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Memorandum

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To: Himanshu Mehta, P.E., Managing Director, Indian River County Solid Waste Disposal District

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Subject: Focused Feasibility Evaluation of Landfill Liquids Management Options
Indian River County Landfill, Vero Beach, Indian River County, Florida

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INTRODUCTION

The Indian River County (IRC) Solid Waste Disposal District (SWDD) requested Geosyntec Consultants, Inc. (Geosyntec) to evaluate landfill liquids management alternatives for the IRC Landfill located in Indian River County, Florida (the Landfill). The Landfill includes a Class I landfill, an inactive Construction and Demolition (C&D) debris disposal facility, and other support facilities. A Residuals Dewatering Facility (RDF) was also constructed at the site and started operation on 5 March 2010. Leachate from the Class I landfill and centrate (i.e., dewatering liquids) from the RDF are transmitted via force main to the West Regional Wastewater Treatment Facility (WRWWTF) for treatment and disposal. The regional lift station, force main, and WRWWTF are operated and maintained by the IRC Utilities Department (IRCUD). The WRWWTF is permitted to operate by the Florida Department of Environmental Protection (FDEP) with Permit No. FL0041637. Treated effluent from the WRWWTF is initially discharged into the created wetland through Outfall R-001 and to the countywide reuse system through Outfall R-002. The overflow treated effluent is discharged into the Lateral D Canal through Outfall D-001. Each outfall has its own monitoring requirements and effluent limitations are stipulated in Part I.A. (surface water discharge) and Part I.B. (reuse and land application systems) of the permit.

A previous leachate pretreatment evaluation performed by CDM Smith (2018)[1] indicated that three constituents in leachate (i.e., arsenic [As], total dissolved solids [TDS], and total nitrogen

[1] CDM Smith (2018). *Indian River County Landfill, Preliminary Leachate Pretreatment Evaluation*; Technical Memorandum, April 2018.

[TN]) are present in concentrations exceeding the local discharge limits established for the WRWWTF. Therefore, additional data collection for leachate and centrate was performed to supplement existing data and to allow the evaluation of multiple liquids treatment and/or management options beyond pretreatment for subsequent discharge to the WRWWTF.

The remainder of this technical memorandum is organized to present the results of the focused feasibility evaluation that include the following elements: (i) a review of liquids chemistry and flow data; (ii) an evaluation of liquids management options; (iii) a discussion of conceptual costs; (iv) a summary of the findings; and (v) recommendations.

REVIEW OF LIQUIDS CHEMISTY AND FLOW DATA

Samples of site-specific leachate, centrate, and combined leachate and centrate were characterized using two different analytical laboratories. ENCO Laboratories, Inc. (ENCO, Orlando, FL) reported results for general chemistry parameters, metals, and a limited set of organic parameters in these three waste streams, and TestAmerica Laboratories, Inc. (TestAmerica, Sacramento, CA) reported results for per- and polyfluoralkyl substances (PFAS) concentrations in the combined leachate and centrate sample. The samples were collected on 11 March 2019 and sent to the laboratories under chain-of-custody protocol.

A follow-up analysis was performed by ENCO, with samples collected on 24 April 2019, to reevaluate select parameters that were measured at a higher concentration in the combined leachate and centrate sample compared to the individual sources. These parameters included fats, oil and grease (FOG), total phosphorus (TP), total suspended soils (TSS), and zinc (Zn). The follow-up analysis confirmed the results of the initial analysis as the same parameters in the combined sample exceeded the measurements in the individual sources. It is believed that the lift station where the Landfill's leachate and centrate are mixed, and where the combined samples were collected from, may contain an accumulation of solids and associated constituents, resulting in the combined samples with higher concentrations of these select parameters.

A table summarizing analytical results collected during the 2019 sampling events is presented as **Table 1** of this memorandum. **Tables 2-1** through **2-3** present a comparison of the 2019 analytical test results and the historical analytical test results for landfill liquids at the Landfill. A review of **Tables 2-1** through **2-3** indicates the current (2019) Landfill's leachate, centrate, and combined leachate and centrate characteristics are generally consistent with the historical analytical test results of the Landfill's liquids. **Table 3** presents a comparison of the Landfill's PFAS concentrations in the combined leachate and centrate sample with a range of concentrations observed in several municipal solid waste (MSW) landfills tested across the

United States (Huset et al., 2011)[2]. Based on this study, the PFAS concentrations appear generally consistent with results obtained for other mature MSW landfills. Note, however, that the site-specific results were obtained from the combined leachate and centrate sample and are not representative of a pure leachate sample.

