clearing of litter and ensuring all loads entering and leaving the site are covered are other measures that can be used.

Air and Dust Emissions

Air and dust emissions at transfer stations can come from unloading dry, dusty waste delivered to the transfer station, as well as being due to exhaust fumes from trucks, loaders and other equipment, and driving over unpaved surfaces. [viii]

Air and dust emissions from the transfer station operations can be minimised using a number of control methods including sealing/watering of access roads, enforcing speed limits, enclosing the waste discharge areas, and using water sprays.[iv]

The following can reduce air emissions:

- Requiring trucks delivering and picking up waste at the facility to reduce unnecessary engine idling;

- Working with fleet operators to reduce engine emissions (e.g. engine improvements or use of cleaner fuels);
- Spraying dusty wastes with water as they are unloaded;
- Ensuring that street sweeping operations use enough water to avoid generating dust; and
- Paving all surfaces where trucks operate.[viii]

Odour

General municipal waste, particularly food waste and garden waste, has a high potential for odour generation. Good facility design can significantly reduce odour problems. Careful positioning of the building and its doorways with respect to neighbours is a good measure to mitigate odour complaints. At the transfer station building itself, exhaust fans with air filters and rooftop exhaust vents can further reduce off-site odour impacts.[iv]

Some of the operating procedures that can help reduce odours include:

- "First-in, first-out" waste handling practices that keep waste on site for short periods of time;
- Removing all waste from the tipping floor or pit at the end of each operating day so that these surfaces can be swept clean and washed down;
- "Good housekeeping" including regular cleaning and disinfecting of surfaces and equipment that come into contact with waste; and
- Water misting and/or deodorising systems.[viii]

Vermin

Rodents and birds can be a nuisance and a health concern at waste transfer stations. There are a number of basic design and operational measures to control vermin infestation, such as good housekeeping practices

Using an enclosed structure to receive waste can reduce the presence of birds.[viii]

Noise

Heavy vehicle traffic and the operation of facility equipment will create noise at a transfer station and drop-off facilities. The design and operation of transfer stations and drop-off facilities should incorporate measures that help reduce noise such as:

- Confining noisy activities within buildings or other enclosures as much as possible;
- Using landscaping, sound barriers, bunding and other mechanisms to absorb exterior noise.
- Arranging the site so that traffic flows are not adjacent to properties that are sensitive to noise;
- Providing buffer zones, to separate noisy activities from adjacent land uses; and
- Conducting activities that generate the most amount of noise during the day.[viii]

Leachate Management

Leachate is likely to be generated at transfer stations where putrescible waste is handled and if the site is not covered, allowing rainwater to mix with the waste. Leachate should be directed to a dedicated drain and appropriately treated, or collected and disposed of offsite.[v] Steps to minimise leachate generation include enclosing facilities to avoid rainwater ingress.

Stormwater Management

Transfer stations or drop-off facilities should be designed to prevent polluted water from being discharged into the stormwater system. All storage and processing areas should be bunded, and any liquid collected in these areas is to be treated as leachate.

Any stormwater runoff from car parking, driveways and hard paved areas should be diverted into a stormwater treatment system capable of removing litter, sediments and oil products.[v]

Fire

There is risk of fire at transfer stations and drop-off facilities, and there must be fire response procedures implemented for the facility, including temporary storage and containment areas for incoming 'hot loads', as well as appropriate equipment and vehicles to manage any fire.[ii] Rainwater harvested on-site may be suitable for use in fire control systems.

Spill Containment

Spill containment procedures should be in place to address identification of spills and the correct deployment of absorbent materials and clean-up processes. The procedures should also address preventing the spill from entering stormwater drains or sewers for larger spills.[ii]

Hazardous Materials

Hazardous materials procedures should include methods to identify and isolate hazardous materials, temporary storage and quarantine locations and methods, and emergency phone numbers.[ii]

6.6 APPLICATION OF TRANSFER STATION

The set-up timeframe for a transfer station and drop-off facility is approximately two and a half years, depending on the complexity of the approvals process. The construction period would be expected to take between six and twelve months.

