

# Summary of Technology Alternatives for Municipal Solid Waste

July 2012

## Current Status

The Trail Ridge Landfill (TRLF) is owned by the City of Jacksonville (City) and operated by Trail Ridge Landfill, Inc. (a Waste Management Company). The total land area of the City-owned site located in northwest Duval County is approximately 978 acres, of which 148 acres are used for the current active Phases 1-5 landfill operation. Over the last ten years, TRLF has received between 1,959 and 2,750 tons per day of Class 1 municipal solid waste (MSW). Even with the recent economic crisis (since 2008) which has resulted in lower solid waste generation rates in Duval County, the existing 148-acre site is expected to be completely filled by 2016 or sooner if the service area is impacted by any natural disaster.

Based on the need to provide additional MSW disposal capacity, the City advertised for a consultant and CDM Smith was selected in 2011 to assist with the design, permitting and other engineering services to construct an extension of the existing Subtitle D landfill on the remaining 580 acres. This approach allows the City to capture the airspace between the existing and proposed hills which represents over \$150 million in revenue from tipping fees. Initially CDM Smith prepared a Master Plan that was submitted to the City in January 2012 which evaluated alternatives for the expansion and build-out of the remaining acreage and determined that approximately 278 acres of actual MSW disposal area would be available for expansion. Upon approval of the Master Plan by the City, CDM Smith was authorized to continue producing the necessary Environmental Resource Permit (ERP) and Solid Waste Permits to permit the full build-out of the site, which would provide MSW disposal capacity for Duval County through approximately the year 2041. The permitting activity was suspended by the City in March 2012 with the permit process being approximately 70 percent complete, depending on the level of request for additional information (RAI) activity from FDEP once the permit is submitted.

It is estimated that the available landfill capacity will be exhausted in approximately 3 to 4 years (2015/2016). To assist the City in meeting their solid waste needs beyond 2015/2016, the following is a list of possible alternatives with a comparison of schedule, permitting complexity and capital and operational costs which are also summarized in Table A.

## Solid Waste Disposal Alternatives

### *Alternative 1 – Expansion of Landfill (base case)*

Alternative 1 is to continue the expansion of the TRLF as originally planned just north of Phases 1-5 and secure the ERP and Solid Waste Permits from the FDEP. Options within

Alternative 1 include either complete expansion/build-out of the footprint or minimal expansion under this Alternative to gain up to an additional 5 years of disposal capacity.

- Capital Cost for an additional 5 year capacity is \$33 million from CDM Smith's cost estimate dated 2/16/12 which includes a 25% contingency factor of \$5.6M. This cost can be reduced to between \$15 to \$20 million in 2013-2014 if partial site grading and partial wetlands mitigation are performed Alternative 1B-See Table A). However, additional construction would be required within 5 years of permit issuance.
- Annual Operating Cost in WMI Contract-- \$18.10/ton
- Schedule: 1 year to permit from the City's notification to continue the permitting process, 6 months to bid and 2 years to build. **(3.5 years + )**
- Ability to meet Florida 75% Recycling Goal—Landfilling alone will not meet the 75% recycling goal. An aggressive recycling program could include single stream recycling, an aggressive commercial recycling program, and a C&D recycling program. Other programs may be required as well including separate organics collection and anaerobic digestion for production of biomethane.
- Advantages
  - Landfilling is the most cost-effective disposal option in Florida
  - Landfilling is the most widely used solid waste disposal option in Florida
- Disadvantages
  - Landfilling, as a low cost disposal option, provides no incentives to recycle unless some sorting operations are performed to recover marketable materials.
  - Landfilling results in a facility which requires long term care—maintenance due to stormwater runoff and erosion, leachate handling and Landfill Gas (LFG) extraction—for at least 30 years after closure

### ***Alternative 2 - Transfer Station for In County Disposal***

Alternative 2 assumes one TS will be constructed east of the St. Johns River and MSW from the TS will be transported approximately 40 miles to the TRLF site for disposal.

- Capital Cost: \$10 - \$12 million for the TS although this cost can vary depending on the size and extent of the services provided at the TS. The capital cost for the TRLF expansion will be the same as Alternative 1B (Table A) which is \$15 to \$20 million for a total Alternative 2 estimated cost of between \$25 and \$32 million.

- Annual Operating Cost—Cost of Transfer Station Operations & Hauling to the TRLF in tons/day is approximately \$4/ton for operations plus \$3.70/ton transportation (assuming 40 mile one way delivery) plus the operational cost of the TRLF from Alternative 1 of \$18.10/ton for a total operational cost of \$25.80/ton.
- Schedule: 1.0 years to site and design from the City's notice to proceed , 6 months to permit, 6 months to bid and 2 years to build **(4.0 years +)**
- Ability to meet Florida 75% Recycling Goal—The use of a TS will not meet the 75% recycling goal unless some sorting operations are performed to recover marketable materials. An aggressive recycling program could include single stream recycling program, an aggressive commercial recycling program, and a C&D recycling program. Other programs may be required as well including separate organics collection and anaerobic digestion for production of biomethane.
- Advantages
  - TS reduce the cost of hauling to the TRLF which would result in a reduction of collection services costs
- Disadvantages
  - The capital costs for this Alternative are greater than landfilling alone due to the added cost of the TS. Siting of a TS site east of the St. Johns River may require extensive public education and outreach.