Table 1 presents the specific local limits on discharge referenced in Section 201.68 of the IRC Code together with the analytical results. A review of leachate characteristics presented in **Table 1** indicates the concentrations of TN, TDS, and As exceed the local limits. In addition, the concentration of alpha terpineol was observed to exceed the categorical effluent limits for the landfill leachate point source stipulated in 40 CFR 445.21, which would be applicable if the Landfill was going to apply for a direct discharge permit rather than routing leachate to the WRWWTF for subsequent treatment and disposal. The leachate also contains ammonia nitrogen (NH_3-N), and biological oxygen demand (BOD) in excess of limits stipulated in 40 CFR 445.21. The analytical results are generally consistent with historical concentrations measured at the Landfill, as summarized in **Table 2-1**. The noted exceedances are also consistent with the leachate study prepared by CDM Smith (2018).

A review of the centrate characteristics presented in **Table 1** indicates the concentrations of TN and TP exceed the local limits. Although the analytical results are generally consistent with historical concentrations measured at the Landfill, the concentrations observed for TN and TP were lower than historically recorded concentrations that were available, as presented in **Table 2-2**. One possible reason for the concentrations of TN and TP being lower than anticipated is due to the Landfill no longer accepting non-domestic (out of county) septage and food establishment sludge since May 2017.

A review of the leachate and centrate combined characteristics presented in **Table 1** indicates the concentrations of FOG, TN, TP, TDS, and Zn exceeded the local limits. As noted earlier, the results obtained for FOG, TP, and Zn are likely the result of a buildup of solids within the lift station from which this sample was collected. The combined sample characteristics for TN and TP are generally consistent with historical concentrations measured based on data obtained from the IRCUD as summarized in **Table 2-3**.

Based on data provided by the IRCUD from June 2017 to February 2019, the Landfill generates an estimated leachate flow of 16,000 gallons per day (gpd) and 57,000 gpd of centrate, with a combined total average flow of 73,000 gpd. **Figure 1** depicts the Landfill's generated flow of

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[2] Huset, C., Barlaz, M., Barofsky, D., and Field, J. (2011). Quantitative determination of fluorochemicals in municipal landfill leachates. *Chemosphere 82 2011*, pp. 1380-1386

liquids, presented as average daily flows calculated on a monthly basis. Note that, as expected, there is substantial fluctuation in the liquids generation rates dependent on climatic conditions as well as operational conditions with biosolids dewatering.

A leachate generation analysis was conducted by CDM Smith (2018) to predict future leachate flow rates for continued landfill expansion using the Hydrologic Evaluation of Landfill Performance (HELP) model. A predicted leachate flow of approximately 60,000 gpd was estimated in the next 10 to 15 years. However, these are worst-case scenarios that assume that certain cells would not be closed while other newly constructed cells are opened. Geosyntec does not anticipate that leachate generation rate would almost quadruple over the next 10 to 15 years. Therefore, for the purposes of this evaluation, the current leachate flow at the Landfill (i.e., slightly increased to 20,000 gpd) was assumed for conceptual design and cost estimating purposes. Should the Landfill leachate generation rate increase significantly compared to the assumed 20,000 gpd, the recommendations can be scaled up accordingly.

EVALUATION OF LIQUIDS MANAGEMENT OPTIONS

The selection of an appropriate liquids treatment and/or management option is dependent on the effluent discharge strategy. Based on discussions with the SWDD and the IRCUD, direct discharge of treated effluent via a National Pollutant Discharge Elimination System (NPDES) permit or deep well injection via an underground injection control (UIC) permit were not considered viable effluent discharge options. Therefore, liquids treatment/management options were evaluated with the goal to either continue conveying the liquids to the WRWWTF for subsequent treatment and disposal, or manage the liquids via onsite thermal evaporation, which would eliminate liquids discharge to the WRWWTF and/or onsite pretreatment and associated permitting.

The characteristics of the Landfill liquids discussed above indicate that both the leachate and the centrate contain certain constituents in excess of the local limits, and that both waste streams would require pretreatment prior to continued discharge to the WRWWTF. However, it was determined by the County that the centrate constitutes a residential stream that does not require pretreatment. Therefore, the evaluation of pretreatment options was limited to the Landfill leachate only.