6.6.1 DESIGN OF TRANSFER STATIONS AND DROP-OFF FACILITIES

Safety, efficiency and maximisation of resource recovery are key considerations in the site layout of transfer stations and drop-off facilities. The design of the facility will be dependent on the constraints of each site but should:

- allow for separation of truck, car and pedestrian traffic movements;
- encourage recovery of materials by placing recycling drop-off areas before any residual waste disposal area;
- utilise natural site features to minimise the works required; and
- provide a separate area for processing operations which is not accessible to facility users.[vi]

6.6.2 SITING TRANSFER STATIONS AND DROP-OFF FACILITIES

To enable an efficient operation within an integrated waste management system, transfer stations should be located:

1 As near as possible to the centroid of the waste generation areas to be served;

2 Within easy access of major highway routes as well as other secondary access routes or supplementary transportation methods;

3 Where there is likely to be minimum public and environmental objection to the operations; and

4 Where construction and operation will be economical.

If operations are to be undertaken at the transfer station in order to recover materials for recycling or reprocessing (such as identifying and isolating 'clean' recyclables materials, like cardboard or metals), then the requirements for these operations must also be taken into consideration.[vii]

Well-managed waste transfer stations are:

- Located, designed, and operated to ensure the public health, safety, and welfare of the community and environment;
- Located so as to minimise incompatibility with the character of the surrounding area;
- Located where traffic patterns to or from the facility minimise the impact on existing traffic flows; and
- Consistent with jurisdictional and local regulations and plans. [viii]

In order to identify a suitable site for a transfer station, the following factors must be considered:

- Equality considerations, which may require weighing the relative benefits of allowing easy access for a range of potential users, with the likely impact of the operations on the surrounding community;
- Community Consultation, as a mechanism for allowing the community to have inputs to the process and provide their views on the relative merits of various options; and
- Siting Criteria, including the a suite of factors as shown in Table 6-4 below.

Table 6-4 Example of potential transfer station site assessment criteria

Category	Criteria
Planning	▪ Appropriate zoning ▪ Land ownership ▪ Available Buffers ▪ Not in an environmentally sensitive or inappropriate area
Technical	▪ Integration with existing and future waste network ▪ Opportunities for Regional/Rural co-operation ▪ Centrality ▪ Accessibility ▪ Existing services and utilities ▪ Size of area required
Environmental	▪ Geology ▪ Groundwater ▪ Surface Water ▪ Ecology ▪ Visibility ▪ Traffic ▪ Topography ▪ Noise ▪ Dust ▪ Odour ▪ Amenity
Community and Social	▪ Environmental Impacts ▪ Social Impacts

Source: *Handbook for Design and Operation of Rural and Regional Transfer Stations*.[iv]

6.6.3 TRAFFIC CONSIDERATIONS

Transfer stations can reduce overall traffic movements associated with the waste management system by consolidating smaller loads into larger vehicles. However, they do also generate additional amounts of traffic in the immediate vicinity of the site. This additional traffic can contribute to increased road congestion, air emissions, noise, and wear on roads themselves.

Waste transfer stations are often located in industrial areas that have easy access to major roads and highways.[viii]

Design and operating features that should be used to mitigate traffic impacts include:

- Selecting sites with direct access to truck routes, highways and rail or barge terminals;
- Providing adequate queuing space within the facility so that waiting customers do not interrupt traffic on public roads or impact nearby residences or businesses;
- Designating haul routes to and from the transfer station that avoid congested areas, residential areas, business districts, schools, hospitals and other sensitive areas; and
- Designing safe intersections with public roads.[viii]

6.7 BENEFITS AND BARRIERS OF TECHNOLOGY

The benefits and barriers of transfer stations are described below:

A reduction the overall costs of hauling

The consolidation of waste can reduce the haulage costs (fuel consumption, staffing) associated with the transfer of waste to designated waste disposal or processing facilities.

Collection vehicle maintenance costs (road wear, tyres) are reduced, and waste collection crews are able to spend more time collecting waste from households, and less time hauling to the waste facilities, making the overall collection operation more efficient.

An additional reduction in the impact to air pollution may also be achieved by consolidating waste into fewer vehicles.