### ***Alternative 3 – Transfer Stations for Out of County Disposal***

Alternative 3 assumes two transfer stations (TS) will be constructed – one on the existing TRLF site and one east of the St. Johns River. MSW from each TS is assumed to be transported out of state to a facility located approximately 65 miles from the TRLF site.

- Capital Cost: \$30 - \$33 million based on a recent CDM Smith project in Palm Beach County for a 3,000 tpd facility although this cost can vary depending on the size and extent of the services provided at each TS.
- Annual Operating Cost—Cost of Transfer Station Operations & Hauling to a Private Landfill in tons/day is approximately \$8/ton for operations of two TS plus \$8/ton transportation (assuming an average 85 mile one way delivery from the two TS) in addition to an estimated tipping fee of \$24/ton.
- Schedule: 1.5 years to site and design from the City's notice to proceed , 6 months to permit, 6 months to bid and 2 years to build **(4.5 years +)**
- Ability to meet Florida 75% Recycling Goal—The use of a Transfer Station will not meet the 75% recycling goal unless some sorting operations are performed to recover marketable materials. An aggressive recycling program could include single stream

recycling program, an aggressive commercial recycling program, and a C&D recycling program. Other programs may be required as well including separate organics collection and anaerobic digestion for production of biomethane.

- Advantages
  - Transfer Stations are needed if waste is to be economically transferred for out of county disposal
  - This would result in a reduction of collection services costs.
- Disadvantages
  - This alternative invariably costs more than landfilling because of the hauling costs to take waste out of the County, with cost of disposal subject to price escalation over time due to the price of fuel and other factors.
  - Long-term liability of transporting solid waste over an extended distance outside of Duval County and disposal by a third party may result in future remediation liability.
  - Diminished control over the flexibility of future solid waste disposal.

#### **Alternative 4- Mass Burn WTE**

An option that is commercially proven and in practice in large metropolitan areas is a Mass Burn “Waste to Energy” (WTE), which generates steam/electricity from waste by feeding mixed municipal waste into a combustion process dedicated to MSW. A few points to consider on this alternative are :

- Capital Cost: \$400 million (assumes 1,800 tpd massburn technology). The size of this facility would need to be determined.
- Annual Operating Cost—\$35/ton or less depending upon price paid for renewable electricity sold to local utility and the value of recyclable metals extracted after combustion (typical WTE O&M contracts include some percentage as incentive for a private O&M contractor)
- Schedule: 2.0 years to conceptually design and permit from the City’s notice to proceed, 1 year to advertise and select contractor, and 3 years to build **(6.0 years +)**
- Ability to meet Florida 75% Recycling Goal—WTE facilities will meet the 75% Recycling goal due to 90% volume reduction of municipal waste and recovery of ferrous and non-ferrous metals (~ 2.5% of incoming waste is recovered as recyclable metal)

- Advantages:
  - WTE facility requires significantly less real estate than equivalent landfill
  - WTE facilities provide 90% volume reduction of waste, thereby significantly extending the useful life of an existing landfill for ash disposal and bypassed municipal waste
  - WTE facilities allow recovery of valuable ferrous and non-ferrous metals (which result in additional project revenues) from wastes that would otherwise be unrecoverable
  - WTE facility project can provide local economic benefits with money spent within the community during construction, along with high paying construction jobs over a 3-year period
  - WTE facility project can provide local economic benefits associated with goods and services procured locally, along with operations and maintenance careers over life of the project (45 – 50 years)
  - WTE facility results in less Greenhouse Gas Emissions than local or remote landfill disposal options
  - WTE facility results in long-term predictable costs, with potential cost savings upon retirement of the debt service
  - WTE facilities can be integrated with other municipal utilities (water, wastewater, power) for synergistic benefits, including optimized operations for the solid waste / renewable energy campus

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- WTE facilities can be integrated into regional renewable energy projects on or adjacent to military installations to help meet federal mandates for clean power on federal sites
- Disadvantages
  - WTE capital and O&M costs are significantly higher than landfill disposal costs
  - WTE facilities will require public involvement and debate
  - WTE facilities represent a long term commitment to this technology (typical financing period of 20-25 years, with expected life of 45 – 50 years)