Based on the received laboratory analytical results for leachate, an onsite treatment system must be able to remove As, FOG, TN, TP, and TDS. The parameters FOG, TN, and TP can be addressed using a biological treatment approach, and As may be partially removed through partitioning into the biomass of a biological treatment system. However, TDS cannot be addressed using a biological approach, and a membrane-based system such as reverse osmosis (RO) is required to remove TDS. Further, this RO system would also remove As to below discharge requirements. While RO might be able to remove all required constituents concurrently, it is not cost-effective as a stand-alone treatment technology for leachate given the potential for membrane fouling without biological pretreatment. Therefore, a combined biological and RO system is required for cost-effective treatment of leachate, and this conceptual layout of a combined biological/RO system is evaluated as a pretreatment option. The RO system will create a waste stream called "concentrate," which could either be recirculated back into the Landfill or managed via off-site disposal. It is estimated that approximately 10 percent (%) to 13% of the total flow would need to be managed as concentrate.

The alternative to onsite treatment is thermal evaporation for zero discharge of liquids to the WRWWTF. A "sludgy" waste stream would be created that contains the concentrated solids in landfill liquids that cannot be evaporated, which is estimated at about 5% by volume of the total waste stream. However, APTIM of Kennesaw, Georgia (one of the two evaporation vendors contacted for this project) indicated that their system may generate a residual waste stream that could be as large as 12% to 14%. If the IRC SWDD elects to dispose of the concentrated waste stream in the Landfill, the waste stream can be stabilized prior to disposal using a residual processing module. According to Heartland Water Technology of Hudson, Massachusetts (the other vendor contacted for this project), a residual processing module can be installed as part of an evaporator system to stabilize the waste stream to pass the Paint Filter Liquids Test. This concentrated waste stream can also be further processed with a binder (e.g., fly ash, biomass) in the unlikely situation that Toxicity Characteristic Leaching Procedure (TCLP) requirements are not met without further processing.

These two alternative management strategies (i.e., onsite treatment and leachate evaporation) were selected for inclusion in this evaluation. The combined biological and RO treatment approach would involve onsite pretreatment via a biological system (membrane bioreactor [MBR]) prior to polishing treatment with an RO unit for removal of TDS and As. The clean permeate from the RO treatment would then be discharged to the WRWWTF for final treatment and disposal. The second alternative evaluated is liquids volume reduction via onsite evaporation. The evaluation of each alternative included an economic analysis of the costs for major items required for implementation of each treatment/management option.

Description of Treatment Alternatives

Membrane Bioreactor (MBR) System Combined with Reverse Osmosis

While a number of biological treatment approaches exist, including but not limited to (i) sequencing batch reactors (SBR), (ii) moving bed biofilm reactors (MBBR), (iii) trickling filters, or (iv) constructed wetlands, the use of an MBR system was considered a preferable pretreatment approach due to its ability to operate at a higher biomass concentration and provide additional filtration capacity due to the ultrafiltration (UF) membrane system incorporated into the treatment train. The effluent from such a system is cleaner and easier to polish with a subsequent RO treatment step, especially for a high-strength wastewater stream such as landfill leachate. In addition, the footprint of such a system is smaller compared to lower-cost alternatives such as constructed wetlands. One vendor of biological and/or physical treatments systems (i.e., Dynatec Systems, Inc. of Burlington, NJ) was contacted to provide the conceptual design and cost estimate to manage 20,000 gpd of leachate.

The proposed MBR system is capable of removing nutrients and FOG from the leachate but would also treat other compounds such as biological oxygen demand (BOD), non-recalcitrant chemical oxygen demand (COD), and total suspended solids (TSS). As briefly discussed above, As would be partially removed through the biological component of the system. The MBR system would be provided by Dynatec and would include:

(i) a strainer for solids removal from landfill liquids accessed from an equalization tank;

(ii) a 15,000-gallon stainless steel bioreactor tank (including a level transmitter to monitor and control tank levels and a dissolved oxygen [DO] probe to measure and control DO levels in the tank);

(iii) two positive displacement blowers for aeration of the liquids (each one capable of providing 550 standard cubic feet per minute [scfm] of air), with one operating at any given time and the second one serving as backup; and

(iv) one tubular ultrafiltration (UF) membrane system (486 ft2) including a strainer, pH controls and a circulation pump.

Biological pretreatment would remove most of the constituents to below local limits and would decrease the potential for membrane fouling of the RO system that is added on for removal of TDS and As, as well as effluent polishing.