Appropriate management of waste resource recovery

Transfer stations can allow for waste to be screened prior to disposal to retrieve recyclables and identify wastes that are inappropriate for landfill disposal (including batteries, hazardous waste, tyres etc.). They can also improve the economics of resource recovery, through consolidation of recyclable materials and more cost effective haulage to a reprocessor or a recycling facility.

Access to a convenient facility to deposit waste and recyclables

Transfer stations may also include a drop-off facility, where householders can deposit waste or recyclables. Drop-off facilities (whether collocated with a transfer facility, or 'stand-alone') can reduce the need for the public to travel large distances to waste treatment or disposal facilities. This can reduce the prevalence of illegal dumping, which may increase in situations where people do not have ready access to appropriate sites for managing waste materials that do not fit within the normal kerbside collection system. Compared to landfills, transfer stations are generally a safer and more pleasant facility for customers to use.

Traffic reduction and safety

By consolidating a number of relatively small loads into fewer, larger vehicles, transfer stations can reduce traffic movements at the disposal or processing site, and also overall traffic movements associated with waste management.

Potential for environmental pollution

If not managed appropriately, the nature of activities undertaken at transfer stations and drop-off facilities mean that they have the potential to create noise, littering and emissions to air (mainly odour and dust).

7 SUMMARY OF WASTE TECHNOLOGY FEATURES

In the project brief, the DER identified a number of key features and parameters to be discussed for each technology type and case study. This information has been collated in the following summary table. By collating information in this standardised summary format, a comparison of different waste technologies should be simplified.

Table 7-5 Summary Features – Transfer Station & Drop-off Facility Technology

Technology	1	2	3	4	5	6
	Process	Feedstock (type and tonnes)	Annual processing capacity (t/yr)	Place in waste hierarchy	Landfill diversion potential (%)	Products and residuals
Literature Review	A transfer station in its simplest form will encompass a designated receiving area where vehicles can discharge waste. This waste is then re-loaded into a larger vehicle for hauling to the treatment or disposal facility. A transfer station receiving recyclables will have designated areas for discharging recycled materials area, or an area to temporary store any recyclables that are picked or sorted from mixed waste. The drop-off facility is site accessible to the householder to dispose of excess waste materials or recyclables. Drop-off facilities can range from single material collection points (bottle banks, or igloo recycling containers), to staffed multi-material drop-off centres. The public use drop-off facilities to deposit recyclable materials or general waste, by bringing them to the specified facility or collection centre.	Transfer stations and drop-off facilities can in reality handle any types of material streams , however typical waste streams include: Municipal solid waste (MSW) generated by households; garden waste, hazardous waste generated by households, and recyclable materials. Drop-off facilities will typically handle: MSW, recyclables and hazardous waste generated by households	This is limited to the development approval and licenced held.	Re-use and recycling	Landfill diversion is possible, however the amount depends on the quantities of recyclable materials contained within the feedstock received.	Recovered materials are sent to be reprocessed, or sorted at a materials recovery facility. Residual waste is sent to landfill for disposal.

Technology	1 Process	2 Feedstock (type and tonnes)	3 Annual processing capacity (t/yr)	4 Place in waste hierarchy	5 Landfill diversion potential (%)	6 Products and residuals
Site A	The transfer station and drop-off facility is open to the public and commercial businesses to dispose of waste materials. The transfer station is a covered area with a flat floor. It accepts two waste streams, a wet putrescible stream and a dry stream. Waste is delivered and tipped onto the floor. An excavator undertakes a limited extraction operation to retrieve recyclables such as metals. The waste is then aggregated and transported to landfill using compact trailers. Recyclables are accepted at the drop-off facility area, where recyclables are placed into respective receptacles. Steel is sent for reprocessing, paper, card, glass and plastics are sent to a material recovery facility sited close by.	The feedstock accepted at the transfer station is: putrescible waste non-putrescible waste and recyclables. The facility does not accept restricted waste, hazardous waste or liquid waste.	The annual capacity of the facility is 150,000 tonnes. This is determined by the licence.	Re-use and recycling.	8-10% of the waste received at facility is recovered and therefore diverted from landfill.	The products recovered at the facility are mixed recyclables. These are sent to a material recovery facility for further sorting. Recovered steel is sent directly to a reprocessor. Residual waste is consolidated and sent to landfill.