### **Alternative 5- Refuse Derived Fuel (RDF) WTE Facility**

Another approach to a WTE facility that is commercially proven is Refuse-derived Fuel (RDF) WTE plants. The RDF process removes recyclable or non-combustible materials (metals, glass, and inert materials) and shreds or processes the remaining MSW into uniform fuel. A few points to consider on this alternative are:

- Capital Cost: \$500 million (higher capital costs than Alternative 4)
- Annual Operating Cost—\$45-50 / ton
- Schedule: 2.0 years to conceptually design and permit from the City's notice to proceed, 1 year to advertise and select contractor, and 3 years to build **(6.0 years +)**
- Ability to meet Florida 75% Recycling Goal—RDF WTE will help meet the 75% Recycling goal by extracting recyclable materials prior to combustion, and 90% volume reduction of the combusted fuel. In addition, a C&D recycling program will likely be needed.
- Advantages
  - Same as Alternative 4 above, although a higher percentage of waste (up to 25%) which cannot be processed as RDF will need to be disposed in a landfill
- Disadvantages
  - This is one of the most expensive alternatives for both Capital and Operating Costs and many of the perceived benefits of RDF technology have not been realized in the current generation of WTE facilities.

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### **Alternative 6- Thermal Gasification**

Another “emerging” alternative available for MSW is Thermal Gasification, by which MSW thermally decomposes in the presence of limited amount of oxygen and produces a mixture of combustible gases (including methane, hydrocarbons, hydrogen and carbon monoxide). A few points to consider on this alternative are :

- Capital Cost: \$300-\$500 million (assumes an estimated 1,800 tpd capacity). There have not been any full scale MSW gasification facilities constructed to date.
- Annual Operating Cost—\$30-\$45/ton or less, depending upon price paid for renewable electricity sold to local utility, or the value of biofuel produced
- Schedule: 2.0 years to conceptually design and permit from the City's notice to proceed, 1 year to advertise and select contractor, and 3 years to build **(6.0 years +)**

- Ability to meet Florida 75% Recycling Goal—A Thermal Gasification facility will help meet the 75% Recycling goal due to 85-90% volume reduction of municipal waste and recovery of ferrous and non-ferrous metals
  - Advantages:
    - Thermal Gasification facility may produce less emissions than massburn or RDF WTE
    - The synthesis gas generated from Thermal Gasification can be used in a number of beneficial applications, including use as a chemical feedstock as a substitute for natural gas, production of chemicals and liquid fuels, or production of steam and electricity. The production of ethanol from municipal waste may be of interest to Jacksonville area due to the large volume of gasoline which is imported into Florida through the Jacksonville port.
  - Disadvantages:
    - Currently in developmental stages with only a limited number of small units in operation primarily in Europe and Japan. The Ineos Bio project in Indian River County, Florida is soon to begin commercial operation for production of ethanol from municipal vegetative waste. This process will also use a Thermal Gasification process followed by a biological reactor to produce fuel grade ethanol.
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Table A