Permeate from the MBR system would be discharged to a 4,200-gallon RO feed tank from which it would be pumped through the RO membrane system, which consists of a 4-membrane RO system to minimize the volume of concentrate to be managed. The RO system would remove TDS and polish the liquids, including removal of metals such as As and Zn. Permeate from the RO system would be discharged to the WRWWTF and concentrate would be collected in a 9,100-gallon reject holding tank for subsequent disposal at the Landfill via recirculation, or off-site disposal. Note that the cost estimate provided below assumes recirculation of the liquids back into the Landfill in order to provide an "apples-to-apples" comparison of costs with the leachate evaporator units. However, offsite disposal of the RO concentrate may be needed to avoid a deterioration of leachate quality that could result in potential membrane fouling and increased treatment costs. The cost implications of offsite disposal of RO concentrate are discussed further below.

The combined MBR/RO system is expected to produce effluent with the following characteristics: (i) non-detect levels for FOG, TP, As, and Zn; (ii) <10 mg/L of TN; and (iii) <300 mg/L of TDS.

Evaporation Systems

Leachate evaporation systems utilize waste heat and/or landfill gas (LFG) combustion systems to reduce the volume of leachate requiring disposal. Through direct injection, the flue gasses are introduced into leachate and/or centrate in order to vaporize the liquid. Alternatively, heat transfer from the gases to the liquid can be accomplished across a conductive barrier as is the case with conventional heat devices such as heat exchangers or jacketed vessels. The water vapor and other constituent gases can be emitted to the atmosphere or passed through the landfill gas flare for additional thermal destruction to minimize potential emissions as well as odors. Leachate evaporation can achieve volume reductions of up to approximately 95%. This residual material can be solidified with absorptive material (e.g. soils, compost, ash, etc.) for on-site disposal.

Unlike conventional treatment systems, evaporation systems are typically insensitive to changes in landfill liquid characteristics including concentrations of BOD, COD, TSS, TDS, and variations in feed temperature. Generally, pH is the only parameter potentially affecting evaporative systems, and this is solely due to the potential corrosiveness of acidic liquids on alloys used in the evaporators. Landfill leachate from mature sites generally exhibits slightly alkaline pH conditions, and site-specific leachate is consistent with this observation. Therefore, corrosivity due to pH is not expected to be an issue. However, corrosivity due to salinity (especially chloride) may need to be considered, depending on the materials used in the evaporator system(s) evaluated.

Two vendors of thermal leachate evaporator systems were contacted to provide conceptual designs and cost estimates for systems to manage 20,000 gpd of leachate.

APTIM, proposed to install CB&I's E-Vap® Evaporator Leachate System, which utilizes a patented submerged combustion technology to reduce leachate water volume by approximately 90%, even though APTIM indicated that the residual stream may be as high as 12% to 14%. The process uses LFG as the primary fuel for the combustion system. Hot combustion gasses are injected into the leachate reservoir generating water vapor. The water vapor is then directly discharged into the atmosphere, leaving behind a concentrated effluent (residual). Fresh leachate is continuously fed into the evaporator while the residual is drawn off and sent to a Clarifier Tank for further concentration. From here the residual is sent to a roll-off container on an automated schedule, where it can either be reintroduced to the open face of the landfill or hauled off site for disposal. A 20,000 gpd unit will require 333 scfm of LFG (50% methane). Note that the cost estimate below assumes onsite management of the residual; offsite management cannot be estimated at this time and would require additional evaluation of potential disposal sites and distances from the Landfill.

Heartland Water Technology proposed to install their LM-HT® Heartland Concentrator™. The design would utilize LFG, engine/turbine exhaust, natural gas, or any combination, as the thermal energy required for evaporation, reducing operating costs and improving overall efficiency. The Heartland Concentrator™ is a patented continuous evaporator that replaces heat exchangers by directly contacting hot gas with wastewater feed within a compact turbulent evaporation zone. The evaporation zone creates acres per minute of dynamic renewable surface area between liquid and gas phases stimulating rapid evaporation. An in-line proprietary and patented entrainment separator removes the liquid phase as the cooled exhaust gas is discharged to the atmosphere. For evaporation of 20,000 gpd, the system requires 315 scfm of LFG (50% methane).

Based on recent discussions with IRC SWDD, the County is currently in negotiations to provide its LFG to a third party. If the County enters into this agreement, the IRC SWDD will be required to obtain the specified volume of LFG available for each evaporator system in order for each system to be operational. If less than the required LFG volume or quality is available, onsite leachate evaporation is not feasible.