Technology	1 Process	2 Feedstock (type and tonnes)	3 Annual processing capacity (t/yr)	4 Place in waste hierarchy	5 Landfill diversion potential (%)	6 Products and residuals
Site B	Vehicles enter the facility off the main road. The public drive to the resource recovery area to deposit: mixed recyclables, and other specified materials[1]. Items with a resale value are deposited for re-selling at the tip shop. Vehicles drive onwards to the other area through the toll booth to dispose of other materials. Receptacles for e-waste, timber, tyres and steel are provided. Residual waste is deposited at the residual waste sorting shed. For domestic drop-off, a 900mm differential is provided, where garbage is tipped onto the concrete slab in the shed for sorting. An excavator recovers cardboard, timber, metals and materials unsuitable for direct landfill disposal such as batteries. Commercial vehicles drive directly into the general waste sorting shed and tip the waste onto the concrete floor The residual waste is consolidated and sent to landfill located 80km away.	Total feedstock is 20,000 tonnes per annum. Feedstock is MSW from local government waste collection, and source separated recyclables delivered to the facility by the public The facility also receives domestic quantities of asbestos, clean soil for landfill capping and green waste. The facility also serves as a venue for the annual hazardous waste collection (chemclear, drumMuster and other similar programs).	The facility has a development approval for accepting up to 30,000 tonnes per annum. It is predicted that in this financial year, the site will receive approximately 20,000 tonnes of waste in total, of which 12,000 tonnes will be sent for landfill disposal and 8,000 tonnes recycled.	Re-use and recycling	Up to 67 % of the total waste stream entering the site is diverted from landfill.	The facility re-sells items in the tip shop such as furniture and bikes. The facility consolidates recyclable materials for reprocessing markets, and consolidates general waste following extraction of further recyclables.

Technology	7	8	9	10	11	12	13
	Capital cost	Operational cost	Gate fees	Set-up timeframe	Lifespan	Technology/ facility footprint	Buffer
Literature Review	The capital cost for transfer stations and drop-off facilities can vary depending on the transfer operations. A stand-alone drop-off facility has an estimated capital cost of $230,000.	The published literature data on the operational costs for transfer stations and drop-off facilities was not available.	The gate fees for transfer stations and drop-off facilities vary from facility to facility and costs are different for individual waste streams.	It is estimated that construction of a transfer station and drop-off facility would take between 9-18 months.	There is no limited lifespan for a transfer stations and drop-off facilities.	The footprint of a transfer station and drop-off facility will depend on the incoming material.	The buffer at a transfer stations and drop-off facility is dictated by the licence or development approval within the jurisdiction.
Site A	The capital cost of the facility was $10M. This cost included; land acquisition, planning approval and construction of the facility.	The operational cost at the facility is $100 per tonne.	The published gate fee for putrescible and non-putrescible waste the facility is $240 per tonne (NSW Landfill Levy component is $95.20 for 2012-13, which equates to a base cost of $144.80 per tonne) Recyclables do not attract a fee.	The set-up time including gaining development approval for the facility was 5 years. Construction took 18 months.	The lifespan of the facility is indefinite.	The footprint for the transfer station facility is 6000m^2. The footprint for the drop-off facility is approximately 120m^2.	The immediate boundary of the facility is the buffer distance. The facility is in an industrial zone and there are neighbours on the boundary.

[1] *Specified materials include waste engine oil, waste cooking oil, gas bottles, batteries, paints, chemical and oil drums and container.

Technology	7	8	9	10	11	12	13
	Capital cost	Operational cost	Gate fees	Set-up timeframe	Lifespan	Technology/ facility footprint	Buffer
Site B	The cost for the new part of the facility was $1.5M. The cost for the existing resource recovery area was not provided.	The operational cost for the new part of the facility is estimated to be $100 per tonne. The operational cost for the existing resource recovery area (drop-off and tip shop) is approximately $75,000 per annum.	Gate fees vary for different material streams. Waste for landfill is charged at $115 per tonne. Fees are provided in more detail in section 5.	The total setup time for the new part of the facility was three years. This included economic and environmental feasibility studies that were undertaken, tendering and construction, which took less than 12 months.	The transfer station has been designed and constructed to operate for 80 years. The design incorporates future proofing (high roof and additional space) to adapt to changes in waste technology and treatment.	The footprint of the site is approximately 20,600m^2. The footprint of the residual waste sorting shed facility is 1,485m^2.	The buffer is 140m. This is accordance with the previous use as a landfill facility.