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| Criteria Description   | Solid Waste Alternatives   |  |   |   |  |  |  |
|--|--|--|---|---|--|--|--|
|  | Alternative 1A Landfill--Full Footprint (Phase 6A & 6B) **<br>Grading for Entire Footprint<br>Wetlands fully mitigated | Alternative 1B Landfill--Phased Footprint (Phases 6A & 6B) **<br>Cell Expansions Constructed as Needed | Alternative 2 - In County Transfer Station<br>One TS East of the River  | Alternative 3 - Out-of-County Transfer Station<br>One TS at TRLF<br>One TS East of the River  | Alternative 4 - Massburn WTE   | Alternative 5 - Refuse Derived Fuel (RDF) WTE                                  | Alternative 6-Thermal Gasification WTE                     |
| Capital Cost--\$<br>Year 2013<br>Year 2018   | \$33M  | \$15M - \$20M<br>\$13M - \$18M   | One TS East of the River<br>\$25 M to \$32 M<br>Assume 40 % of MSW Stream to TS<br>TS Estimated Cost - \$10-\$12 M<br>Total Cost of Alternative 3 - \$25 to \$32 M<br>(Adding Cost of Alternative 1B)   | \$30M to \$33 M   | \$400M   | \$500M   | \$300 M- \$500 M   |
| Operational Cost--Unit Cost/ton<br>Potential Revenue is Not Included in O&M Cost for the Various Options | \$18.10/ton  | \$18.10/ton  | \$25.80/ton<br>Hauling Cost from TS Based on an Estimated 40 mile One Way Distance- \$3.70 /ton. Total Operational Cost is \$25.80/ton (Adding Cost of Alternative 1 and TS Operations cost of \$4/ton) | \$40/ton<br>Total for the Two Transfer Stations<br>In year 2016 assume 50% of the waste stream goes to a TS at TRLF and the remaining 50 % to a TS East of the St. Johns River. Material from both TS are assumed to go to Folkston, Ga (65 miles one way from TRLF and 105 miles from the Southeast TS . | \$35/ton   | \$45-\$50/ton  | \$30./ton-\$45/ton   |
| Option Ranking   | 4  | 1 (Lowest)   | 2   | 3   | 5  | 7  | 6  |
| Initial Capital Cost   | 1  | 1 (Lowest)   | 2   | 5   | 3  | 6  | 4  |
| Schedule--Years  |  |  |   |   |  |  |  |
| Design & Permitting  | 1.0  |  | 1.5   | 2.0   | 2.0  | 2.0  | 2.0  |
| Bidding or RFP   | 0.5  |  | 0.5   | 0.5   | 1.0  | 1.0  | 1.0  |
| Construction   | 2.0  |  | 2.0   | 2.0   | 3.0  | 3.0  | 3.0  |
| Total  | 3.5  | 3.0  | 4.0   | 4.5   | 6.0  | 6.0  | 6.0  |
| Ability to Meet 75% Recycling Goal by 2020   | Will not meet Recycling goal without:  | Will not meet Recycling goal without:  | Will not meet Recycling goal without:   | Will not meet Recycling goal without:   | Will meet Recycling Goal   | Will meet Recycling Goal   | Will meet Recycling Goal                                   |
|  | - Aggressive Household Recycling<br>-Aggressive Commercial Recycling<br>-C&D Recycling                                 | - Aggressive Household Recycling<br>-Aggressive Commercial Recycling<br>-C&D Recycling                 | - Aggressive Household Recycling<br>-Aggressive Commercial Recycling<br>-C&D Recycling<br>- Possible with "dirty" materials recycling center  | - Aggressive Household Recycling<br>-Aggressive Commercial Recycling<br>-C&D Recycling<br>- Possible with "dirty" materials recycling center  |  |  |  |
| Advantages   | Most widely used disposal option in Florida  | Most widely used disposal option in Florida  | Often considered when decision is made not to dispose by landfill   | Often considered when decision is made not to dispose by landfill   | Often considered in large municipal areas where electrical rates are favorable | Often considered in large municipal areas where electrical rates are favorable | May produce less gas emissions than Massburn or RDF        |
|  | Most Cost effective disposal option in Florida   | Most Cost effective disposal option in Florida   | Should reduce collection system costs   | Should reduce collection system costs   | Substantially reduces the volume of waste to be landfilled                     | Substantially reduces the volume of waste to be landfilled                     | The Synthesis Gas generated can be used to produce ethanol |



Table A

| Solid Waste Alternatives |   |   |  |  |   |   |  |
|--------------------------|---|---|--|--|---|---|--|
| Criteria Description     | Alternative 1A Landfill-Full Footprint (Phase 6A & 6B) **   | Alternative 1B Landfill-Phased Footprint (Phases 6A & 6B) **  | Alternative 2- In County Transfer Station  | Alternative 3- Out-of-County Transfer Station  | Alternative 4 - Massburn WTE  | Alternative 5 - Refuse Derived Fuel (RDF) WTE   | Alternative 6-Thermal Gasification WTE   |
|                          | Produces LFG--LFG to Energy is common in larger landfills Consistent with current WMI Contract  | Produces LFG--LFG to Energy is common in larger landfills Consistent with current WMI Contract  |  | Meets the 75% Recycling goal in Florida  | Meets the 75% Recycling goal in Florida   |   |  |
| <b>Disadvantages</b>     | Provides little incentive to Recycle<br>Higher wetlands impacts because it has the largest footprint of all the Long Term care costs--for at least 30 years<br>Will not meet Recycling Goal alone | Provides little incentive to Recycle<br>Higher wetlands impacts because it has the largest footprint of all the Long Term care costs--for at least 30 years<br>Will not meet Recycling Goal alone | Costs more than landfilling because hauling costs are higher<br>Some liability associated with hauling waste out of County<br>Not consistent with current WMI contract<br>Will not meet Recycling Goal alone | Costs more than landfilling because hauling costs are higher<br>Some liability associated with hauling waste out of County<br>Not consistent with current WMI contract<br>Will not meet Recycling Goal alone | An expensive option relative to Landfilling<br>Still requires a landfill for the ash produced<br>Not consistent with current WMI contract | An expensive option relative to Landfilling<br>Still requires a landfill for the ash produced<br>Not consistent with current WMI contract | Not Commercially proven yet. This technology (and others like it) is still in the developmental stage.<br>Not consistent with current WMI contract<br>Costs to construct can vary widely based on the lack of multiple installations |
| <b>Recommendations</b>   | This Option is recommended as the best way to preserve the entire airspace at the Trail Ridge Landfill  | This Option is recommended if the Capital cost needs to be minimized in the next 2-3 years  |  |  |   |   | This Option would not be recommended to the City of Jacksonville due to not being commercially proven.   |