Representatives of the evaporator vendors have indicated that the generated residuals (approximately 5% of the total volume according to Heartland and 12% to 14% according to

APTIM) are typically applied to the working face of the landfill at other sites. Geosyntec is currently unaware of any problems/interferences with landfill operations as a result of returning the residuals to the landfill. Geosyntec also understands that odor generation has not been an issue at other installations.

The budgetary proposals received, and included with this memorandum, present a conceptual process schematic. The conceptual process schematic consists of a central evaporator, a solids clarifier, and auxiliary pumps and blowers. The anticipated footprint of the APTIM system is approximately 75 ft x 40 ft for a 20,000 gpd. The anticipated footprint of the Heartland system is approximately 11 ft x 29 ft for a 20,000 gpd system.

DISCUSSION OF CONCEPTUAL COSTS

Capital and operation & maintenance (O&M) costs for each leachate management alternative were based on the following items and/or assumptions: (i) new or recent vendor quotes for major process equipment; (ii) engineering cost; and (iii) projected labor requirements based on experience with similar systems and vendor recommendations. **Table 4** attached to this memorandum presents the identified major costs as well as summarizes the total estimated costs of ownership.

Cost estimates for the combined MBR/RO system were obtained from a budgetary proposal submitted by Dynatec dated 27 June 2019 for a 20,000 gpd system. The proposal provided costs for a combined MBR/RO system with a treatment capacity of 20,000 gpd to process the Landfill's leachate flow. The final pricing as quoted in the budgetary proposal for the 20,000 gpd system includes the following: (i) a system price of $490,000; (ii) an estimated installation price of $265,000; (iii) an estimated enclosure price of $95,000; and (iv) an estimated equipment and transfer pump price of $125,000. The total equipment and installation costs (without design support services and onsite utilities) for this unit would be $975,000. The Dynatec budgetary proposal is presented as **Attachment A** of this memorandum.

Cost estimates for the E-VAP® landfill liquids evaporator system were obtained from a budgetary proposal by APTIM dated 22 April 2019. The proposal provided costs for an evaporator unit with a treatment capacity of 20,000 gpd to process the Landfill's leachate flow. The final pricing as quoted in the budgetary proposal for equipment supply and installation services (without design support services and onsite utilities) for this unit would be $2,364,000. The APTIM budgetary proposal is presented as **Attachment B** of this memorandum.

Cost estimates for the LM-HT® Heartland Concentrator™ were obtained from a budgetary proposal dated April 2019. The proposal provided costs for an evaporator unit with a treatment capacity of 20,000 gpd to process the Landfill's leachate flows. The final pricing as quoted in the budgetary proposal for equipment supply of the 20,000 gpd evaporator system is $1,490,000. Based on an electronic mail (email) correspondence with Heartland dated 23 April 2019, the estimated pricing for site preparation and installation costs are $439,550. Therefore, the installed cost estimates (without design support services and onsite utilities) for this unit would be $1,929,550. The Heartland budgetary proposal and 23 April 2019 email correspondence are presented as **Attachment C** of this memorandum.

Total cost estimates for each alterative were amortized over a 10-year period, which is the expected useful life period of typical evaporator unit. However, the Heartland system is expected to have a longer life expectancy and the MBR/RO system is also expected to be operational over an extended period of time, although occasional membrane replacement may be needed. An annual interest of 6% was utilized for this evaluation.

Total capital costs, which include design, permitting, and system equipment and installation to manage 20,000 gpd of leachate are estimated at $1,130,000, $2,494,000 and $2,059,550 for the proposed MBR/RO, APTIM, and Heartland systems, respectively, with corresponding monthly amortized costs of $0.04 per gallon, $0.07 per gallon, and $0.06 per gallon, respectively (Table 4a). As noted above, these costs assume onsite management of either RO concentrate or evaporator residuals. The costs for offsite disposal of evaporator residuals cannot be evaluated at this time. However, offsite disposal of RO concentrate was evaluated using deep (underground) injection well at the same location that St. Lucie County uses for disposal of its landfill leachate. Using these cost assumptions, offsite disposal of RO concentrate would add monthly costs of $24,700, which would result in amortized leachate management costs of $0.08 per gallon for the MBR/RO system (Table 4b).