Technology	14	15	16	17	18
	Emissions	Environmental impacts	Social impacts	Supporting technology required	Risks
Literature Review	n/a, transfer stations themselves do not generate emissions. Vehicles taking waste to and from the site will generate emissions.	There are many potential impacts to the environment from transfer stations and drop-off facilities including: odour, nose litter, leachate, surface, and stormwater. There also potential for vermin and risk of fire.	Transfer stations and drop-off facilities, like all waste facilities have a negative perception form the community. For transfer stations, noise, traffic and odour would be the key issues.	Transfer stations complement waste facilities by enabling efficiency in material transportation. Drop-off facilities enable the public to have a convenient and safe place to dispose of waste materials.	Commercial and technical risks for a transfer station are reasonably low; transfer stations are not a complex technology. They are a necessary part of modern integrated waste management systems, and are used around the world to provide efficiencies in delivering waste to its end point. There is a risk of odour and other environmental impacts, however modern management measures can mitigate these risks considerably.

Technology	14	15	16	17	18
	Emissions	Environmental impacts	Social impacts	Supporting technology required	Risks
Site A	n/a, the facility is not required to monitor emissions.	Potential impacts include: odour beyond the boundary of the site, and the potential to pollute waterways.	As with any similar facility, noise and odour can be potential issues.	The facility is located closely to a MRF and works very well. A transfer station located close to the end disposal point, saves time and travelling distance. Transfer stations complement other waste facilities.	The risks at a transfer station are from odour and noise.
Site B	n/a, the transfer station is not required to monitor emissions.	The previous use of the site as a landfill requires the facility to monitor water quality. Other environmental considerations are as specified for a commercial development (i.e. noise, hours of operation, dust and littering).	n/a the facility has not had any issues.	The facility's residual waste sorting shed is very large. It has been designed to accommodate other waste operations or treatment technologies if required in the future. Currently the facility can recover a whole range of materials.	Providing there are markets for the materials, the risks are minimal. Current risks involve the feasibility of the green waste market. The transportation distance and costs are not feasible for this material, and they are looking find an alternate market if available.

Technology	19	20	21	22	23	24	25
	Applicability to local context	Technology maturity	Availability rate	Regional penetration	Benefits	Barriers	Other
Literature Review	The ideal site for a transfer station and drop-off facility is close to the waste generating areas that are being served.	Transfer stations are not a new technology. They are historically a logistics operation, used to consolidate loads of waste, and therefore reduce the traffic and transporting requirements to the waste facility. Drop-off facilities are a more recently introduced concept to capture recyclable waste materials.	Transfer stations and drop-off facilities do not require substantial maintenance, and can be available all year round. Maintenance can be scheduled during the non-operating hours.	Transfer stations and drop-off facilities are usually networked well within a metropolitan area. There were 47 waste facilities operating in the Perth metro area in 2006, of which 30 facilities were transfer stations.	Transfer stations reduce the overall costs of hauling, allow for resource recovery, and reduce traffic at the waste facility. Drop-off facilities provide a convenient destination for the public to dispose waste and recyclables.	The main barriers of transfer stations and drop-off facilities are the potential impacts to the environment and increased traffic in the immediate vicinity.	

Technology	19	20	21	22	23	24	25
Site A	Ideal location for a transfer stations is a central area between a group of waste generators (group of local governments). The geographical siting is important, they should be close to source of waste and close to end point.	The transfer station operations are very proven and essential part of the waste management network in Sydney.	The facility operates 365 days per year and has no shutdowns. Maintenance is undertaken out of hours and operations are not impacted.	There are eight transfer stations in the metropolitan area.	Transfer stations create efficiencies in transportation, resulting in less traffic to the waste facility and savings in haulage costs.	Public perception i.e. Not in my backyard (NIMBY) is the main barrier associated with transfer stations and drop-off facilities.	Transfer stations are an essential facility for the management and handling of domestic waste.
Site B	The ideal location for a transfer station and drop-off facility would be at the edge of an urban fringe, where the public travelling time is not more than 10 minutes driving time for metropolitan users, and 30 minutes for rural users.	In Tasmania, transfer stations with covered resource recovery operations are relatively new, and have been operating over the last 5 to 6 years.	The facility has no shutdown periods unless there is a case of extreme winds, flooding or fire. The facility can operate even if there is a power cut.	There are similar operations in Tasmania, however the design and layout of the site differ in terms of the siting of receptacles, sorting shed and traffic flows.	Transfer stations in comparison to landfill (provided within reasonable transport distance to a landfill) have similar costs without the environmental risks, they are more socially acceptable and can be future proofed to adapt to changes in the waste management systems.	No barriers (in comparison to previous use of the site as a landfill).	

8 STUDY SYNOPSIS

Technology	1	2	3
	Process	Feedstock (type and tonnes)	Annual processing capacity (t/yr.)
Transfer Station and Drop-off Facility Study Synopsis	A transfer station in its simplest form will encompass a designated receiving area where vehicles can discharge waste. An excavator can be used in a sorting shed to sort and extract some designated recyclables such as metals and timber. This waste is then re-loaded into a larger vehicle for hauling to the treatment or disposal facility. A drop-off facility is site accessible to the householder to dispose of excess waste materials or recyclables. Drop-off facilities can range from single material collection points (bottle banks, or igloo recycling containers), to staffed multi-material drop-off centres. Transfer stations and drop-off facilities are generally open to the public as well as commercial businesses to dispose of their waste.	Transfer stations and drop-off facilities typically handle putrescible and non-putrescible municipal solid waste (MSW) generated by households; and commercial businesses. Drop-off facilities accept recyclable materials and can accept other specified materials such as: waste engine oil, waste cooking oil, gas bottles, batteries, paints, chemicals and oil drums.	The capacity of a transfer station and drop-off facility is defined by the development approval and licenced held. The two facilities consulted had capacity's of 30,000 tonnes and 150,000 tonnes per annum.

Technology	4	5	6
	Place in waste hierarchy	Landfill diversion potential (%)	Products and residuals
Transfer Station and Drop-off Facility Study Synopsis	Transfer stations and drop-off facilities that undertake separation and recovery of recyclblae materials (e.g. cardboard and metals) are placed within the 'recycling' category of the waste hierarchy. They may undertake recycling directly (e.g. through mulching of green waste) or facilitate recycling through the separation and aggregation or recyclables (which are transported to reprocessors or recycling facilities). Some drop-off facilities and transfer station also fit within the 'reuse' category of the waste hierarchy, through the sale of second hand products dropped off at the facilities at on-site 'tip shops'.	The landfill diversion potential at transfer stations and drop-off facilities depends on a number of factors including; the recyclable materials contained within the mixed waste feedstock, the amount of sorting undertaken on-site and the quantities of recyclables captured at the drop-off facilities. The two facilities consulted recovered 8%-10% and 67% of the waste material received.	The materials recovered from the sorting operations at a transfer station and the recyclables captured at the drop-off facility are sent directly to a reprocessor, or for further sorting at a materials recovery facility. Typical recyclables captured include: metals, paper, card, glass and plastics.. The remaining residual waste is compacted and sent to landfill for disposal. Some facilities accept and re-sell items in the tip shop such as furniture and bikes.