Geosyntec also prepared a preliminary cost estimate for offsite management of the Landfill leachate and assumed that the leachate would be sent to the same deep injection well in St. Lucie County. The total cost for the 20,000 gpd of leachate would be $56,090 per month, or $673,080 per year, with a corresponding monthly amortized cost of $0.09 per gallon. This is comparable to the range of $0.09 to $.12 per gallon charged by other privately-owned facilities in Florida (e.g., Your Environment Solutions, Inc., Orlando, FL and Aquaclean Environmental Co., Inc., Tampa, FL).

Detailed yearly O&M tasks and associated costs for select items were not available for each alternative system at the time of this evaluation. Thus, estimated total costs are developed for comparison purposes only and should not be considered as exact determinations.

SUMMARY

The IRC Landfill located in Indian River County, Florida, currently manages leachate and centrate via offsite disposal to the WRWWTF. Based on data provided by the IRCUD from June 2017 to February 2019, the Landfill generates an estimated flow of 16,000 gpd and 57,000 gpd of leachate and centrate, respectively. The County has determined that the centrate constitutes a residential waste stream that does not require pretreatment. Therefore, only Landfill leachate treatment was evaluated in this memorandum, and a conceptual design flow of 20,000 gpd was assumed.

Two alternatives were evaluated including: (i) onsite pretreatment using a combined MBR/RO system (provided by Dynatec); and (ii) a leachate evaporation system, utilizing two different equipment vendors (i.e., APTIM and Heartland).

There are advantages and disadvantages to both liquids management approaches. Onsite (pre-) treatment using the MBR/RO system can achieve the local limits and is generally more cost-effective compared to evaporation systems. However, this assumes that the generated concentrate (estimated at 10% to 13% of the total volume treated) can be managed onsite via recirculation back into the Landfill. If off-site management of concentrate is needed due to its potential negative impact on leachate quality and treatment performance, the total leachate management costs may be higher than leachate evaporation with onsite disposal of the evaporator residuals. The MBR/RO system is likely to remove a large percentage of PFAS compounds from leachate, which may become more important in the near future. However, it requires continued effluent monitoring, can lead to permit exceedances and violations, and is dependent on the willingness/ability of the WRWWTF to continue to accept leachate for the foreseeable future. Furthermore, the costs presented in this evaluation do not include the disposal costs of the treated effluent to the treatment plant, since these costs may be considered “internal” costs, even though final treatment of 20,000 gpd of liquids is not “free.”

Alternatively, evaporation is generally more expensive compared to treatment, but it does not need subsequent discharge of effluent to the WRWWTF. Moreover, it is insensitive to the chemical characteristics of leachate and can handle complex chemistries (including PFAS). It does, however, also create a “sludgy” waste stream (approximately 5% of the total volume processed according to Heartland, and 12% to 14% according to APTIM) that contains concentrated residuals of salts, nutrients, and contaminants (including PFAS) that need to be stabilized and landfilled. The cost estimate provided in this evaluation assumes that the residuals can be stabilized and landfilled onsite, which is why the estimated costs are cheaper compared to leachate treatment with offsite disposal of the generated concentrate from the MBR/RO system. If offsite disposal of the evaporator residuals were required, total costs would likely increase substantially.

RECOMMENDATIONS

Based on the technical and economic evaluations presented above, there is a potential that leachate evaporation using the Heartland system could be a cost-competitive alternative to onsite treatment and continued discharge of pretreated effluent to the WRWWTF if the RO concentrate needs to be managed via offsite disposal. However, this assumes that the evaporator residuals can be managed through onsite disposal at the Landfill and that sufficient LFG of the required quality (i.e., 50% methane) is available as a fuel source.

To better evaluate the feasibility of leachate evaporation, a pilot study in cooperation with Heartland should be implemented. Geosyntec recommends cooperation with Heartland due to their lower overall costs, anticipated longer life expectancy of their unit, and reported lower residual volumes compared to the APTIM system. The pilot study should address the following technical and economic issues: (i) is there enough LFG available and is the existing infrastructure adequate to handle current (and potentially increased future) leachate flows; (ii) evaluate the effectiveness of the evaporation system under site-specific conditions to confirm volume reductions of approximately 95%; (iii) evaluate the need to further process the residuals to pass the Paint Filter Liquids Test and TCLP requirements for onsite disposal of these residuals; (iv) evaluate the ultimate management of evaporator residuals (onsite versus offsite), especially if the evaporator unit is not installed at the Landfill, but at the adjacent Indian River EcoDistrict property; and (v) re-evaluate final system costs using the pilot study results.

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