Technology	7	8	9
	Capital cost	Operational cost	Gate fees
Transfer Station and Drop-off Facility Study Synopsis	The capital cost of a transfer station and drop-off facility can vary depending on the transfer operations. A stand-alone drop-off facility has an estimated capital cost of $230,000. The facilities consulted had a large difference in capital costs. One facility was $10M. This cost included the purchasing of the land, the costs of planning approval and construction of the facility. The cost provided by the other facility was for a new undercover area (sorting shed) at an existing site. The cost for the new part of the facility (planning, design and construction) was $1.5M.	The operational cost advised by both facilities was $100 per tonne.	The gate fees charged by transfer stations vary from facility to facility and can be priced different for individual waste streams. The facilities consulted had a gate fee between $115 per tonne and $144.80[2] for putrescible and non-putrescible waste destined for landfill. Recyclables do not usually attract a gate fee.
Technology	10	11	12
	Set up Timeframe	Lifespan	Technology Footprint
Transfer Station and Drop-off Facility Study Synopsis	The set-up time for transfer stations can vary greatly due to the time taken to gain development approval. The two facilities consulted had set up time of 3 years and 5 years. The construction of a transfer station and drop-off facility would take between 9-18 months.	There is no definite lifespan for a transfer station or drop-off facility, however, one facility consulted was designed and constructed to operate for 80 years. The design incorporated future proofing to adapt to changes in waste technology and treatment.	The footprint for transfer stations and drop-off facilities will vary depending on the capacity they are built to serve. One transfer station facility had an overall site footprint of 20,600m^2 of which 1,485m^2 was a sorting shed. The other facility had a footprint of 120m^2 its drop-off facility and 6000m^2, for a sorting shed.

[2] $240 per tonne inclusive of a landfill Levy cost of $95.20.

Technology	13	14	15
	Buffer	Emissions	Environmental impacts
Transfer Station and Drop-off Facility Study Synopsis	The buffer is dictated by the licence or development approval within the jurisdiction. At one facility the immediate boundary is was the extent of the buffer. The facility, however, is sited in an industrial zone and has commercial business neighbouring it. The other facility has a buffer of 140m. It is located on a decommissioned landfill site, and the buffer is in accordance with the previous use of the site as a landfill facility.	n/a, transfer stations themselves do not directly generate emissions.	There are many potential impacts to the environment from transfer stations including: odour, noise, litter, leachate and pollution to surface and stormwater. There is also potential for vermin, risk of fire.

Technology	16	17	18
	Social impacts	Supporting technology Required	Risks
Transfer Station and Drop-off Facility Study Synopsis	Transfer stations and drop-off facilities, as with all waste facilities have a negative perception from the community. The main issues are associated with, noise, traffic and odour.	Transfer stations can complement a waste facility by providing efficiencies in transportation of waste material. Drop-off facilities enable the public to have a convenient and safe place to dispose of waste materials. A transfer station located close to the end disposal point, waste facility or reprocessor makes savings in travelling distance and time.	Commercial and technical risks for a transfer station are reasonably low. Transfer stations are not a complex technology, they are a necessary part of modern integrated waste management systems. They are used around the world to provide efficiencies in delivering waste to its end point. There can be risks in the end markets for some waste materials accepted at the site if the end point is a considerable distance away. Transfer stations can pose a risk to the environment, however modern management measures can mitigate these risks considerably.

Technology	19	20	21
	Applicability to local context	Technology maturity	Availability rate
Transfer Station and Drop-off Facility Study Synopsis	The ideal site for a transfer station or drop-off facility is to be central to the waste generating areas that are being served. Another factor to consider for drop-off facilities is travelling time. The public travelling time should be reasonable.	Transfer stations are not a new technology. Transfer station operations are a very proven and essential part of the waste management network. Historically consolidation of waste loads were undertaken to reduce the traffic and transporting requirements to the waste facility. In Australia, transfer stations with covered resource recovery operations are relatively new, and have been operating over the last 5 to 6 years.	Transfer stations require little maintenance, and can be available all year round. Maintenance programs can be scheduled during the non-operating hours.
Technology	22	23	24
	Regional penetration	Benefits	Barriers
Transfer Station and Drop-off Facility Study Synopsis	Transfer stations are usually networked well within a metropolitan area. Generally, there will be a reasonable number of transfer stations serving a large metropolitan area to create efficiencies throughout the city and region.	Transfer Stations reduce the overall costs of hauling, allow for resource recovery, and reduce traffic at the waste facility. Drop-off facilities provide a convenient destination for the public to dispose waste and recyclables.	The main barriers are the potential impacts to the environment and increased traffic in the immediate vicinity. Public perception is also a barrier to establishing a new transfer station i.e. Not in my backyard (NIMBY).
Technology	25		
	Other		
Transfer Station and Drop-off Facility Study Synopsis	Transfer stations are an essential facility for the management and handling of domestic waste.		

9 REFERENCE

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